

SOLID STATE INTEGRATED AMPLIFIER

L80/81/V

SERVICE MANUAL

Circuit Description

1. Equalizer Amp. Section

Adopted is an Operational I.C., RAYTHEON RC-4558-DN, which is of 8-pin Dual In-Line Package Type. A built-in phase compensation capacitor for high frequency makes it impossible to adjust the value even for the R & D works. This contributes so much to the various characteristics and sonic quality. Fundamentally at the negative feedback amplifier, especially at the equalizer amplifier, the high frequency phase compensation should be kept in proper condition. When the compensation is too weak, the circuit becomes instable and in many case oscillation is inevitable. In such state, the sonic quality is out of discussion.

On the contrary, if the phase compensation is too strong, the distortion at high frequency range is much increased and at the same time it affects sonic quality to a great extent. That is why the input impedance is reduced by the high frequency phase compensation (e.g., Mirror Integration), which is indispensable to the multi-stage amplifier, and linearity of the former stage is affected to deteriorate the distortion characteristic. The capacitor inserted between Q6 and Q7 is for high frequency phase compensation.

To comply with the unique gain distribution of the L-80V, we considered a semi-conductor device which offers more inherent gain, comparing with the conventional 3-stage E-E Feedback type equalizer. The I.C. offers more than 100dB of inherent gain, and the loop gain at 1KHz is approximately 37dB, which ensures sufficient amount of Negative Feedback at low frequency range. The RC-4558-dN is carefully selected to fulfill no more than 1.5uV Input-Conversion Noise Voltage. Despite that the phase compensation is included, proper compensation is realized as well as the stability, and therefore any type of cartridge can be connected. As for the load condition, the I.C. circuitry exceeds the conventional 3-stage E-E Feedback Circuitry.

2. Power Amp. Section

Adopted is the fully complementary circuit configuration, which seems to be the most ideal one at present. Signals are supplied from the equalizer amp directly to the power amp section via buffer stage. The rated output of 50W/ch is realized at 190mV of equalizer output voltage (Input Sensitivity 2.8mV). This means the voltage gain is approximately 39dB, which is higher by some 6dB than that of standard power amplifiers. And naturally various problems must be considered. First, the harmonic distortion, especially at high frequency range, tends to be worse. In actuality, distortion at 10KHz is twice as bad as that of the amplifier having some 33dB voltage gain. This is of course in the case of using the same semi-conductor device.

To compensate the lost gain caused by applying Negative Feedback, it is necessary to increase the inherent gain by studying the inherent characteristics. At the first differential input stage, it is of utmost necessity to reduce the DC offset voltage at the output terminal, and therefore required are transistors of matched hfe characteristic, and of high hfe at the operational current area. For the L-80V, adopted is that of 3dB allowance between minimum and maximum. The standard hfe value is 500, which is very high. Also at this stage a zener diode is arranged to deal with the mains power fluctuation.

Second differential Amp. Stage

This stage plays an important role to decide distortion ratio, especially at high frequency range. Fundamentally transistors of high f_T and low C_{ob} are necessary, and high load impedance should be realized since most of the voltage gain depends on this stage. Therefore inherent gain is obtained sufficiently up to high frequency range thanks to constant current drive. The f_T of the transistors is more than 130MHz ($I_c = 10mA$), and the C_{ob} is less than 2pF, which is far above the audio frequency band. Nevertheless from the view point of fae, the fae is 75kHz in case hfe is determined as 200. Thus such high frequency characteristic is indispensable.

Also at the driver stage and the power stage, transistors of high f_T are necessary when good high frequency characteristic is required, but there exists a close relation between f_T and breakdown of transistors: When f_T is extended, high frequency becomes unstable, and power transistors are easily damaged due to oscillation etc. And recently, this is solved by increasing $V_{CE(sat)}$, the saturation voltage between collector and emitter, which deteriorates voltage utilization ratio as well as linearity of h_{fe} at the time of huge current driving.

The power transistors adopted in the L-80V ensure excellent reliability against breakdown by using larger scale pellet than that of the conventional transistors. Therefore, the L-80V realized excellent reliability against breakdown without deteriorating high frequency characteristic. Of course the linearity of h_{fe} is excellent.

