NIKKO RECEIVER

NR-1219

AM/FM STEREO RECEIVER

TYPE AND VOLTAGE

W-TYPE	UL and CSA type	120V AC
E-TYPE	NK-STD type	220/240V AC
N-TYPE	DEMKO and SEMKO type	
D-TYPE	DIN type	

SERVICE MANUAL

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SPECIFICATIONS

FM TUNER SECTION 〈W, E & N–TYPE〉

Usable Sensitivity: ..... better than 10 dBμ (3.16 μV)
50 dB Quieting Sensitivity:
..... better than 15 dBμ (5.6 μV)
Signal to Noise Ratio
(MONO): ..... better than 65 dB
(STEREO): ..... better than 60 dB
T. H. Distortion at 1 kHz
(MONO): ..... no more than 0.3 %
(STEREO): ..... no more than 0.8 %
Alternate Channel Selectivity: ..... better than 60 dB
Spurious Rejection Ratio: ..... better than 80 dB
Image Frequency Rejection Ratio: .... better than 80 dB
IF Rejection Ratio: ..... better than 80 dB
AM Suppression Ratio: ..... better than 50 dB
Capture Ratio: ..... better than 4 dB
Stereo Separation
(100 Hz): ..... better than 30 dB
(1 kHz): ..... better than 35 dB
(10 kHz): ..... better than 30 dB
Subcarrier Supression Ratio: ..... better than 58 dB
Muting Sensitivity: ..... 30 dBμ ± 8 dB
T-LOCKED System
(Lock Range): ..... 150 kHz ± 100 kHz
(Lock in Range): ..... 50 kHz ± 20 kHz
FM Tuning Range: ..... 87.9 ~ 108.5 MHz
Antenna Impedance
..... 300 ohms balanced & 75 ohms unbalanced
Output Level: ..... 550 mV ± 2 dB

AM TUNER SECTION

Usable Sensitivity, Ferrite Loopstick Antenna:
..... better than 1000 μV/m
Signal to Noise Ratio: ..... better than 38 dB
Image Frequency Rejection Ratio: .... better than 30 dB
IF Rejection Ratio: ..... better than 25 dB
Selectivity (± 10 kHz): ..... better than 30 dB
AM Tuning Range: ..... 530 ~ 1630 kHz
Output Level: ..... 120 mV ± 3 dB

AUDIO AMPLIFIER SECTION

Continuous Power Output per channel
20 ~ 20000 Hz (8 ohms): ... more than 100 Watts
1000 Hz (8 ohms): ..... more than 100 Watts
1000 Hz (4 ohms): ..... more than 110 Watts
T. H. Distortion, 8 ohms
at Continuous Power Output:
..... no more than 0.03 %
at 1 Watt Power Output: .... no more than 0.05 %
I. M. Distortion, 8 ohms
at Continuous Power Output:
..... no more than 0.03 %
at 1 Watt Power Output: .... no more than 0.05 %
IHF Power Bandwidth, 8 ohms: ..... 20 ~ 30000 Hz
Damping Factor, at 1000 Hz, 8 ohms: 50
Frequency Response
PHONO → TAPE OUT (RIAA Equalization):
..... 30 ~ 15000 Hz ± 0.5 dB
AUX, TAPE IN → SPEAKER TERMINAL:
..... 10 ~ 40000 Hz ± 2 dB
Input Sensitivity for 100 Watts Power Output
PHONO ..... 2.5 mV ± 2 dB
AUX, TAPE IN ..... 150 mV ± 2 dB
MAIN IN ..... 1000 mV ± 2 dB
PHONO Maximum Input Capability, at 1000 Hz:
..... more than 200 mV
Output Level at Continuous Power Output,
(input: PHONO) TAPE OUT: ..... 150 mV ± 2 dB
PRE OUT: ..... 1000 mV ± 2 dB
Tone Control
BASS (70 Hz) Boost: ..... +10 dB ± 2 dB
Cut: ..... –10 dB ± 2 dB
MID (1000 Hz) Boost: ..... + 6 dB ± 2 dB
Cut: ..... –6 dB ± 2 dB
TREBLE (10000 Hz) Boost: ..... + 10 dB ± 2 dB
Cut: ..... – 10 dB ± 2 dB
Loudness Control (Volume control set at –30 dB position)
70 Hz: ..... + 10 dB ± 2 dB
10000 Hz: ..... + 6 dB ± 2 dB
Subsonic Filter, at 20 Hz: ..... –3 dB ± 2 dB
High Filter, at 10000 Hz: ..... –3 dB ± 2 dB
Signal to Noise Ratio, IHF "A" Network
PHONO: ..... better than 82 dB
AUX, TAPE IN: ..... better than 90 dB
Audio Muting: ..... –20 dB ± 2 dB
Output Muting Delay Time: ..... 6 Sec. ± 3 Sec.
Residual Hum and Noise, 8 ohms:
..... no more than 1.5 mV
Idling Current: ..... 40 mA ± 20 mA
Midpoint Voltage: ..... 0 V ± 100 mV

FM TUNER SECTION 〈D–TYPE〉 They were measured according to DIN standard.

Usable Sensitivity: . . . . . better than 3 dBμ (1.4 μV)
50 dB Quieting Sensitivity:
. . . . . better than 14 dBμ (5.0 μV)
Signal to Noise Ratio
(MONO): . . . . . better than 55 dB
(STEREO): . . . . . better than 55 dB
T. H. Distortion at 1 kHz
(MONO): . . . . . no more than 0.3 %
(STEREO): . . . . . no more than 0.8 %
Alternate Channel Selectivity: . . . . . better than 50 dB
Spurious Rejection Ratio: . . . . . better than 80 dB
Image Frequency Rejection Ratio: . . . . better than 80 dB
IF Rejection Ratio: . . . . . better than 80 dB
AM Suppression Ratio: . . . . . better than 50 dB
Capture Ratio: . . . . . better than 4 dB
Stereo Separation
(100 Hz): . . . . . better than 30 dB
(1 kHz): . . . . . better than 35 dB
(10 kHz): . . . . . better than 30 dB
Subcarrier Supression Ratio: . . . . . better than 58 dB
Muting Sensitivity: . . . . . 8 dBμ ± 8 dB
T-LOCKED System
(Lock Range): . . . . . 150 kHz ± 100 kHz
(Lock in Range): . . . . . 50 kHz ± 20 kHz
FM Tuning Range: . . . . . 87.5 ~ 108.5 MHz
Antenna Impedance
. . . . . 300 ohms balanced & 75 ohms unbalanced
Output Level: . . . . . 280 mV ± 2 dB

AM TUNER SECTION

Usable Sensitivity, Ferrite Loopstick Antenna:
. . . . . better than 1000 μV/m
Signal to Noise Ratio: . . . . . better than 38 dB
Image Frequency Rejection Ratio: . . . . better than 30 dB
IF Rejection Ratio: . . . . . better than 25 dB
Selectivity (± 10 kHz): . . . . . better than 30 dB
AM Tuning Range: . . . . . 530 ~ 1630 kHz
Output Level: . . . . . 120 mV ± 3 dB

AUDIO AMPLIFIER SECTION

Continuous Power Output per channel
20 ~ 20000 Hz (8 ohms): . . . more than 100 Watts
1000 Hz (8 ohms): . . . . . more than 100 Watts
1000 Hz (4 ohms): . . . . . more than 110 Watts
T. H. Distortion, 8 ohms
at Continuous Power Output:
. . . . . no more than 0.03 %
at 1 Watt Power Output: . . . . no more than 0.05 %
I. M. Distortion, 8 ohms
at Continuous Power Output:
. . . . . no more than 0.03 %
at 1 Watt Power Output: . . . . no more than 0.05 %
IHF Power Bandwidth, 8 ohms: . . . . . 20 ~ 30000 Hz
Damping Factor, at 1000 Hz, 8 ohms: 50
Frequency Response
PHONO → TAPE OUT (RIAA Equalization):
. . . . . 30 ~ 15000 Hz ± 0.5 dB
AUX, TAPE IN → SPEAKER TERMINAL:
. . . . . 10 ~ 40000 Hz ± 2 dB
Input Sensitivity for 100 Watts Power Output
PHONO . . . . . 2.5 mV ± 2 dB
AUX, TAPE IN . . . . . 150 mV ± 2 dB
MAIN IN . . . . . 1000 mV ± 2 dB
PHONO Maximum Input Capability, at 1000 Hz:
. . . . . more than 200 mV
Output Level at Continuous Power Output,
(input: PHONO) TAPE OUT: . . . . . 150 mV ± 2 dB
PRE OUT: . . . . . 1000 mV ± 2 dB
Tone Control
BASS (70 Hz) Boost: . . . . . +10 dB ± 2 dB
Cut: . . . . . –10 dB ± 2 dB
MID (1000 Hz) Boost: . . . . . + 6 dB ± 2 dB
Cut: . . . . . –6 dB ± 2 dB
TREBLE (10000 Hz) Boost: . . . . . + 10 dB ± 2 dB
Cut: . . . . . – 10 dB ± 2 dB
Loudness Control (Volume control set at –30 dB position)
70 Hz: . . . . . + 10 dB ± 2 dB
10000 Hz: . . . . . + 6 dB ± 2 dB
Subsonic Filter, at 20 Hz: . . . . . –3 dB ± 2 dB
High Filter, at 10000 Hz: . . . . . –3 dB ± 2 dB
Signal to Noise Ratio, IHF "A" Network
PHONO: . . . . . better than 82 dB
AUX, TAPE IN: . . . . . better than 90 dB
Audio Muting: . . . . . –20 dB ± 2 dB
Output Muting Delay Time: . . . . . 6 Sec. ± 3 Sec.
Residual Hum and Noise, 8 ohms:
. . . . . no more than 1.5 mV
Idling Current: . . . . . 40 mA ± 20 mA
Midpoint Voltage: . . . . . 0 V ± 100 mV

