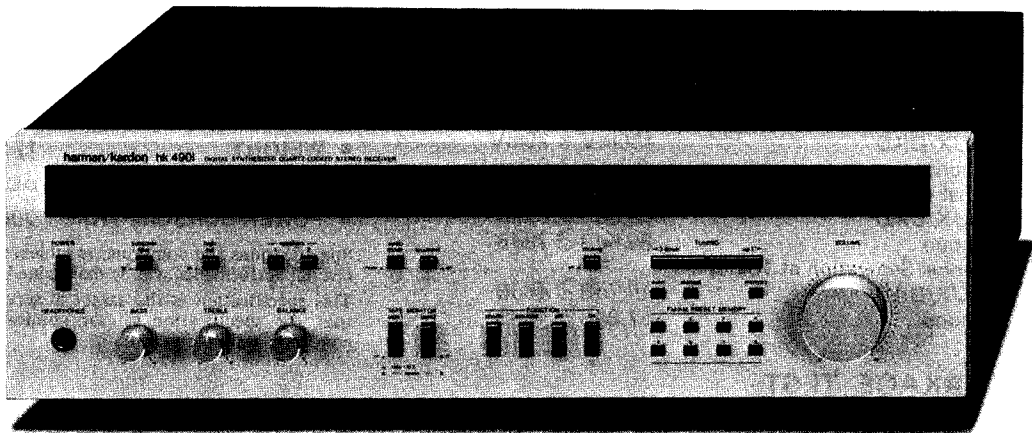


The Harman Kardon Model hk490i

Manual No. 58A

DIGITAL SYNTHESIZED QUARTZ-LOCKED STEREO RECEIVER

Technical Manual



hk490i

harman/kardon
240 CROSSWAYS PARK WEST, WOODBURY, N.Y. 11797
1112-H15258A5 P-08834 1650 PRINTED IN JAPAN

SPECIFICATIONS

• FM SECTION

| | Nominal | Limit |
|--|-----------------|-----------|
| Tuning Range | 87.5 ~ 108.0MHz | |
| 50dB Quieting Sensitivity | | |
| Mono | 15.2dBf | ≤ 17dBf |
| Stereo | 36.2dBf | ≤ 38dBf |
| Usable Sensitivity | 10.5dBf | ≤ 12.5dBf |
| Image Ratio | 79.4dB | ≥ 60dB |
| IF Rejection | 76dB | ≥ 70dB |
| Spurious Response Rejection | 97.8dB | ≥ 80dB |
| Capture Ratio | 1.5dB | ≤ 2.5dB |
| Alternate Channel Selectivity | 73.3dB | ≥ 50dB |
| AM Rejection | 52.4dB | ≥ 45dB |
| Signal to Noise Ratio | | |
| Mono | 82.5dB | ≥ 78dB |
| Stereo | 74.5dB | ≥ 72dB |
| Total Harmonic Distortion (65dBf 1kHz Input) | | |
| Mono | 0.08% | ≤ 0.2% |
| Stereo | 0.1% | ≤ 0.3% |
| Stereo Separation at 1kHz | 53.5dB | ≥ 45dB |

• AM SECTION

| | | |
|-----------------------|----------------|--------|
| Tuning Range | 520 ~ 1,710kHz | |
| Usable Sensitivity | 17μV | |
| Selectivity | 31.3dB | ≥ 22dB |
| Signal to Noise Ratio | 53dB | ≥ 50dB |
| Image Rejection | 33dB | ≥ 28dB |
| IF Rejection | 61dB | ≥ 50dB |

• AUDIO SECTION

| | | |
|-----------------------------|--------|---------|
| Usable Sensitivity | | |
| AUX/DAD | 135mV | ± 25mV |
| Phono | 2.2mV | ± 0.2mV |
| Signal to Noise Ratio | | |
| AUX/DAD | 83.8dB | ≥ 82dB |
| Phono | 80.5dB | ≥ 78dB |
| Channel Separation at 10kHz | | |
| AUX/DAD | 49.7dB | ≥ 45dB |
| Phono | 52.0dB | ≥ 45dB |

| | Nominal | Limit |
|--|--------------|-----------------|
| IM Distortion Ratio | 0.1% ≤ 0.25% | |
| RMS Output Power | | |
| 8Ω, 1kHz, THD 0.09% | 36W | ≥ 30W |
| 4Ω, 1kHz, THD 0.2% | 49.6W | ≥ 40W |
| Damping Factor at 1kHz | 65 | ≥ 45 |
| Tone Control Characteristics | | |
| Bass at 50Hz | | |
| Boost | 10dB | ± 2dB |
| Cut | -10dB | ± 2dB |
| Treble at 10kHz | | |
| Boost | 10dB | ± 2dB |
| Cut | -10dB | ± 2dB |
| Loudness Control | | |
| at 10kHz | 3dB | ± 1dB |
| at 50Hz | 10dB | ± 3dB |
| Subsonic Control | | |
| at 15Hz | 3dB | ± 1dB |
| High Cut Control | | |
| at 6kHz | 3dB | ± 1dB |
| DC Output Voltage | | |
| L channel | 0mV | ± 60mV |
| R channel | 0mV | ± 60mV |
| RIAA Equalization at Tape Out (20Hz/20kHz) | 0.4dB | +1.0dB / -0.5dB |

• DIMENSIONS (W x H x D) 17-3/8" x 5-1/4" x 14-3/8"
(443 x 134 x 365 mm)

• WEIGHT 17 lbs. 10 oz. (8.0 kg)

• POWER SUPPLY AC120V, 60Hz

• POWER CONSUMPTION 200W (220VA)

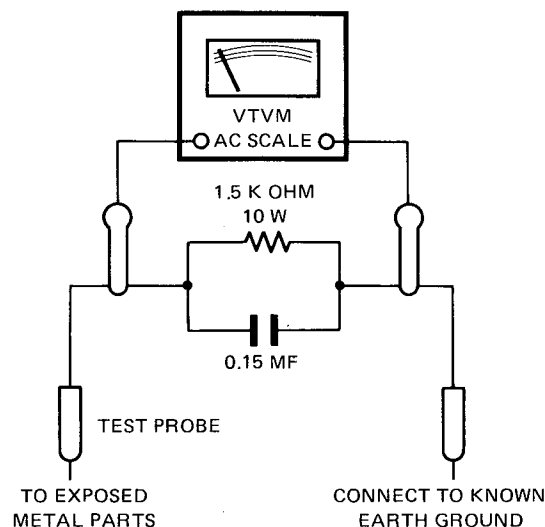
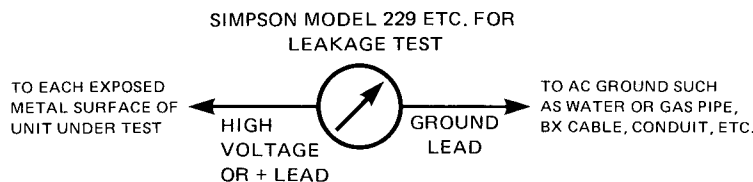
Specifications and components subject to change without notice. Overall performance will be maintained or improved.

This specification is the target of servicing. But, there is a case that the specification is not applicable to the measurement condition and instrument.

LEAKAGE TEST

Before returning the unit to the user, perform the following safety checks:

- Inspect all lead dress to make certain that leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the unit.
- Replace all protective devices such as nonmetallic control knobs, insulating fishpapers, cabinet backs, adjustment and compartment covers or shields, isolation resistor/capacitor networks, mechanical insulators, etc.
- Be sure that no shock hazard exists; check for leakage current using Simpson Model 229 Leakage Tester, standard equipment item No. 21641, RCA Model WT540A or use alternate method as follows: Plug the AC line cord directly into a 120-volt AC receptacle (do not use an Isolation Transformer for this test). Using two clip leads, connect a 1500 ohm, 10-watt resistor paralleled by a 0.15mf capacitor, in series with all exposed metal cabinet parts and a known earth ground, such as a water pipe or conduit. Use a VTVM or VOM with 1000 ohms per volt, or higher, sensitivity to measure the AC voltage drop across the resistor. (See Diagram.) Move the resistor connection to each exposed metal part having a return path to the chassis (antenna, metal, cabinet, screw heads, knobs and control shafts, escutcheon, etc.) and measure the AC voltage drop across the resistor. (This test should be performed with the power switch in both the On and Off positions.) A reading of 0.35 volt RMS or more is excessive and indicates a potential shock hazard which must be corrected before returning the unit to the owner.



ALIGNMENT PROCEDURES

■ AMPLIFIER SECTION

● DC balance and idling adjustments

- Conditions:
- Set the function switch to aux/DAD.
 - Set the volume to minimum.
 - Set the speaker system switches 1 and 2 to OFF.
 - Make the adjustment at a room temperature of 25°C.

| Step | Item | Connections required | Adjustment location | Correct value |
|------|---|---|---------------------|---------------|
| 1 | DC balance adjustment | Connect the digital voltmeter between TP1 and ground. | VR403 (L channel) | 0 ± 30mV |
| 2 | | Connect the digital voltmeter between TP2 and ground. | VR404 (R channel) | 0 ± 30mV |
| 3 | Idling adjustment | Connect the digital voltmeter to TP3 and TP4. | VR401 (L channel) | 33mV |
| 4 | | Connect the digital voltmeter to TP5 and TP6. | VR402 (R channel) | 33mV |
| 5 | Repeat steps 1 through 4 after aging for 5 minutes. | | | |

■ TUNER SECTION

1. STANDARD FREQUENCY CHECK

- Condition: ● Set the function switch to FM.

| Step | Connections required | Measurement frequency | Station display | Adjustment location | Adjustment method |
|------|--|-----------------------|-----------------|---------------------|-------------------|
| 1 | ● Connect the frequency counter to TP7 (+) and ground (-). | | 98.3 MHz | | 109MHz ± 2kHz |

2. AM ALIGNMENT

- Conditions:
- Set the function switch to AM.
 - Set the muting switch to off (—).

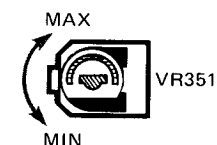
| Step | Item | Connections required | Measurement frequency | Station display | Adjustment location | Adjustment method |
|------|----------------------------|---|-----------------------|-----------------|---------------------|--|
| 1 | Tuning voltage adjustment | ● Connect the DC voltmeter to TP11 (+) and ground (-). | | 520kHz | L252 | 1.5V ± 0.05V |
| 2 | | | | 1710kHz | TC252 | 23V ± 0.5V |
| 3 | IF adjustment | ● Radiate output of AM signal generator (400Hz 30% modulation) to AM loop antenna. ● Connect oscilloscope to TP8 (+) and ground (-). | 450kHz | 1600kHz | T251 T252 | Adjust so that peak and good waveform. |
| 4 | Tracking adjustment | ● Radiate output of AM signal generator (400Hz 30% modulation) to AM loop antenna. ● Connect oscilloscope and AC voltmeter to TAPE 1 OUT terminal. | 600kHz | 600kHz | L251 | Maximize the output level. |
| 5 | | | 1400kHz | 1400kHz | TC251 | |
| 6 | | | Repeat steps 4 and 5. | | | |
| 7 | Tuned indicator adjustment | ● Radiate output of AM signal generator (400Hz 30% modulation) to AM loop antenna. | 1000kHz | 1000kHz | VR251 | Adjust so that the tuned indicator lights at 54dB input. |

3. FM ALIGNMENT

- Conditions:
- Set the function switch to FM.
 - Set the muting switch to off (—).

| Step | Item | Connections required | Measurement frequency | Station display | Adjustment location | Adjustment method |
|------|-----------------------------|---|------------------------|-----------------|---------------------|---|
| 1 | Discriminator adjustment | ● Connect the FM signal generator (1kHz 100% modulation) to FM 300Ω BAL ANT terminals through the 300Ω balanced dummy. ● Connect the oscilloscope and distortion meter to TAPE 1 OUT terminals. | 98.14MHz | 98.1MHz | T201 (A) | Adjust so that the waveforms in steps 1 and 2 become the same level. At this time tuned indicator lights. |
| 2 | | | 98.06MHz | 98.1MHz | T201 (A) | |
| 3 | | | 98.1MHz | 98.1MHz | T201 (B) | Adjust so that the distortion become minimum. |
| 4 | Repeat steps 1 through 3. | | | | | |
| 5 | Tuned indicator adjustment | ● Same as above. | | | VR202 | Adjust so that the tuned indicator lights at 10μV input. |
| 6 | Signal indicator adjustment | ● Connect the DC voltmeter to TP9 (+) and ground (-). | | | VR201 | Adjust so that the DC voltage becomes 12V at 1mV input. And then, confirm the five signal indicator lights. |
| 7 | MPX adjustment | ● Connect the stereo modulator (L + R = 45.5%, L - R = 45.5%, 19kHz = 9%) to FM signal generator. ● Apply signal generator output to FM 300Ω BAL ANT terminals through the 300Ω balanced dummy. ● Connect the frequency counter to TP10 (+) and ground (-). ● Connect the oscilloscope and AC voltmeter to TAPE 1 OUT terminals. | 98.1MHz (unmodulation) | 98.1MHz | VR303 | 75.95kHz ± 0.05kHz |
| 8 | | | 98.1MHz | 98.1MHz | VR351 (MAX) | Confirm the stereo indicator lights at 30μV ± 3dB input. |
| 9 | | | 98.1MHz | 98.1MHz | VR301 | Set the stereo modulator to 19kHz only. Adjust so that L and R output level becomes minimum. |
| 10 | | | 98.1MHz | 98.1MHz | VR302 | Adjust so that the right channel output becomes minimum when only the left channel of the stereo modulator modulated and so that the left channel output becomes minimum when only the right channel modulated. |

NOTE) Adjustment of step 8 should be done after setting the VR351 in the position as shown in the figure.



ALIGNMENT PROCEDURES

■ AMPLIFIER SECTION

● DC balance and idling adjustments

- Conditions:
- Set the function switch to aux/DAD.
 - Set the volume to minimum.
 - Set the speaker system switches 1 and 2 to OFF.
 - Make the adjustment at a room temperature of 25°C.

| Step | Item | Connections required | Adjustment location | Correct value |
|------|---|---|---------------------|---------------|
| 1 | DC balance adjustment | Connect the digital voltmeter between TP1 and ground. | VR403 (L channel) | 0 ± 30mV |
| 2 | | Connect the digital voltmeter between TP2 and ground. | VR404 (R channel) | 0 ± 30mV |
| 3 | Idling adjustment | Connect the digital voltmeter to TP3 and TP4. | VR401 (L channel) | 33mV |
| 4 | | Connect the digital voltmeter to TP5 and TP6. | VR402 (R channel) | 33mV |
| 5 | Repeat steps 1 through 4 after aging for 5 minutes. | | | |


■ TUNER SECTION

1. STANDARD FREQUENCY CHECK

- Condition: ● Set the function switch to FM.

| Step | Connections required | Measurement frequency | Station display | Adjustment location | Adjustment method |
|------|--|-----------------------|-----------------|---------------------|-------------------|
| 1 | ● Connect the frequency counter to TP7 (+) and ground (-). | | 98.3 MHz | | 109MHz ± 2kHz |

2. AM ALIGNMENT

- Conditions:
- Set the function switch to AM.
 - Set the muting switch to off ().

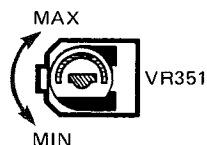
| Step | Item | Connections required | Measurement frequency | Station display | Adjustment location | Adjustment method |
|------|----------------------------|---|-----------------------|-----------------|---------------------|--|
| 1 | Tuning voltage adjustment | ● Connect the DC voltmeter to TP11 (+) and ground (-). | | 520kHz | L252 | 1.5V ± 0.05V |
| 2 | | | | 1710kHz | TC252 | 23V ± 0.5V |
| 3 | IF adjustment | ● Radiate output of AM signal generator (400Hz 30% modulation) to AM loop antenna. ● Connect oscilloscope to TP8 (+) and ground (-). | 450kHz | 1600kHz | T251 T252 | Adjust so that peak and good waveform. |
| 4 | Tracking adjustment | ● Radiate output of AM signal generator (400Hz 30% modulation) to AM loop antenna. ● Connect oscilloscope and AC voltmeter to TAPE 1 OUT terminal. | 600kHz | 600kHz | L251 | Maximize the output level. |
| 5 | | | 1400kHz | 1400kHz | TC251 | |
| 6 | | | Repeat steps 4 and 5. | | | |
| 7 | Tuned indicator adjustment | ● Radiate output of AM signal generator (400Hz 30% modulation) to AM loop antenna. | 1000kHz | 1000kHz | VR251 | Adjust so that the tuned indicator lights at 54dB input. |

3. FM ALIGNMENT

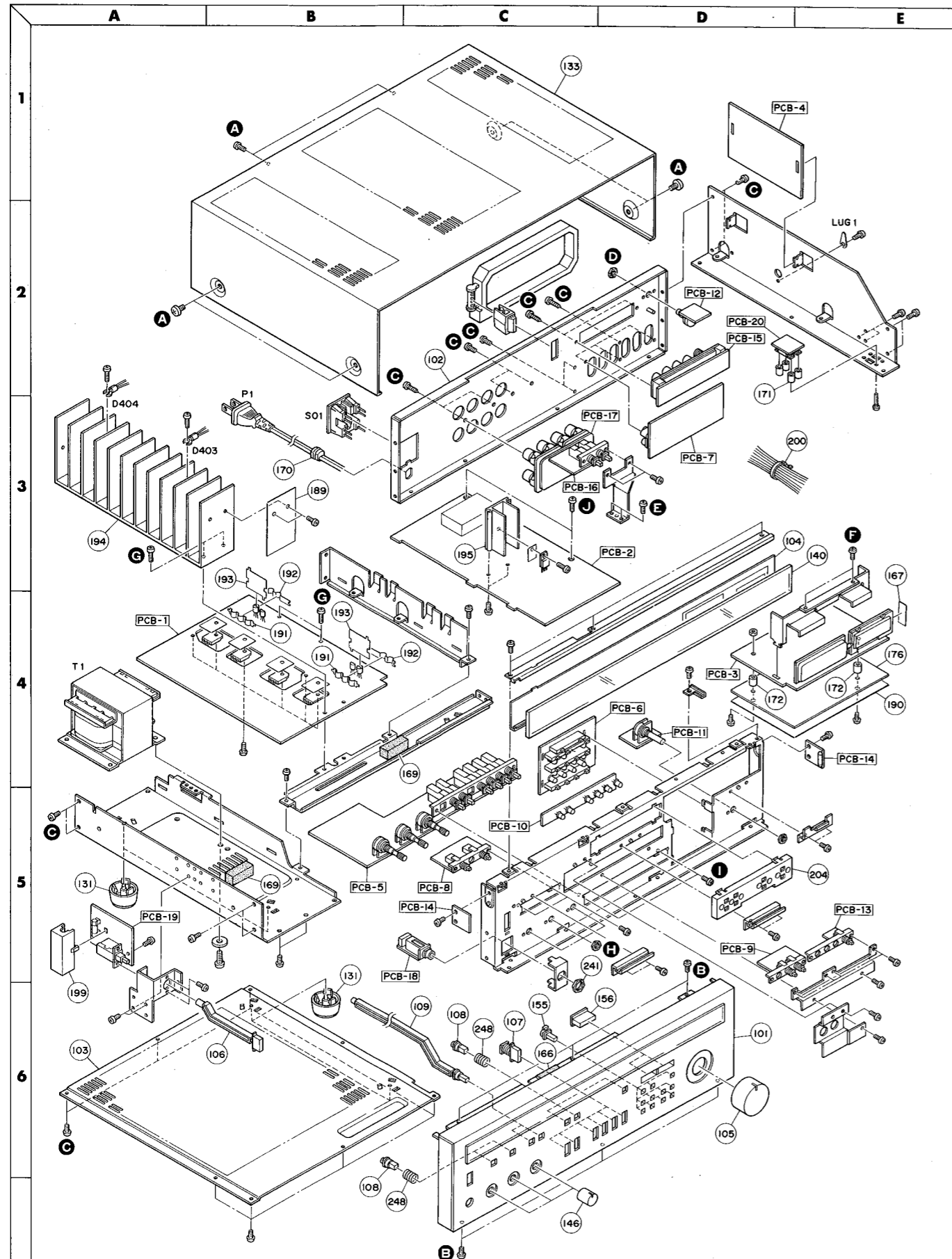
- Conditions: • Set the function switch to FM.
• Set the muting switch to off (—).

| Step | Item | Connections required | Measurement frequency | Station display | Adjustment location | Adjustment method |
|------|-----------------------------|---|------------------------|-----------------|---------------------|---|
| 1 | Discriminator adjustment | <ul style="list-style-type: none"> Connect the FM signal generator (1kHz 100% modulation) to FM 300Ω BAL ANT terminals through the 300Ω balanced dummy. Connect the oscilloscope and distortion meter to TAPE 1 OUT terminals. | 98.14MHz | 98.1MHz | T201 (A) | Adjust so that the waveforms in steps 1 and 2 become the same level. At this time tuned indicator lights. |
| 2 | | | 98.06MHz | 98.1MHz | T201 (A) | |
| 3 | | | 98.1MHz | 98.1MHz | T201 (B) | Adjust so that the distortion become minimum. |
| 4 | Repeat steps 1 through 3. | | | | | |
| 5 | Tuned indicator adjustment | <ul style="list-style-type: none"> Same as above. Connect the DC voltmeter to TP9 (+) and ground (—). | | | VR202 | Adjust so that the tuned indicator lights at 10μV input. |
| 6 | Signal indicator adjustment | | | | VR201 | Adjust so that the DC voltage becomes 12V at 1mV input. And then, confirm the five signal indicator lights. |
| 7 | MPX adjustment | <ul style="list-style-type: none"> Connect the stereo modulator (L + R = 45.5%, L - R = 45.5%, 19kHz = 9%) to FM signal generator. Apply signal generator output to FM 300Ω BAL ANT terminals through the 300Ω balanced dummy. Connect the frequency counter to TP10 (+) and ground (—). Connect the oscilloscope and AC voltmeter to TAPE 1 OUT terminals. | 98.1MHz (unmodulation) | 98.1MHz | VR303 | 75.95kHz ± 0.05kHz |
| 8 | | | 98.1MHz | 98.1MHz | VR351 (MAX) | Confirm the stereo indicator lights at 30μV ± 3dB input. |
| 9 | | | 98.1MHz | 98.1MHz | VR301 | Set the stereo modulator to 19kHz only. Adjust so that L and R output level becomes minimum. |
| 10 | | | 98.1MHz | 98.1MHz | VR302 | Adjust so that the right channel output becomes minimum when only the left channel of the stereo modulator modulated and so that the left channel output becomes minimum when only the right channel modulated. |

NOTE) Adjustment of step 8 should be done after setting the VR351 in the position as shown in the figure.



