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ROTEL®

# Technical Manual

## STEREO DC INTEGRATED AMPLIFIER

# RA-2020

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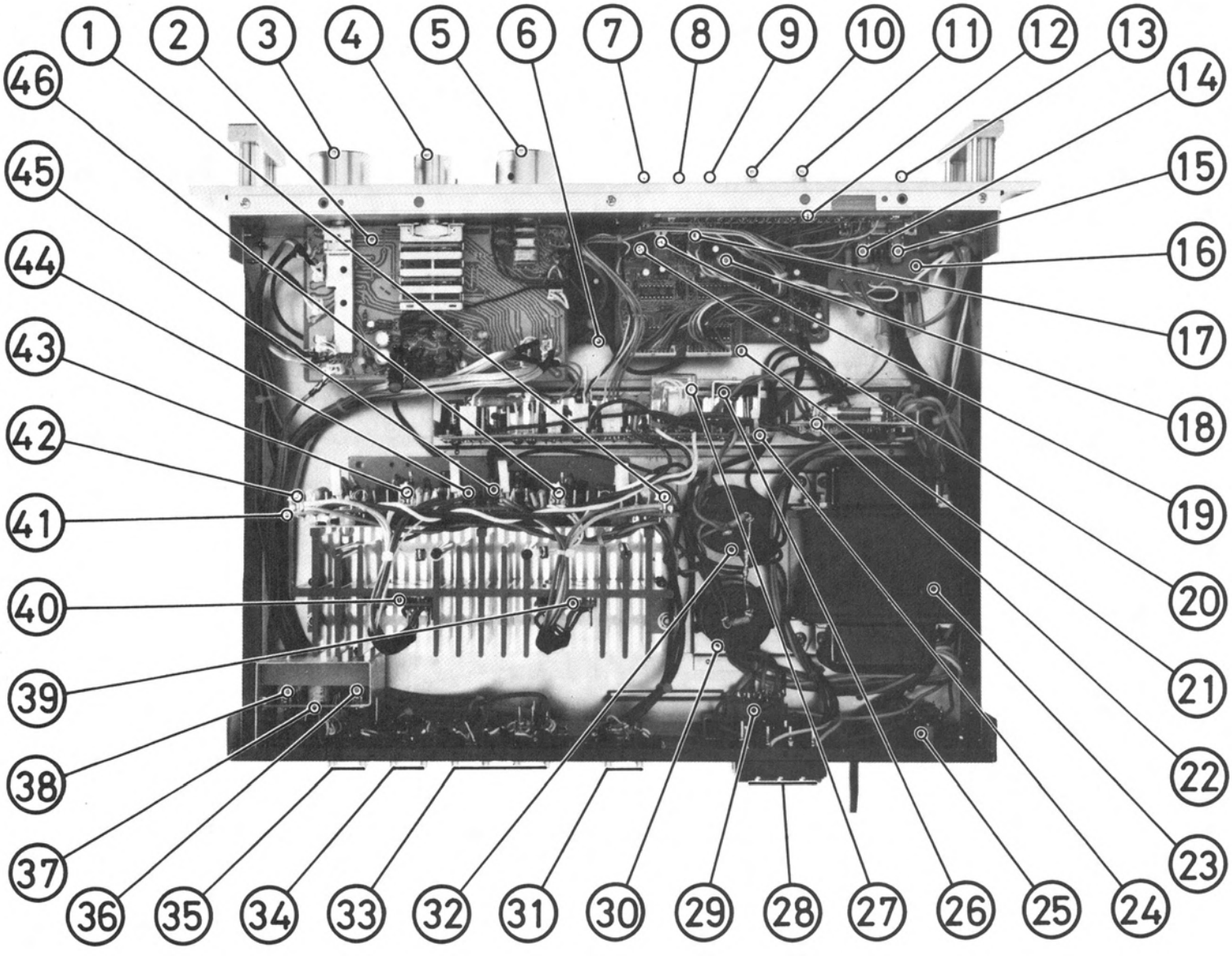
**Serial No. Beginning NB77329**


THE ROTEL CO., LTD.
1-36-8 OHOKAYAMA, MEGURO-KU, TOKYO 152, JAPAN

ROTEL ELECTRONICS CO., LTD.
2ND FLOOR, EVERGLORY BLDG., NO. 305, SECTION 3, NANKING E. ROAD. TAIPEI. TAIWAN. REPUBLIC OF CHINA

ROTEL OF AMERICA, INC.
1055 SAW MILL RIVER ROAD, ARDSLEY, N.Y. 10502, U.S.A.

# Chassis Layout (Top View)



1. VR405, L-CH OVERLOAD PROTECTION LEVEL ADJ
2. FUNCTION AND PHONO EQUALIZER AMP PC BOARD (TC-146)
3. FUNCTION SELECTOR
4. RECORDING SELECTOR
5. VOLUME CONTROL
6. TONE CONTROL AMP PC BOARD (TC-147)
7. SUPERSONIC SWITCH
8. SUBSONIC SWITCH
9. TONE DEFEAT SWITCH
10. TREBLE CONTROL
11. BASS CONTROL
12. PEAK LEVEL INDICATOR PC BOARD (X-275)
13. POWER SWITCH
14. SPEAKER B SWITCH
15. SPEAKER A SWITCH
16. SPEAKER SWITCH PC BOARD (X-301)
17. LEVEL INDICATOR SENSITIVITY SWITCH
18. VR601, L-CH LEVEL INDICATOR CAL
19. LEVEL INDICATOR OFF SWITCH
20. VR602, R-CH LEVEL INDICATOR CAL
21. PEAK LEVEL INDICATOR DRIVER PC BOARD (X-298)
22. FUSE PC BOARD (X-296)
23. T001, POWER TRANSFORMER
24. POWER SUPPLY PC BOARD (B-137)
25. AC OUTLET
26. D708, RECTIFIER
27. RY701, SPEAKER RELAY
28. SPEAKER TERMINALS
29. VOLTAGE SELECTOR (not used on chassis for Europe)
30. C002, SMOOTHING CAPACITOR FOR –B
31. PRE/MAIN JACKS
32. C001, SMOOTHING CAPACITOR FOR +B
33. TAPE MONITOR-1, -2 JACKS
34. AUX, TUNER JACKS
35. PHONO-1, -2 JACKS
36. VR402, R-CH MC HEAD-AMP DISTORTION ADJ
37. MC HEAD-AMP PC BOARD (X-283)
38. VR401, L-CH MC HEAD-AMP DISTORTION ADJ
39. POWER AMP, L-CH
40. POWER AMP, R-CH
41. DRIVER PC BOARD (AF-113)
42. VR406, R-CH OVERLOAD PROTECTION LEVEL ADJ
43. VR404, R-CH IDLING CURRENT ADJ
44. VR402, R-CH DC BALANCE ADJ
45. VR401, L-CH DC BALANCE ADJ
46. VR403, L-CH IDLING CURRENT ADJ

# Adjustment

**Instruments:** Audio Generator, Oscilloscope, AC voltmeter, DC millivoltmeter, HD Analyzer.

**Note:**

Set Balance Control to mid-position, Muting and Filter Switches to OFF, Mode Switch to STEREO and Tape Monitor Switch to SOURCE.

## A. Main Amp DC Balance Adjustment

Before starting this adjustment, calibrate the oscilloscope as follows: set the vertical gain control at 0.1 volt/cm. Set AC-GND-DC switch to GND to determine zero point on the screen. Then set the switch to DC position.

1. Short-circuit Main-In terminals. Set UNITE-SEPARATE switch to SEPARATE. Connect the oscilloscope to the speaker terminals, and adjust potentiometer VR401 (VR402 for R-channel) so that the horizontal line on the oscilloscope screen, which indicates voltage, comes to 0-volt position.
2. Next, check that when Main-In terminals are opened, or when UNITE-SEPARATE switch is set to UNITE position with Main-In terminals open, fluctuation of voltage is within ±0.04 volts.

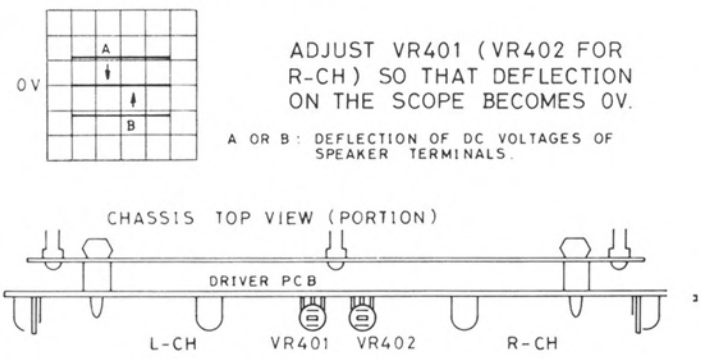



**Fig. 1. Main Amp DC Balance Adjustment**

## B. Idling Current (Bias) Adjustment

Before starting this adjustment, warm up the unit for 3 minutes or so to stabilize the power transistors and the heat sink, with Volume Control set at minimum.

1. Connect the plus lead of DC millivoltmeter to pin 19 (pin 20 for R-channel) and the minus lead to pin 13 (pin 14 for R-channel) on the Driver PC board.
2. Adjust potentiometer VR403 (VR404 for R-channel) on the Driver PC board so that DC millivoltmeter reads 10mV.

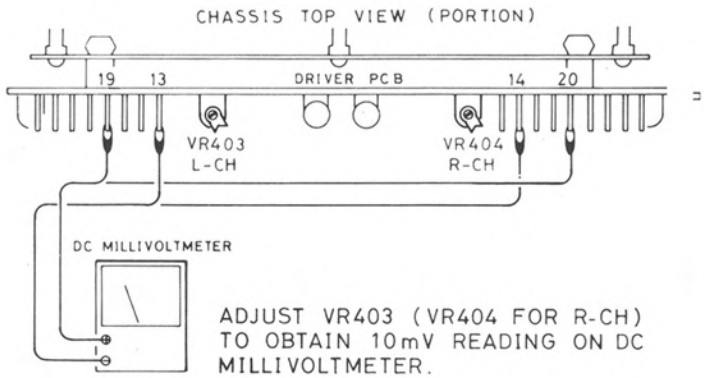



**Fig. 2. Idling Current (Bias) Adjustment**

## C. Overload Protection Level Adjustment

Make this adjustment for left and right channels separately (feed signal only to the channel to be adjusted).