GENERAL

Power Requirement
W–TYPE: . . . . . AC 120V, 60 Hz
E, N and D–TYPE: . . . . . AC 220/240V, 50/60 Hz
Power Consumption: . . . . . 470 Watts
Dimensions (Width): . . . . . 556 mm (22 inches)
(Height): . . . . . 179 mm (7 inches)
(Depth): . . . . . 380 mm (15 inches)
Weight, without package: . . . . . 17.5 Kg

Specifications are subject to change without notice.

BLOCK DIAGRAM

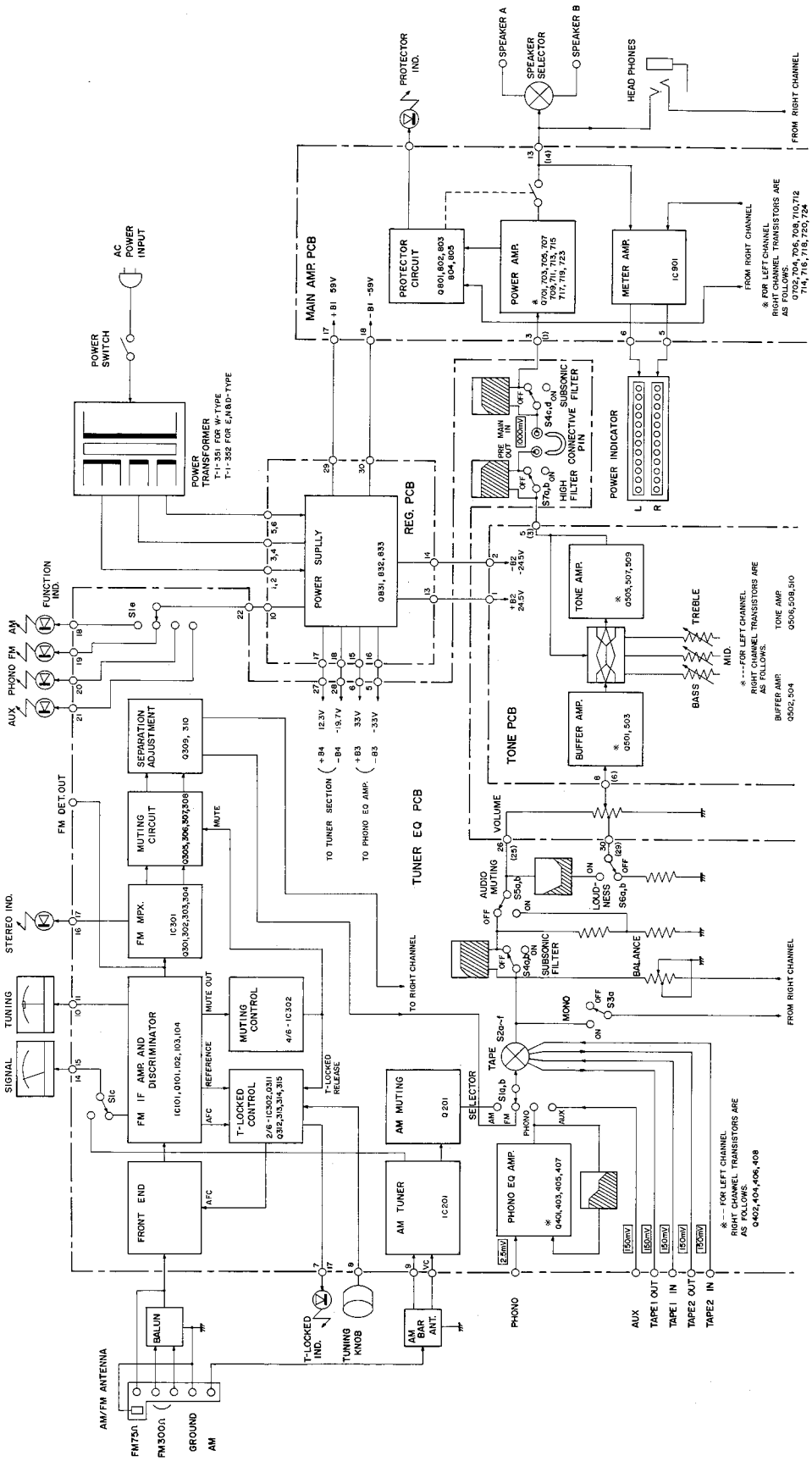


Figure 1

CIRCUIT DESCRIPTION

THE T-LOCKED (TUNE-LOCKED) SYSTEM

1. FUNCTION

The T-Locked System automatically detects and modifies frequency drifts due to changes in temperature or humidity when FM broad cast is received, controls the increase in the distortion due to drifts and keeps the receiver in the optimum condition. (in the lock condition)
Furthermore, this locked condition is cancelled automatically when the tuning knob is touched. After choosing the broadcasting station, taking finger away from the tuning knob, the circuit reoperates again and returns to the lock condition. The lock condition is shown by the emitting of the green LED.

2. ACTION

(a) Cancellation of the lock condition

1. On putting a finger on the tuning knob, the hum which induced in the human body is inputed to pin #13 of IC302 (μPD4069C). Here this IC is used as a high impedance amplifier and outputs into pin #12 after an amplification of about 20 dB. This signal goes through the resistor R361 and is rectified by two diodes, D302 and D303, to produce direct durrent (approx. 3 ~ 6 V). This "H" signal is inverted between the #1 and the #2 pin of IC302 and then becomes the "L" signal.
2. This "L" signal turns off the T-Locked indicator (LED #5) in order to cut off the transistor Q311 (2SC945L). Simultaneously, as this signal also cuts off FET Q312 (2SK104), the transistor Q313 connected to the source of Q312 is also cut off. As the transistors, Q313 and Q314, are used as differential amplifier, only the reference signal from the #10 pin of IC101 (HA11225), which is inputed to the base of Q314 appeares in the collector output of the transistor Q315. This signal is fed back to the front end as the AFC signal. However, this signal does not influence the local frequency in any way. Because of this, the lock is cancelled.

   NOTE: Further, in the case when the input from the antenna is weak or detuned, the mute output from the #12 pin of IC101 triggers the schmidt trigger (which consists of the #3, 4, 5 and 6 pins of IC302 and the resistor R363), cancelling the T-Locked System. Also this signal goes through the diodes, D305 and D314, and is used as the muting signal.

(b) Lock action

1. Taking the finger away from the tuning knob, the input to the #13 pin of IC301 goes to zero, turning both Q311 and Q312 on and Q311 excites the T-Locked indicator (LED #5), while Q312 adds the AFC signal outputed from the #7 pin of IC101 to the base of Q313. As mentioned in the section on the lock cancellation, Q313 and Q314 are differential amplifier and after the AFC signal is added to the base of Q313 and the reference signal is added to the base of Q314, the difference of the two signals mentioned above appears at the collector of Q315. This signal is fed back to the Front End as the AFC signal controls. The AFC signal controls the local frequency oscillator in such a way that the difference between the reference signal and the AFC signal is minimized and the circuit becomes stable. Namely, this is the lock condition.
   Further, in the actual movement, the LED #5 is not turned on immediately after the finger is taken away from the tuning knob, but its lighting depends on the time constant of C330 and R358 and thus the circuit gets into the lock condition a few seconds after the finger is taken away from it.

CIRCUIT SUPPLEMENTARY EXPLANATION

For the following explanation, refer to the block diagram on page 3 and the attached schematic diagram.
The electric circuit of this set is constructed of ten PCB (Printed Circuit Board), a power transformer, switches of many kinds, and other components.
There are four main PCB's: Tuner EQ (Equalizer) PCB, Tone PCB, Main Amp PCB and the Reg (Regulator) PCB. The outline of the circuits in each PCB and their action follows.