Thus after exhaustive study of the semi-conductor device, we increased the loop gain, and the high frequency characteristic is far much improved. This is because the high frequency compensation could be slighter thanks to the betterment of the inherent characteristics.

3. Tone Control Section

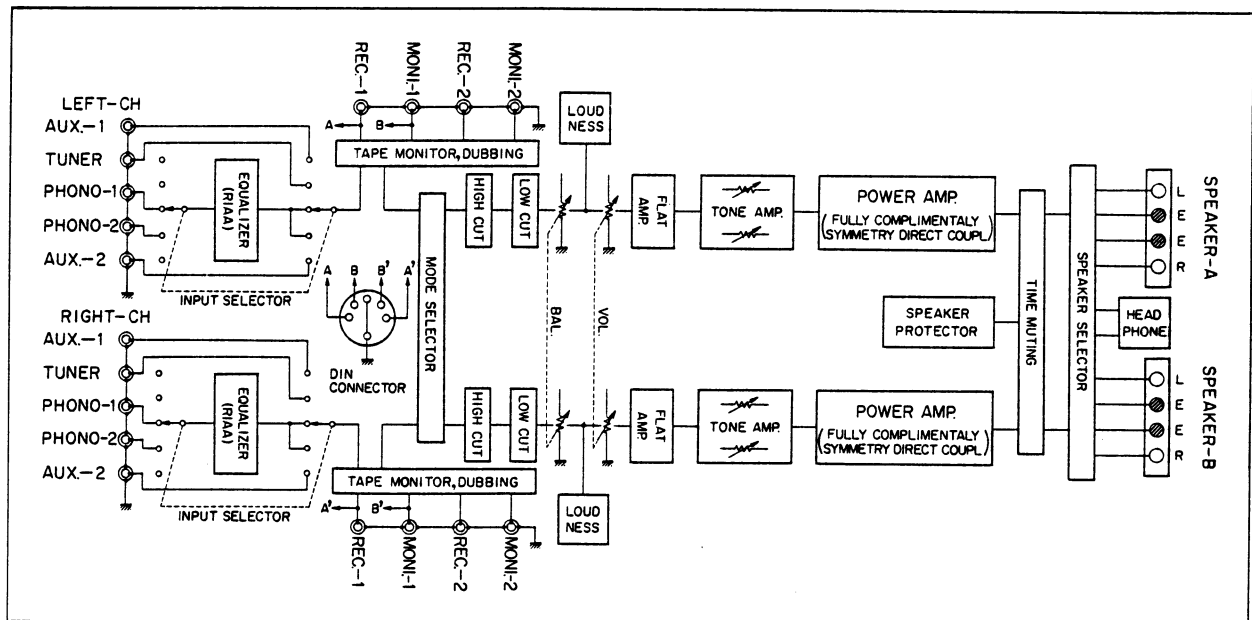
Adopted is the LUX NF type with turnover frequency selector of two steps both for bass and treble respectively.

| | | |
|----------------------------|--------|-------|
| Bass turnover frequency: | 150Hz, | 300Hz |
| Treble turnover frequency: | 3KHz, | 6KHz |

4. Delay Time Muting Section

In the amplifier of Direct-Coupled configuration, the speaker loads are directly connected to the power transistors, therefore it may be possible to impair the speaker systems in case DC potential appears at the output terminal. Also a slight DC potential gives some bias to the speakers, which affects the sonic quality adversely. Thus the protection circuit is indispensable to eliminate these phenomena. For the L-80V, the Delay Time Muting Circuit operates as a protection circuit at the same time. Therefore the amplifier is muted 5 - 10 seconds at the time of turning the power switch on.