GENERAL UNIT EXPLODED VIEW



DISASSEMBLY PROCEDURES (REFER TO PAGES 5 AND 16)

1 CABINET TOP REMOVAL

Remove 6 screws **A** and then remove the cabinet top.

2 FRONT PANEL ASSEMBLY REMOVAL

1. Remove the cabinet top. (Refer to step **1**.)
2. Pull off Volume, Bass, Treble and Balance knobs (105 and 146).
3. Remove 6 screws **B** and then remove the front panel assembly.

3 SPEAKER SWITCH AND SPEAKER TERMINAL P.C. BOARDS (PCB-16 AND PCB-17) REMOVAL

1. Remove the front panel assembly. (Refer to step **2**.)
2. Pull off push button assembly (109).
3. Remove 19 screws **C** and a hexagonal nut **D**, and remove the cabinet back assembly (102) with AC outlet (SO1). If necessary, unsolder the leads.
4. Remove 2 screws **E** and then remove speaker switch and speaker terminal P.C. boards (PCB-16 and PCB-17). If necessary, unsolder the leads.

4 LOGIC CONTROL P.C. BOARD (PCB-3) REMOVAL

1. Remove the front panel assembly. (Refer to step **2**.)
2. Disconnect J701 and J706 from P701 and P706 on the logic control P.C. board (PCB-3).
3. Open the lid of connectors (P702, 703, 704, 705, 707, 708) on the logic control P.C. board (PCB-3) and then disconnect the lead wires.
4. Remove 2 screws **F** and then remove the logic control P.C. board (PCB-3).

5 MAIN AMP. P.C. BOARD (PCB-1) REMOVAL

1. Remove the speaker switch and speaker terminal P.C. boards (PCB-16 and PCB-17). (Refer to step **3**.)
2. Open the lid of connectors (P101, 102) on the main amp. P.C. board (PCB-1) and then disconnect the lead wires.
3. Open the lid of connector (P301) on the tuner P.C. board (PCB-2) and then disconnect the lead wire.
4. Remove 4 screws **G** and then remove the main P.C. board (PCB-1). If necessary, unsolder the leads.

6 TONE P.C. BOARD (PCB-5) REMOVAL

1. Remove the main P.C. board (PCB-1). (Refer to step **5**.)
2. Remove 3 hexagonal nuts **H** and 2 screws **I**, and remove tone P.C. board (PCB-5) backward. If necessary, unsolder the leads.

7 TUNER P.C. BOARD (PCB-2) REMOVAL

1. Remove the logic control P.C. board (PCB-3). (Refer to step **4**.)
2. Open the lid of connectors (P301, 351, 352) and then disconnect the lead wires.
3. Remove 2 screws **J** and then remove the tuner P.C. board (PCB-2). If necessary, unsolder the leads.

CIRCUIT DESCRIPTION

[1] MUTING CIRCUIT

The muting control voltage is taken out from ⑫ pin of IC201 and then fed to the base of Q203. At the weak station or detuned point the ⑫ pin becomes high level, Q203 becomes low, Q355 is turned off, Q357 and Q358 are turned to on, Q302 (Lch) and Q303 (Rch) are turned to ON and muting operation is completed.

[2] SYNTHESIZER SECTION**1) FM**

The output of local oscillator in the front-end is fed to ⑤ pin of the pre-scaler IC701 and then divided by 30 or 32 and fed to ⑳ pin of the PLL synthesizer IC702. The standard quartz oscillator output (4.5MHz) is divided by 180 in IC702 and 25kHz standard signal is got. The divided local oscillator output is compared with the 25kHz standard signal in the phase comparator. When the divided local oscillator frequency is higher than standard frequency, ⑳ pin of IC702 becomes high level but when it is lower, ⑳ pin of IC702 becomes low level. When the both frequencies are equal, ⑳ pin becomes floating.

⑳ pin output of IC702 is fed to the vari-cap diode of the front-end through L.P.F. (Q702, Q703, Q712) and controls the frequency of VCO (local oscillator frequency).

2) AM

The local oscillator output of AM IC251 is fed to ⑳ pin of the PLL synthesizer IC702 and divided. The standard quartz oscillator output (4.5MHz) is divided by 450 in IC702 and 10kHz standard signal is got. The divided local oscillator output is compared with the 10kHz standard signal in phase comparator.

[3] PRESET MEMORY**1) Memorizing**

When one of the preset keys, M1 to M8 is depressed, one of the ⑫ to ⑲ pins of IC702 becomes high level. The displayed frequency is memorized into the memory (RAM) with correspond to the depressed key.

2) Recalling

When one of the preset keys, M1 to M8 is depressed, the contents of the memory (frequency) is recalled.

[4] FM/AM STATION SCANNING**1) When tuning mode switch is set to AUTO**

When the UP key is depressed, the frequency rises at saw tooth wave mode and when DOWN key is depressed, the frequency falls. When the high level input is fed to stop, terminal (⑳ pin of IC702), the scanning is stopped.

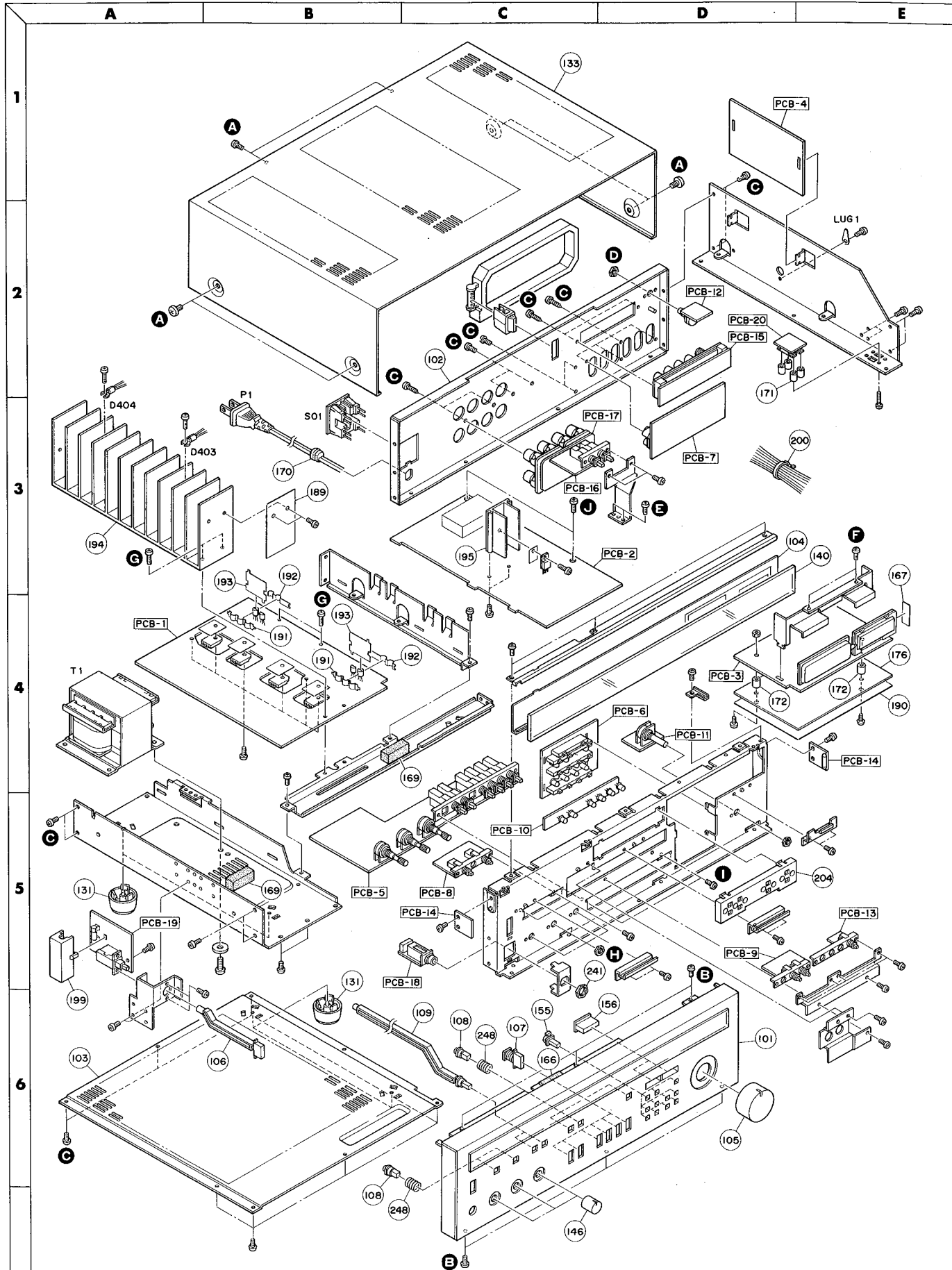
2) When tuning mode switch is set to MANUAL

Whenever UP or DOWN key is depressed once, the frequency rises or falls by one step (channel space).

[5] OVERLOAD PROTECTION

As soon as the current over rated power flows, the voltage between both emitters of Q421 and Q423 (Rch) rises and Q7, Q9 and Q4 are turned ON. So Q1 (Schmitt trigger circuit) is turned ON. The base of Q10 becomes 0V and Q1 is turned off. The operation of power amp. circuit stops and the circuit is protected.

GENERAL UNIT EXPLODED VIEW



DISASSEMBLY PROCEDURES (REFER TO PAGES 5 AND 16)

1 CABINET TOP REMOVAL

Remove 6 screws **A** and then remove the cabinet top.

2 FRONT PANEL ASSEMBLY REMOVAL

1. Remove the cabinet top. (Refer to step 1.)
2. Pull off Volume, Bass, Treble and Balance knobs (105 and 146).
3. Remove 6 screws **B** and then remove the front panel assembly.

3 SPEAKER SWITCH AND SPEAKER TERMINAL P.C. BOARDS (PCB-16 AND PCB-17) REMOVAL

1. Remove the front panel assembly. (Refer to step 2.)
2. Pull off push button assembly (109).
3. Remove 19 screws **C** and a hexagonal nut **D**, and remove the cabinet back assembly (102) with AC outlet (SO1). If necessary, unsolder the leads.
4. Remove 2 screws **E** and then remove speaker switch and speaker terminal P.C. boards (PCB-16 and PCB-17). If necessary, unsolder the leads.

4 LOGIC CONTROL P.C. BOARD (PCB-3) REMOVAL

1. Remove the front panel assembly. (Refer to step 2.)
2. Disconnect J701 and J706 from P701 and P706 on the logic control P.C. board (PCB-3).
3. Open the lid of connectors (P702, 703, 704, 705, 707, 708) on the logic control P.C. board (PCB-3) and then disconnect the lead wires.
4. Remove 2 screws **F** and then remove the logic control P.C. board (PCB-3).

5 MAIN AMP. P.C. BOARD (PCB-1) REMOVAL

1. Remove the speaker switch and speaker terminal P.C. boards (PCB-16 and PCB-17). (Refer to step 3.)
2. Open the lid of connectors (P101, 102) on the main amp. P.C. board (PCB-1) and then disconnect the lead wires.
3. Open the lid of connector (P301) on the tuner P.C. board (PCB-2) and then disconnect the lead wire.
4. Remove 4 screws **G** and then remove the main P.C. board (PCB-1). If necessary, unsolder the leads.

6 TONE P.C. BOARD (PCB-5) REMOVAL

1. Remove the main P.C. board (PCB-1). (Refer to step 5.)
2. Remove 3 hexagonal nuts **H** and 2 screws **I**, and remove tone P.C. board (PCB-5) backward. If necessary, unsolder the leads.

7 TUNER P.C. BOARD (PCB-2) REMOVAL

1. Remove the logic control P.C. board (PCB-3). (Refer to step 4.)
2. Open the lid of connectors (P301, 351, 352) and then disconnect the lead wires.
3. Remove 2 screws **J** and then remove the tuner P.C. board (PCB-2). If necessary, unsolder the leads.

CIRCUIT DESCRIPTION

[1] MUTING CIRCUIT

The muting control voltage is taken out from **12** pin of IC201 and then fed to the base of Q203. At the weak station or detuned point the **12** pin becomes high level, Q203 becomes low, Q355 is turned off, Q357 and Q358 are turned to on, Q302 (Lch) and Q303 (Rch) are turned to ON and muting operation is completed.

[2] SYNTHESIZER SECTION

1) FM

The output of local oscillator in the front-end is fed to **5** pin of the pre-scaler IC701 and then divided by 30 or 32 and fed to **37** pin of the PLL synthesizer IC702. The standard quartz oscillator output (4.5MHz) is divided by 180 in IC702 and 25kHz standard signal is got. The divided local oscillator output is compared with the 25kHz standard signal in the phase comparator. When the divided local oscillator frequency is higher than standard frequency, **35** pin of IC702 becomes high level but when it is lower, **35** pin of IC702 becomes low level. When the both frequencies are equal, **35** pin becomes floating.

35 pin output of IC702 is fed to the vari-cap diode of the front-end through L.P.F. (Q702, Q703, Q712) and controls the frequency of VCO (local oscillator frequency).

2) AM

The local oscillator output of AM IC251 is fed to **39** pin of the PLL synthesizer IC702 and divided. The standard quartz oscillator output (4.5MHz) is divided by 450 in IC702 and 10kHz standard signal is got. The divided local oscillator output is compared with the 10kHz standard signal in phase comparator.

[3] PRESET MEMORY

1) Memorizing

When one of the preset keys, M1 to M8 is depressed, one of the **12** to **19** pins of IC702 becomes high level. The displayed frequency is memorized into the memory (RAM) with correspond to the depressed key.

2) Recalling

When one of the preset keys, M1 to M8 is depressed, the contents of the memory (frequency) is recalled.

[4] FM/AM STATION SCANNING

1) When tuning mode switch is set to AUTO

When the UP key is depressed, the frequency rises at saw tooth wave mode and when DOWN key is depressed, the frequency falls. When the high level input is fed to stop, terminal (**39** pin of IC702), the scanning is stopped.

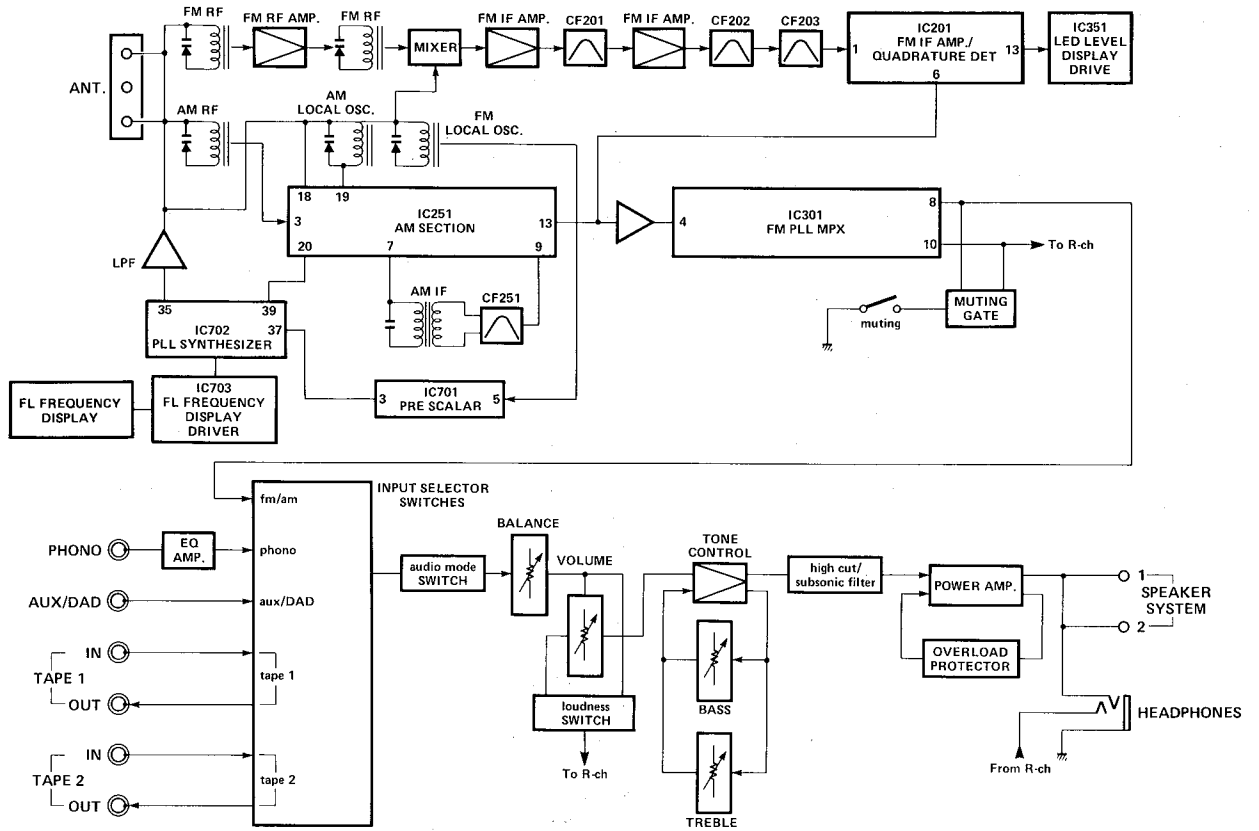
2) When tuning mode switch is set to MANUAL

Whenever UP or DOWN key is depressed once, the frequency rises or falls by one step (channel space).