1. TUNER EQ PCB

This PCB contains the following circuit blocks: FM Front End FM IF Block, FM MPX (Multiplex) Block, T-Locked System Block, Muting Control Block, Muting Circuit Block, Separation Adjustment Block, AM Tuner Block, AM Muting Block, and Phono EQ Block.

1. FM Front End

   The FM Front End uses four linked variable capacitor in the tuning circuit. In the RF amplifier, a dual gate MOS FET of high PG (Power Gain) low NF (Noise Figure) low feedback capacitance is used. For the local oscillator, a stable Clapp type-oscillating circuit having good stability has been used. The input of the

FM front end is a high stability RF amplifier and the mixer stage, the double-tuned circuit has been inserted. The RF signal which has passed through the double-tuned circuit is added to the base of the transistor, mixer, however, the oscillating output from the local oscillating circuit is also added to the base of this transistor through a small value capacitor and thus conversion of the frequency is performed. A varicap diode has been inserted to the resonance circuit of the local oscillator and by adding the AFC signal from the T-Locked System to this diode, the oscillating frequency can be varied within a small range.

2. FM IF Block

The FM IF block consists of four transistors, one IC and three ceramic filters chosen for the selection elements. The transistors, acting as two pairs of differential amplifiers, amplify the IF signal. On the other hand, the IC (HA11225) amplifies the IF signal, restricts the amplitude gain, recovers the quadrature type FM, detects the muting level and also, drives the signal meter and the tuning meter. In the case when the IF signal to the IC is too weak and goes down lower than the level which was set beforehand, the IC releases the mute signal and this is sent to the muting control block.

The three ceramic filters of the selection elements are inserted between each stage. Further, this set has FM DET OUT terminal. Adding an adaptor to this terminal, enables the receiver to receive FM 4 Channels broadcaseing, the SCA signal etc.

3. FM MPX Block

The FM MPX block consists of four transistors and one IC. The transistor, Q301, works as a low cut filter, suppressing the noise in the very lower frequency bounds involved when the FM station is being chosen. IC (HA11223W) is a PLL (Phase Locked Loop) MPX IC and is an IC with high S/N and a low distortion rate. It contains the PLL VCO, MPX demodulator, pilot cancel circuit, the stereo/mono automatic switching circuit, and the stereo lamp driver.

The transistor Q302 stops the VCO of the IC, when the selector is not in the position of "FM AUTO". Q303 and Q304 do the switching of the stereo indicator. Switching of stereo/monoral is provided in this instrument and in the case of monoral, the stereo indicator does not turn on even though the broad casting is in stereo. When the MONO switch on the front panel is turned "ON", Q304 is on, the base of Q303 becomes 0 volt, Q303 is cut off, and the stereo indicator is turned off. In the case when the MONO switch is "OFF", it responds according to the signal from the Muting Control Block.

4. T-Locked System Block

Refer to page 4.

5. Muting Control Block, and Muting Circuit Block

The muting control block consists of the C-MOS Digital IC (μPD4069C) and RC parts. This IC contains six inverters, as shown in the semi-conductor data section at the end of the Service Manual. These inverters are mainly used in the two pairs of schmidt trigger circuits consisting of four out of the six inverters. The output of the schmidt trigger circuit switches "ON" or "OFF" the transistors of the muting circuit block is explained in the following. The muting circuit block contains four transistors. When they are on, they short the output of the FM MPX demodulator to ground and perform muting. In order to make the muting effective, Q307 and Q308 mute after Q305 and Q306 mute. When the FM signal gets weaker, the FM IF block sends the mute signal to the muting control block. This signal triggers one pair of the schmidt trigger circuits (IC302, Pin #3, 4 5 & 6). This output (IC302, Pin #6) goes through the diode, D305, then through the FM muting switch (S 11) and being added to the bases of the transistors, Q305 ~ Q308, mutes the FM output. Also, in the case when the mono switch is in the "OFF" position, this signal is added to the base of the transistor, Q304, and the stereo indicator is turned off because Q304 is on and Q303 is off. In the case when FM muting switch is off, obviously muting does not occur, so we can listen to the broadcasting even though the input of the antenna is weak.

The input (IC302 Pin #11) of the other pair of the schmidt trigger circuits in the Muting Control Block (IC302, Pin #11, 10, 9 & 8) is connected to the selector (S Id).

When the selector is in any position except the "FM AUTO" position, the DC power source is connected and the schmidt trigger circuit produces about 5.9V of output (IC302, Pin #8). This voltage goes through the diode D307 and the resistor R370 and turns on the transistors, Q305 ~ Q308, muting the FM output. When the selector is switched from "AM" to "FM AUTO", or from "PHONO" to "FM AUTO", the electric charge stored in the capacitor (C311) at the input of the schmidt trigger circuit does not discharge at once, but it is discharged slowly at a rate according to the resistor R366. Accordingly, until this voltage comes to the threshold voltage of the schmidt trigger circuit, the schmidt trigger circuit continues outputing, after triggering the output goes to 0 V and so the muting is cancelled a short time after the FM output has been switched in the selector.

In the case when the selector is switched from "FM AUTO" to "AM" or from "FM AUTO" to "PHONO",

the time constant of the charge of the capacitor C311, depends on the value of the capacitor C311 and the value of the resistor R367. As this time constant is small, the FM output is muted nearly immediately in this case.

6. Separation Adjustment Block

After the FM MPX demodulator output, the circuit consisting the two transistors, Q309 and Q310, is in the separation adjustment block. Generally the separation after output of the FM MPX demodulator is already enough in itself, however this receiver has this block designed into it to improve the separation. The circuit is a general emitter (grounded) amplifier, and it is connected by semi-fixed resistor between these emitters of the two channels. For example, if the crosstalk level of the left channel input is made to be ΔR. (the crosstalk level of the left channel input is the component which leaks from the right channel). Now, some part of the right channel is added to the emitter of the left channel and the level is controlled to be equal to ΔR component become equal and the input signal does not flow to the base.
This means that the ΔR component is not amplified, therefore this does not appear in the output, which means further that the separation has improved in the system. The improvement of the separation is performed in the right channel in the same way.

7. AM Tuner Block

The kernel of the AM Tuner Block is only one IC. This IC (HA1197) contains a RF amplifier, a frequency converter section, an IF amplifier section, a demodulation circuit and AGC circuit. It also performs all the necessary work of the AM tuner. Further, the antenna circuit incorporates the ferrite loop stick antenna, the tuning circuit equips two linked variable capacitor and the selection element equips two ceramic filters.

8. AM Muting Block

The transistor Q201 is this block. In all cases when the position of the selector is not in "AM" position, the power sources of the RF amplifier, and the frequency converter section are cutoff. So, when the selector is changed from "FM AUTO" to "AM", click noise at changing the source might occur. The transistor Q201, avoide this. When the selector is in "FM AUTO" the base of the transistor, Q201, is turned on as its power source is connected through the resistor R214, the output of the AM tuner shorts with ground, and the output is muted. At this time, the capacitor, C214, connected to the base of the transistor, Q201, is charged. When the selector is changed into the "AM" position, the power source of the base of Q201 is cut off, but still the capacitor connected to the base, Q201, keeps "ON" for a while and then turns "OFF". In this way the click noise of the selector change is eliminated.

9. Phono EQ Block

The EQ amplifier is a three-stage direct coupled circuit and also the final stage adopts a SEPP (Single Ended Push-Pull) circuit.
All the transistors used in this block are high breakdown voltage, low noise types in order to get the high ratio of S/N and the wide dynamic range. As the equalizing capacitors and resistors with very small errors have been used in the NF circuit, the deviation to the RIAA curve is very small.

2. TONE PCB

This PCB consists of a buffer amplifier and NF type tone control amplifier. The buffer amplifier is a two stage direct coupled circuit with two silicon transistors per channel. Care has been taken to eliminate effects of the impedance of the previous stage on the tone control frequency characteristic. The tone control amplifier is of the NF type. It is made to have the frequency characteristic depending on the resistor and the capacitor inside of the NF loop. This amplifier also adopts a two stage direct coupled circuit, but the first stage is a differential amplifier. The special characteristic of this receiver is the addition of the control of the mid-range which controlls ordinary bass as well as the treble control. The flexibility to control the quality of sound is made large by this three system tone control.

3. MAIN AMP PCB

This PCB contains the following circuit block: Power Amplifier Block, Protector Block and Meter Amplifier Block.