- Before making adjustment, warm up the unit adequately to prevent fluctuation of the preset level caused by temperature rise.
- Do not short-circuit the output pins for more than one minute. This requires the adjustment to be made bit by bit by repeating the action of turning the potentiometer a bit and short-circuiting the pins momentarily.

  Note that short-circuiting output pins for a prolonged period of time when the protection circuit is not activated will damage power transistors, etc.

1. Connect an 8-ohm load resistor to speaker terminals. Connect AC voltmeter in parallel with the load resistor. Set Volume Control to maximum. Connect Audio Generator to AUX input jack and feed in 1,000Hz (sine wave) signal. Adjust the input level with the attenuator of Audio Generator to obtain 0.38-volt reading on AC voltmenter.
2. Adjust potentiometer VR405 (VR406 for R-channel) on Driver PC board so that the protection circuit is activated (i.e. Speaker relay is set to OFF) the instant pins 15 and E3 (pins 16 and E2 for R-channel) are short-circuited.
3. Reduce the input level until AC voltmeter reads 0.33 volts. Then, make certain that the protection circuit is not activated (i.e. Speaker Relay keeps ON) when pins 15 and E3 (pins 16 and E2 for R-channel) are shorted.

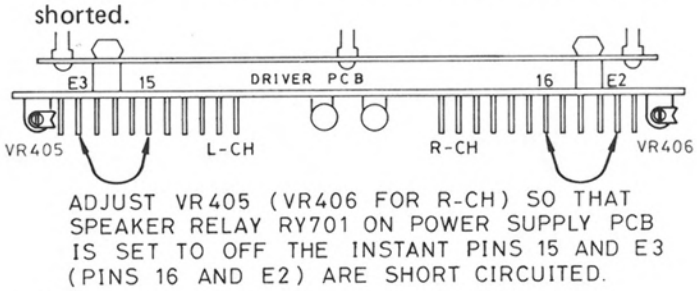



**Fig. 3. Overload Protection Level Adjustment**

## D. Distortion Adjustment of PHONO-2 (MC) Head Amp

1. Connect HD Analyzer to Tape Monitor Out jack. Connect Audio Generator to PHONO-3 (MC) jack. Feed in 1,000Hz (sine wave) signal and adjust input level to obtain 3-volt reading on HD Analyzer.
2. Adjust potentiometer VR101 (VR102 for R-channel) on MC Head Amp PC board so that HD Analyzer gives minimum distortion.

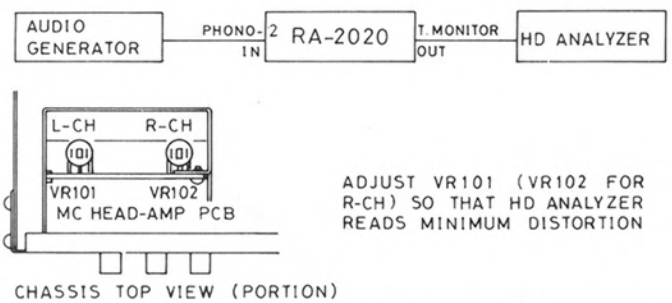
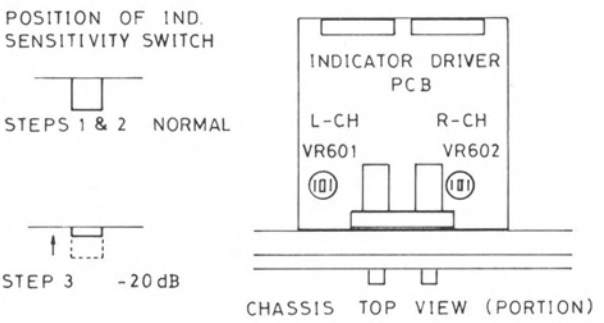



**Fig. 4. Distortion Adjustment of Phono-2 (MC) Head Amp**

## E. Peak Level Indicator Calibration

1. Connect an 8-ohm load resistor to speaker terminals. Connect AC voltmeter in parallel with the resistor. Connect Audio Generator to AUX input and feed in 1,000Hz (sine wave) signal. Adjust the input level to obtain 23.7-volt reading on AC voltmeter. Set the sensitivity changeover switch for Peak Level Indicator to NORMAL.
2. Maintaining this state, adjust by turning potentiometer VR601 (VR602 for R-channel) on the Indicator Driver PC board so that the Level Indicator lights up to 0dB position.
3. Adjust the input level so that AC voltmeter indicates the point 20dB lower than that at 23.7-volt reading. Push on the sensitivity changeover switch to –20dB position. Check that the Peak Level Indicator lights up to 0dB position.

**Fig. 5. Peak Level Indicator Adjustment**




# Specifications

## A. EQUALIZER AMP SECTION (measured at Tape Out)

- Output Voltage/Impedance (at 1,000Hz)
  Rated Output:
  Pin Jack Output . . . . . 150mV/2kΩ
  DIN Socket Output . . . . . 50mV/80kΩ
  Maximum Output:
  Pin Jack (at 0.5% THD) . . . . 15V
- Harmonic Distortion (20Hz to 20,000Hz at 5V output)
  Phono-1 . . . . . 0.006%
  Phono-2 (MC) . . . . . 0.008%
- Phono Equalization (20Hz to 20,000Hz)
  Phono-1 RIAA STD. . ±0.5dB
  Phono-2 (MC) RIAA STD. . ±0.5dB
- Hum and Noise (IHF A-network)
  Phono-1 . . . . . 75dB
  Phono-2 (MC) . . . . . 62dB
- Input Sensitivity/Impedance (at rated output)
  Phono-1 . . . . . 2mV/50kΩ
  Phono-2 (MC) . . . . . 200μV/150Ω
- Crosstalk (at 20,000Hz) . . . . . 50dB
- Overload (at 1,000Hz, 0.1% THD)
  Phono-1 . . . . . 200mV
  Phono-2 (MC) . . . . . 5mV

## B. PREAMPLIFIER SECTION (measured at preamp out)

- Output Voltage/Impedance (at 1,000Hz)
  Rated Output . . . . . 1V/600Ω
  Maximum Output . . . . . 7V (at 0.5% THD)
- Harmonic Distortion (20Hz to 20,000Hz at rated output) . . . . . 0.01%
- Frequency Response
  +0dB, –1dB . . . . . 5Hz to 120kHz
- Hum and Noise (IHF, A-network)
  Tuner, AUX . . . . . 92dB
  Tape Monitor-1, -2 . . . . . 92dB
  Residual (Volume Control at minimum) . . . . 8μV100dB
- Input Sensitivity/Impedance
  Tuner, AUX . . . . . 150mV/50kΩ
  Tape Monitor-1, -2 . . . . . 150mV/50kΩ
- Overload (at 1,000Hz, 0.5% THD)
  Tuner, AUX . . . . . 15V
  Tape Monitor-1, -2 . . . . . 15V
- Crosstalk (at 1,000Hz) . . . . . 70dB AVE
- Intermodulation Distortion (60Hz:7,000Hz = 4:1) . . . . 0.015%
- Tone Controls
  Bass (at 100Hz) . . . . . ±10dB
  Treble (at 10,000Hz) . . . . . ±10dB
- Loudness (at 100Hz/10,000Hz). +8dB/+4dB
- Supersonic Filter (at 24,000Hz). –12dB/oct
- Subsonic Filter (at 15,000Hz). . –12dB/oct
- Audio Muting . . . . . –15dB±1dB

## C. POWER AMPLIFIER SECTION

- Continuous Power Output . . . 60W* per channel min. RMS both channels driven at 8Ω from 20Hz to 20,000Hz with no more than 0.02% total harmonic distortion.
- Harmonic Distortion (at 1,000Hz, 8Ω load)
  30W Output per Channel. . . 0.008%
  1W Output per Channel . . . 0.01%
- Intermodulation Distortion (60Hz:7,000Hz = 4:1)
  30W Output per Channel. . . 0.02%
  1W Output per Channel . . . 0.01%
- Frequency Response (at 1W output, 8Ω load)
  +0dB, –1dB . . . . . 4Hz to 80,000Hz
  +0dB, –3dB . . . . . 2Hz to 160kHz
- Input Sensitivity/Impedance . . 1V/50kΩ
- Damping Factor (20Hz to 20,000Hz) . . . . . 50
- Hum and Noise (IHF A-network) .100dB
- Crosstalk (at 10,000Hz) . . . . . 57dB

## MISCELLANEOUS

- Power Requirement . . . . . 120V/60Hz, 220V/50Hz, 240V/50Hz or 100V, 120V, 220V or 240V/50Hz or 60Hz (switchable)
- Power Consumption . . . . . 450W

**Note:** Specifications and design are subject to change without prior notice.

* Measured pursuant to Federal Trade Commission's Trade Regulation Rule on Power Claims for Amplifiers. (Applicable to U.S. only.)

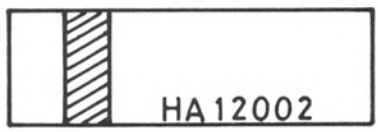
# Addendum

1. IC (HA-12002) used in the protection circuit has been changed to a new IC marked HA-12002W*. This change is applicable to all units with serial nos. NB83146 or over.
   HA-12002W is listed in the repair parts noted in this manual.
   (N.B. The new IC has the same number on the IC molding as on the old one. To distinguish them, note carefully the shape of the band printed on the molding. See Marking of IC in Fig. A.)
   As the circuit constant of the new IC is different from conventional ones, when using the new IC, be sure to remove R713 and R714 (82kΩ) on the protection circuit, replacing them with 56kΩ resistors.

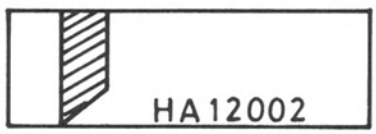
**Fig.A. Marking on IC Molding**

* Shape of band (portion in oblique lines) differs.