[5] OVERLOAD PROTECTION

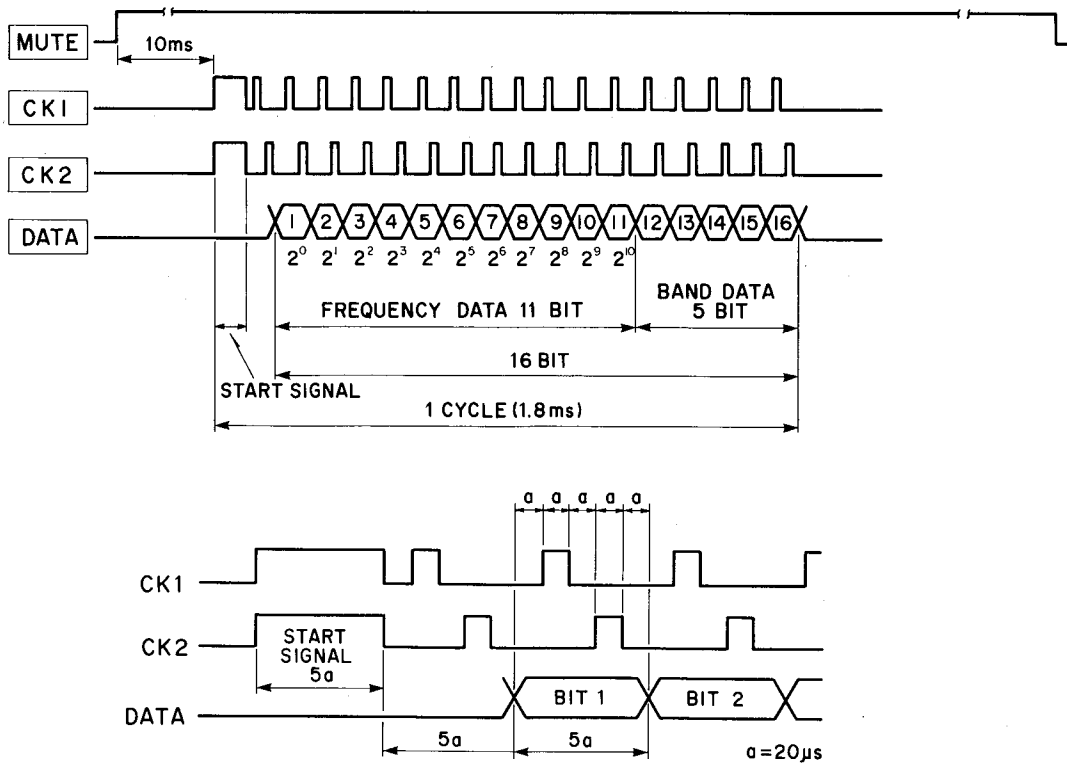
As soon as the current over rated power flows, the voltage between both emitters of Q421 and Q423 (Rch) rises and Q7, Q9 and Q4 are turned ON. So Q1 (Schmit trigger circuit) is turned ON. The base of Q10 becomes 0V and Q1 is turned off. The operation of power amp. circuit stops and the circuit is protected.

BLOCK DIAGRAM



TIMING CHART

Frequency display timing chart of IC702 (TC9147AP)



GENERAL UNIT PARTS LIST

| Ref. No. | Part No. | Description |
|----------|--------------|--|
| 101 | A443-HK490A | Front Panel Assembly |
| 102 | A424-HK490A | Cabinet Back Assembly |
| 103 | A424-HK490B | Cabinet Bottom Assembly |
| 104 | A554-HK490A | Dial Back Assembly |
| 105 | A630-HK490A | Knob Assembly, Volume |
| 106 | A662-HK490A | Push Button Assembly, Power |
| 107 | A662-HK490B | Push Button Assembly, Tape Monitor, Function |
| 108 | A662-HK490C | Push Button Assembly, Subsonic Filter, High Cut, Audio Mode, Loudness, Muting |
| 109 | A662-HK490D | Push Button Assembly, Speakers |
| 131 | 1319-0139 | Foot |
| 133 | 1414-03901 | Cabinet Top |
| 140 | 1541-02301 | Dial Panel |
| 146 | 1630-02501 | Knob, Bass, Treble, Balance |
| 155 | 1662-12701 | Push Button, Auto, Manual, Memory, FM/AM Preset Memory |
| 156 | 1662-12801VN | Push Button, Tuning |
| 166 | 2112-11762 | Sponge |
| 167 | 2111-11738 | Felt |
| 169 | 2112-11769 | Sponge |
| 170 | 2114-415027 | Bushing |
| 171 | 2132-01401 | Spacer |
| 172 | 2132-5052 | Spacer |
| 176 | 2216-7142 | Shield Plate |
| 189 | 2224-7083 | Insulator |
| 190 | 2216-7143 | Shield Plate |
| 191 | 2222-7100 | Heat Sink |
| 192 | 2222-7101 | Heat Sink |
| 193 | 2222-7103 | Heat Sink |
| 194 | 2222-7148 | Heat Sink |
| 195 | 2222-7149 | Heat Sink |
| 199 | 2240-7176 | Holder |
| 200 | 2240-7120 | Holder |
| 204 | 2240-7206 | Holder |
| 241 | 2440-61 | Special Nut |
| 248 | 2651-210189 | Spring |
| | 2211-7240 | Chassis, Front |
| | 2211-7241 | Chassis, T1 |
| | 2211-7242 | Chassis, Right |
| | 2219-7645 | Bracket, Dial Back Upper Side |
| | 2219-7671 | Bracket, Dial Panel Right Side |
| | 2219-7879 | Bracket, PCB-18 |
| | 2219-7913 | Bracket, Transverse Direction |
| | 2219-7914 | Bracket, PCB-3 |
| | 2219-7915 | Bracket, Vertical Direction |
| | 2219-7916 | Bracket, Speakers Switch |
| | 2219-7917 | Bracket, Power Switch |
| | 2219-7919 | Bracket, Tape Monitor & Function Switches |
| | 2219-7920 | Bracket, Dial Back Hold (Left, Center) |
| | 2219-7921 | Bracket, Dial Back Hold (Right) |
| | 2219-7946 | Bracket, Speakers Switch Shaft |
| | 1111-J30130 | Owner's Guide |
| | 1222-7263 | Cushion (2 Used) |
| | 1221-717167 | Carton Box |

ELECTRICAL PARTS LIST

| Ref. No. | Part No. | Description |
|--|---------------|--|
| CHASSIS MISCELLANEOUS | | |
| P1 | 4161-71151 | AC Line Cord |
| T1 | 5584-701426 | Power Transformer |
| SO1 | 4474-157 | AC Outlet, Switched, Unswitched |
| R1 | 5135-335J50P | Resistor, 3.3M Ω , \pm 5%, 1/2W, Carbon |
| J701 | 4163-70196 | Connector with Lead Wire, 5Pos. |
| J706 | 4163-023503 | Connector with Lead Wire, 2Pos. |
| Lug 1 | 4211-4 | Lug Terminal |
| PCB-1 MAIN AMP. P.C. BOARD | | |
| RESISTORS | | |
| R61, 423, 424, 425, 426, 427, 428, 429, 430 | 5102-2214713 | 220 Ω , \pm 2%, 1/4W, Fuse |
| R417, 418 | 5174-222381 | 2.2k Ω , \pm 1%, 1/4W, Metal |
| R437, 438, 439, 440 | 5102-6804713 | 68 Ω , \pm 2%, 1/4W, Fuse |
| R455, 456, 457, 458 | 5102-1004713 | 10 Ω , \pm 2%, 1/4W, Fuse |
| R459, 460 | 5174-820381 | 82 Ω , \pm 1%, 1/4W, Metal |
| R461, 462 | 5273-R22672 | 0.22 Ω , \pm 10%, 3Wx2, Cement |
| R467, 468 | 5173-100571 | 10 Ω , \pm 5%, 2W, Metal |
| R475, 476 | 5171-471572 | 470 Ω , \pm 5%, 1W, Metal |
| R479, 480 | 5102-3314713 | 330 Ω , \pm 2%, 1/4W, Fuse |
| CONTROLS | | |
| VR401, 402 | 5101-20171920 | 200 Ω B |
| VR403, 404 | 5101-10471920 | 100k Ω B |
| CAPACITORS | | |
| C4, 12 | 5345-476F041 | 47 μ F, \pm 20%, 50V, Electrolytic |
| C5, 6, 7, 8 | 5341-478F0955 | 4700 μ F, \pm 20%, 50V, Electrolytic |
| C9 | 5345-107C041 | 100 μ F, \pm 20%, 16V, Electrolytic |
| C10 | 5345-476C041 | 47 μ F, \pm 20%, 16V, Electrolytic |
| C11 | 5345-106C041 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C13 | 5345-477G041 | 470 μ F, \pm 20%, 63V, Electrolytic |
| C401, 402 | 5345-107B0951 | 100 μ F, \pm 20%, 10V, Electrolytic |
| C403, 404 | 5359-2215851 | 220pF, \pm 5%, 100V, Polypropylene |
| C405, 406 | 5345-106D041 | 10 μ F, \pm 20%, 25V, Electrolytic |
| C407, 408, 409, 410 | 5345-227F041 | 220 μ F, \pm 20%, 50V, Electrolytic |
| C415, 416 | 5353-050934 | 5pF, \pm 0.5pF, 500V, Mica |
| C417, 418 | 5345-106F041 | 10 μ F, \pm 20%, 50V, Electrolytic |
| TRANSISTORS | | |
| Q1, 2, 4, 10 | 5611-1115(E) | 2SA1115(E) or 2SA1115(F) |
| Q7, 8 | 5611-872(E) | 2SA872(E) |
| Q9, 405, 406 | 5613-2603(E) | 2SC2603(E) or 2SC2603(F) |
| Q401, 402, 403, 404 | 5613-2240(BL) | 2SC2240(BL) |
| Q407, 408, 409, 410, 411, 412 | 5611-1145(Y) | 2SA1145(Y) |
| Q413, 414 | 5613-2705(Y) | 2SC2705(Y) |
| Q415, 416 | 5613-945(K) | 2SC945(K) or 2SC945(P) |
| Q417, 418 | 5613-2235(Y) | 2SC2235(Y) |
| Q419, 420 | 5611-965(Y) | 2SA965(Y) |
| Q421, 422 | 5613-3181(O) | 2SC3181(O) |
| Q423, 424 | 5611-1264(O) | 2SA1264(O) |
| DIODES | | |
| D1, 2, 3, 4 | 5632-ERC102FL | ERC102FL |
| D5, 6, 11, 12 | 5636-1S2471 | 1S2471 |
| D7 | 5635-HZ11B2L | Zener, HZ11B2L |
| D8, 13, 14, 401, 402, 409, 410 | 5636-1S2473 | 1S2473 |
| D403, 404 | 5641-MV12YM | Varistor, MV12YM |
| D405, 406, 407, 408 | 5632-DS135E | DS135E |
| D411, 412 | 5635-HZ12C3L | Zener, HZ12C3L |

| Ref. No. | Part No. | Description |
|--|---------------------------|--|
| | COILS | |
| L401, 402 | 5991-7165 | |
| | MISCELLANEOUS | |
| P101, 102 | 4443-030185 | Connector, 3Pos. |
| PCB-2 TUNER P.C. BOARD | | |
| | RESISTORS | |
| R51 | 5102-3R3579 | 3.3 Ω , \pm 5%, 1/4W, Fuse |
| R305 | 5102-2204713 | 22 Ω , \pm 2%, 1/4W, Fuse |
| R323 | 5174-183381 | 18k Ω , \pm 1%, 1/4W, Metal |
| | CONTROLS | |
| VR201, 251 | 5101-50371920 | 50k Ω B |
| VR202 | 5101-20371920 | 20k Ω B |
| VR301, 302, 351 | 5101-10471920 | 100k Ω B |
| VR303 | 5101-1037187 | 10k Ω |
| | CAPACITORS | |
| C51 | 5345-337-16 | 330 μ F, +50%–10%, 16V, Electrolytic |
| C52, 220 | 5345-108-16 | 1000 μ F, +50%–10%, 16V, Electrolytic |
| C201, 304 | 5345-476-16 | 47 μ F, +50%–10%, 16V, Electrolytic |
| C208, 217, 257, 351, 352 | 5345-106-16 | 10 μ F, +50%–10%, 16V, Electrolytic |
| C214 | 5359-1015851 | 100pF, \pm 5%, 100V, Polypropylene |
| C215 | 5345-105-50 | 1 μ F, +75%–10%, 50V, Electrolytic |
| C216 | 5345-226C0952 | 22 μ F, \pm 20%, 16V, Electrolytic |
| C218, 260 | 5345-L104M50 | 0.1 μ F, \pm 20%, 50V, Electrolytic |
| C263 | 5345-107-16 | 100 μ F, +50%–10%, 16V, Electrolytic |
| C266 | 5345-335-50 | 3.3 μ F, +75%–10%, 50V, Electrolytic |
| C267 | 5345-475-25 | 4.7 μ F, +75%–10%, 25V, Electrolytic |
| C269 | 5359-5115851 | 510pF, \pm 5%, 100V, Polypropylene |
| C271 | 5345-225-50 | 2.2 μ F, +75%–10%, 50V, Electrolytic |
| C301, 303 | 5345-L226M16 | 22 μ F, \pm 20%, 16V, Electrolytic |
| C302 | 5345-L107M10 | 100 μ F, \pm 20%, 10V, Electrolytic |
| C305 | 5345-227-16 | 220 μ F, +50%–10%, 16V, Electrolytic |
| C309, 310 | 5359-6815851 | 680pF, \pm 5%, 100V, Polypropylene |
| C311, 312 | 5345-L225M50 | 2.2 μ F, \pm 20%, 50V, Electrolytic |
| C315 | 5345-L106M16 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C316 | 5345-L475M25 | 4.7 μ F, \pm 20%, 25V, Electrolytic |
| C317 | 5345-L474M50 | 0.47 μ F, \pm 20%, 50V, Electrolytic |
| C320 | 5359-8215851 | 820pF, \pm 5%, 100V, Polypropylene |
| C353 | 5345-474-50 | 0.47 μ F, +75%–10%, 50V, Electrolytic |
| C354 | 5345-226-16 | 22 μ F, +50%–10%, 16V, Electrolytic |
| TC251, 252 | 5371-93 | Trimmer Capacitor |
| | INTEGRATED CIRCUIT | |
| IC201 | 5652-HA11225 | HA11225 |
| IC251 | 5652-LA1245 | LA1245 |
| IC301 | 5652- μ PC1223C | μ PC1223C |
| IC352 | 5654-TC4049BP | TC4049BP |
| | TRANSISTORS | |
| Q51 | 5614-880(GR) | 2SD880(GR) |
| Q201, 202 | 5613-2058(N) | 2SC2058(N) or 2SC2058(P) |
| Q203, 251, 252, 301, 302, 303, 352, 355, 356, 357 | 5613-2603(F) | 2SC2603(F) or 2SC2603(E) |
| Q351, 353, 354, 358, 359, 360 | 5611-1115(F) | 2SA1115(F) or 2SA1115(E) |
| | DIODES | |
| D51 | 5635-HZ15-1L | Zener, HZ15-1L or RD15JB2 |
| D201, 202, 203, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364 | 5636-1SS53 | 1SS53 |
| D251, 252 | 5633-1SV102 | Capacitor Diode, 1SV102 |
| D351 | 5635-RD5R1EB2 | Zener, RD5.1EB2 |

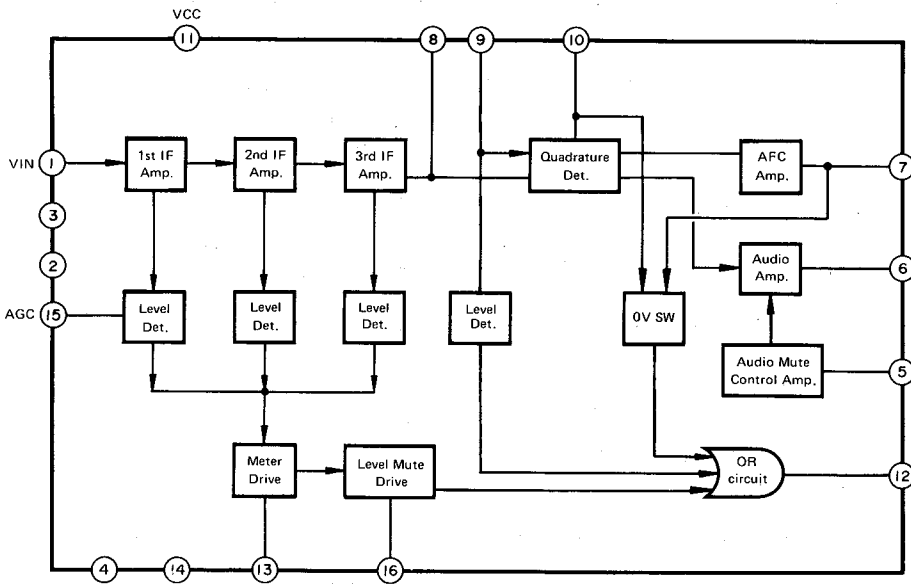
| Ref. No. | Part No. | Description |
|---------------------------------------|---------------------------|--|
| | COILS | |
| L202 | 5995-2R2269 | 2.2 μ H |
| L251 | 5933-70127 | |
| L252 | 5923-70133 | |
| | TRANSFORMERS | |
| T201 | 5574-7024 | |
| T251 | 5552-70113 | |
| T252 | 5932-70123 | |
| | MISCELLANEOUS | |
| CF201, 202, 203 | 6114-7128 | FM Tuner Assembly |
| CF251 | 5671-7117A | Ceramic Filter, MA8 |
| CF252 | 5671-7138F | Ceramic Filter, SFZ450F |
| P301, 351 | 5671-7137C | Ceramic Filter, BFU450C4N |
| P352 | 4443-040185 | Connector, 4Pos. |
| | 4443-010185 | Connector, 7Pos. |
| PCB-3 LOGIC CONTROL P.C. BOARD | | |
| | RESISTORS | |
| R712 | 5171-221581 | 220 Ω , \pm 5%, 1W, Metal |
| R752, 753 | 5171-680581 | 68 Ω , \pm 5%, 1W, Metal |
| | CAPACITORS | |
| C355 | 5345-106-16 | 10 μ F, +50%–10%, 16V, Electrolytic |
| C703 | 5345-476-10 | 47 μ F, +50%–10%, 10V, Electrolytic |
| C708 | 5345-336-35 | 33 μ F, +50%–10%, 35V, Electrolytic |
| C709 | 5345-334F0951 | 0.33 μ F, \pm 20%, 50V, Electrolytic |
| C712 | 5350-4730H651 | 47000 μ F, +80%–20%, 5V, Special |
| C715 | 5345-227-10 | 220 μ F, +50%–10%, 10V, Electrolytic |
| C716, 717 | 5345-L225M50 | 2.2 μ F, \pm 20%, 50V, Electrolytic |
| C721, 722 | 5345-225-50 | 2.2 μ F, +75%–10%, 50V, Electrolytic |
| | INTEGRATED CIRCUIT | |
| IC351 | 5652-AN6875 | AN6875 |
| IC701 | 5654-TD6104P | TD6104P |
| IC702 | 5654-TC9147AP | TC9147AP |
| IC703 | 5654-TD6301AP | TD6301AP |
| | TRANSISTORS | |
| Q701 | 5616-2SK362GR | F.E.T., 2SK362(GR) |
| Q702 | 5616-2SK117(Y) | F.E.T., 2SK117(Y) |
| Q703 | 5613-2320L(F) | 2SC2320L(F) or 2SC2320L(G) |
| Q704, 705, 708, 709, 710, 711 | 5613-2603(F) | 2SC2603(F) or 2SC2603(E) |
| Q707, 712 | 5611-1115(F) | 2SA1115(F) or 2SA1115(E) |
| | DIODES | |
| D371, 372, 373, 374, 375, 376, 377 | 5623-LS007S | LED Display |
| D701 | 5635-HZ27-3L | Zener, HZ27-3L |
| D702, 703, 704, 705, 706 | 5636-1SS53 | 1SS53 |
| D707 | 5635-RD5R6EB2 | Zener, RD5.6EB2 |
| D708 | 5635-RD10EB3 | Zener, RD10EB3 |
| D709 | 5635-RD9R1EB1 | Zener, RD9.1EB1 |
| D722, 723 | 5631-1S2473 | 1S2473 |
| | COILS | |
| L701, 702 | 5995-2R2269 | 2.2 μ H |
| | MISCELLANEOUS | |
| X701 | 5722-10 | Tube Display |
| F701, 702, 703 | 5691-00720019 | Crystal Osc. |
| P701 | 5212-3 | R Components |
| P702 | 4443-057114 | Connector, 5Pos. |
| P703 | 4443-030185 | Connector, 3Pos. |
| P704 | 4443-080185 | Connector, 8Pos. |
| P705, 707, 708 | 4443-070185 | Connector, 7Pos. |
| P706 | 4443-050185 | Connector, 5Pos. |
| | 4443-027114 | Connector, 2Pos. |