Block Diagram



Replacement Parts List

L-80

PB-891 (Resistors; 1/4W, [±]5% unless otherwise noted.)

| | | | | | | | | |
|------|-----------|--------|------|----------|--------|------|-----------|----|
| R101 | 1M | 3Y, 2Y | R120 | 120 | 3X, 2X | R604 | 10K | 5Y |
| 102 | 5.6K | 3Y, 2Y | 121 | 100 1/2W | 3Y, 2Y | 605 | 10K | 5Y |
| 103 | 47 | 3X, 2X | 122 | 100 1/2W | 3Y, 2Y | 606 | 3.9K | 4Y |
| 104 | 47 | 3X, 2X | 123 | 0.33 3W | 3Y, 2Y | 607 | 2.7K | 4Y |
| 105 | 6.8K 1/2W | 3X, 2X | 124 | 0.33 3W | 3Y, 2Y | 608 | 18K | 5Y |
| 106 | 6.8K 1/2W | 3X, 2X | 125 | 22 1W | 3Y, 2Y | 609 | 18K | 5Y |
| 107 | 47K | 3Y, 2Y | R201 | 120K | 1X, 1Y | R701 | 4.7K 1W | 5X |
| 108 | 3.3K | 3Y, 2Y | 202 | 3.3K | 1X, 1Y | 702 | 4.7K 1W | 5X |
| 109 | 3.3K | 3Y, 2Y | 203 | 390K | 1X, 1Y | 703 | 27K | 4Y |
| 110 | 8.2K | 3Y, 2Y | 204 | 1K | 1X, 1Y | 704 | 27K | 4X |
| 111 | 180 | 3X, 2X | 205 | 39K | 1X, 1Y | 705 | 1K 1/2W | 4X |
| 112 | 22 1/2W | 3X, 2X | 206 | 560K | 1X, 1Y | 706 | 3.3K 1/2W | 4X |
| 113 | 47K | 3Y, 2Y | 207 | 1K | 1X, 1Y | 707 | 1.8K 1/2W | 4X |
| 114 | 1.2K | 3Y, 2Y | 208 | 680 | 1X, 1Y | 708 | 1.8K 1/2W | 5X |
| 115 | 1.5K 1/2W | 3X, 2X | 209 | 220 | 1X, 1Y | 709 | 4.7K 1W | 4X |
| 116 | 470 | 3X, 2X | R601 | 33 1/2W | 5Y | 710 | 4.7K 1W | 5X |
| 117 | 33K 1/2W | 3X, 2X | 602 | 56K | 5Y | | | |
| 118 | 22 1/2W | 3X, 2X | 603 | 1K | 5Y | | | |
| 119 | 3.9K | 3Y, 2Y | | | | | | |

| | | | | | | | |
|------|---------|------|--------|------|-------|-----|----|
| C101 | 10uF | 10V | 3Y, 2Y | C601 | 22uF | 50V | 5Y |
| 102 | 220pF | | 3Y, 2Y | 602 | 220uF | 10V | 4Y |
| 103 | 100uF | 16V | 3Y, 2Y | 603 | 220uF | 16V | 4Y |
| 104 | 100uF | 50V | 3X, 2X | 604 | 220uF | 16V | 4Y |
| 105 | 47pF | | 2X, 3X | C705 | 220uF | 35V | 4X |
| 106 | 47pF | | 3Y, 2Y | 706 | 220uF | 35V | 5X |
| 107 | 33uF | 10V | 3Y, 2Y | 707 | 100pF | | 4Y |
| 108 | 100uF | 50V | 3X, 2Y | 708 | 100pF | | 4X |
| 109 | 150pF | | 3X, 2X | 709 | 100uF | 35V | 4X |
| 110 | 0.022uF | | 3X, 2X | 710 | 100uF | 35V | 4X |
| 111 | 470uF | 6.3V | 3Y, 2Y | 711 | 100uF | 35V | 4X |
| 112 | 1uF | 50V | 2X | 712 | 47uF | 35V | 4X |
| 113 | 0.04uF | | 3X | 713 | 100uF | 35V | 4X |
| 114 | 1uF | 50V | 2X | 714 | 100uF | 35V | 4X |
| 115 | 0.04uF | | | | | | |
| 116 | 0.1uF | | 3Y, 2Y | | | | |
| C201 | 2.2uF | 25V | 1X, 1Y | | | | |
| 202 | 22uF | 10V | 1X, 1Y | | | | |
| 203 | 1800pF | | 1X, 1Y | | | | |
| 204 | 6200pF | | 1X, 1Y | | | | |
| 205 | 0.47uF | | 1X, 1Y | | | | |
| 206 | 0.04uF | | 1Y | | | | |
| 207 | 0.04uF | | 1X | | | | |