1. Power Amplifier Block

This circuit is a DC amplifier which does not have the coupling capacitor connected at the input section or the NF loop (when the subsonic filter is off) and not only the music signal but also the direct current can be amplified with flat gain. So for this reason the speaker can be damped effectively to the ultra low frequency range.
Also, as it does not have the coupling capacitor, the S/N ratio and the distortion ratio are improved. The circuit is composed of two main sections. They are the voltage amplification section and the power amplification section.
This receiver has three stages of voltage amplification Also, for the power amplification stage, a Darlington Pure Complementary OCL Circuit is used.

The first stage is a differential amplifier using dual transistors. Generally this teansistor (2SA798) is a mold of two low-noise transistors and as a special characteristic, the difference of each *hfe* is very small and its thermal condition is balanced.
For this reason the stability of the mid-point of the voltage drift of the power amplifier stage is high. Also, when this transistor does not have any signal, a circuit is equipped inside such that the base current is cancelled and the voltages of the input and the output maintain zero voltage. In the second stage, similar PNP transistors Q703 and Q705 (R ch. = Q704, 706) form the differential amplifier such that it drives the third stage. The transistor, Q707 and Q709 (R ch. = Q708, 710) composed the third stage of the voltage amplification section and drive the power stage. Most of the open loop gain is developed by this third stage.
Q721 (R ch. = Q722) is thermal coupled with the heat sink and makes the idle current of the power stage stable. In the case of no-signal, the idle current is gained by controlling R753 (R ch. = R754).
For the power stage, the Darlington Pure Complementary OCL Circuit is used. For the power transistor, the mold package type transistor is used.

2. Protector Circuit Block

The protector circuit block consists of five transistors (Q801 ~ Q805). Also, the transistors Q723 and Q724 which belong to the power amplifier block belong to this block. This can be seen from the examination of their functions. When the circuit is turned on, the excessive current which is output and at the same time occurs due to the shorting of the load circuit and the change of the mid-point voltage occuring due to abnormal inputs are detected. In these cases the speaker is cut off from the power amplifier block and the circuit and speakers are protected.

(a) The output muting action

Consider when the power source is turned on. The transistors, Q801 ~ Q803, are cut off. The positive voltage through R807 to the base of Q804 and the negative voltage through R807 are added, so these voltages cancel each other, then consequently the voltage becomes about –4.3 V and Q804 is cut off. Though the positive voltage is pressed to the base of Q805 through R809, the base current does not flow until the capacitor, C804, is charged, and then it also is cut off. The AC voltage is also added to the collector of Q805 through the diode, D802, but as it does not flow to Q805, this voltage flows to the LED through the diodes, D804 and D805 and the protect indicator is emitted.

As the times goes on, the voltage of the capacitor, C804, rises and after it rises higher than the Zener voltage of the zener diode, the base current flow in Q805 so that it is "ON" and the Relay LY801 starts to work. As the current flows through the collector of Q805 and through the diode D802, the voltage drops due to the resistor R813 and the protect indicator is turned off. Further, at this time, the voltage taken to C804 (zener voltage) + (Vbe), is about 12.6 V – 13 V and it does not rise more than this value. Also, if it drops even a little less than this value, Q805 is made to cut off.
Inversely, when the power switch is turned off, the negative voltage impressing on Q804 becomes 0 V immediately since the capacity of the filter capacitor is very small. As the positive voltage does not drop down to 0 V immediately, the base of Q804 has the positive voltage and Q804 is turned on. Then the voltage charged in to the capacitor C804, is discharged through Q804. Therefore, Q805 is turned off and the relay stops working. This action is rather fast.

(b) The protect action to the load short

When the load shorts, excessive current flows through the power transistor of the output stage. Even when the circuit and the load are normal, a great amount of current flows in the case when a great amount of output is acting, but in this case the current varies due to the signal, so it is distinct from the case of the load short.
In this receiver, the excessive current is detected by the drops of voltage occurring in the resistors R767 and R781 (R768 and R782 for the right channel) connected to the emitter of the power transistor.
When excessive current flows and the voltage of this section is higher than about 0.6 V, then Q723 (Q724) is turned on. The current flows from the base of Q803 to the collector through the diode D711 (D712), and Q803 is turned on, so the current flows from the emitter to the collector, then the collector, then the positive voltage of the base of Q803 is raised.
Therefore, as Q804 is turned on and the capacitor C804 is discharged, Q805 is cut off, the relay stops pulling and the protect indicator is turned on. The capacitor C725 (C726) of the base of Q723 (Q724) is a time-constant circuit for the high frequency range signal and the capacitor C803 of the base of Q803 is a time-constant circuit for the lower frequency range signal. These are designed to stop the protect circuit in the case of great amount of output in the normal condition.

(c) The examination of the direct current and the protect action

When the signal, including the component of the power amplifier the extreme low frequency signal is added, or on the rare occasion when the DC ballance of the amplifier is destroyed, the DC voltage signal and the ultra low frequency signal appear at the output of the amplifier. This is not favorable to the speaker.

Examination of the DC voltage of the output is done by Q801 and Q802, and the protect action is performed when the DC voltage is more than +1.5 V or less than −1.5 V. When more than +1.5 V of DC voltage occurs at the output of the amplifier, this voltage turns on Q801 through R801 (R802). Then as Q801 discharges the capacitor C804, Q805 is cut off the relay stops pulling and the protect indicator is emitted. In the case when less than −1.5 V DC voltage occurs at the output of the amplifier, Q802 is turned on and shorts the negative voltage added to the base of Q804 with the ground. Therefore, the base of Q804 is a positive voltage and Q804 is turned on. Q805 is cut off as the capacitor C804 is discharged through Q804, the relay stops pulling and the protect indicator is emitted. The capacitors, C801 and C802, of the bases of Q801 and Q802 are the time-constants and are designed such as to stop the protect circuit from acting for the AC signal. Therefore, the polarities of these two capacitors are connected oppositely and are used as non-polar capacitors.

3. Meter Amplifier Block

The meter amplifier block is a circuit which used only one IC. This IC (TA7318P) has a demodulate circuit, a 1/4 power compresser and a DC drive amplifier (the hold action is included) for each of the two channels. Due to passing through the 1/4 power compresser the meter can be ranged widely and it is possible to display from a small amount of the output power without changing the range of the meter. The capacitors at pin #3 of the IC and pin #7, C903 and C904, are set for the recovery time of the meter.

4. REG PCB

Each block of this instrument works by receiving the supply of DC power source only from the Reg PCB. The kinds of source voltage supplied from the Reg PCB are many, but these sources are very stable, except of course for the supply to the main amplifier PCB, the lamps, and the indicators. The main electric sources are from a large capacity silicon diode bridge type rectifier that gives the positive and the negative voltages. Then they get smoothed going through the large capacity of the filter capacitor and are finally sent to the main amplifier PCB.

The electric source to the tone PCB, the Phono EQ block and the negative voltage source to the tuner section are supplied from this source. The source of the tone PCB is stabilized by a 1 W-type zener diode and the Phono EQ source is sent through both the constant voltage circuit and the ripple filter Q832, Q833. The negative voltage source to the tuner section is stabilized by the zener diode as well. After the positive voltage source to the tuner section is rectified at the bridge-type silicon diode, it is sent, as expected, through the constant voltage circuit and the ripple filter.

The sources for lamp use in used for the lighting of the LED of the mode indicator and for the illumination of the dial; Also it flows to the small capacity of the diode and is used as the negative voltage source of the protector circuit.

DISASSEMBLY

1. SIDE WOODS REMOVAL
   a. Remove eight screws from both sides of the wooden covers.

2. METAL COVER REMOVAL
   a. Remove wooden covers from both sides.
   b. Remove three tapping screws (#1 ~ #3) from the back plate as shown in Photo 1.
   c. Slide the metal cover back slightly and lift it up.

3. BOTTOM PLATE REMOVAL
   a. Remove wooden covers from both sides.
   b. Remove fourteen tapping screws (#1 ~ #14) (Photo 2) from the bottom of the unit.

4. FRONT PANEL REMOVAL
   a. Remove wooden covers and the metal cover.
   b. Useing the hexagonal wrench, remove the VOLUME knob.
   c. Disconnect the LED socket connecting to LED as shown in Photo 6.
   d. Remove five tapping screws (#1, 3, 5, 15 and 16) from the bottom of the unit as shown in Photo 2.
   e. Remove three tapping screws (#1 ~ #3) from the top of the unit (Photo 3).
   f. Lift the front panel away from the unit.

5. POWER TRANSFORMER REMOVAL
   a. Disconnect all the wires from the power transformer.
   b. Remove four screws (#4 ~ #7) as shown in Photo 3.
   c. Lift the power transformer away from the unit.

6. REFLEX PLATE REMOVAL
   a. Remove three lamps by pushing them downward.
   b. Push the center of push rivet (#1 and #2) (Photo 4) by small screw driver as shown in Fig. 2.
   c. Pull the push rivet upward, small printed circuit board (#5) (Photo 4) is now free to be pulled off.
   d. Similarly, remove two push rivets (#3 and #4) as shown in Photo 4.