| Ref. No. | Part No. | Description |
|--|---------------|--|
| PCB-4 EQUALIZER P.C. BOARD | | |
| RESISTORS | | |
| R37, 38 | 5102-1014713 | 100 Ω , \pm 2%, 1/4W, Fuse |
| R623, 624 | 5174-Z412228 | 41k Ω , \pm 1%, 1/4W, Metal |
| CAPACITORS | | |
| C23, 24 | 5345-476D041 | 47 μ F, \pm 20%, 25V, Electrolytic |
| C27, 28 | 5345-227D041 | 220 μ F, \pm 20%, 25V, Electrolytic |
| C601, 602 | 5345-336B0951 | 33 μ F, \pm 20%, 10V, Electrolytic |
| C603, 604 | 5359-1215851 | 120pF, \pm 5%, 100V, Polypropylene |
| C605, 606 | 5345-337A0952 | 330 μ F, \pm 20%, 6.3V, Electrolytic |
| C607, 608 | 5359-2025851 | 2000pF, \pm 5%, 100V, Polypropylene |
| C609, 610 | 5359-5625851 | 5600pF, \pm 5%, 100V, Polypropylene |
| C611, 612, 613, 614 | 5345-106C0951 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C617, 618 | 5345-336E041 | 33 μ F, \pm 20%, 35V, Electrolytic |
| TRANSISTORS | | |
| Q11 | 5613-1627(Y) | 2SC1627(Y) |
| Q12 | 5611-817(Y) | 2SA817(Y) |
| Q601, 602 | 5613-2320L(F) | 2SC2320L(F) |
| Q603, 604 | 5611-999L(F) | 2SA999L(F) |
| Q605, 606, 609, 610 | 5611-1115(E) | 2SA1115(E) or 2SA1115(F) |
| Q607, 608 | 5613-2603(E) | 2SC2603(E) or 2SC2603(F) |
| DIODES | | |
| D15, 16 | 5635-HZ15-2L | Zener, HZ15-2L or RD15EB2 |
| D601, 602 | 5635-HZ20-2L | Zener, HZ20-2L |
| MISCELLANEOUS | | |
| P801 | 4443-040185 | Connector, 4Pos. |
| PCB-5 TONE P.C. BOARD | | |
| RESISTORS | | |
| R19, 20 | 5102-3314713 | 330 Ω , \pm 2%, 1/4W, Fuse |
| CONTROLS | | |
| VR501/502 | 5113-50385122 | 50k Ω MN, Balance |
| VR505/506 | 5113-50371148 | 50k Ω C, Treble |
| VR507/508 | 5113-10472148 | 100k Ω C, Bass |
| CAPACITORS | | |
| C17, 18 | 5345-476C041 | 47 μ F, \pm 20%, 16V, Electrolytic |
| C21, 22 | 5345-227C041 | 220 μ F, \pm 20%, 16V, Electrolytic |
| C505, 506 | 5345-106C0951 | 10 μ F, \pm 20%, 16V, Electrolytic |
| C507, 508 | 5345-226C0951 | 22 μ F, \pm 20%, 16V, Electrolytic |
| C509, 510 | 5345-476B0951 | 47 μ F, \pm 20%, 10V, Electrolytic |
| C525, 526 | 5359-1015851 | 100pF, \pm 5%, 100V, Polypropylene |
| TRANSISTORS | | |
| Q5 | 5613-1627(Y) | 2SC1627(Y) |
| Q6 | 5611-817(Y) | 2SA817(Y) |
| Q501, 502, 503, 504 | 5613-2320L(F) | 2SC2320L(F) |
| Q505, 506 | 5611-1115(E) | 2SA1115(E) or 2SA1115(F) |
| DIODES | | |
| D9, 10 | 5635-HZ15-2L | Zener, HZ15-2L |
| MISCELLANEOUS | | |
| SW501, 502, 503, 504, 505, 506 | 4431-06247157 | Push Switch, Tape Monitor, Function |
| PCB-6 LOGIC CONTROL SWITCHES P.C. BOARD | | |
| DIODES | | |
| D711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721 | 5637-GL5NG6 | L.E.D., GL5NG6, Green, Auto, Manual, Memory, FM/AM Preset Memory |
| MISCELLANEOUS | | |
| SW701, 702 | 4431-02027167 | Push Switch, Tuning |
| SW703, 704, 705 | 4431-03037155 | Push Switch, Auto, Manual, Memory |
| SW706, 707, 708, 709, 710, 711, 712, 713 | 4431-04047165 | Push Switch, FM/AM Preset Memory |

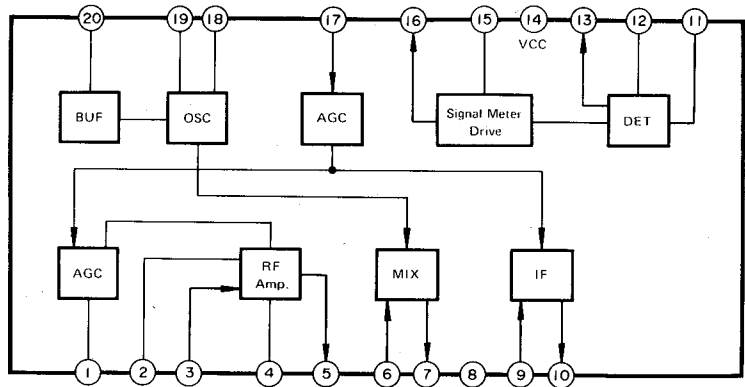
| Ref. No. | Part No. | Description |
|---|-------------------------------|---|
| PCB-7 PIN JACK P.C. BOARD | | |
| J1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 | 4486-8 | 6-Pin Jack, Phono, Aux/DAD, Tape 1, Tape 2 |
| PCB-8 SUBSONIC FILTER & HIGH CUT SWITCHES P.C. BOARD | | |
| C523, 524 SW507, 508 | 5345-474F041 4431-02087265 | Capacitor, 0.47 μ F, \pm 20%, 50V, Electrolytic Push Switch, Subsonic Filter, High Cut |
| PCB-9 AUDIO MODE & LOUDNESS SWITCHES P.C. BOARD | | |
| C503, 504 SW509, 510 | 5359-1815851 4431-02047165 | Capacitor, 180pF, \pm 5%, 100V, Polypropylene Push Switch, Audio Mode, Loudness |
| PCB-10 TAPE MONITOR & FUNCTION INDICATORS P.C. BOARD | | |
| D17, 18, 19, 20 D21, 22 | 5637-GL5NG6 5637-GL5PR6 | L.E.D., GL5NG6, Green, Function L.E.D., GL5PR6, Red, Tape Monitor |
| PCB-11 VOLUME P.C. BOARD | | |
| VR503, 504 | 5113-10476122 | Control, 100k Ω B, Volume |
| PCB-12 MUTE ADJ. VR P.C. BOARD | | |
| VR352 P301 | 5113-50372136 4443-030185 | Control, 50k Ω B, Mute Adjust Connector, 3Pos. |
| PCB-13 MUTING SWITCH P.C. BOARD | | |
| SW301 | 4431-A027137 | Push Switch, Muting |
| PCB-14 LAMP P.C. BOARD | | |
| LP1, 2 | 5731-1507245 | Lamp, 15V, 100mA, Illuminator |
| PCB-15 ANTENNA TERMINAL P.C. BOARD | | |
| TE1 | 4214-95 | External Antenna Terminal |
| PCB-16 SPEAKER SWITCH P.C. BOARD | | |
| R475, 476 SW401, 402 | 5171-471572 4431-02047166 | Resistor, 470 Ω , \pm 5%, 1W, Metal Push Switch, Speaker 1, Speaker 2 |
| PCB-17 SPEAKER TERMINAL P.C. BOARD | | |
| TE2 | 4214-121 | Terminal, Speaker System 1/2 |
| PCB-18 HEADPHONE JACK P.C. BOARD | | |
| J401 P401 | 4451-00139 4443-030185 | Jack, Headphones Connector, 3Pos. |
| PCB-19 POWER SWITCH P.C. BOARD | | |
| CAPACITORS | | |
| C1 | 5352-1030959 | 0.01 μ F, \pm 20%, AC125V, Metalized Polyester |
| C30 | 5345-105F041 | 1 μ F, \pm 20%, 50V, Electrolytic |
| TRANSISTOR | | |
| Q13 | 5613-2603(E) | 2SC2603(E) or 2SC2603(F) |
| DIODES | | |
| D23 | 5636-1S2472 | 1S2472 |
| D24 | 5631-1S2473 | 1S2473 |
| MISCELLANEOUS | | |
| SW1 | 4431-A01716 | Push Switch, Power |
| F1 | 5732-312031 | Fuse, 3.15A, 125V |
| | 4472-7122 | Fuse Holder (x 2) |
| PCB-20 FREQUENCY STEP CONTROL SWITCHES P.C. BOARD | | |
| SW714, 715 | 4421-012413 | Slide Switch, AM 9kHz/10kHz, FM 50kHz/100kHz |

IC FUNCTIONAL BLOCK DIAGRAM

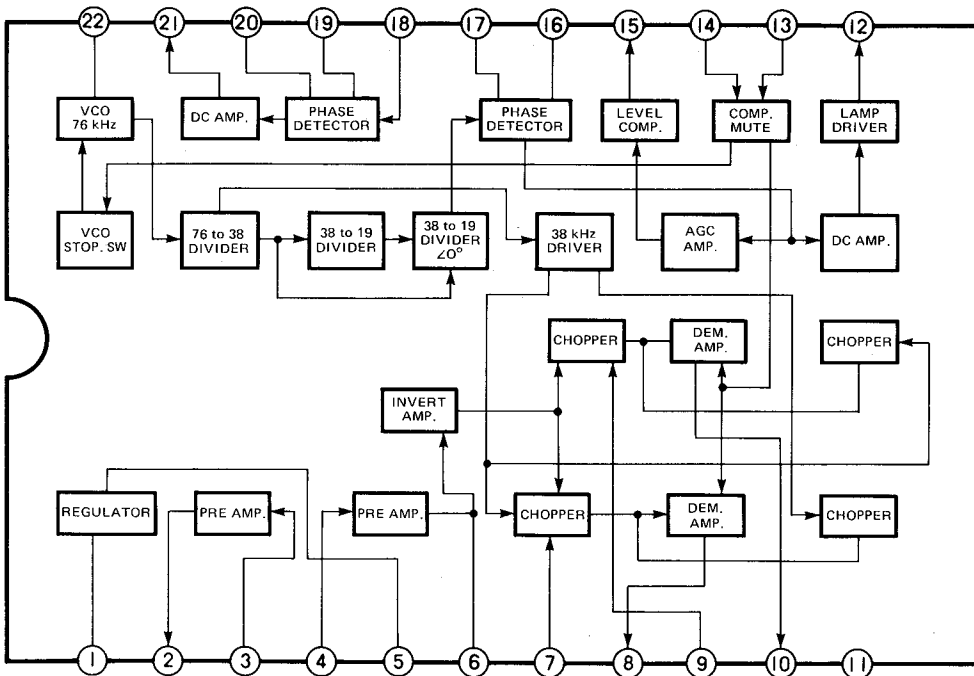
HA11225: IC201



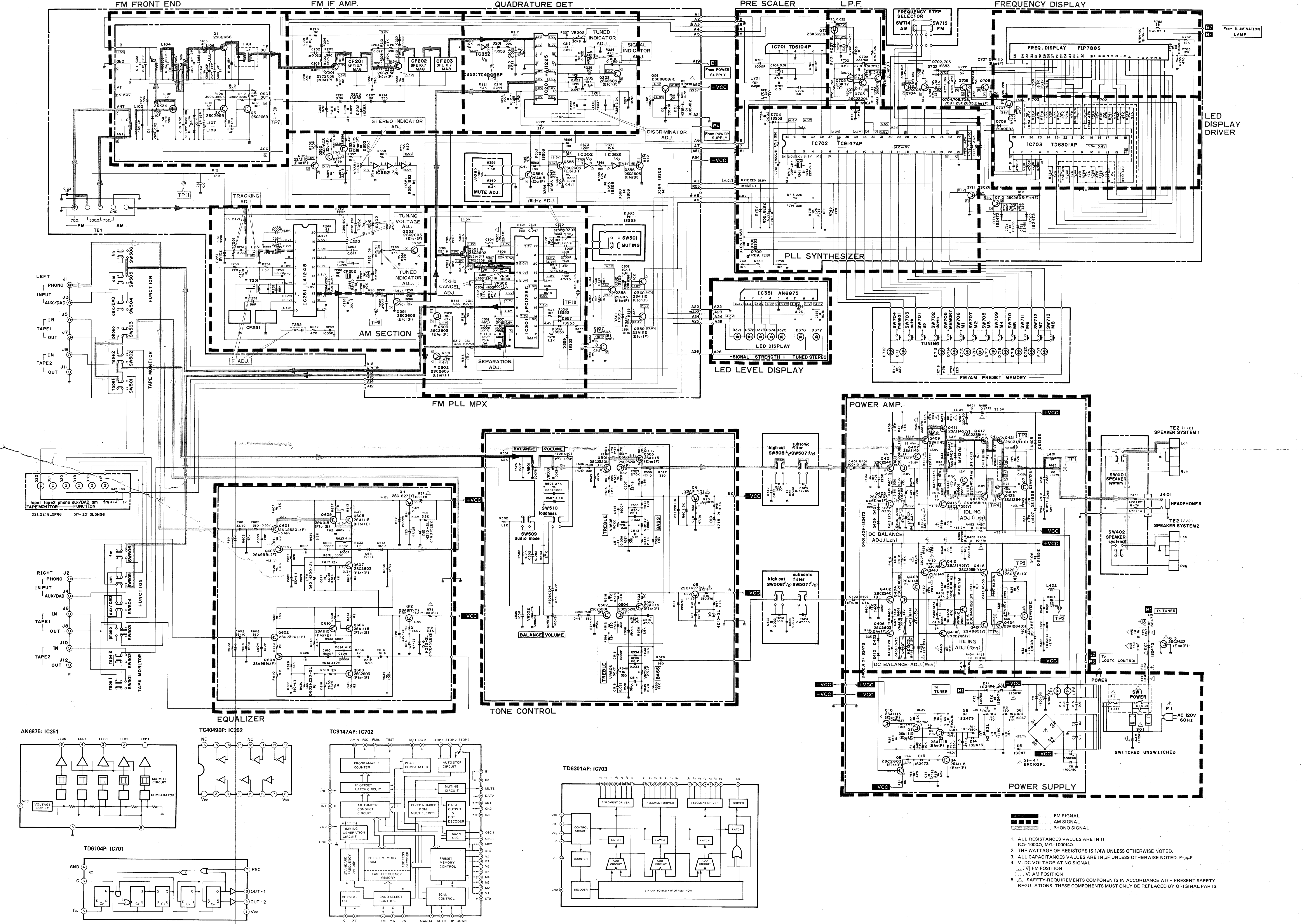
LA1245: IC251



μPC1223C: IC301



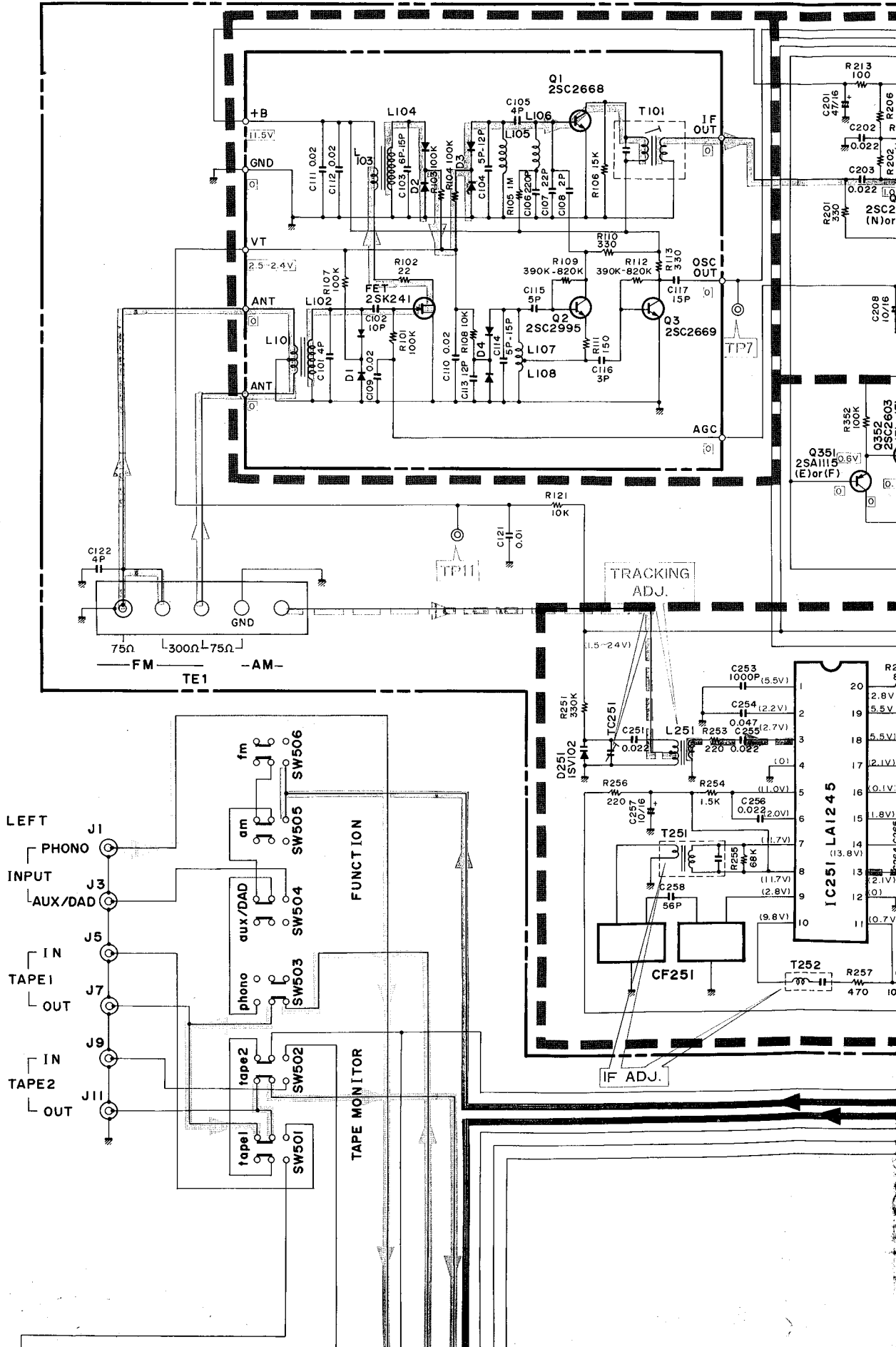
SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM