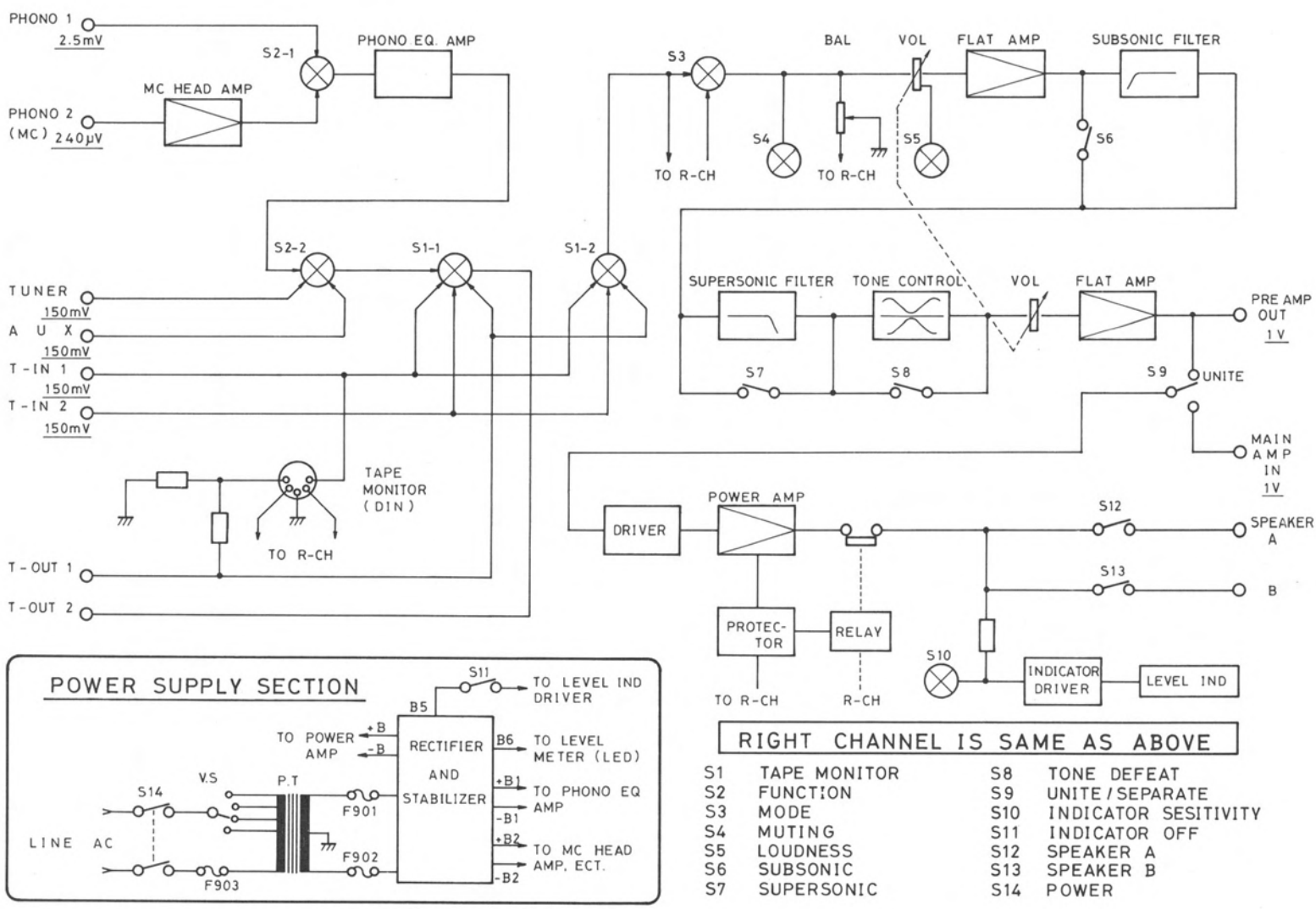
**Conventional marking**




**"W" type marking**




# Block Diagram




RIGHT CHANNEL IS SAME AS ABOVE

| | | | |
|---|---|---|---|
| S1 | TAPE MONITOR | S8 | TONE DEFEAT |
| S2 | FUNCTION | S9 | UNITE / SEPARATE |
| S3 | MODE | S10 | INDICATOR SESITIVITY |
| S4 | MUTING | S11 | INDICATOR OFF |
| S5 | LOUDNESS | S12 | SPEAKER A |
| S6 | SUBSONIC | S13 | SPEAKER B |
| S7 | SUPERSONIC | S14 | POWER |

# Repair Parts List

| Schematic Location | Part No. | Description |
|---|---|---|
| **TRANSISTORS, DIODES AND IC'S** | | |
| Q101, 102, 103, 104, 105, 106 | 302001113 | 2SK68A (M) |
| Q107, 401, 402 403, 404, 413, 414, 415, 416, 704 | 301201146 | 2SC1885 (S) or (T) |
| Q301, 302* | 302001113 | 2SK68A (M) |
| Q303, 304, 409 410, 411, 412 | 301001142 | 2SA912 (S) or (T) |
| Q305, 306, 307 308, 421, 422 | 301001145 | 2SA921 (S) or (T) |
| Q309, 310, 407, 408 | 301201171 | 2SC1980 (S) or (T) |
| Q405, 406 | 302001122 | μPA63H, Dual FET |
| Q417, 418, 701 703 | 301201165 | 2SC1913 (Q) or (R) |
| Q419, 420, 702, | 301001143 | 2SA913 (Q) or (R) |
| Q423, 424 | 301301134 | 2SD571 (K) or (L) |
| Q425, 426 | 301101124 | 2SB605 (K) or (L) |
| Q901 | 301201190 | 2SC2581 (R), (Q), (Y) |
| Q902 | 301001160 | 2SA1106 (R), (Q), (Y) |
| D401, 402 | 300313007 | BZ-210, Zener Regulator, 21V, 1W |
| D403, 404, 405, 406 | 300212008 | KB-165, Varistor |
| D407, 408, 409, 410, 704, 705 | 300111010 | 1S2472 |
| D601, 602, 603, 604 | 300313028 | WZ-050, Zener Regulator, 5V, 0.5W |
| D701, 702 | 300313009 | BZ-240, Zener Regulator, 24V, 1W |
| D703 | 300313004 | BZ-120, Zener Regulator, 12V, 1W |
| D706, 707 | 300919024 | SR1K-4, Rectifier for Protection |
| D708 | 300919032 | S-5VB-20, Rectifier |
| D901 | 300414021 | SLP-237, LED (GRN), Power Ind |
| D902 to 908 | 300414020 | SLP-137B, LED (RED), Protection and Level Ind |
| D001, 002 | 300212015 | SV-03S, Varistor |
| IC101 | 303452189 | NJM 78L-15A, Stabilizer 15V |
| IC201, 202, 301, 302 | 303452191 | HA-1457, Phono Amp, etc. |
| IC601, 602, 603, 604 | 303452188 | LB-1405S, Level Ind (LED) Driver |
| IC701 | 303452187 | HA-12002W, Protection |
| **VARIABLE RESISTORS** | | |
| VR101, 102** | 510502178 | 330B, MC Head Amp Distortion Adj |
| VR201 | 525121142 | 100KBTx2 + 20KCx2, Volume Control |
| VR301, 302 | 525101157 | 50KBx2, Bass and Treble Control |
| VR303 | 515121129 | 250KW, Balance Control |
| VR401, 402 | 510502176 | 100B, DC Balance Adj |
| VR403, 404 | 510502147 | 10KB, Idling Current Adj |
| VR405, 406 | 510502146 | 5KB, Overload Protetion Level Adj |
| VR601, 602 | 510502138 | 10KB, Level Indicator Cal |

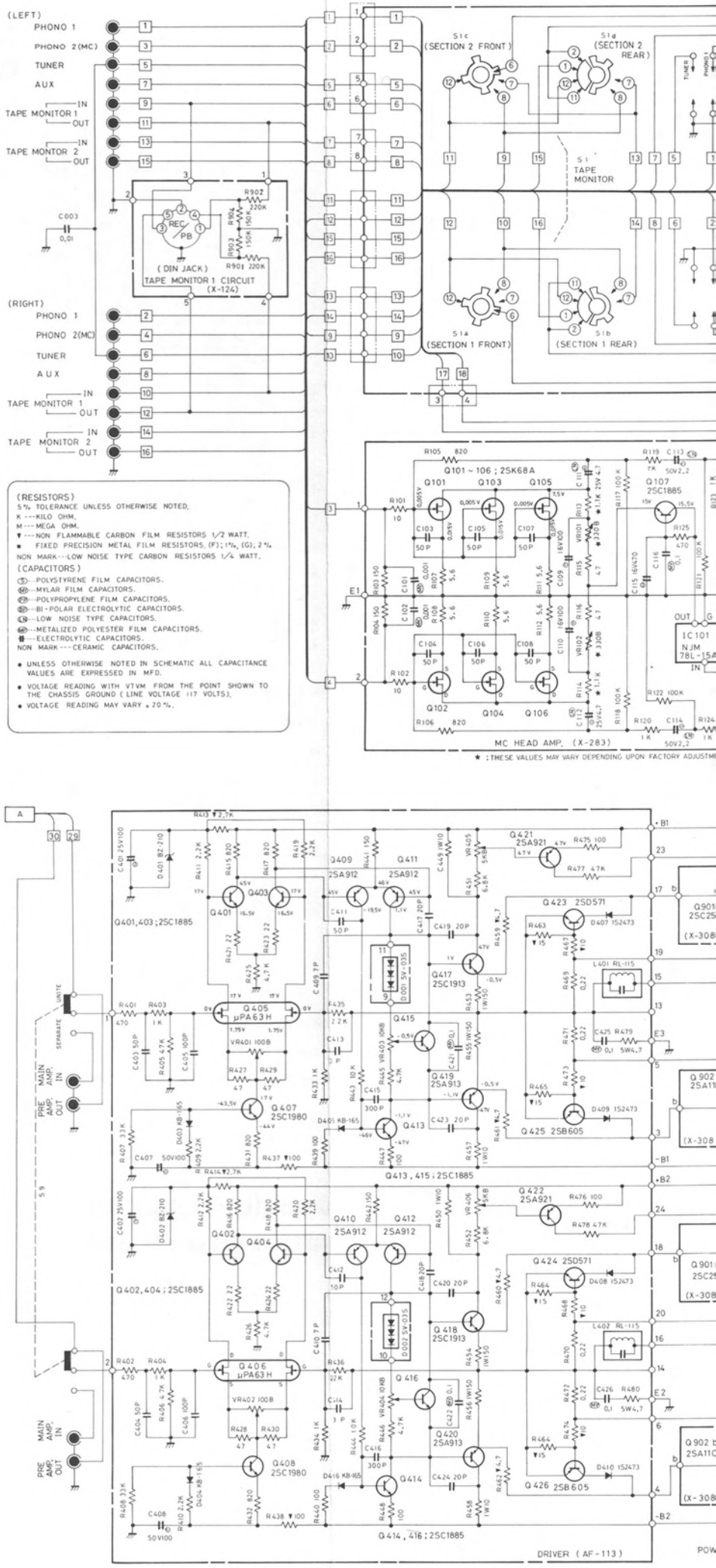
| Schematic Location | Part No. | Description |
|---|---|---|
| **SWITCHES** | | |
| S1 | 601011275 | Tape Monitor |
| S2 | 601011338 | Function Selector |
| S3 | 601011335 | Mode |
| S4, 5 | 611001268 | Muting, Loudness |
| S6, 7, 8 | 611001275 | Subsonic Filter, Supersonic, Tone Defeat |
| S9 | 613000022 | SEPARATE-UNITE |
| S10, 11 (1 set) | 614020425 | Indicator |
| S12, 13 (1 set) | 614020426 | Speaker A, B |
| S14 | 611001272 | Power |
| | 611001271 | Power (Sweden only) |
| **OTHERS** | | |
| F901, 902 | 341221700 | Fuse 7A-3AG, Secondary AC, (STD Type) |
| | 345952630 | Fuse 6.3AT (φ5.2x20mm), (European Type) |
| F903 | 341221700 | Fuse 7A-3AG, Primary AC (STD Type), 100V/120V |
| | 341221350 | Fuse 3.5A-3AG, Primary AC (STD Type), 220V/220V/240V |
| | 345952315 | Fuse, 3.15AT (φ5.2x20mm), (European Type) |
| T001 | 205001443 | Power Transformer (Multivoltage), (STD Type) |
| | 206001443 | Power Transformer (220V/240V), (European Type) |
| C004 | 470101118 | Noise Canceller, NSK-135 (STD Type) |
| | 470101126 | Noise Canceller, 0.047μF, ECQ-EC (European Type) |
| | 626110028 | Headphone Jack |
| | 624200204 | Pin Jack, 4P |
| | 648211141 | AC Outlet (not used on units for UK) |
| | 642400111 | Speaker Terminal Strip |
| | 648211121 | Voltage Selector (not used on European Type) |
| | 625001114 | DIN Socket, 5P |
| RY701 | 240111241 | Relay, Speaker |
| | 141710305 | Phono Equalizer Amp PC Board Ass'y |
| | 141710307 | Tone Control Amp PC Board Ass'y |
| | 141810844 | Level Indicator Driver PC Board Ass'y |
| | 141810828 | Level Indicator (LED) PC Board Ass'y |
| | 141810842 | Speaker Switch PC Board Ass'y |
| | 141810845 | Phono-2 (MC) Head Amp PC Board Ass'y |
| | 141810730 | DIN Socket PC Board Ass'y |
| | 141610318 | Driver PC Board Ass'y |
| | 141810843 | Power Supply PC Board Ass'y |
| | 141810837 | Fuse PC Board Ass'y (STD Type, 100V/120V) |