7. METER REFLEX PLATE REMOVAL
   a. Remove the lamp by pushing it downward. (Refer to Photo 5).
   b. Remove two screws (#1 and #2) as shown in Photo 5.

8. METER REMOVAL
   a. Remove the meter bracket by removing two tapping screws (#3 and #4) as shown in Photo 5.
   b. Remove the meter by pulling it backward.

9. POWER INDICATOR REMOVAL
   a. Pull out the connector (#5) as shown in Photo 5.
   b. Remove the bracket of the indicator by removing two tapping screws (#6 and #7) (Photo 5).
   c. Remove the power indicator by pulling it back ward.

10. LED PC BOARD REMOVAL
    a. Disconnect all the cables from the LED PC board.
    b. Remove two tapping screws (#8 and #9) as shown in Photo 5.

11. DIAL SCALE REMOVAL
    a. Remove all the parts from the back of the dial scale according to the paragraph 6 ~ 9.
    b. Remove the dial cord from the slider of the dial p pointer.
    c. Remove the head phones jack by removing two screws (#1 and #2) as shown in Photo 6.
    d. Remove five tapping screws (#3 ~ #7) (Photo 6) and lift the dial scale away from the unit.

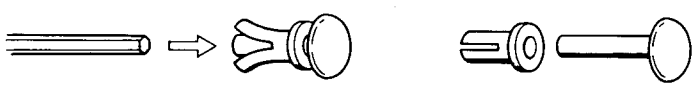


Figure 2 PUSH RIVET

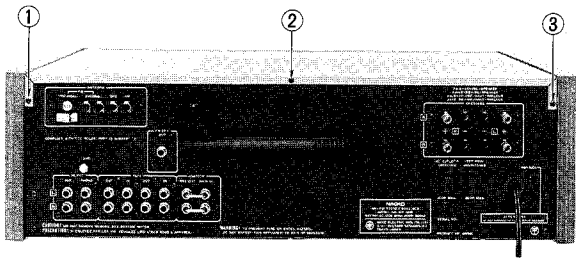


Photo 1

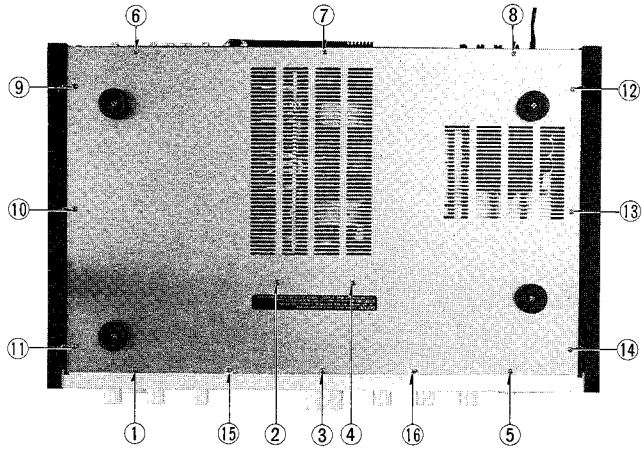


Photo 2

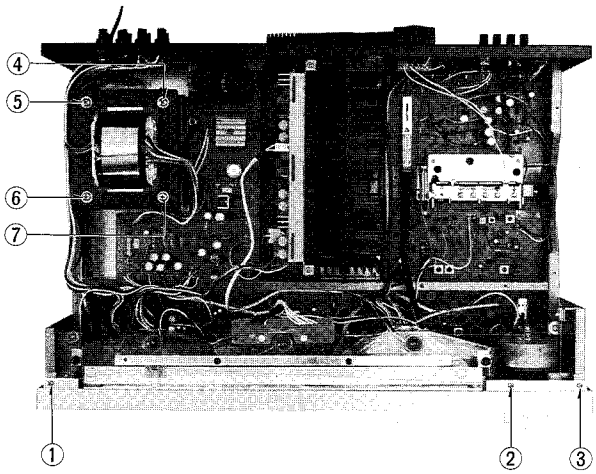


Photo 3

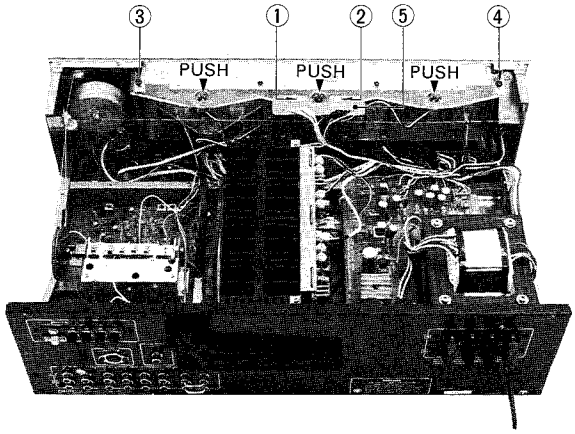


Photo 4

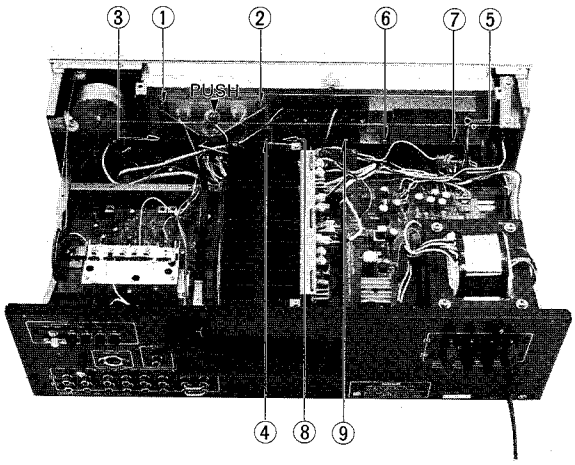


Photo 5

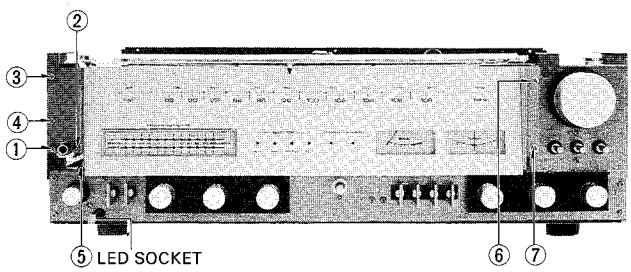


Photo 6

ALIGNMENT

TEST EQUIPMENT

Allow a minimum of 10 minutes warm-up for test equipment and the receiver to be tested.
Maintain rated line voltage.

FM Signal Generator (FM SG)
Oscilloscope
AC Voltmeter
Distortion Meter
MPX Signal Generator (MPX SG)
Frequency Counter
AM Sweep Generator (AM SG)
DC Voltmeter
Audio Frequency Generator
2-Dummy Load Resistor, 8 ohms, 250W

GENERAL ALIGNMENT INSTRUCTION

Always observe response curve on oscilloscope during alignment procedure:

1. Do not apply signal from FM or AM stations. Apply signals only.
2. Use of excessive signal from FM SG or AM SG can cause overloading of the tuner circuits. To properly align the receiver, adjust FM SG or AM SG output level control so that response curve on oscilloscope is not distorted.
3. Turn the volume controls down to the fully counter clockwise when the dummy load resistors or speakers are not connected to the speaker terminal.