FM FRONT END

FM



E

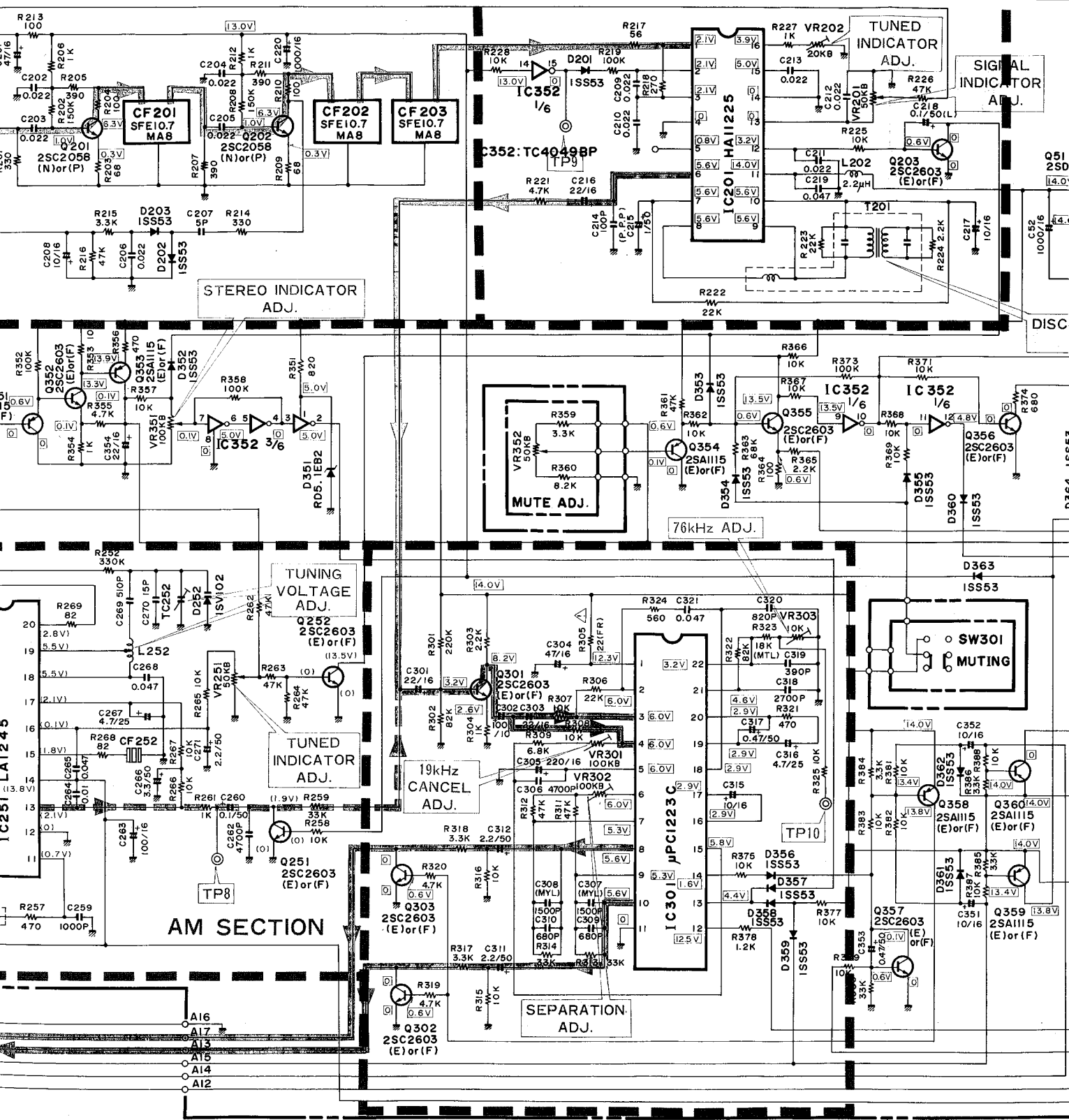
F

G

H

FM IF AMP.

FM IF AMP.
QUADRATURE DET



FM PLL MPX

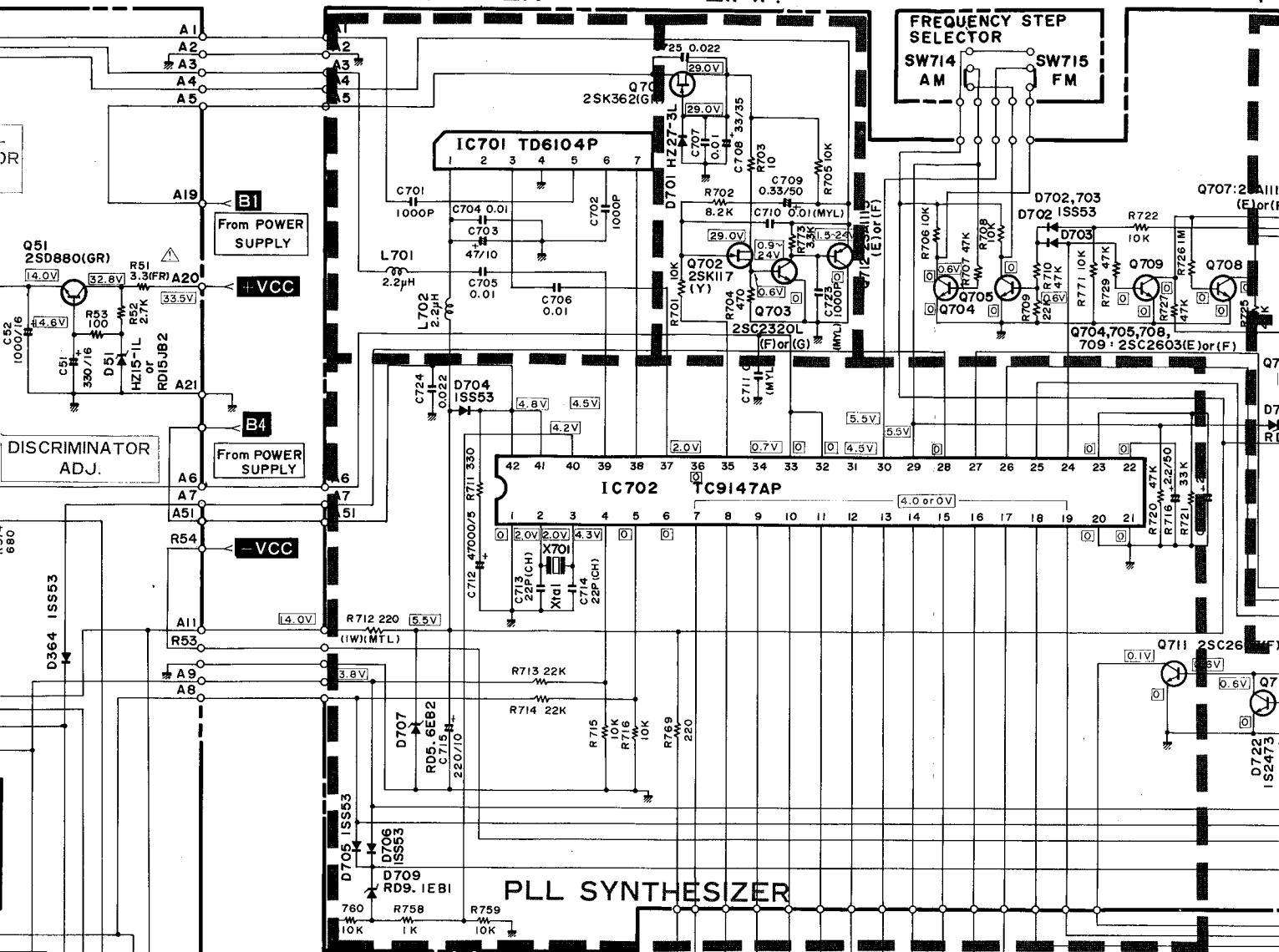
BALANCE VOLUME

17 18 19 20

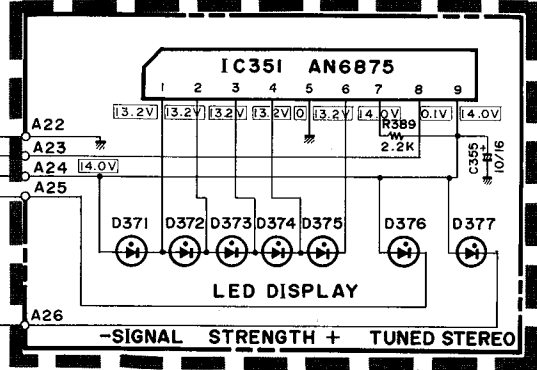
PRE SCALER

L.P.F.

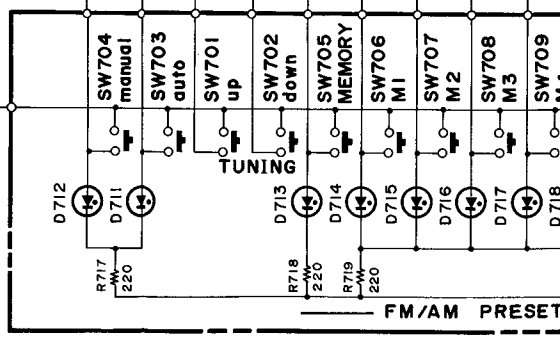
FREQUENCY STEP SELECTOR
SW714 AM
SW715 FM



PLL SYNTHESIZER

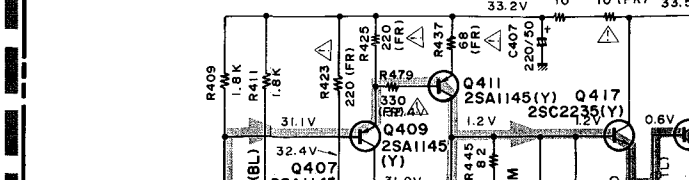


LED LEVEL DISPLAY



FM/AM PRESET

POWER AMP.



high cut subsonic filter

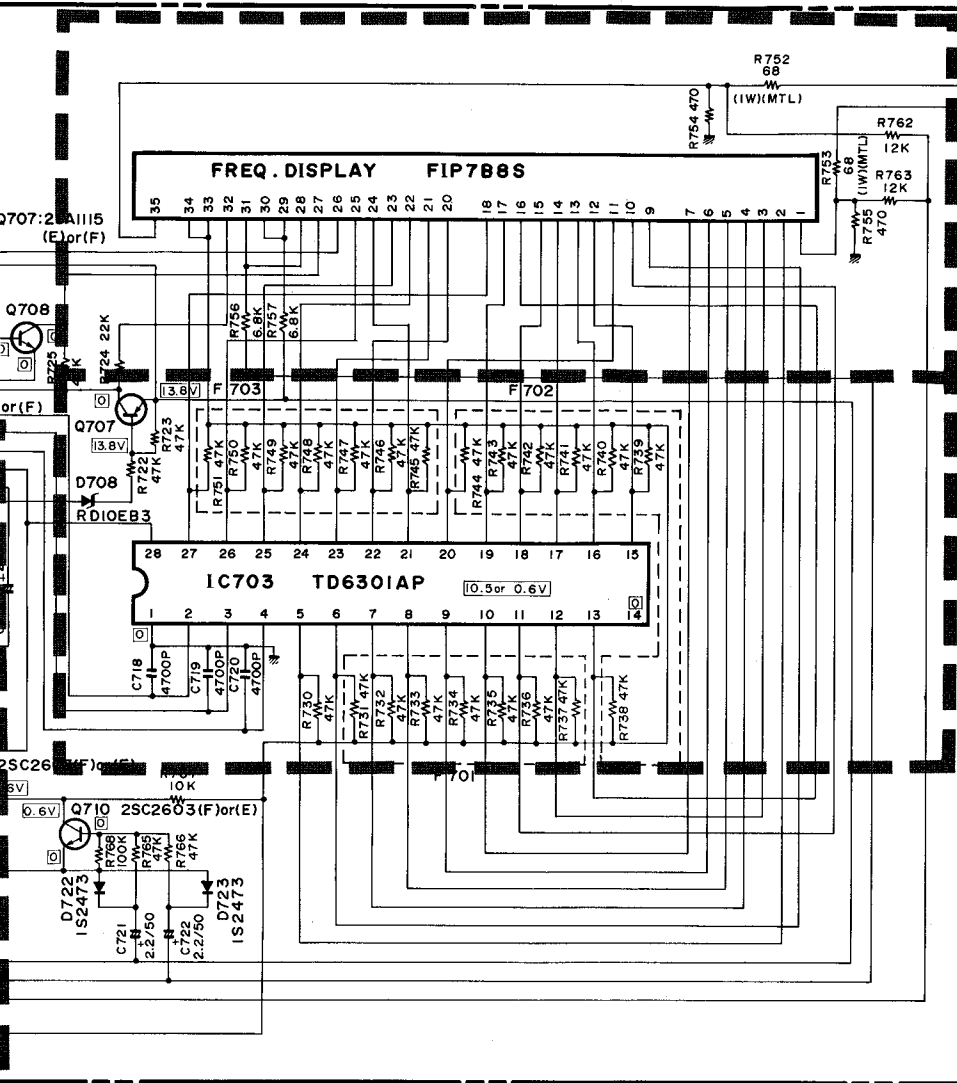
M

N

O

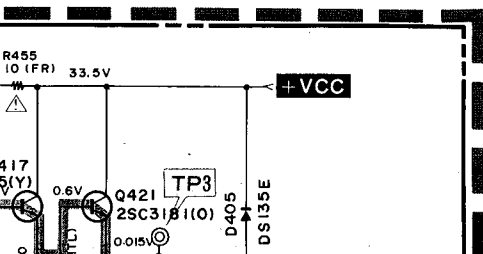
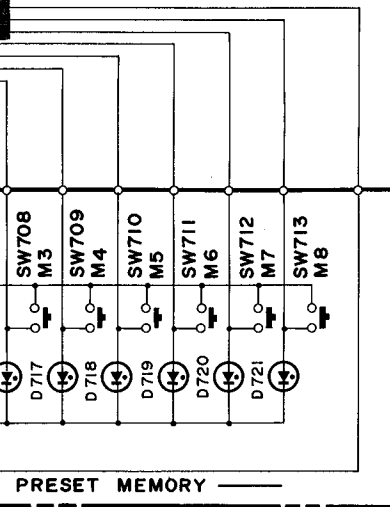
P

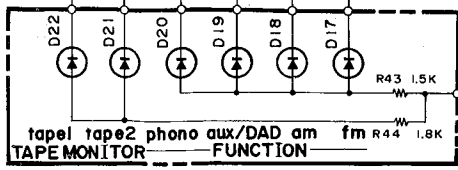
FREQUENCY DISPLAY



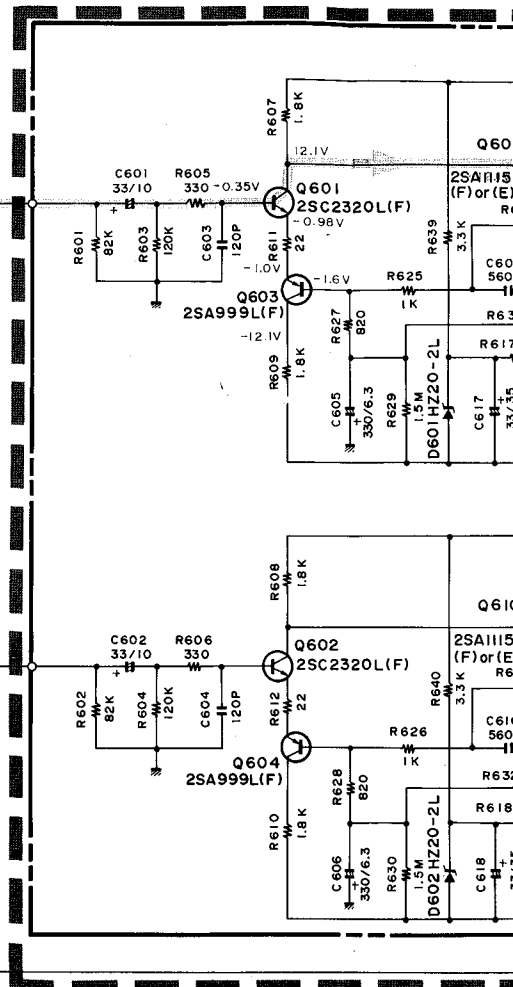
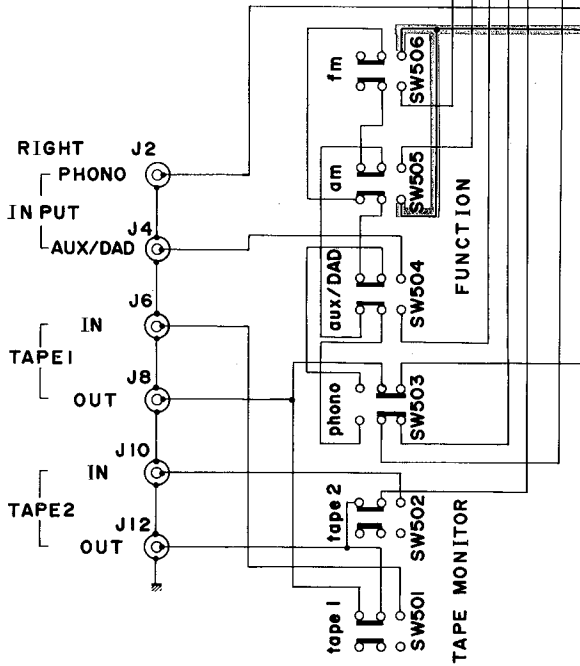
From ILLUMINATION LAMP