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|------|---------|--------|------|--------|----|
| Q101 | 2SA750 | 2Y, 3Y | Q601 | 2SD571 | 5Y |
| 102 | 2SA750 | 2Y, 3Y | 602 | 2SC945 | 5Y |
| 103 | 2SC1940 | 2X, 3X | 603 | 2SA733 | 4Y |
| 104 | 2SC1940 | 2Y, 3Y | 604 | 2SC945 | 4Y |
| 105 | 2SA915 | 2X, 3X | 605 | 2SC945 | 4Y |
| 106 | 2SC945 | 2Y, 3Y | Q701 | 2SD571 | 4X |
| 107 | 2SB536 | 2X, 3X | 702 | 2SB605 | 4X |
| 108 | 2SD381 | 2X, 3X | | | |
| Q201 | RC-4558 | 1Y | | | |

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|------|---------|--------|------|---------|----|
| D101 | RD-12EB | 2X, 3X | D702 | 1N-4002 | 5X |
| 102 | VD-1221 | 2X, 3X | 703 | 1N-4002 | 5X |
| 103 | VD-1221 | 2Y, 3Y | 704 | 1N-4002 | 5X |
| | | | 705 | 1N-4002 | 5X |
| D601 | 1N-4002 | 5Y | | | |
| 602 | 1N-4002 | 5Y | | | |
| 603 | 1S-1555 | 5Y | | | |

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|-------|--------|--------|
| VR101 | 4.7K-B | 2X, 3X |
| 102 | 4.7K-B | 2Y, 3Y |

PB-894

| | | | | | |
|------|-------|------|---------|------|-----|
| R501 | 27K | R502 | 12K | R503 | 12K |
| C501 | 220pF | C502 | 0.082uF | | |

PB-892

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|------|------|------|-----|------|-----|
| R301 | 680K | R307 | 68K | R314 | 1M |
| 302 | 470K | 308 | 1K | 315 | 10K |
| 303 | 4.7K | 309 | 10K | 316 | 1M |
| 304 | 100K | 310 | 82K | 317 | 1M |
| 305 | 8.2K | 311 | 27K | | |
| 306 | 18K | 312 | 10K | | |

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|------|---------|-----|------|----------|-----|
| C301 | 4.7uF | 16V | C307 | 22pF | |
| 302 | 33uF | 10V | 308 | 2.2uF | 25V |
| 303 | 0.047uF | | 310 | 0.033uF | |
| 304 | 47uF | 10V | 311 | 0.1uF | |
| 305 | 100uF | 35V | 312 | 0.0022uF | |
| 306 | 100uF | 10V | 313 | 0.0012uF | |

| | |
|------|----------|
| Q301 | 2SC-1222 |
| 302 | 2SA-750 |

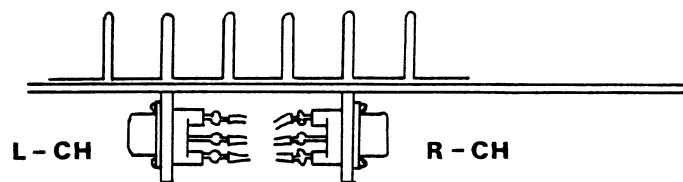
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| | | | | | | |
|------|------|--------|------|---------|------|--------|
| R401 | 18K | 3X | C402 | 0.033uF | | 2X, 3X |
| 403 | 2.7K | 2X, 3X | 405 | 4.7uF | 16V | 1X, 3X |
| 404 | 18K | 1X, 3X | 406 | 100uF | 6.3V | 1Y, 2Y |
| 405 | 1K | 1X, 2Y | 407 | 0.04uF | | 1X, 2Y |
| 406 | 1K | 2X, 2Y | 408 | 100uF | 35V | |
| 410 | 220K | 1X, 2X | 409 | 2.2uF | 25V | 1Y, 3X |
| 411 | 39K | 1X, 2X | | | | |
| 412 | 5.6K | 1Y, 2X | | | | |
| 413 | 1.5K | 1X, 2X | | | | |
| 414 | 100K | 3X, 1Y | | | | |