FM SECTION

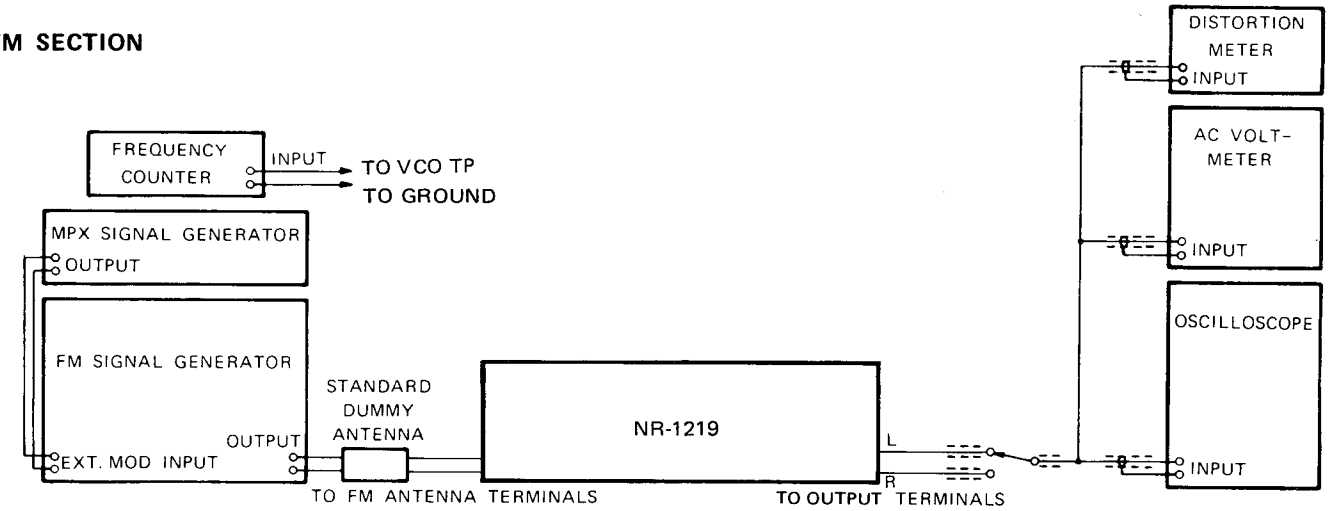


Figure 3. Test Equipment Hook-up

FM IF Alignment

STEP	FM SG FREQUENCY/ CALIBLATION	MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE RECEIVER	DIAL POINTER POSITION	ADJUST-MENT POINT	PROCEDURE	REMARKS
1			A. POWER to "ON". B. SELECTOR to "FM AUTO". C. MONO SW. to "ON".			Temporarily connect the wiring terminal #8 of the Tuner EQ PCB and the wiring terminal #8 of the REG PCB by clip lead.	This is to prevent operation of T-Locked System.
2				Where no signal is tuned.	T101 (Figure 4)	Adjust until tuning meter indicates mid-scale.	Repeat steps 2 and 3 until distortion can no longer be minimized.
3	98 MHz/60 dBμ	400 Hz/mono [±75 KHz]		98 MHz	T102 (Figure 4)	Adjust for minimum distortion.	
4						Remove the clip lead which was temporarily connected in the step 1. Confirm that T-Locked Indicator is lighted and Tuning Meter indicates mid-scale.	Do not touch the Tuning Knob.

Table 1 – 1

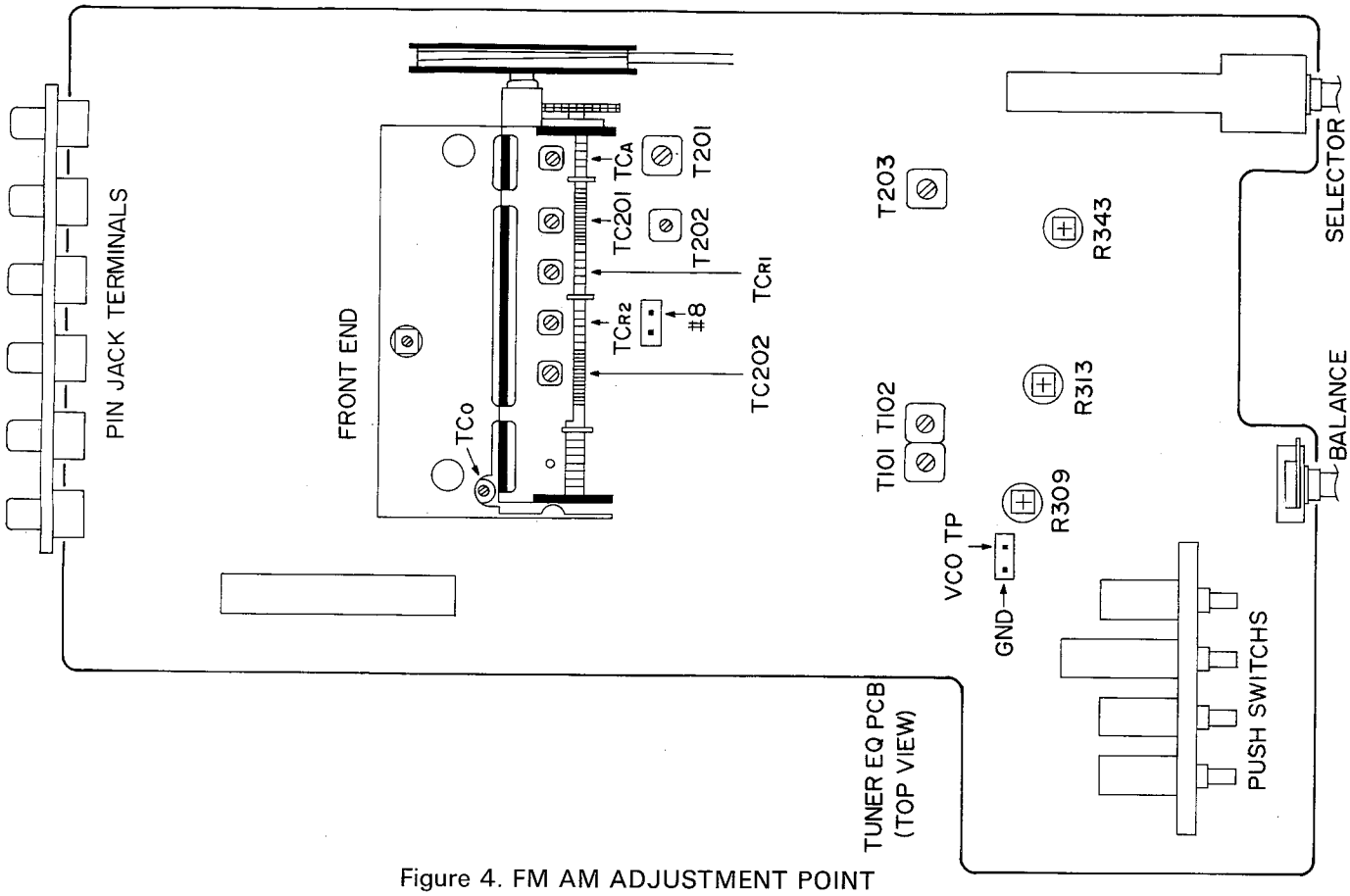


Figure 4. FM AM ADJUSTMENT POINT

FM Frequency Coverage and FM Tracking Alignments

These adjustments are factory preset and normally need no further adjustment.
However, if necessary proceed as follows:

STEP	FM SG FREQUENCY/ CALIBLATION	MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE RECEIVER	DIAL POINTER POSITION	ADJUST-MENT POINT	PROCEDURE	REMARKS
1			A. POWER			Temporarily connect the wiring terminal #8 of the Tuner EQ PCB and the wiring terminal #8 of the REG PCB by clip lead.	This is to prevent operation of T-Locked System.
2	87.4MHz/10dBμ	400 Hz/mono [±75 kHz]	A. POWER to "ON". B. SELECTOR to "FM AUTO". C. MONO SW. to "ON".	Low frequency end of the dial scale.	TC_0 (Figure 4)	Adjust for maximum AC Voltmeter deflection and for mid-scale tuning meter indication.	
3	108 MHz/ Attenuate for response with 3 % distortion.			108 MHz	TC_A TC_{R1} TC_{R2} (Figure 4)	Adjust for maximum output.	
4						Remove the clip lead which was temporarily connected in the step 1.	

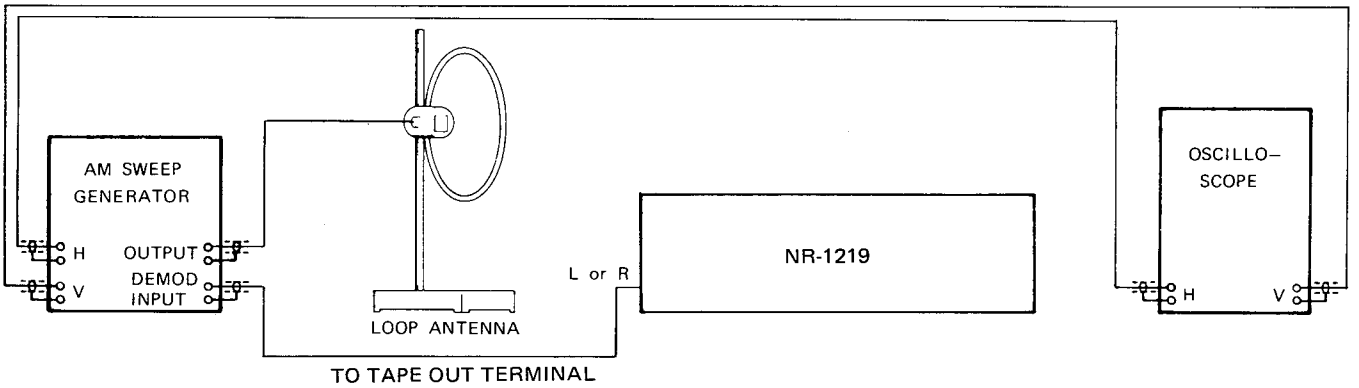
Table 1 – 2

FM MPX Alignment

STEP	FM SG FREQUENCY/ CALIBLATION	MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE TUNER	DIAL POINTER POSITION	ADJUST-MENT POINT	PROCEDURE	REMARKS
1	98MHz/60dBμ	(Unmodulated carrier)	A. POWER to "ON". B. SELECTOR to "FM-AUTO". C. MONO SW. to "OFF".	98MHz (Set to that tuning meter indicates mid-scale.)	R309 (Figure 4)	Connect frequency counter to "VCO TP" (Figure 4) and adjust for 76kHz.	
2		Pilot signal only: ±7.5kHz			R313 (Figure 4)	Adjust for minimum AC voltmeter deflection. Check that stereo indicator lamp lights up.	Outputs of right and left channel should be equal.
3		1000Hz/stereo [main (L) & sub (L): ±67.5kHz/ pilot signal: ±7.5 kHz]			R343 (Figure 4)	Adjust for maximum separation (minimum output of right channel)	Both the separations (both the outputs of right and left channel) should be equal.
4		1000Hz/stereo [main (R) & sub (-R): ±67.5kHz/ pilot signal: ±7.5 kHz]				Adjust for maximum separation (minimum output of left channel)	