LED DISPLAY DRIVER



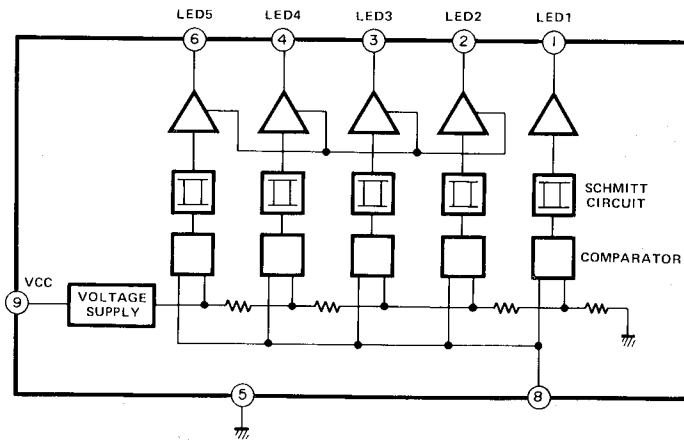


D21,22: GL5PR6 D17~20: GL5NG6

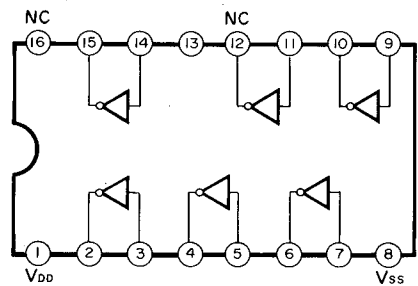


EQUALIZER

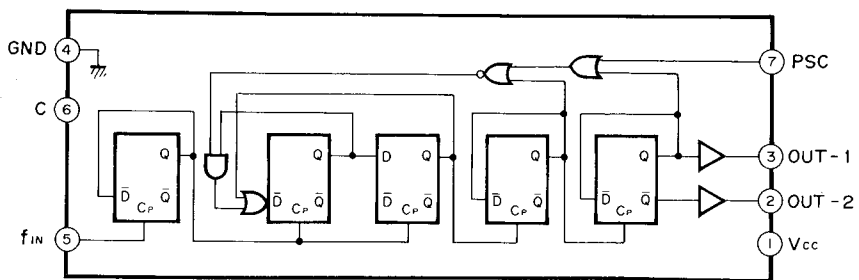
AN6875: IC351

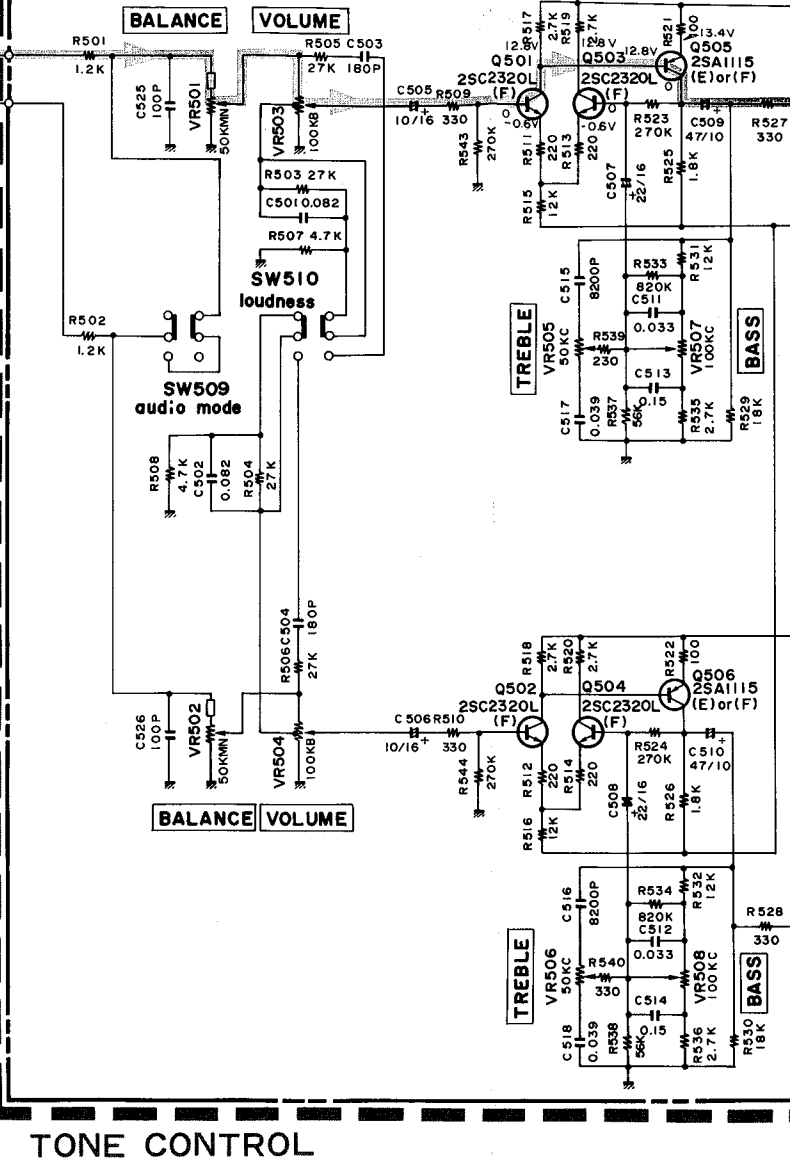
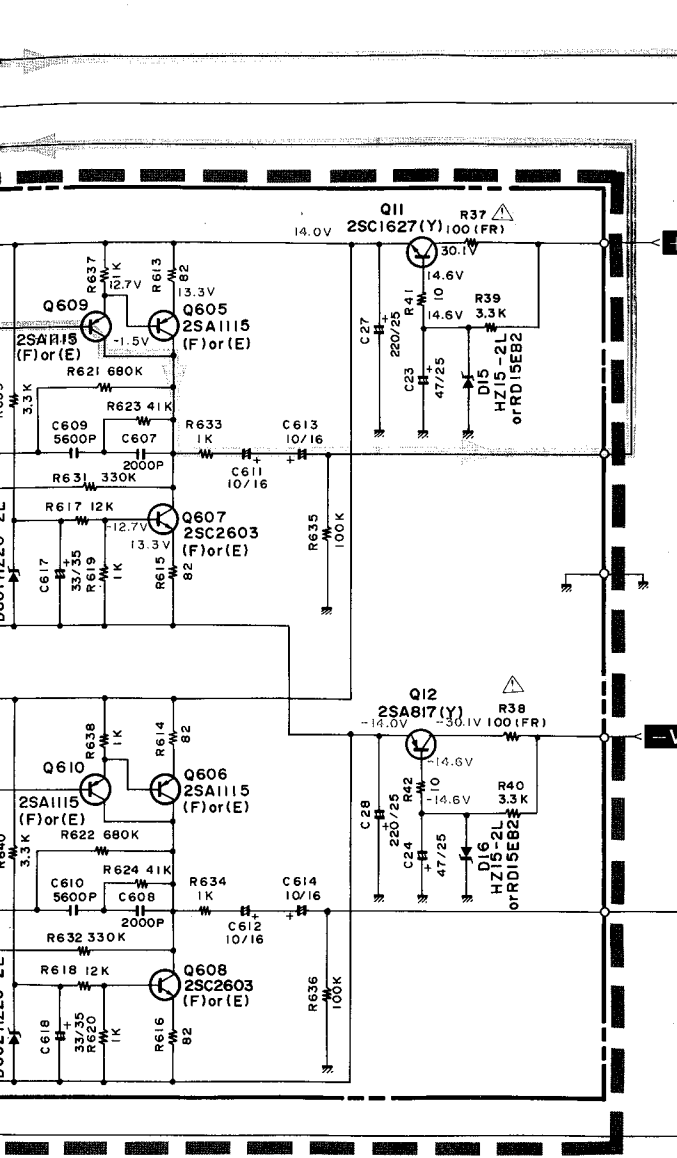


TC4049BP: IC352



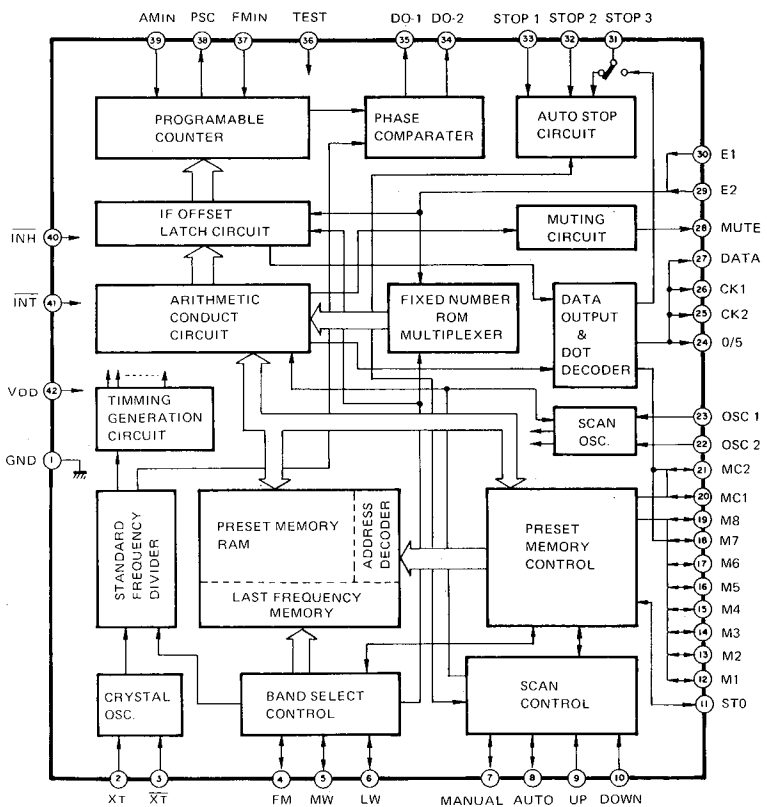
TD6104P: IC701



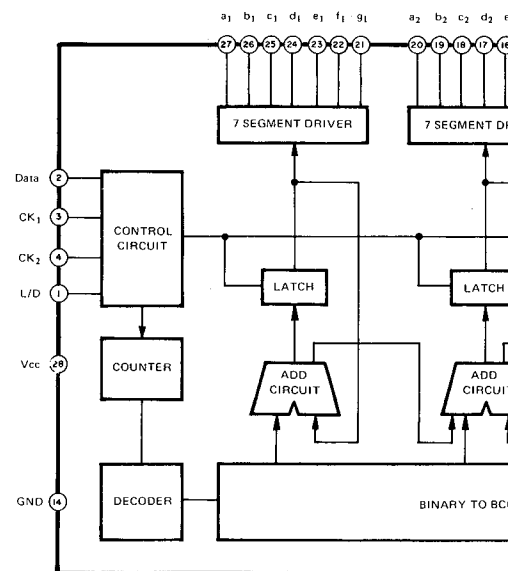


TONE CONTROL

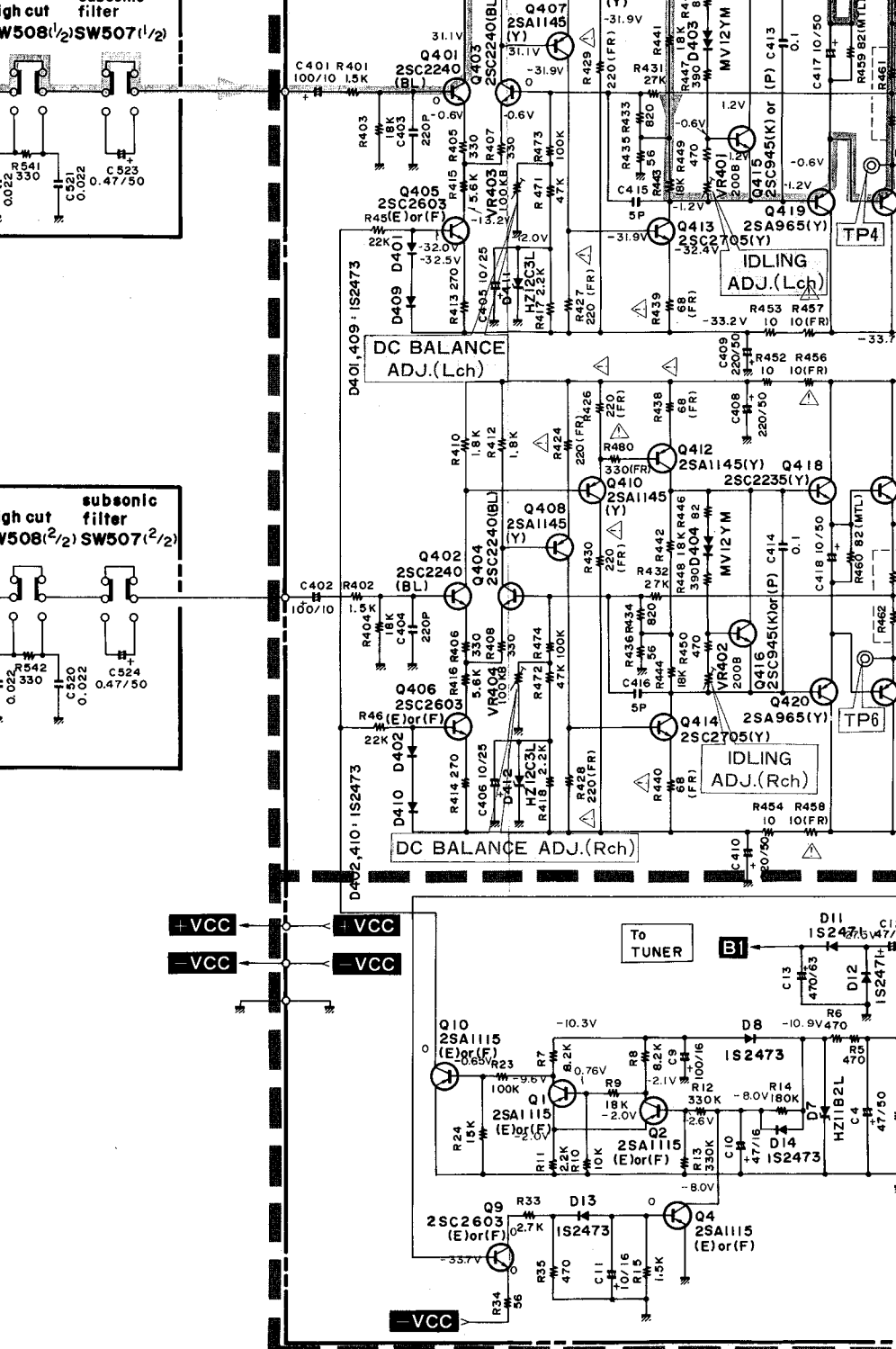
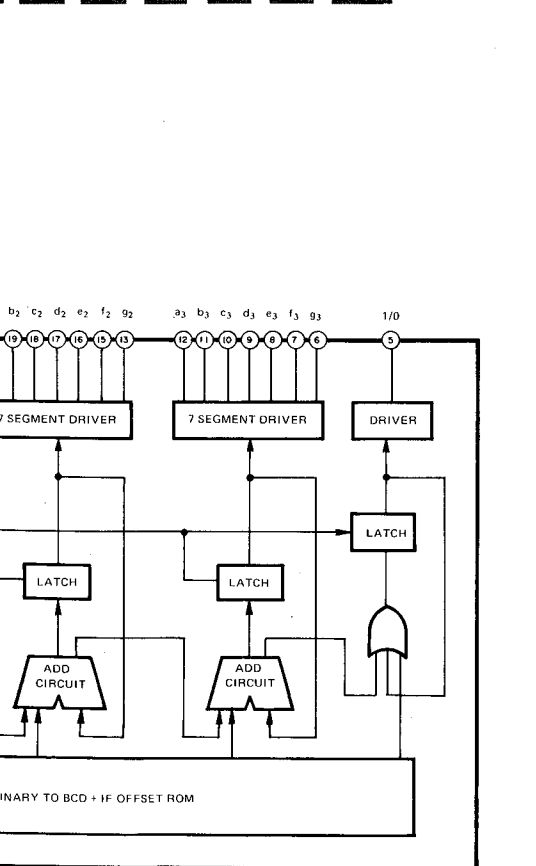
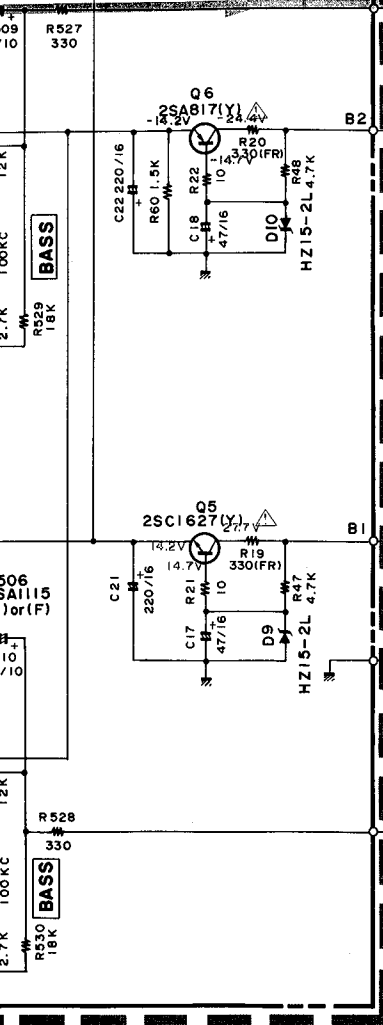
TC9147AP: IC702

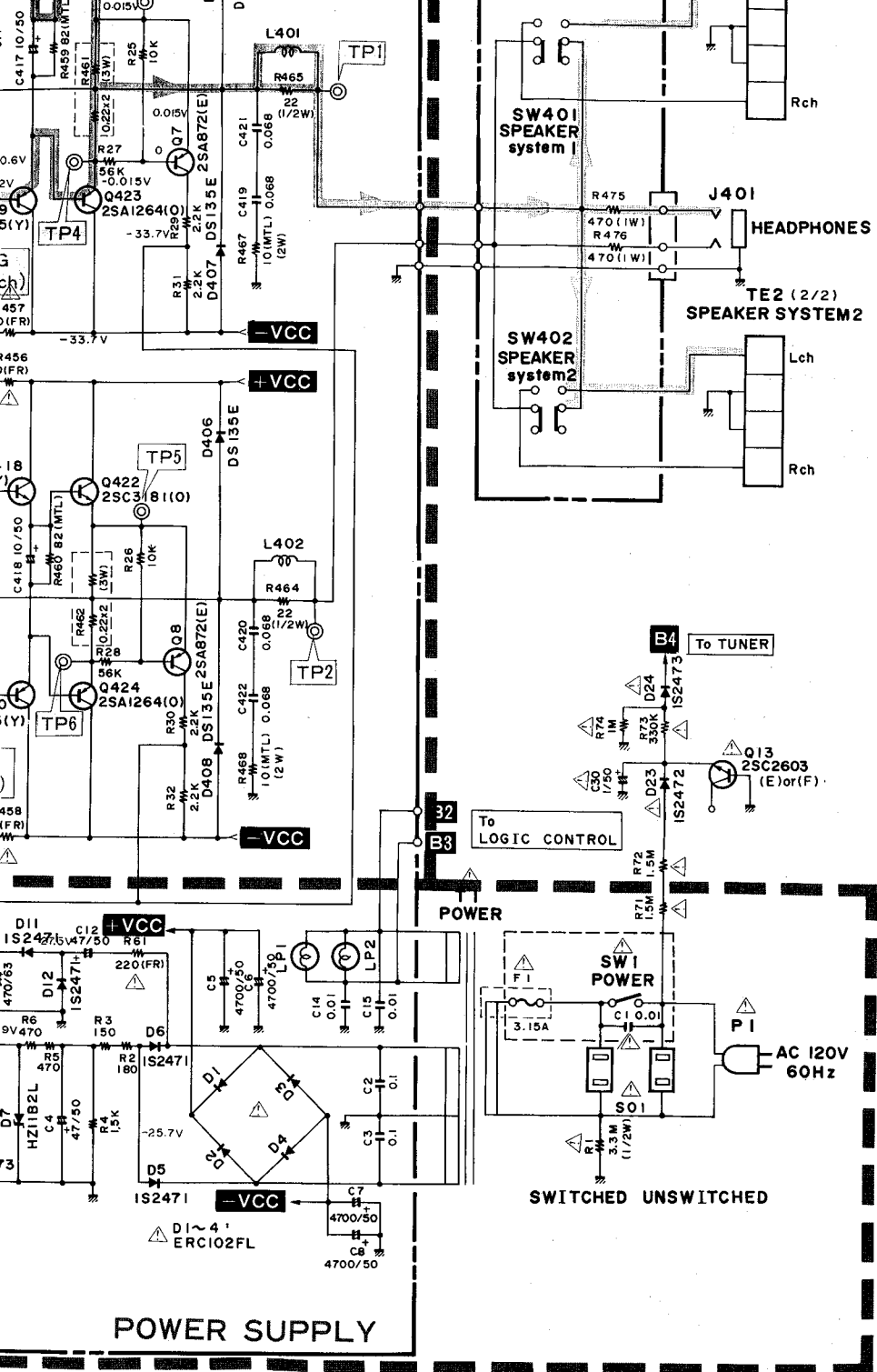


TD6301AP: IC703



3.4V
505
2SA1115
(or(F))