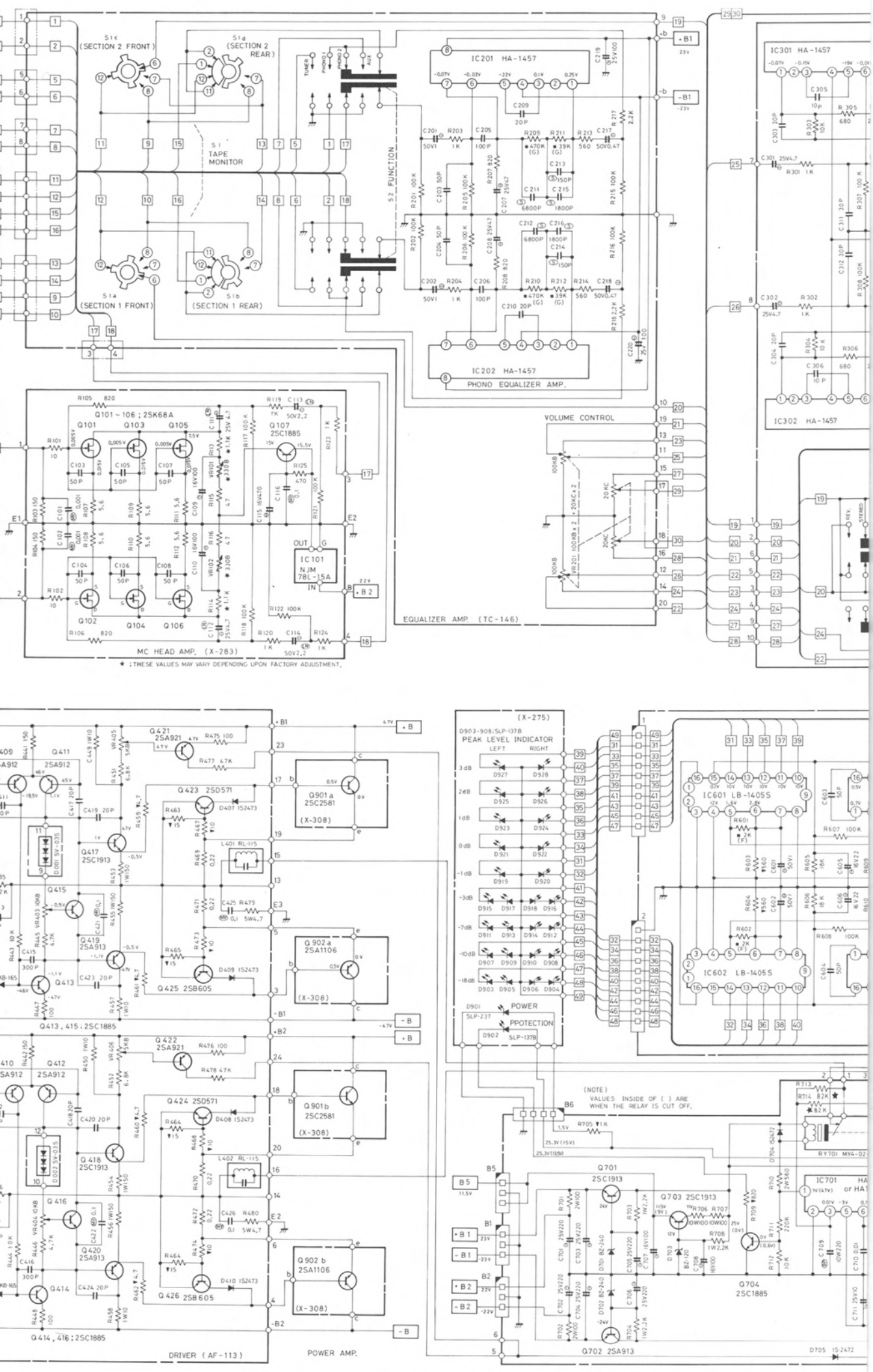
*For Q301 and 302, "2SK136(S)/302001118" can also be used. Check polarity in the schematic diagram.

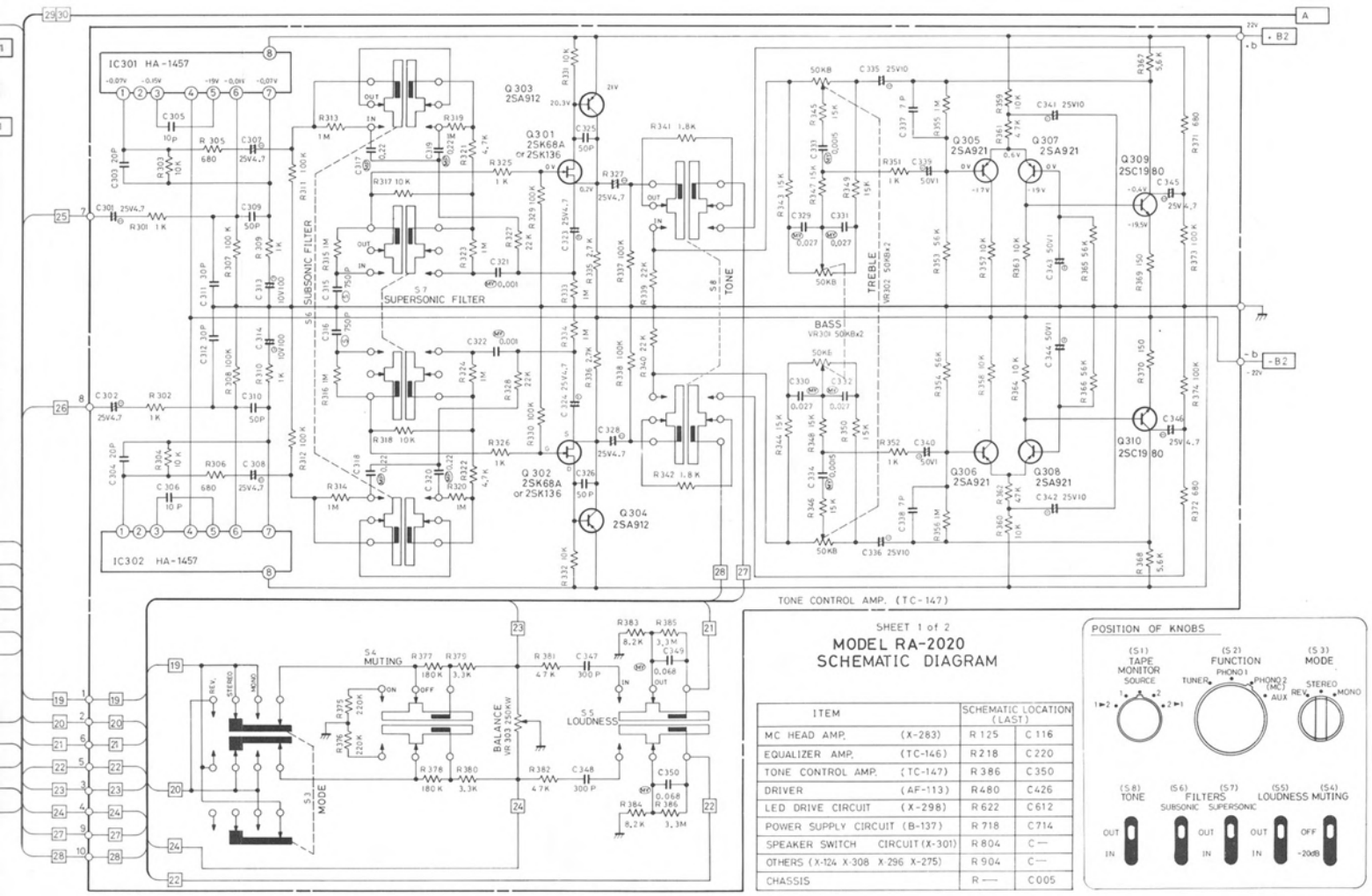
**Some units employ "1KB/510502169" depending on FET for VR101 and VR102.