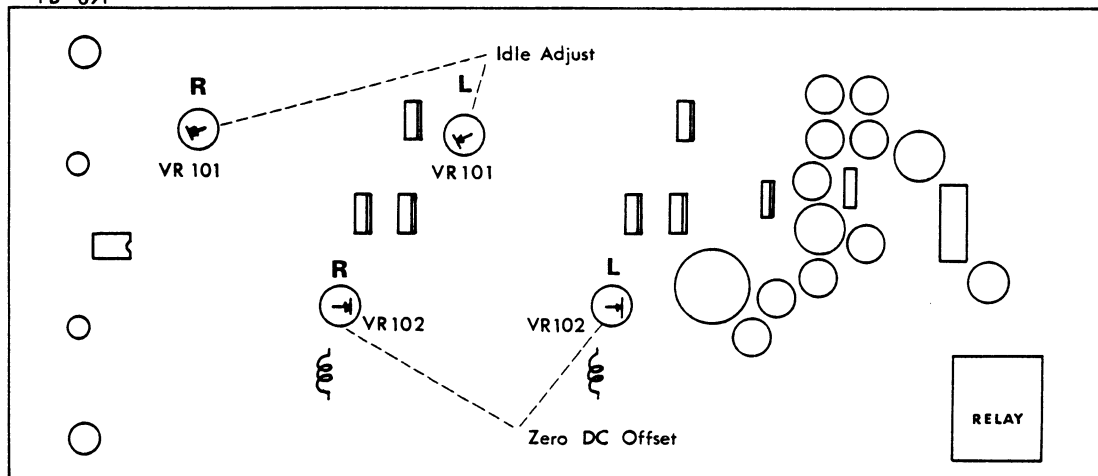
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|------|----------|-------|--------|
| Q401 | 2SC-1222 | VR401 | 100K-B |
|------|----------|-------|--------|

Idle Adjust & Zero DC Offset

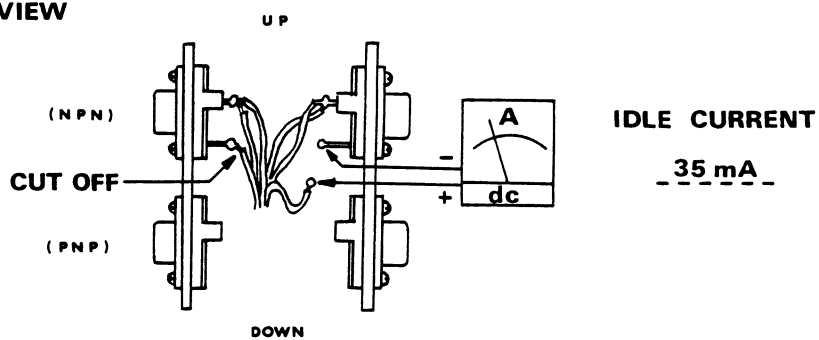
TOP VIEW



PB-891



FRONT VIEW



L-80V

PB-891 (Resistors; 1/4W, $\pm 5\%$ unless otherwise noted.)

| | | | | | | | | |
|------|-----------|--------|------|----------|--------|------|-----------|----|
| R101 | 1M | 3Y, 2Y | R120 | 120 | 3X, 2X | R604 | 10K | 5Y |
| 102 | 5.6K | 3Y, 2Y | 121 | 100 1/2W | 3Y, 2Y | 605 | 10K | 5Y |
| 103 | 47 | 3X, 2X | 122 | 100 1/2W | 3Y, 2Y | 606 | 3.9K | 4Y |
| 104 | 47 | 3X, 2X | 123 | 0.33 3W | 3Y, 2Y | 607 | 2.7K | 4Y |
| 105 | 6.8K 1/2W | 3X, 3Y | 124 | 0.33 3W | 3Y, 2Y | 608 | 18K | 5Y |
| 106 | 6.8K 1/2W | 3X, 2X | 125 | 22 1W | 3Y, 2Y | 609 | 18K | 5Y |
| 107 | 47K | 3Y, 2Y | 201 | 120K | 1X, 1Y | R701 | 4.7K 1W | 5X |
| 108 | 3.3K | 3Y, 2Y | 202 | 3.3K | 1X, 1Y | 702 | 4.7K 1W | 5X |
| 109 | 3.3K | 3Y, 2Y | 203 | 390K | 1X, 1Y | 703 | 27K | 4Y |
| 110 | 8.2K | 3Y, 2Y | 204 | 1K | 1X, 1Y | 704 | 27K | 4X |
| 111 | 180 | 3X, 2X | 205 | 39K | 1X, 1Y | 705 | 1K 1/2W | 4X |
| 112 | 22 1/2W | 3X, 2X | 206 | 560K | 1X, 1Y | 706 | 3.3K 1/2W | 4X |
| 113 | 47K | 3Y, 2Y | 207 | 1K | 1X, 1Y | 707 | 1.8K 1/2W | 4X |
| 114 | 1.2K | 3Y, 2Y | 208 | 680 | 1X, 1Y | 708 | 1.8K 1/2W | 5X |
| 115 | 1.5K 1/2W | 3X, 2X | 209 | 220 | 1X, 1Y | 709 | 4.7K 1W | 4X |
| 116 | 470 | 3X, 2X | 601 | 100 1/2W | 5Y | 710 | 4.7K 1W | 5X |
| 117 | 33K 1/2W | 3X, 2X | 602 | 56K | 5Y | | | |
| 118 | 22 1/2W | 3X, 2X | 603 | 1K | 5Y | | | |
| 119 | 3.9K | 3Y, 2Y | | | | | | |