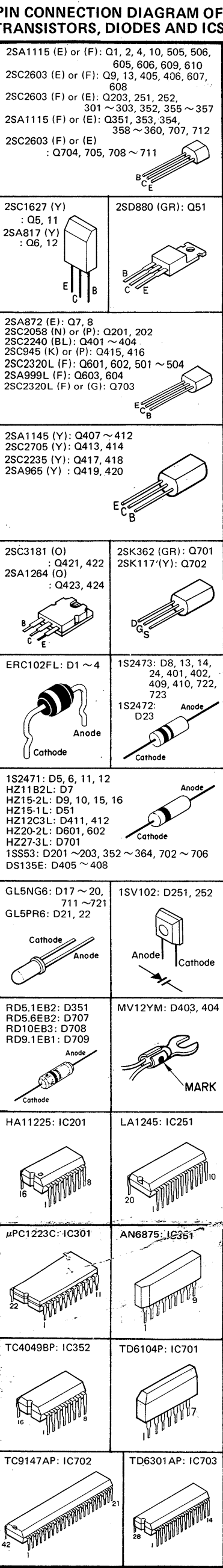
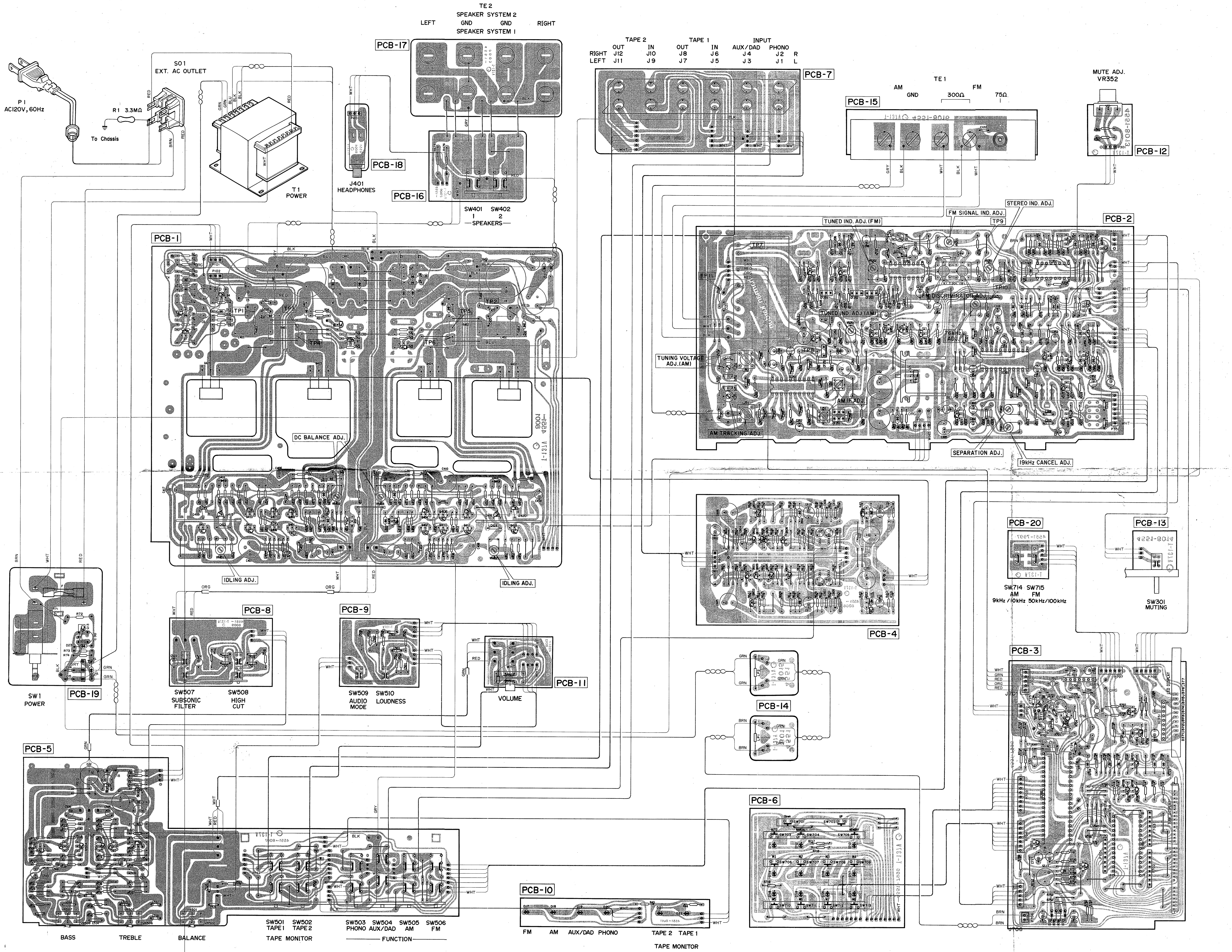




..... FM SIGNAL
 ■■■■■ AM SIGNAL
 PHONO SIGNAL

1. ALL RESISTANCES VALUES ARE IN Ω .
 $K\Omega=1000\Omega$, $M\Omega=1000K\Omega$.
2. THE WATTAGE OF RESISTORS IS 1/4W UNLESS OTHERWISE NOTED.
3. ALL CAPACITANCES VALUES ARE IN μF UNLESS OTHERWISE NOTED. $P=\mu\mu F$
4. V: DC VOLTAGE AT NO SIGNAL
 (... V) FM POSITION
 (... V) AM POSITION
5. \triangle SAFETY-REQUIREMENTS COMPONENTS IN ACCORDANCE WITH PRESENT SAFETY REGULATIONS. THESE COMPONENTS MUST ONLY BE REPLACED BY ORIGINAL PARTS.

WIRING DIAGRAM



A

B

C

D

WIRING DIAGRAM

1

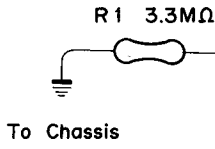
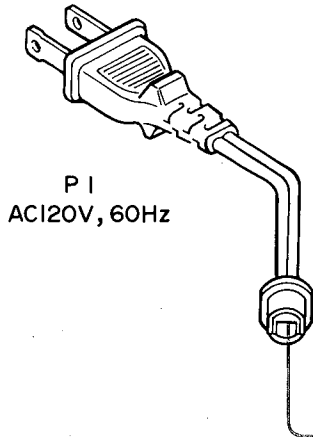
2

3

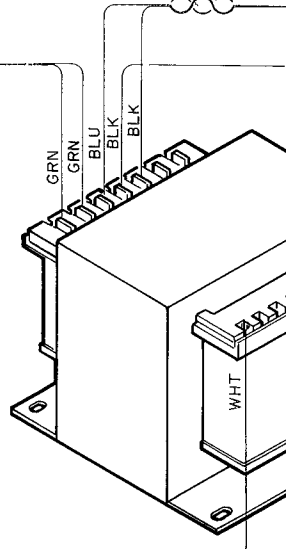
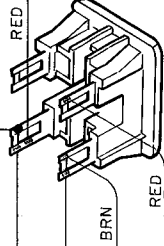
4

5

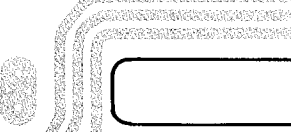
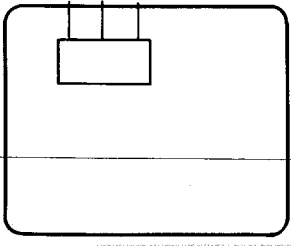
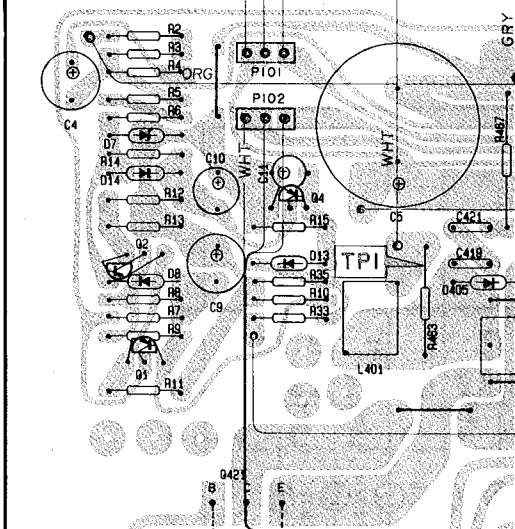
6



S01
EXT. AC OUTLET



PCB-1

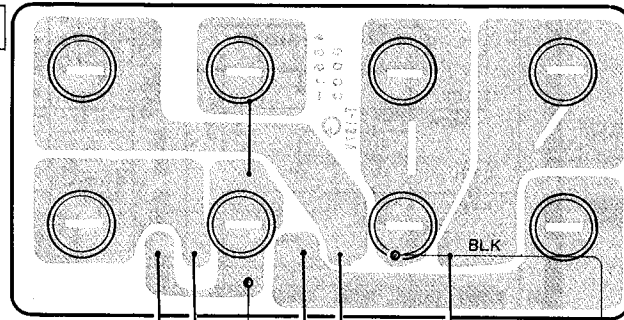


TE 2
 SPEAKER SYSTEM 2
 GND GND
 SPEAKER SYSTEM 1

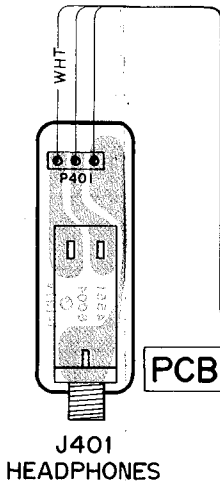
LEFT

RIGHT

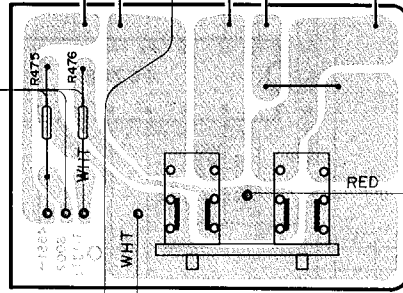
PCB-17



PCB-18

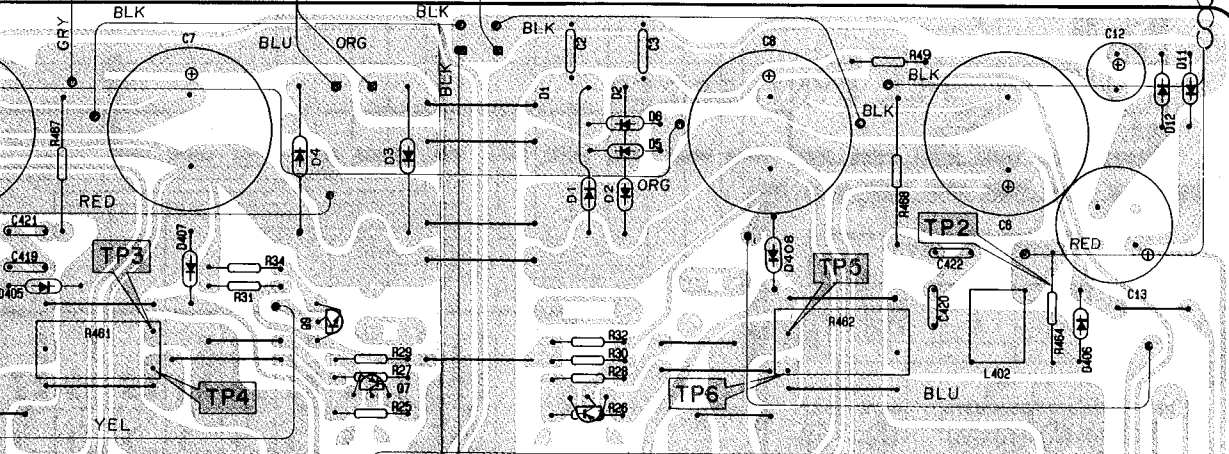
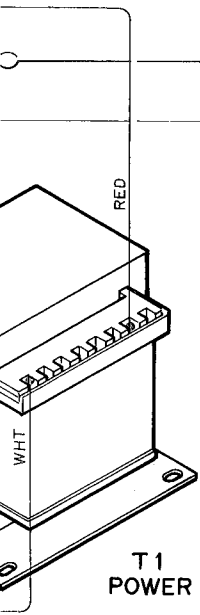


PCB-16



SW401 SW402
 1 2
 — SPEAKERS —

TAP
 OUT J12
 RIGHT
 LEFT J11



DC BALANCE ADJ.

1-101A
 1-101A
 1-101A

I

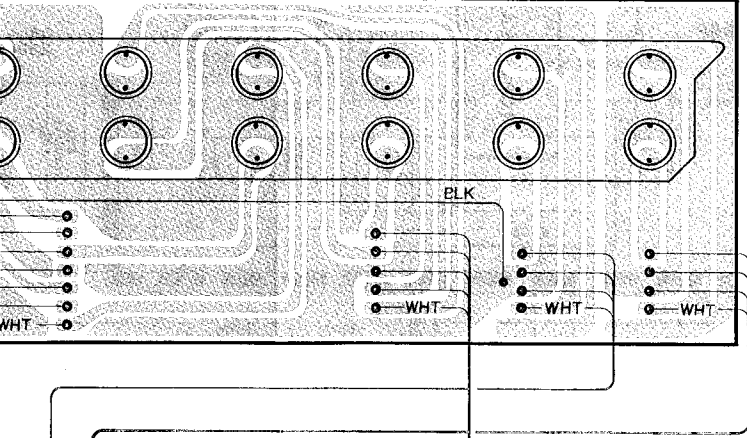
J

K

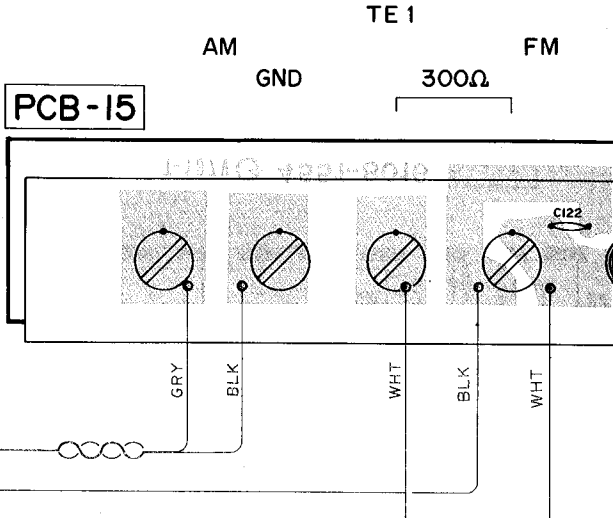
L

| | | | | | | | |
|----|--------|-----|--------|----|---------|-------|---|
| | TAPE 2 | | TAPE 1 | | INPUT | | |
| IN | J10 | OUT | J8 | IN | AUX/DAD | PHONO | |
| 2 | J9 | | J7 | J6 | J4 | J2 | R |
| 1 | | | | J5 | J3 | J1 | L |

PCB-7



PCB-15



TE 1

AM

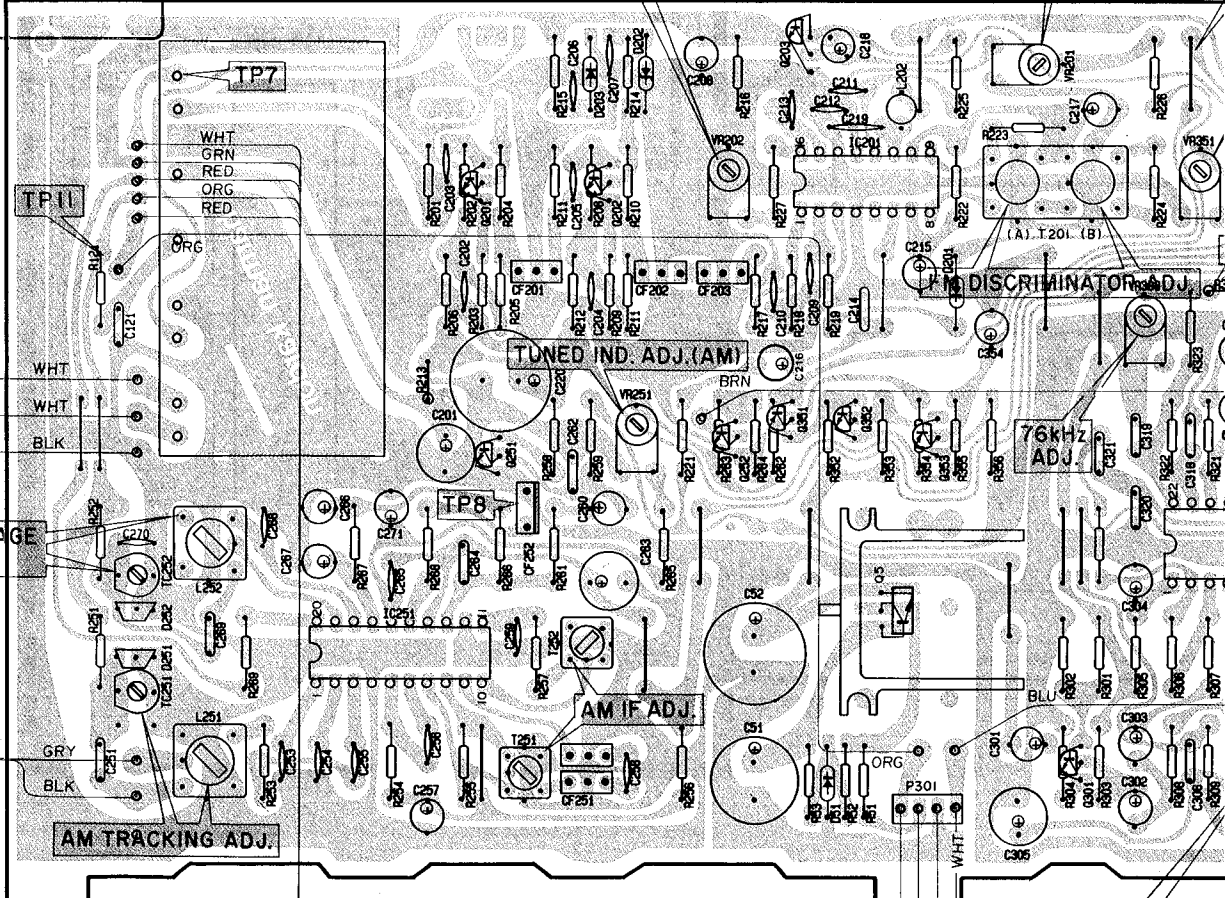
GND

FM

300Ω

TUNED IND. ADJ. (FM)

FM SIGNAL IND. A



TP11

WHT
GRN
RED
ORG
RED

WHT
WHT
BLK

TUNED IND. ADJ. (AM)

DISCRIMINATOR ADJ.

76KHZ ADJ.

AM IF ADJ.

TUNING VOLTAGE ADJ. (AM)

AM TRACKING ADJ.

SEPARATION ADJ.

PIN CONNECTION DIAGRAM OF TRANSISTORS, DIODES AND ICs.

2SA1115 (E) or (F): Q1, 2, 4, 10, 505, 506, 605, 606, 609, 610
 2SC2603 (E) or (F): Q9, 13, 405, 406, 607, 608
 2SC2603 (F) or (E): Q203, 251, 252, 301 ~ 303, 352, 355 ~ 357
 2SA1115 (F) or (E): Q351, 353, 354, 358 ~ 360, 707, 712
 2SC2603 (F) or (E): Q704, 705, 708 ~ 711

2SC1627 (Y): Q5, 11
 2SA817 (Y): Q6, 12

2SD880 (GR): Q51

2SA872 (E): Q7, 8
 2SC2058 (N) or (P): Q201, 202
 2SC2240 (BL): Q401 ~ 404
 2SC945 (K) or (P): Q415, 416
 2SC2320L (F): Q601, 602, 501 ~ 504
 2SA999L (F): Q603, 604
 2SC2320L (F) or (G): Q703

2SA1145 (Y): Q407 ~ 412
 2SC2705 (Y): Q413, 414
 2SC2235 (Y): Q417, 418
 2SA965 (Y): Q419, 420

2SC3181 (O): Q421, 422
 2SA1264 (O): Q423, 424

2SK362 (GR): Q701
 2SK117 (Y): Q702

ERC102FL: D1 ~ 4

1S2473: D8, 13, 14, 24, 401, 402, 409, 410, 722, 723
 1S2472: D23

1S2471: D5, 6, 11, 12
 HZ11B2L: D7
 HZ15-2L: D9, 10, 15, 16
 HZ15-1L: D51
 HZ12C3L: D411, 412
 HZ20-2L: D601, 602
 HZ27-3L: D701
 1SS53: D201 ~ 203, 352 ~ 364, 702 ~ 706
 DS135E: D405 ~ 408

1S2471: D5, 6, 11, 12
 HZ11B2L: D7
 HZ15-2L: D9, 10, 15, 16
 HZ15-1L: D51
 HZ12C3L: D411, 412
 HZ20-2L: D601, 602
 HZ27-3L: D701
 1SS53: D201 ~ 203, 352 ~ 364, 702 ~ 706
 DS135E: D405 ~ 408