| Schematic Location | Part No. | Description |
|---|---|---|
| | 141810838 | Fuse PC Board Ass'y (STD Type, 220V/240V) |
| | 141810839 | Fuse PC Board Ass'y (European Type) |
| | 141810888 | Power Amp (Upper Half Cycles) PC Board Ass'y |
| | 141810889 | Power Amp (Lower Half Cycles) PC Board Ass'y |
| | 796301115 | Line Cord (STD Type) |
| | 796301139 | Line Cord (Europe) |
| | 796301125 | Line Cord (Australia) |
| | 796301130 | Line Cord (UK) |
| | 796301121 | Line Cord (Sweden) |
| | 111911410 | Front Panel Ass'y |
| | 670101118 | Handle |
| | 116310235 | Knob, Function, Volume |
| | 116310236 | Knob, Mode, Balance |
| | 116310237 | Knob, Tape Monitor |
| | 116310238 | Knob, Bass, Treble |
| | 116310242 | Knob, Loudness, Power, etc. |
| | 116210046 | Button, Speaker, Indicator |
| | 673402018 | Foot |
| | 770911216 | Collar, Handle Mtg |
| | 770911209 | Cap Screw, 6x40mm, Handle Mtg |
| | 770911211 | Spacer for Rack Mounting |
| | 762213008 | Screw, 3x8mm, Tap-tight, Oval Countersunk |
| | 766213008 | Screw, 3x8mm, Tap-tight, (Ni) |
| | 766223008 | Screw, 3x8mm, Tap-tight, (BLZ) |
| | 765224008 | Screw, 4x8mm, Tap-tight, (BLZ) |
| | 766223012 | Screw, 3x12mm, Tap-tight, (BLZ) |
| | 766213006 | Screw, 3x6mm, Tap-tight, (Ni) |
| | 762213006 | Screw, 3x6mm, Tap-tight, (Ni), Oval Countersunk |
| | 725223008 | Screw, 3x8mm, Tapping, (BLZ), Terminal Mtg, etc. |
| | 705213004 | Screw, 3x4mm, (Ni), Binding, MC Head Amp PC Board Mtg |
| | 770911166 | Screw, 3x6mm, (BLZ), Flat Head |
| | 766213010 | Screw, 3x10mm, (Ni), Tap-tight |
| | 725213014 | Screw, 3x14mm, (Ni), Tapping, Power Transistors Mtg |
| | 725213008 | Screw, 3x8mm, (Ni), Tapping, LED PC Board Mtg |
| | 765224012 | Screw, 4x12mm, (BLZ), Tap-tight, Foot Mtg |
| | 765214008 | Screw, 4x8mm, (Ni), Tap-tight |
| | 705214008 | Screw, 4x8mm, (Ni), Binding, Power Trans Mtg |
| | 770402209 | Nut, M12, Hex Phone Jack Mtg. |
| | 770402206 | Nut, M8, Hex, Tape Monitor SW Mtg |
| | 770402205 | Nut, M7, Hex, Vol Mtg, etc. |
| | 770402201 | Nut, M3, Hex |
| | 770911144 | Nut, M3, Square, Transistor Mtg |
| | 770402210 | Nut, M5, Hex, Heat Sink Mtg |
| | 770402204 | Nut, M6, Hex, Handle Mtg |
| | 770500009 | Washer, $\phi$12 |
| | 770500007 | Washer, $\phi$8 |
| | 770500006 | Washer, $\phi$7 |
| | 770500003 | Washer, $\phi$3 |
| | 770500010 | Spring Washer, $\phi$3 |
| | 770500033 | Washer, $\phi$5 |
| | 770500029 | Spring Washer, $\phi$5 |
| | 770500044 | Washer, $\phi$4 |
| | 770500011 | Spring Washer, $\phi$4 |
| | 770500012 | Spring Washer, $\phi$6 |
| | 770911119 | GND Terminal |
| | 992001111 | Spacer, Tr Mtg, etc. |

# Schematic Diagram




S1c (SECTION 2 FRONT)
S1d (SECTION 2 REAR)
S1 TAPE MONITOR
S2 FUNCTION
S1a (SECTION 1 FRONT)
S1b (SECTION 1 REAR)
TUNER
PHONO 1
PHONO 2
AUX
IC201 HA-1457
IC202 HA-1457
PHONO EQUALIZER AMP.
IC301 HA-1457
IC302 HA-1457
VOLUME CONTROL
EQUALIZER AMP. (TC-146)
Q101 ~ 106 ; 2SK68A
Q107 2SC1885
IC101 NJM 78L-15A
MC HEAD AMP. (X-283)
★ ; THESE VALUES MAY VARY DEPENDING UPON FACTORY ADJUSTMENT.
(X-275)
D903-908;SLP-137B
PEAK LEVEL INDICATOR
LEFT
RIGHT
3dB
2dB
1dB
0dB
-1dB
-3dB
-7dB
-10dB
-18dB
D901 POWER SLP-237
PPOTECTION D902 SLP-137B
IC601 LB-1405S
IC602 LB-1405S
Q421 2SA921
Q423 2SD571
Q901a 2SC2581 (X-308)
Q902a 2SA1106 (X-308)
Q425 2SB605
Q413 , 415 : 2SC1885
Q422 2SA921
Q424 2SD571
Q901b 2SC2581 (X-308)
Q902b 2SA1106 (X-308)
Q426 2SB605
Q414 , 416 : 2SC1885
DRIVER ( AF-113 )
POWER AMP.
(NOTE) VALUES INSIDE OF ( ) ARE WHEN THE RELAY IS CUT OFF.
RY701 MY4-02
Q701 2SC1913
Q703 2SC1913
Q704 2SC1885
Q702 2SA913
D705 1S2472







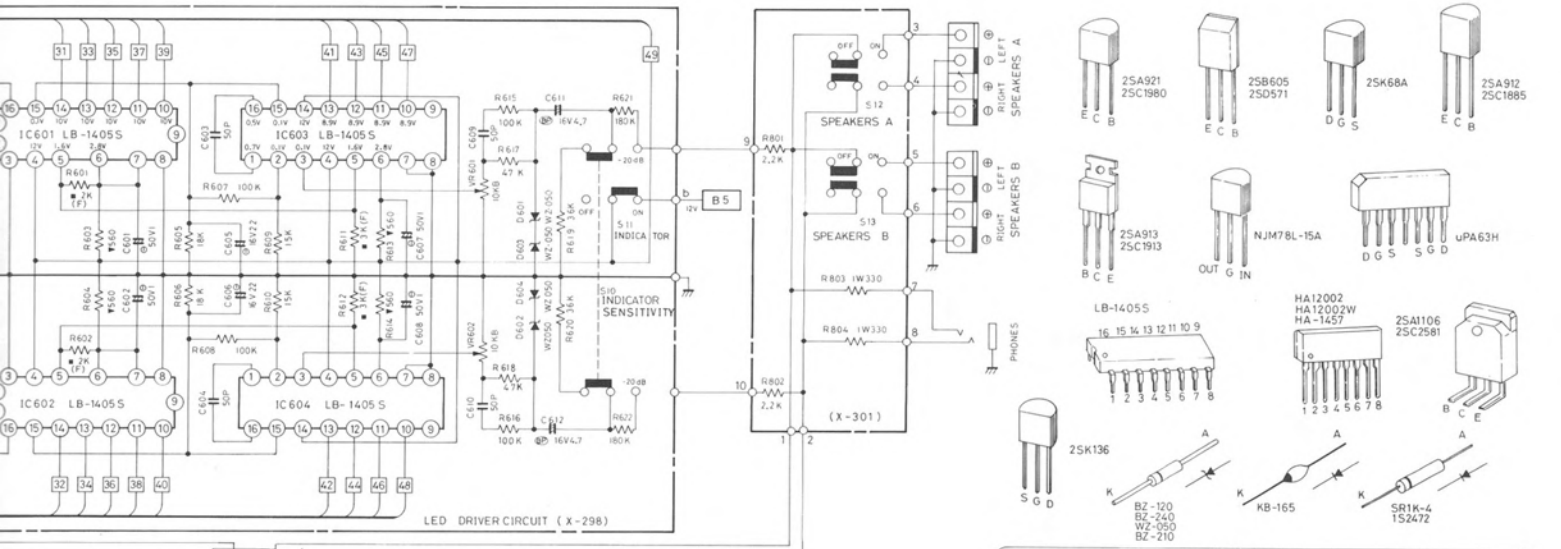
SHEET 1 of 2

# MODEL RA-2020
# SCHEMATIC DIAGRAM

| ITEM | | SCHEMATIC LOCATION (LAST) | |
|---|---|---|---|
| MC HEAD AMP. | (X-283) | R 125 | C 116 |
| EQUALIZER AMP. | (TC-146) | R 218 | C 220 |
| TONE CONTROL AMP. | (TC-147) | R 386 | C 350 |
| DRIVER | (AF-113) | R 480 | C 426 |
| LED DRIVE CIRCUIT | (X-298) | R 622 | C 612 |
| POWER SUPPLY CIRCUIT | (B-137) | R 718 | C 714 |
| SPEAKER SWITCH CIRCUIT | (X-301) | R 804 | C — |
| OTHERS (X-124 X-308 X-296 X-275) | | R 904 | C — |
| CHASSIS | | R — | C 005 |