| | | | | | | | |
|------|---------|------|--------|------|-------|-----|----|
| C101 | 10uF | 10V | 3Y, 2Y | C601 | 22uF | 50V | 5Y |
| 102 | 220pF | | 3Y, 2Y | 602 | 220uF | 10V | 4Y |
| 103 | 100uF | 16V | 3Y, 2Y | 603 | 220uF | 16V | 4Y |
| 104 | 100uF | 50V | 3X, 2X | 604 | 220uF | 16V | 4Y |
| 105 | 47pF | | 2X, 3X | 705 | 220uF | 35V | 4X |
| 106 | 47pF | | 3Y, 2Y | 706 | 220uF | 35V | 5X |
| 107 | 33uF | 10V | 3Y, 2Y | 707 | 100pF | | 4Y |
| 108 | 100uF | 50V | 3X, 2Y | 708 | 10CpF | | 4X |
| 109 | 150pF | | 3X, 2X | 709 | 100uF | 35V | 4X |
| 110 | 0.022uF | | 3X, 2X | 710 | 100uF | 35V | 4X |
| 111 | 470uF | 6.3V | 3Y, 2Y | 711 | 100uF | 35V | 4X |
| 112 | 1uF | 50V | 2X | 712 | 47uF | 35V | 4X |
| 113 | 0.04uF | | 3X | 713 | 100uF | 35V | 4X |
| 114 | 1uF | 50V | 2X | 714 | 100uF | 35V | 4X |
| 115 | 0.04uF | | | | | | |
| 116 | 0.1uF | | 3Y, 2Y | | | | |
| 201 | 2.2uF | 25V | 1X, 1Y | | | | |
| 202 | 22uF | 10V | 1X, 1Y | | | | |
| 203 | 1800pF | | 1X, 1Y | | | | |
| 204 | 6200pF | | 1X, 1Y | | | | |
| 205 | 0.47uF | | 1X, 1Y | | | | |
| 206 | 0.04uF | | 1Y | | | | |
| 207 | 0.04uF | | 1X | | | | |

| | | | | | |
|------|---------|--------|------|--------|--------|
| Q101 | 2SA750 | 2Y, 3Y | Q601 | 2SD571 | 5Y |
| 102 | 2SA750 | 2Y, 3Y | 602 | 2SC945 | 5Y |
| 103 | 2SC1507 | 2X, 3X | 603 | 2SA733 | 4Y |
| 104 | 2SC1507 | 2Y, 3Y | 604 | 2SC945 | 4Y |
| 105 | 2SB536 | 2X, 3X | 605 | 2SC945 | 4Y |
| 106 | 2SC945 | 2Y, 3Y | 701 | 2SD571 | 4X |
| 107 | 2SB536 | 2X, 3X | 702 | 2SB605 | 4X |
| 201 | RC-4558 | 1Y | 108 | 2SD381 | 2X, 3X |