GL5NG6: D17 ~ 20, 711 ~ 721
 GL5PR6: D21, 22

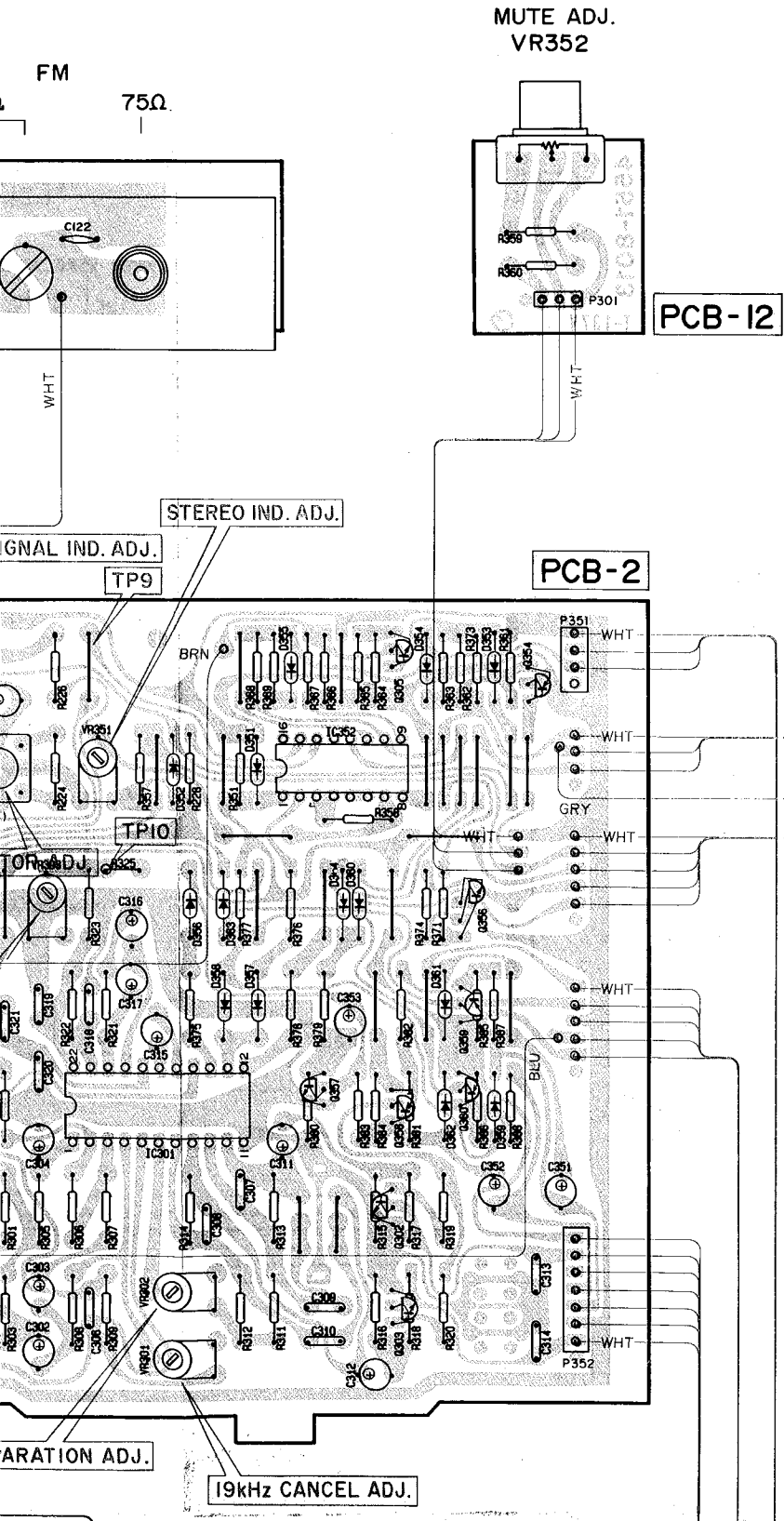
1SV102: D251, 252

RD5.1EB2: D351
 RD5.6EB2: D707
 RD10EB3: D708
 RD9.1EB1: D709

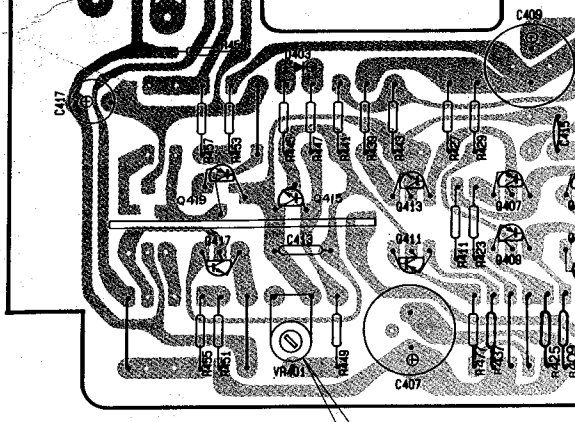
MV12YM: D403, 404

HA11225: IC201

LA1245: IC251

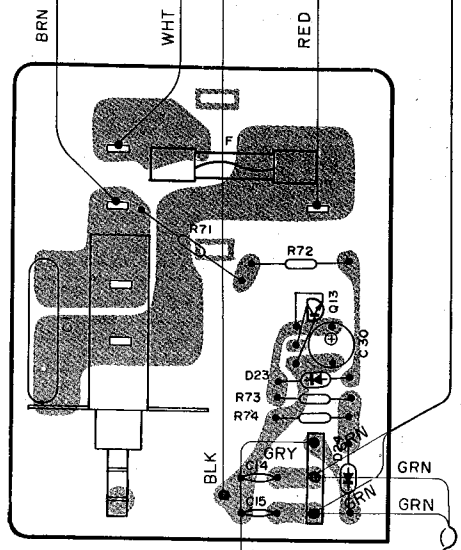


7



IDLING ADJ.

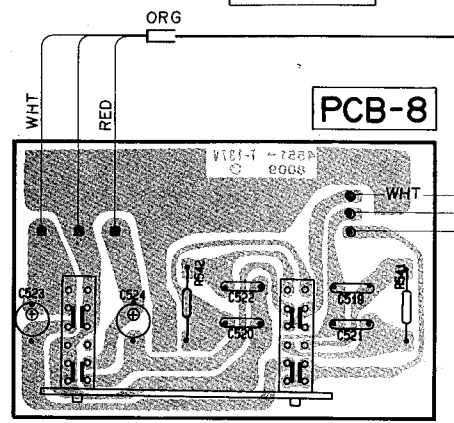
8



SW1
POWER

PCB-19

9

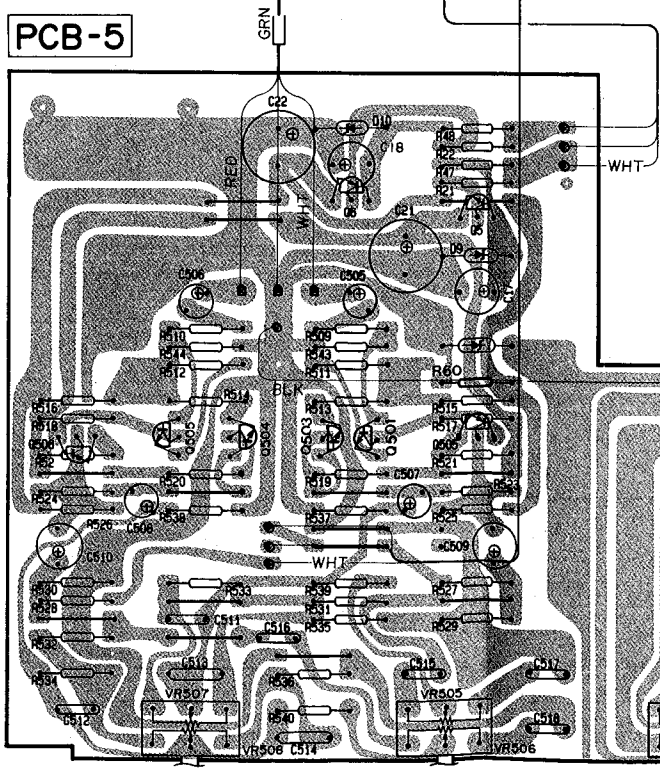


SW507
SUBSONIC
FILTER

SW508
HIGH
CUT

PCB-8

10

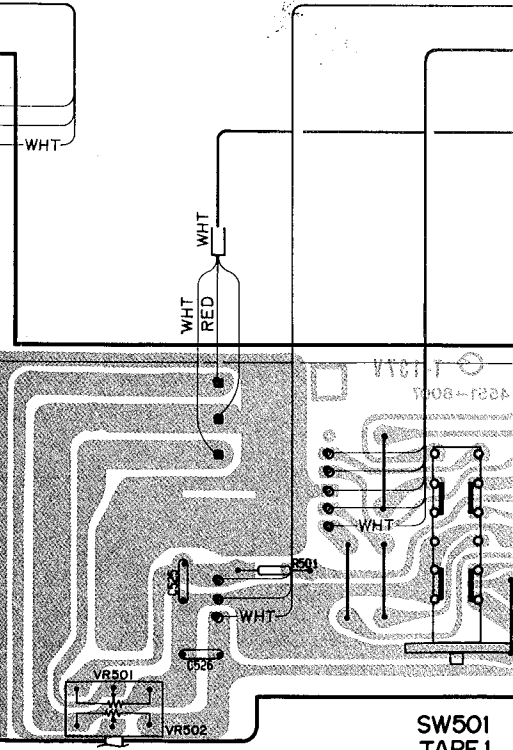


BASS

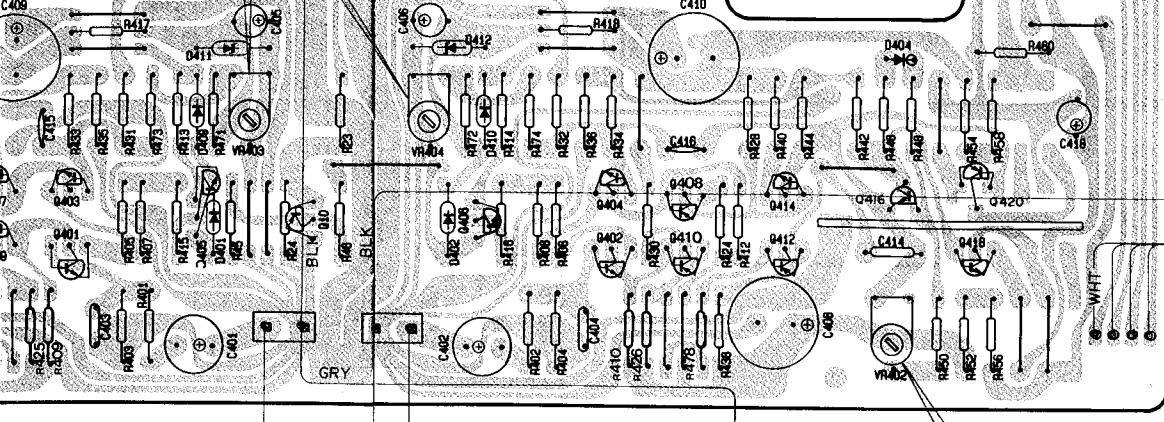
TREBLE

BALANCE

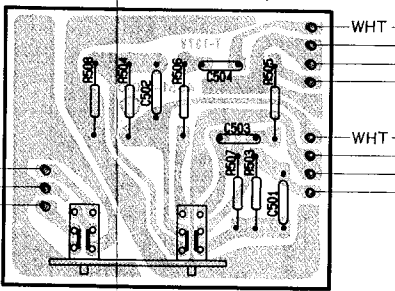
11



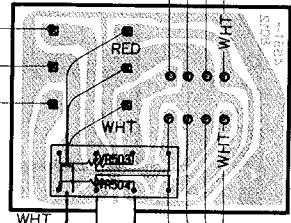
SW501
TAPE I
TAPE M



PCB-9

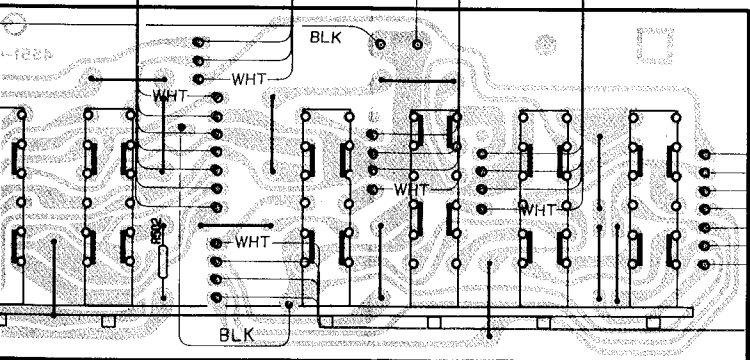


SW509 AUDIO MODE
SW510 LOUDNESS

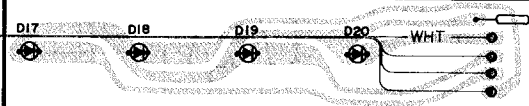


PCB-11

VOLUME

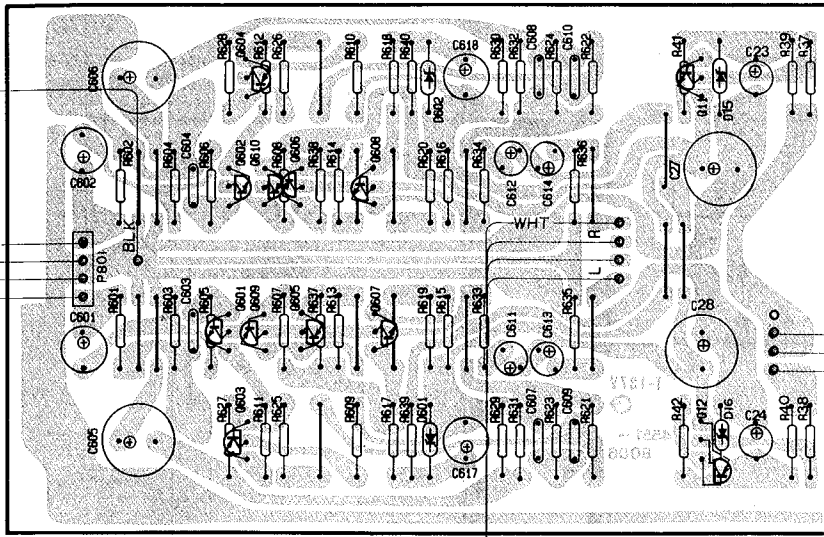


PCB-10

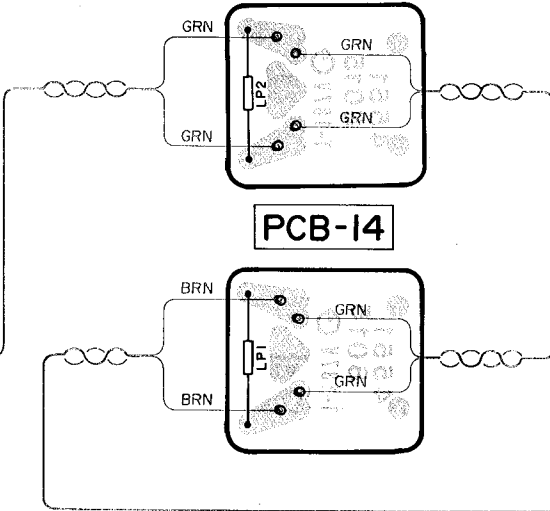


FM AM AUX/DAD PHONO

SW501 PE1
SW502 TAPE 2
SW503 PE MONITOR
SW504 PHONO
SW505 AUX/DAD
SW506 AM FM
FUNCTION

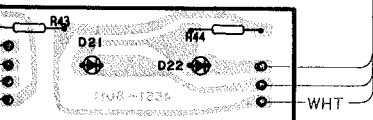
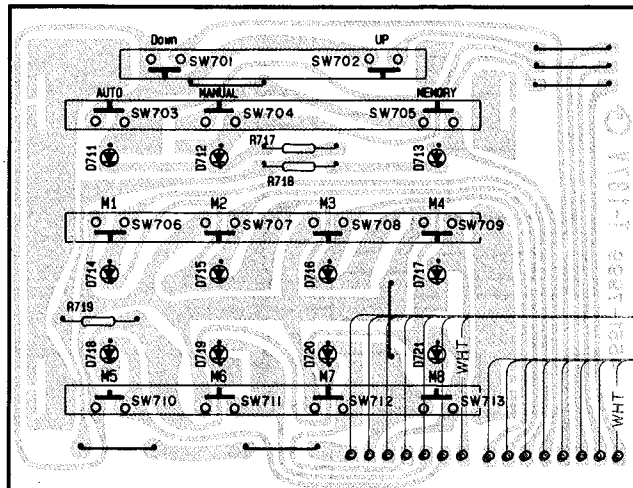


PCB-4



PCB-14

PCB-6



TAPE 2 TAPE 1
TAPE MONITOR

SW
A
9kHz / I

WHT
GRN
RED
ORG
RED

WHT

WHT

WHT

WHT

WHT

WHT

WHT

WHT

WHT

WHT

WHT

WHT

WHT

WHT

WHT

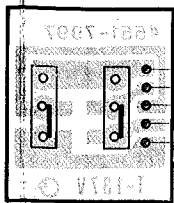
WHT

WHT

WHT

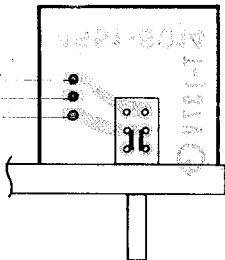
WHT

PCB-20



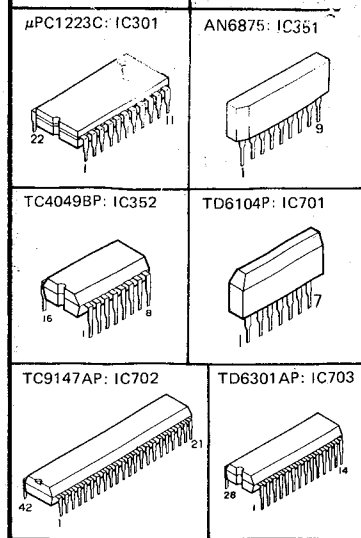
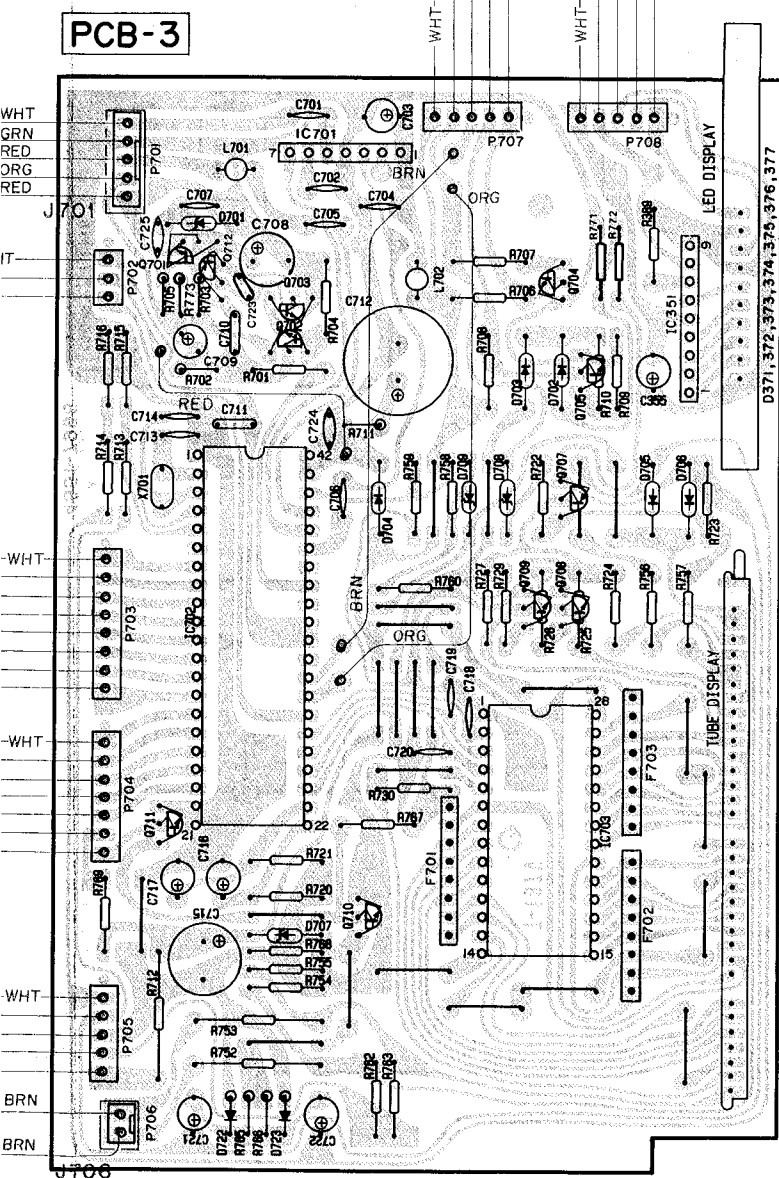
SW714 SW715
AM FM
9kHz / 10kHz 50kHz/100kHz

PCB-13



SW301
MUTING

PCB-3



WIRE COLOR ABBREVIATIONS

- | | |
|------------|-------------|
| RED: Red | GRN: Green |
| WHT: White | ORG: Orange |
| BLK: Black | YEL: Yellow |
| GRY: Gray | BRN: Brown |
| BLU: Blue | |