POSITION OF KNOBS







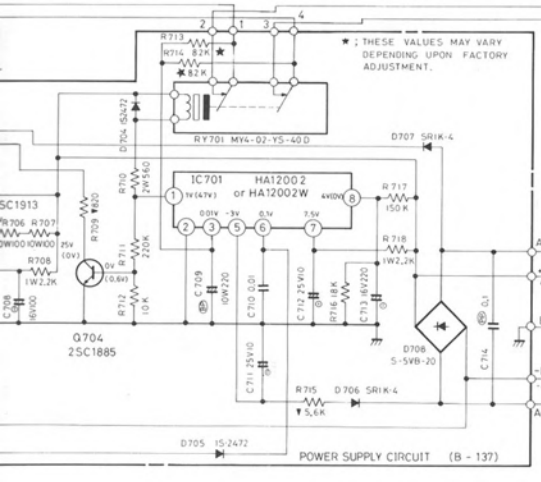
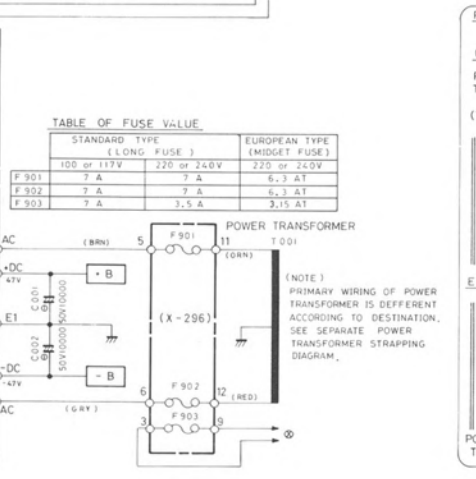
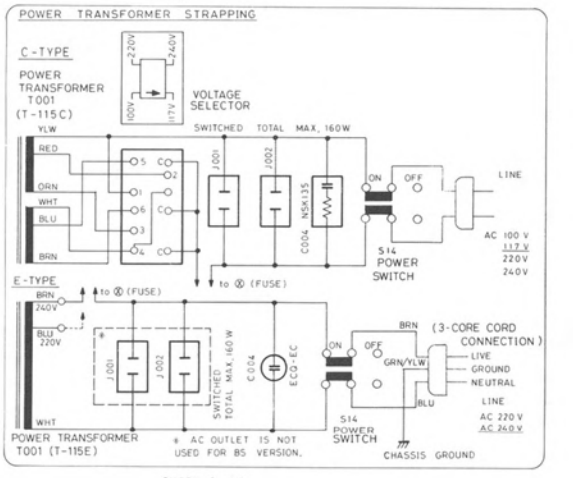



TABLE OF FUSE VALUE

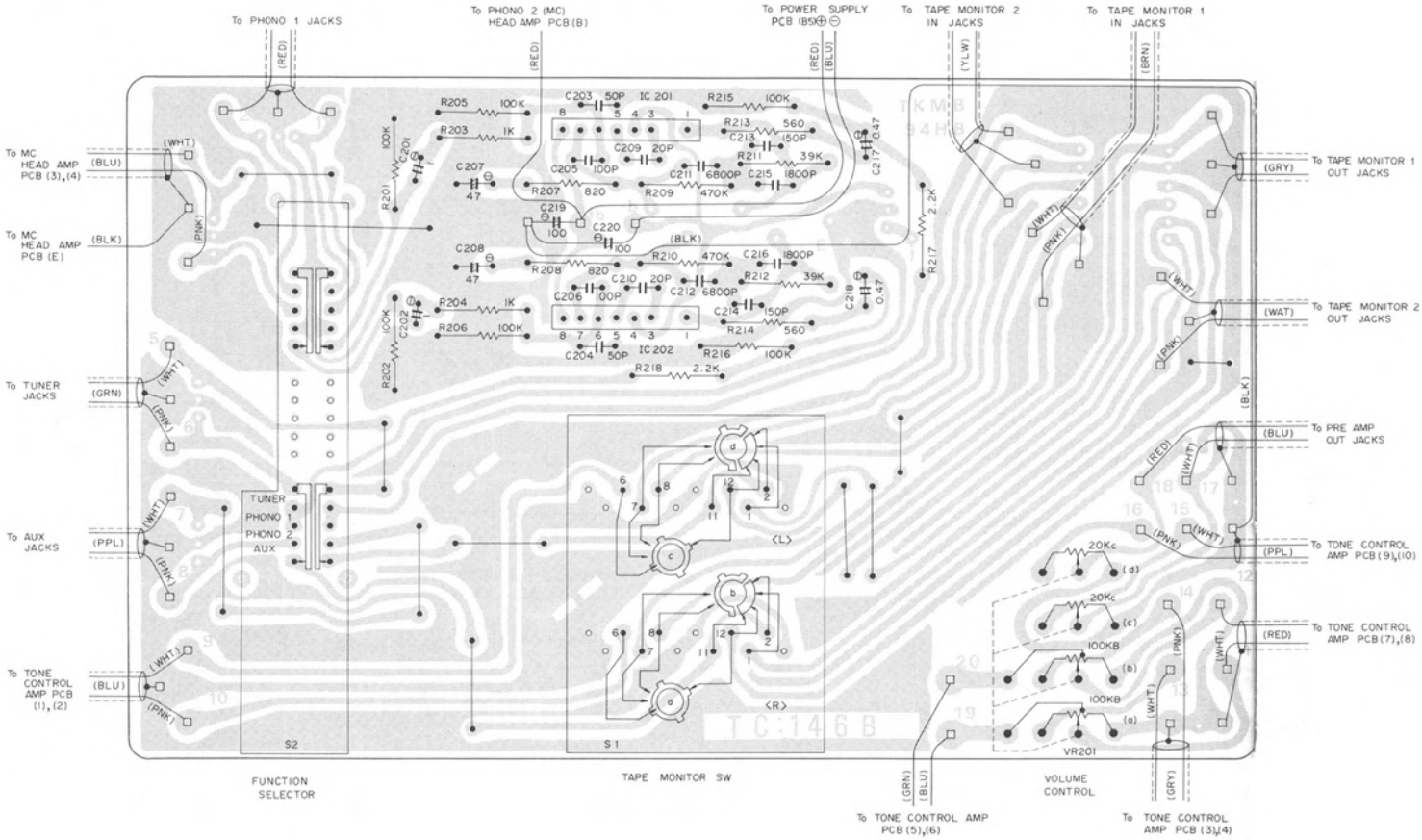
| | STANDARD TYPE (LONG FUSE) | | EUROPEAN TYPE (MIDGET FUSE) |
|---|---|---|---|
| | 100 or 117V | 220 or 240V | 220 or 240V |
| F 901 | 7 A | 7 A | 6.3 AT |
| F 902 | 7 A | 7 A | 6.3 AT |
| F 903 | 7 A | 3.5 A | 3.15 AT |