| | | | | | |
|------|---------|--------|------|--------|----|
| D101 | RD-12EB | 2X, 3X | D702 | 1N4002 | 5X |
| 102 | VD-1221 | 2X, 3X | 703 | 1N4002 | 5X |
| 103 | VD-1221 | 2Y, 3Y | 704 | 1N4002 | 5X |
| 601 | 1N-4002 | 5Y | 705 | 1N4002 | 5X |
| 602 | 1N-4002 | 5Y | | | |
| 603 | 1S-1555 | 5Y | | | |

| | | |
|-------|--------|--------|
| VR101 | 4.7K-B | 2X, 3X |
| 102 | 4.7K-B | 2Y, 3Y |

PB-894

| | | | | | |
|------|-------|------|---------|------|-----|
| R501 | 27K | R502 | 12K | R503 | 12K |
| C501 | 220pF | C502 | 0.082uF | | |

PB-892

| | | | | | |
|------|------|------|-----|------|-----|
| R301 | 680K | R307 | 68K | R314 | 1M |
| 302 | 470K | 308 | 1K | 315 | 10K |
| 303 | 4.7K | 309 | 10K | 316 | 1M |
| 304 | 100K | 310 | 82K | 317 | 1M |
| 305 | 8.2K | 311 | 27K | | |
| 306 | 18K | 312 | 10K | | |

| | | | | |
|------|--------|-----|------|-------------|
| C301 | 4.7uF | 16V | C307 | 22pF |
| 302 | 33uF | 10V | 308 | 25V - 2.2uF |
| 303 | 0.04uF | | 310 | 0.033uF |
| 304 | 47uF | 10V | 311 | 0.1uF |
| 305 | 100uF | 35V | 312 | 0.0022uF |
| 306 | 100uF | 10V | 313 | 0.0012uF |

| | |
|------|----------|
| Q301 | 2SC-1222 |
| 302 | 2SA-750 |

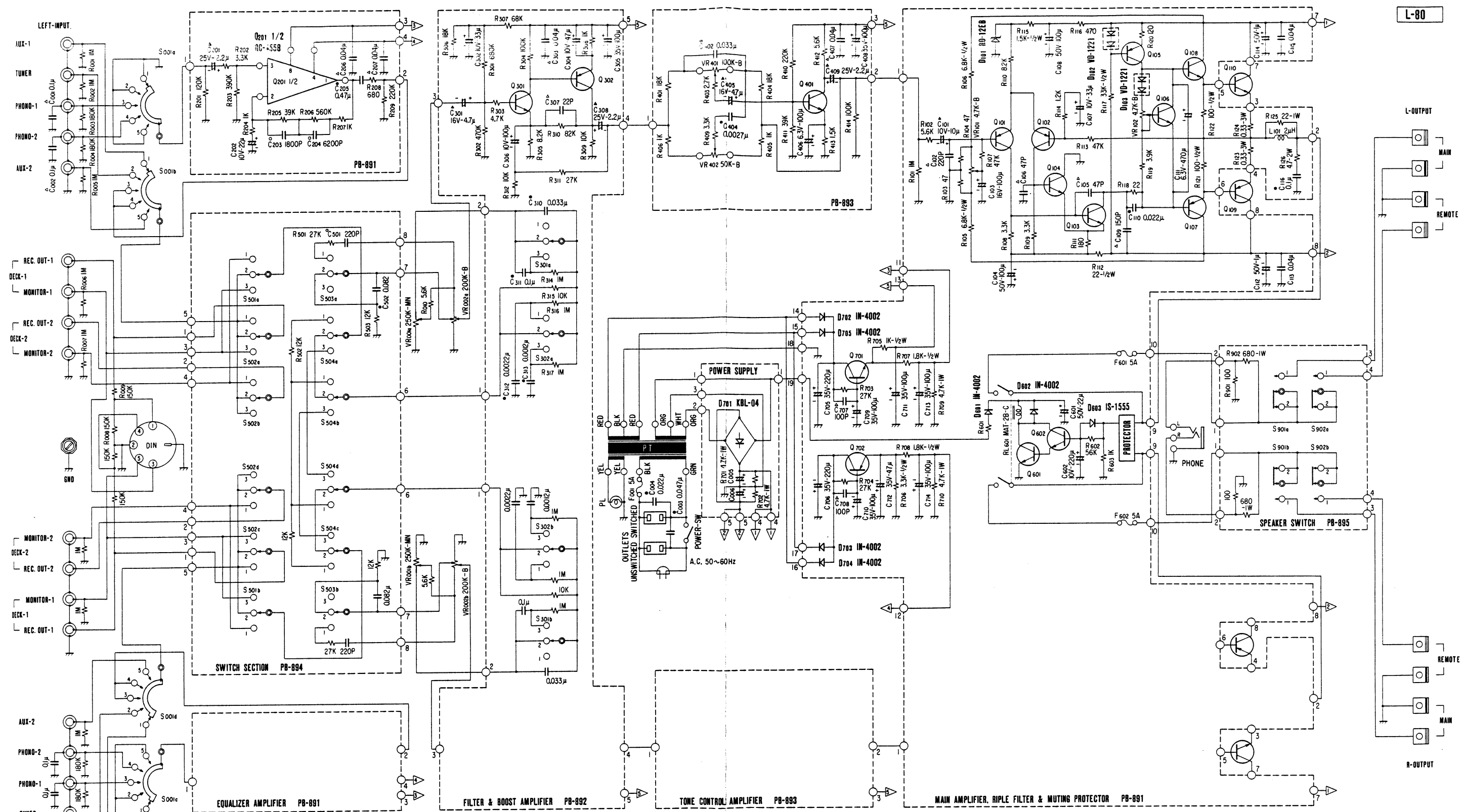
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|------|------|------|------|
| R401 | 18K | R408 | 1M |
| 402 | 1M | 409 | 3.3K |
| 403 | 2.7K | 410 | 220K |
| 404 | 18K | 411 | 39K |
| 405 | 1K | 412 | 5.6K |
| 406 | 1K | 413 | 1.5K |
| 407 | 1M | 414 | 100K |