Table 1 – 3

AM SECTION



Figures 5 Test Equipment Hook-up

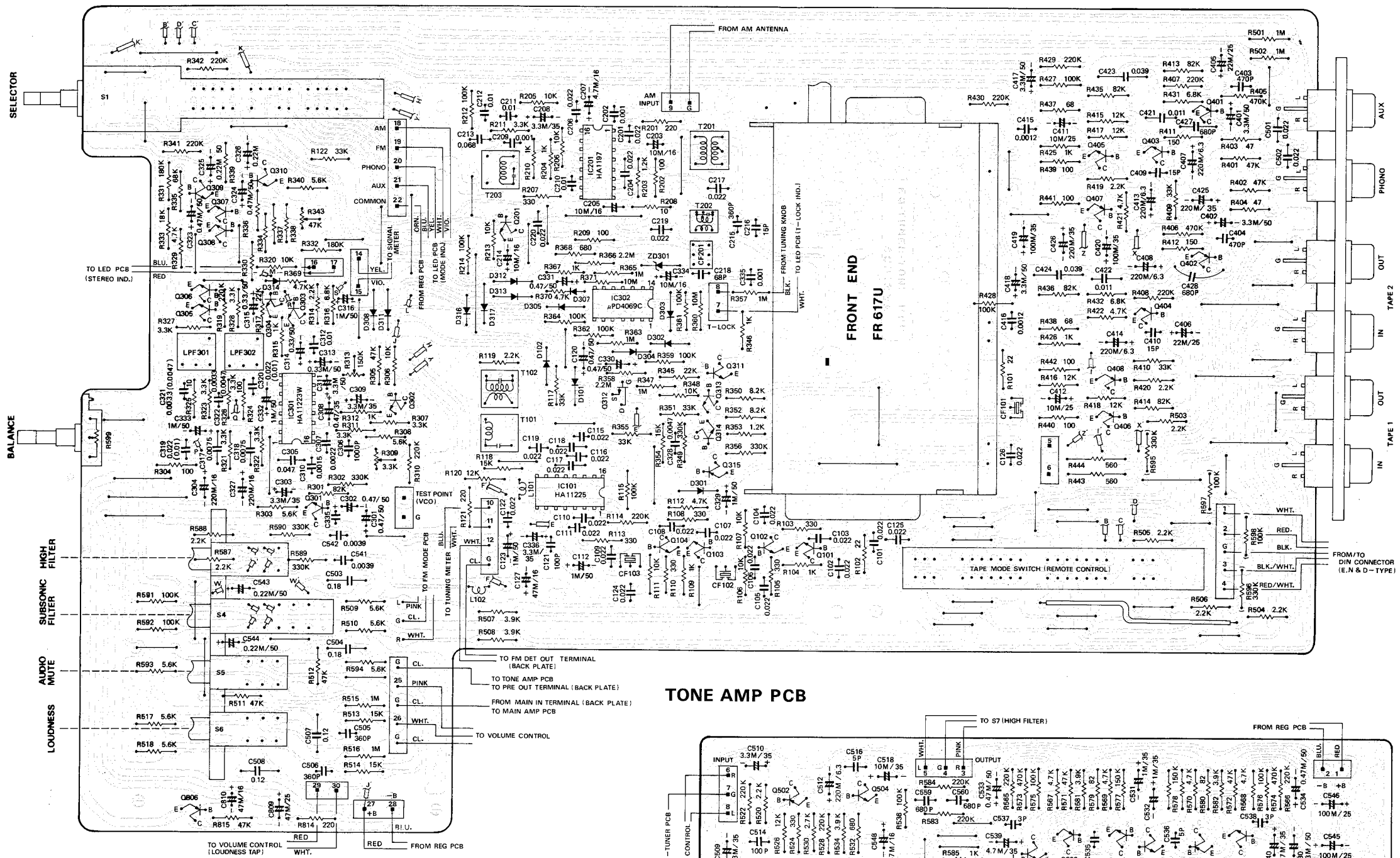
AM IF Alignment

STEP	AM SG FREQUENCY/ CALIBLATION		MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE RECEIVER	DIAL POINTER POSITION	ADJUST FOR MAX. SCOPE INDICATION	REMARKS
1	455kHz/ 50dBμ	Set AM SG IF/ RF switch to "IF" position.	(Unmodulated carrier)	A. POWER to "ON" B. SELECTOR to "AM"	High frequency end of the dial scale.	T202 (Figure 4)	Repeat steps 1 and 2 until response curve on oscilloscope indicates maximum waveform. (See Figure 6)
2						T203 (Figure 4)	

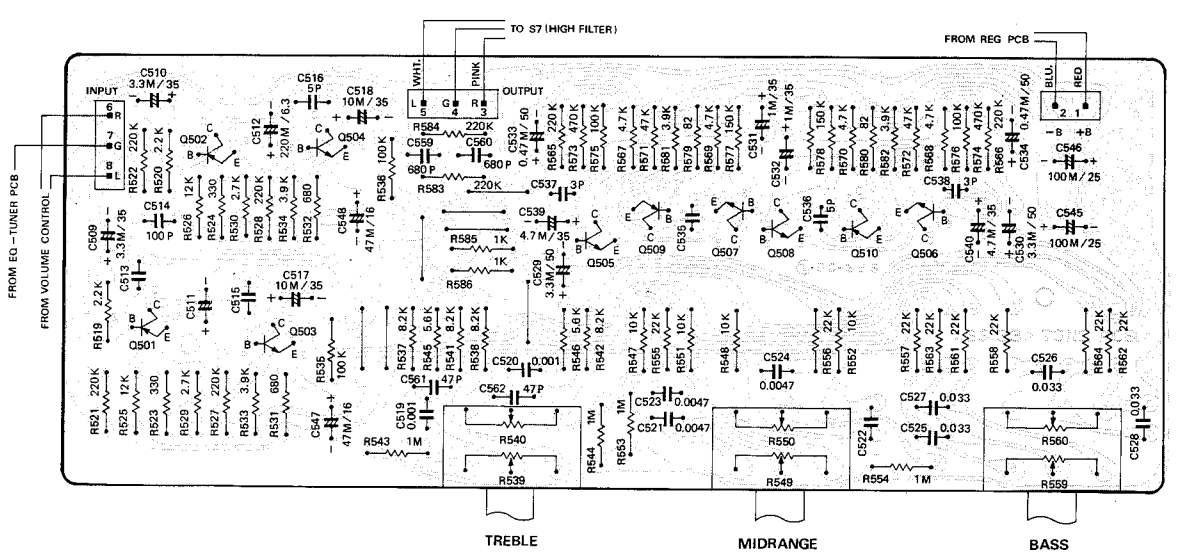
Table 2 – 1

P. C. BOARD (BOTTOM VIEW)

EQ-TUNER PCB



TONE AMP PCB



AM Frequency Covorage and AM Tracking Alignment

STEP	AM SG FREQUENCY/ CALIBLATION		MODULATING FREQUENCY/ DEVIATION	SWITCHES OF THE RECEIVER	DIAL POINTER POSITION	ADJUST FOR MAX. SCOPE INDICATION	REMARKS
1	520 kHz/ 50 dBμ	Set AM SG IF/ RF switch to RF position.	400 Hz/30%	A. POWER to "ON" B. SELECTOR to "AM"	Low frequency end of the dial scale.	T201 (Figure 4, Figure 7)	Repeat steps 1 and 2 several times.
2	1650kHz/ 50 dBμ				High frequency end of the dial scale.	TC104 (Figure 4, Figure 7)	To check tracking errors, use an apparatus made of ferrite rod and copper wire (Figure 6). Move it toward the AM loopstick antenna gradually, while checking for the response curve on oscilloscope becoming smaller. If the response curve becomes larger, repeat steps 3 and 4. (Figure 7).
3	600 kHz/ 50 dBμ				600 kHz	AM loopstick antenna core	
4	1400kHz/ 50 dBμ				1400 kHz	TC105 (Figure 4)	