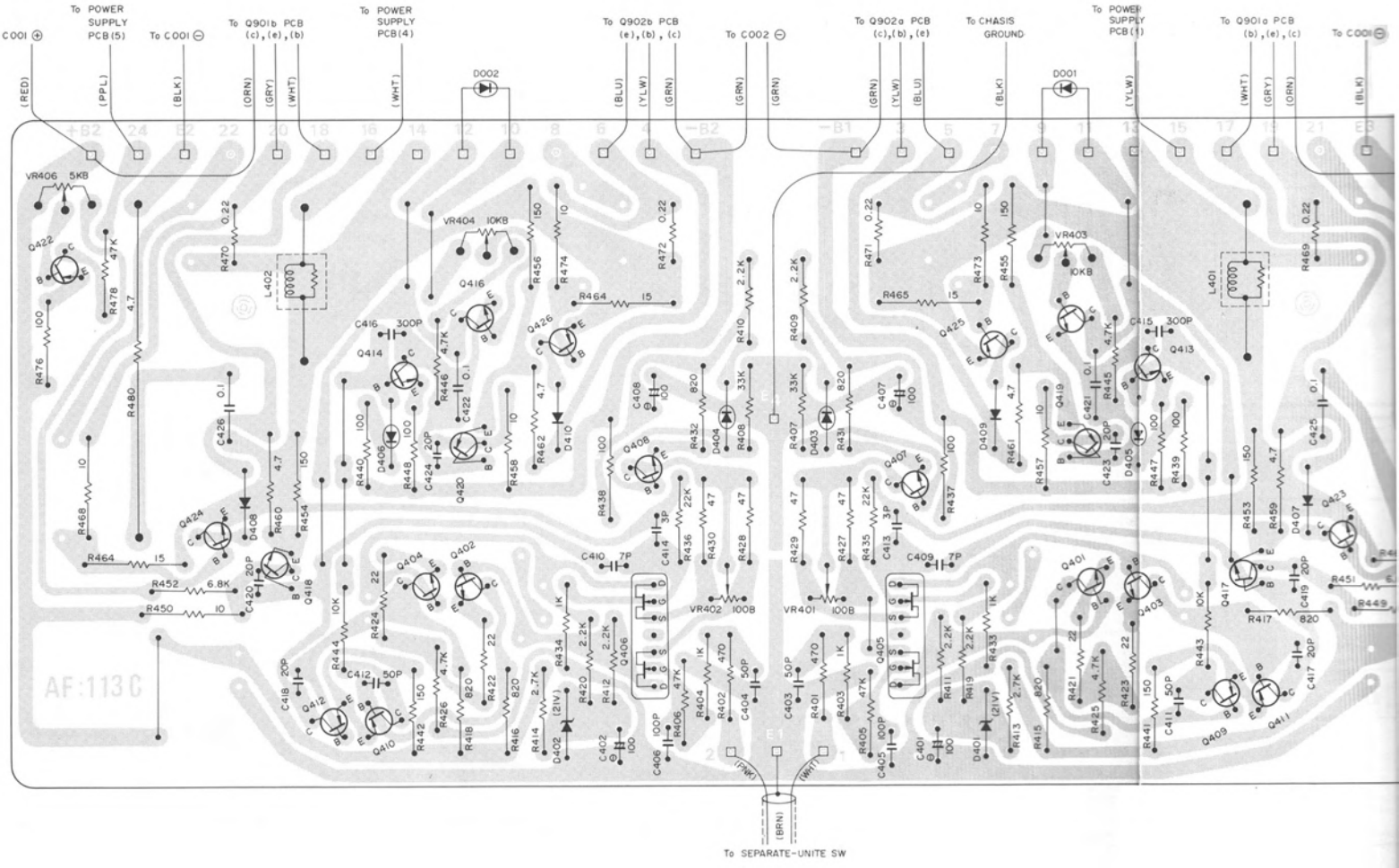



# PC BOARD DIAGRAMS

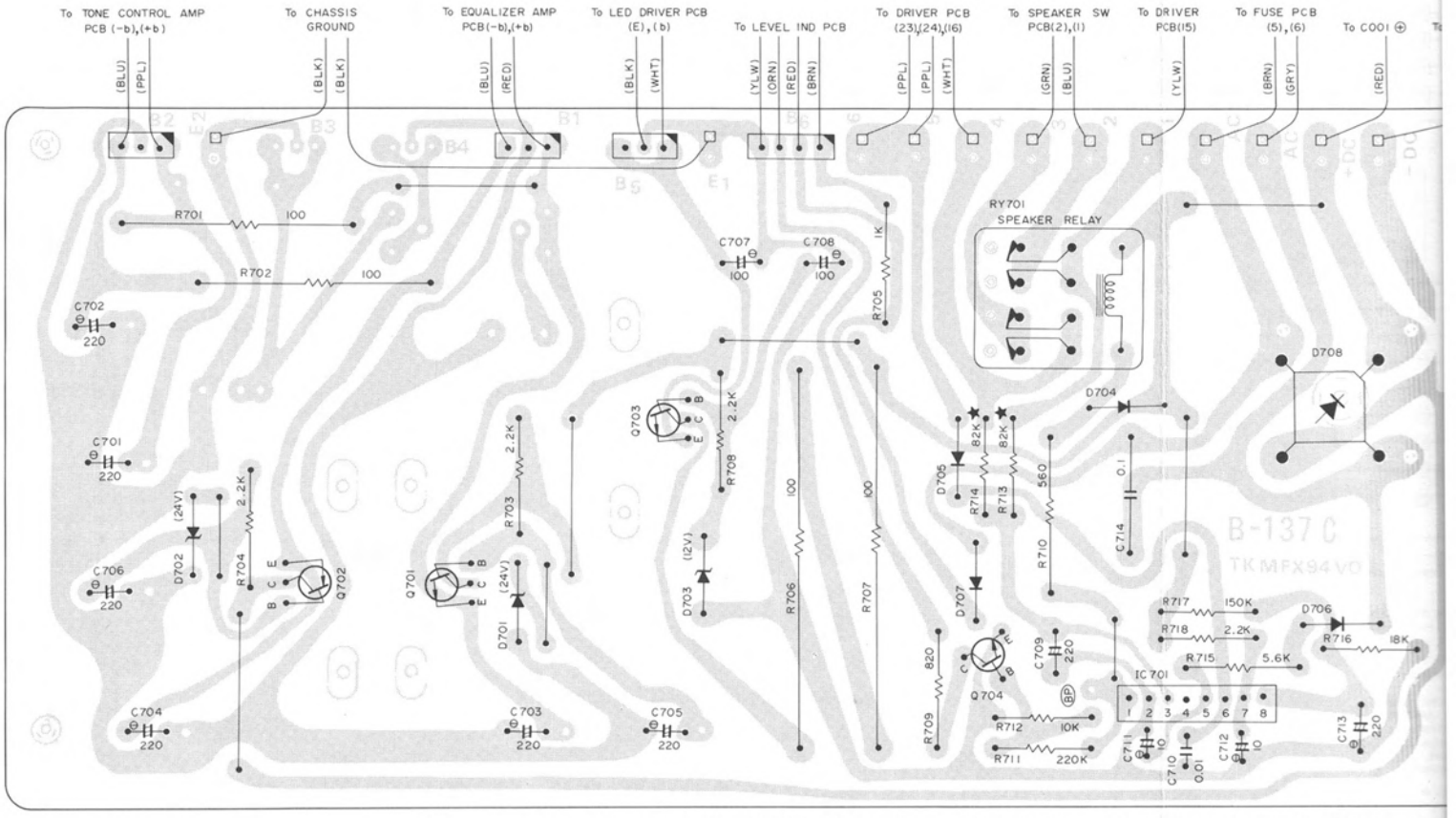
## Phono Equalizer Amp and Function Selector Circuit




## Driver Circuit

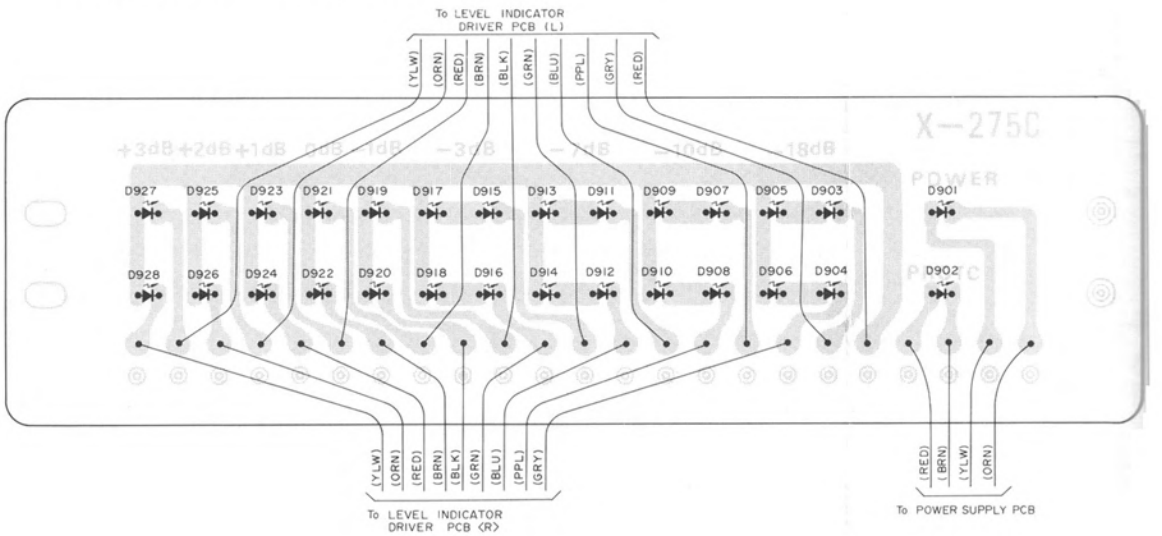


## Power Supply and Protection Circuit

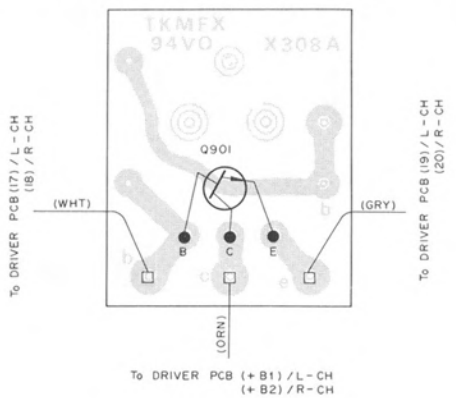



*These values must be changed to 5.6kΩ when using HA-12002W instead of HA-12002 for IC701 (see Add