| | | | |
|------|-------------|------|--------------|
| C401 | 0.033uF | C406 | 100uF - 6.3V |
| 402 | 0.033uF | 407 | 0.04uF |
| 403 | 0.0012uF | 408 | 100uF - 35V |
| 404 | 0.0027uF | 409 | 2.2uF - 25V |
| 405 | 4.7uF - 16V | | |

| | |
|------|----------|
| Q401 | 2SC-1222 |
|------|----------|

| | |
|-------|--------|
| VR401 | 100K-B |
| 402 | 50K-B |



S001a,001b,001c,001d...FUNCTION (1.AUX-1, 2.TUNER, 3.PHONO-1, 4.PHONO-2, 5.AUX-2)
S301a,301b...LOW CUT (1.SUBSONIC, 2.DEFEAT, 3.70Hz)
S501a,501b...MONITOR (1.DECK-2, 2.SOURCE, 3.DECK-1)
S502a,502b,502c,502d...DUBBING (1.DECK-2 TO DECK-1, 2.SOURCE, 3.DECK-1 TO DECK-2)
S503a,503b...LOUDNESS (1.LOW FREQUENCY ONLY, 2.DEFEAT, 3.LOUDNESS IN)

S504a,504b,504c,504d...MODE (1.MONO, 2.STEREO, 3.REVERSE)
S901a,901b...MAIN SPEAKER (1.OFF, 2.ON)
S902a,902b...REMOTE SPEAKER (1.OFF, 2.ON)
VR001a,001b...BALANCE CONTROL
VR002a,002b...VOLUME CONTROL
VR401a,401b...BASS CONTROL
VR402a,402b...TREBLE CONTROL

Q301,401...2SC-1222
Q101,102,302...2SA-750
Q103,104...2SC-1940
Q105...2SA-915
Q107...2SB-536
Q108...2SD-381
Q109...2SB-545-A
Q110...2SD-188-A
Q702...2SB-605
Q601,701...2SD-571
Q106,802...2SC-945
C005,006...50V-6800μF
R601...33-1/2W
P.T...P-1980-B

1. Unless otherwise specified, all resistors are in ohm ¼ watt, all capacitors are in micro farad (μF).
2. Transistors, IC and diodes may be replaced with any types having comparable rating.
3. There might be slight changes in the actual set.

LUX CORPORATION, JAPAN

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TELEX: J63694

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