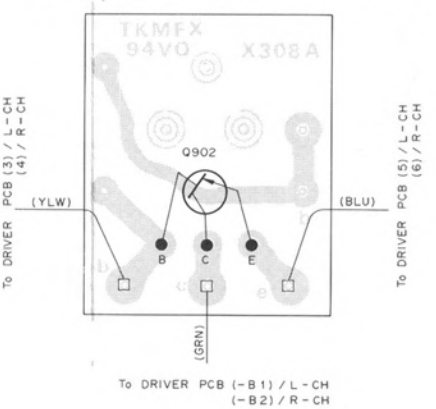
## Peak Level Indicator Circuit



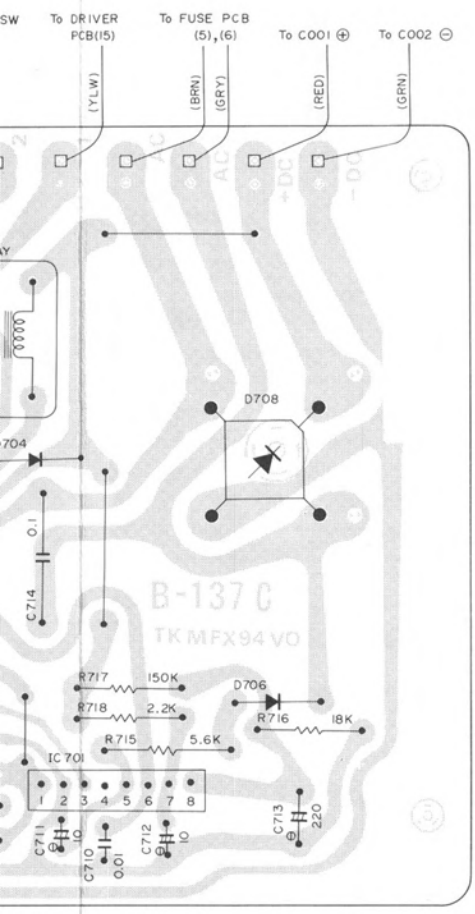

## Power Amp Circuit (Upper Half Cycles)

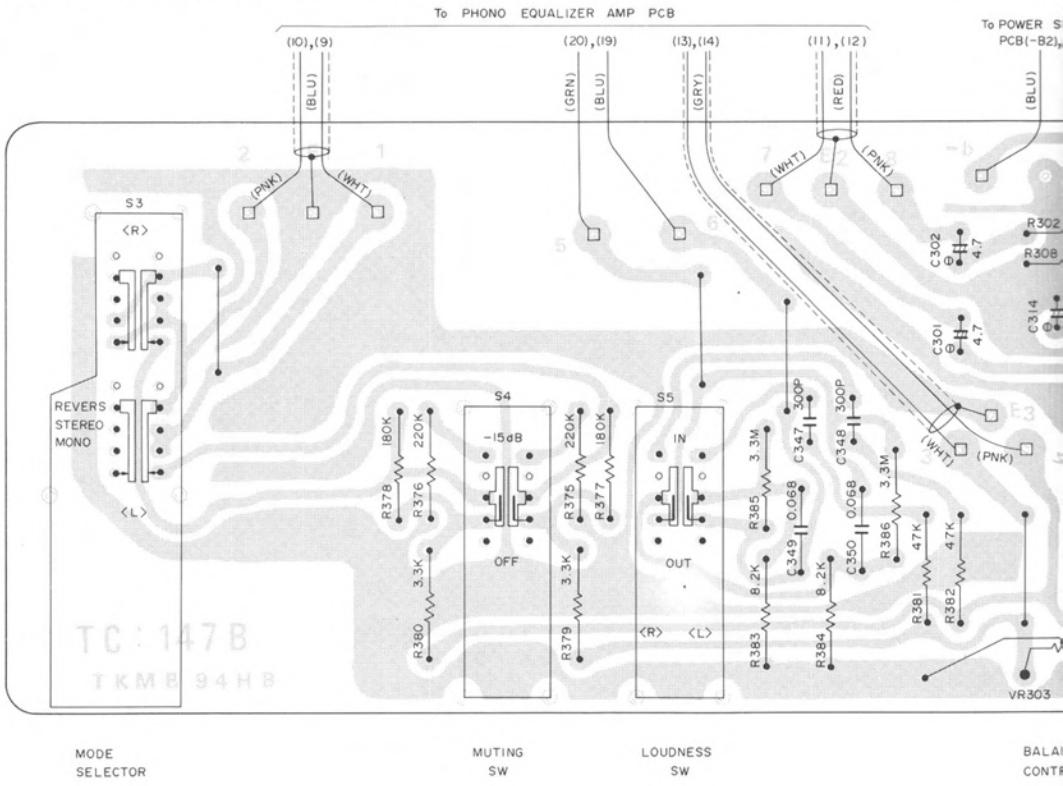



## Power Amp Circuit (Lower Half Cycles)



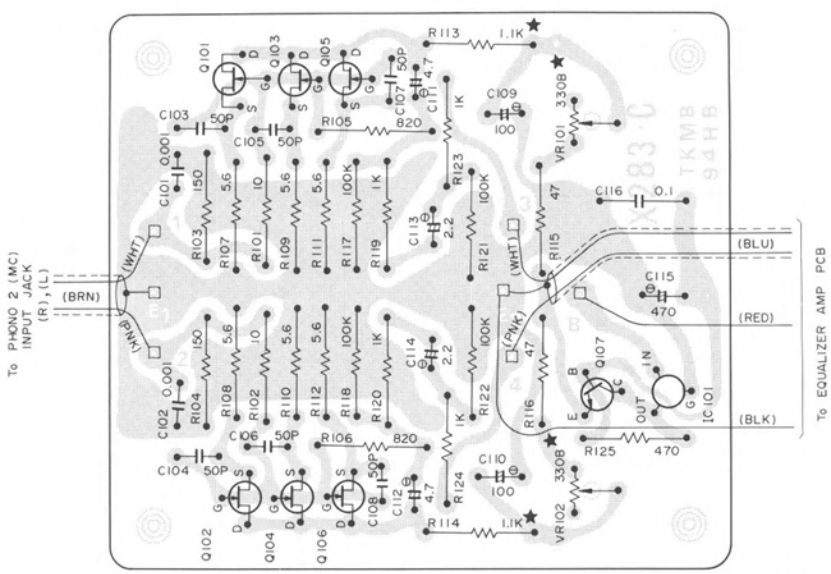
## Tone Control Amp Circuit



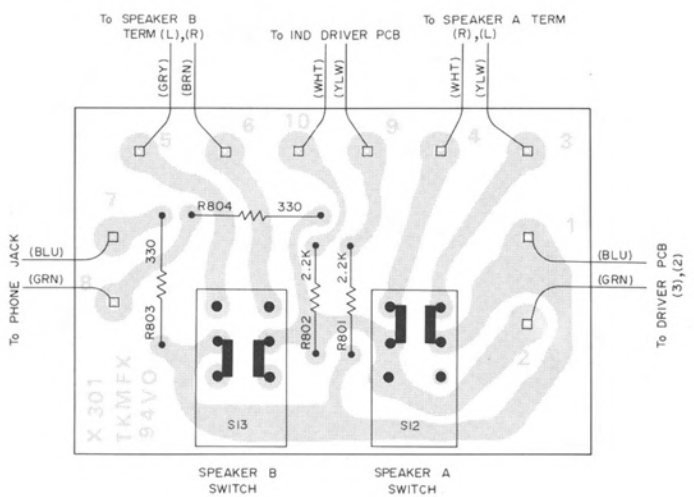

tead of HA-12002 for IC701 (see Addendum).

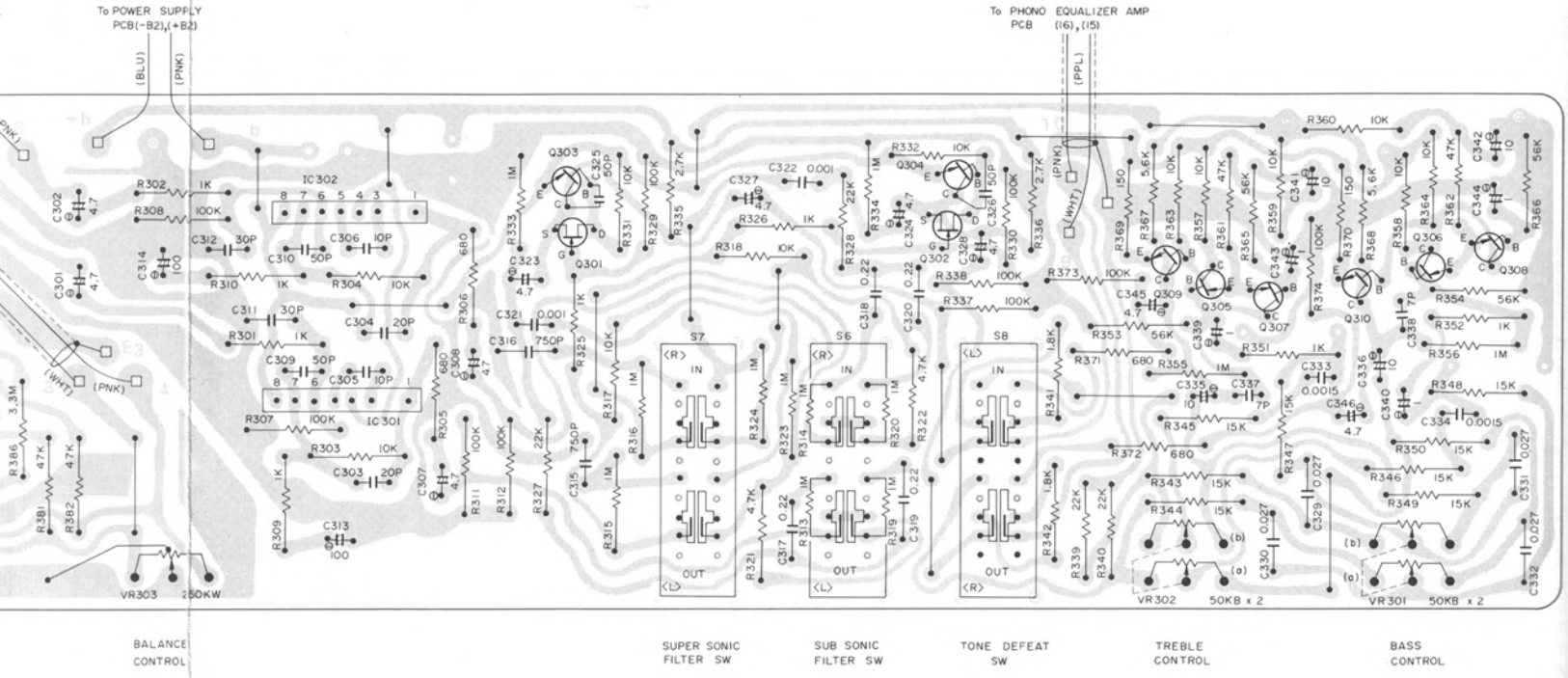
## Phono-2 (MC) Head Amp Circuit



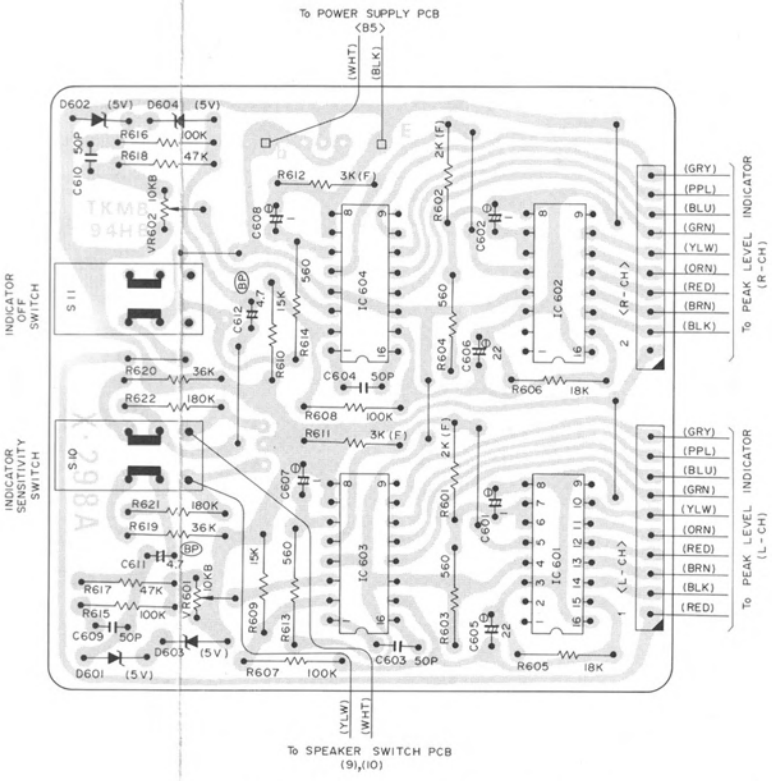

*These values may vary according to factory adjustment.

## Speaker Switch Circuit

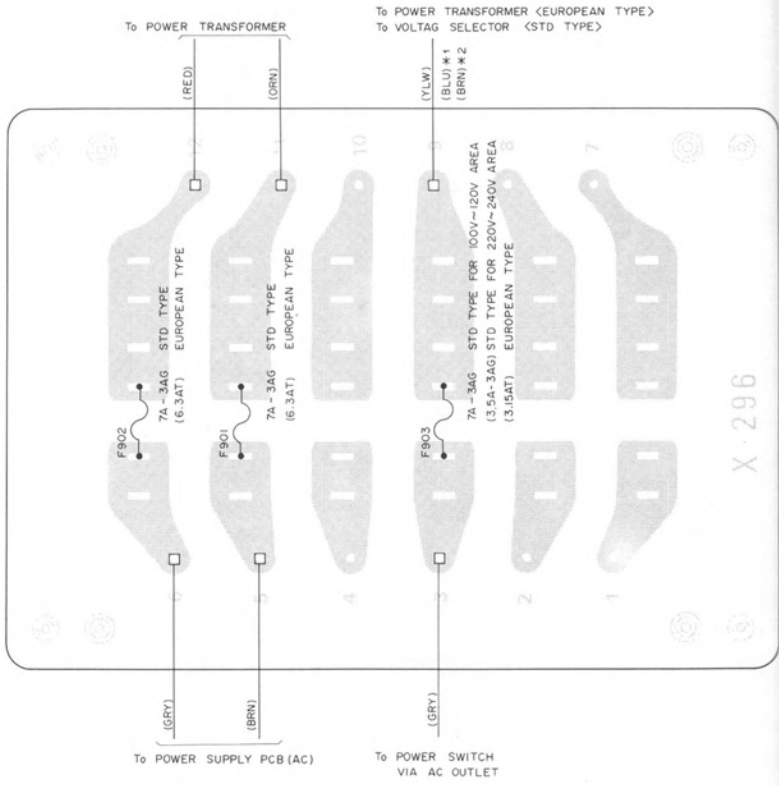





## Level Indicator (LED) Driver Circuit




## Fuse Circuit




*1 European type (220V setting
*2 European type (240V setting

## Tape Monitor-1 (DIN) Circuit