Table 2 – 2

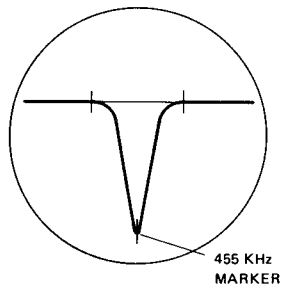


Figure 6 AM IF

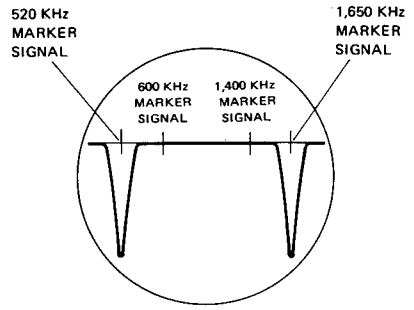


Figure 7 AM Frequency Coverage

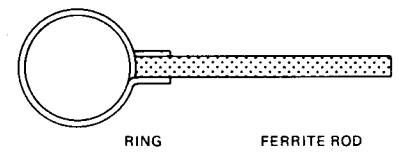


Figure 8 Apparatus

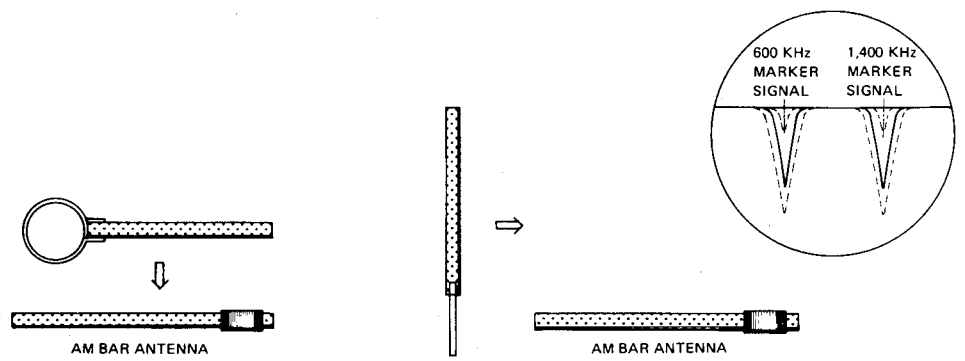


Figure 9 Tracking Errors

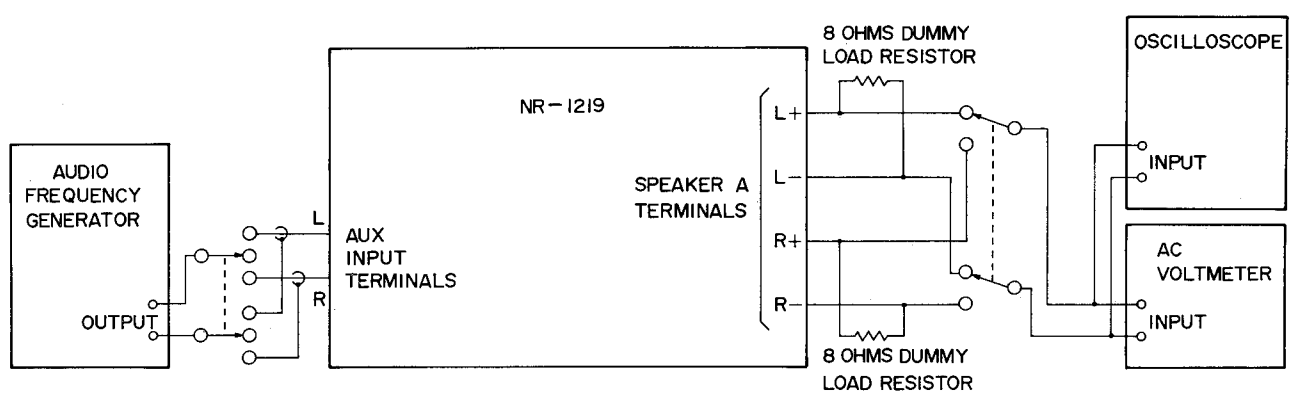


Figure 10 AMP SECTION TEST EQUIPMENT HOOK-UP

AUDIO SECTION

DC Balance Adjustment

See illustration, Figure 11, for test equipment hook-up.

1. Remove connective pin from PRE OUT and MAIN IN terminals.
2. Connect shorting pin plug to MAIN IN terminals. (Short MAIN IN terminals to chassis ground.)
3. Set the SUBSONIC FILTER switch to "ON" position. Adjust potentiometer R707 (left channel) R708 (right channel) on the MAIN AMP PC Board, for a 0 ± 20 mV DC voltmeter reading.
4. Set the SUBSONIC FILTER switch to "OFF" position. Adjust potentiometer R709 (left channel) R710 (right channel) on the MAIN AMP PC Board, for a 0 ± 20 mV DC voltmeter reading.
5. Repeat steps 3 and 4 until both the reading become 0 ± 10 mV.
6. Remove shorting pin plug. Remove DC voltmeter.
7. Insert connective pin to PRE OUT and MAIN IN terminals.

Idling Current Adjustment

See illustration, Figure 11, for test equipment hook-up.

1. Turn the VOLUME controls down to the fully counter clockwise. (No signal applied to the MAIN AMP circuit)
2. Adjust potentiometer R753 (left channel) R754 (right channel) on the MAIN AMP PC Board, for a 20 ~ 26 mV DC voltmeter reading.
3. Remove DC voltmeter.

Power Display Circuit Adjustment

See illustration, Figure 10, for test equipment hook-up.

1. Connect AC voltmeter and oscilloscope to left (right) speaker terminals. Connect generator to left (right) AUX input terminals.
2. Turn the VOLUME controls up to the fully clockwise. Set generator frequency to 1 kHz. Set generator output for a 28 V AC voltmeter reading.
   Adjust potentiometer R903 (left channel) R904 (right channel) on the MAIN AMP PC Board, so that the LED of 100 W lights steadily.
3. Remove AC voltmeter, oscilloscope and generator.

Output Mute Time Check

Relay must operate five to twelve second later after AC power is turned on.

Protection Circuit Check

See illustration, Figure 10, for test equipment hook-up.

1. Connect AC voltmeter to left (right) speaker terminals. Connect generator to left (right) AUX input terminal.
2. Turn the VOLUME controls up to the fully clockwise. Set generator frequency to 20 kHz. Set generator output for a 3 V AC voltmeter reading.
3. Short left (right) speaker terminals; Relay's contacts should open.
4. Remove all test equipment.

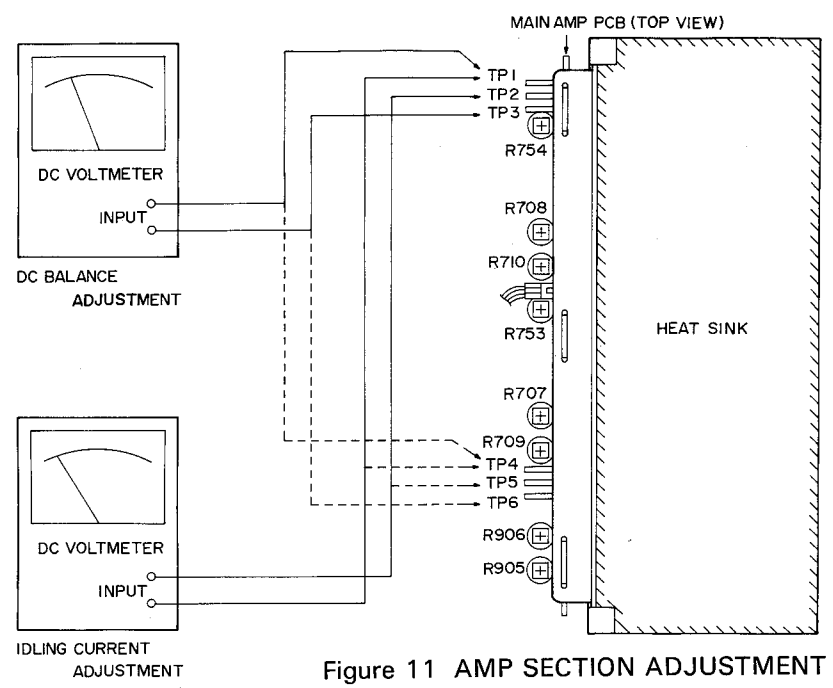
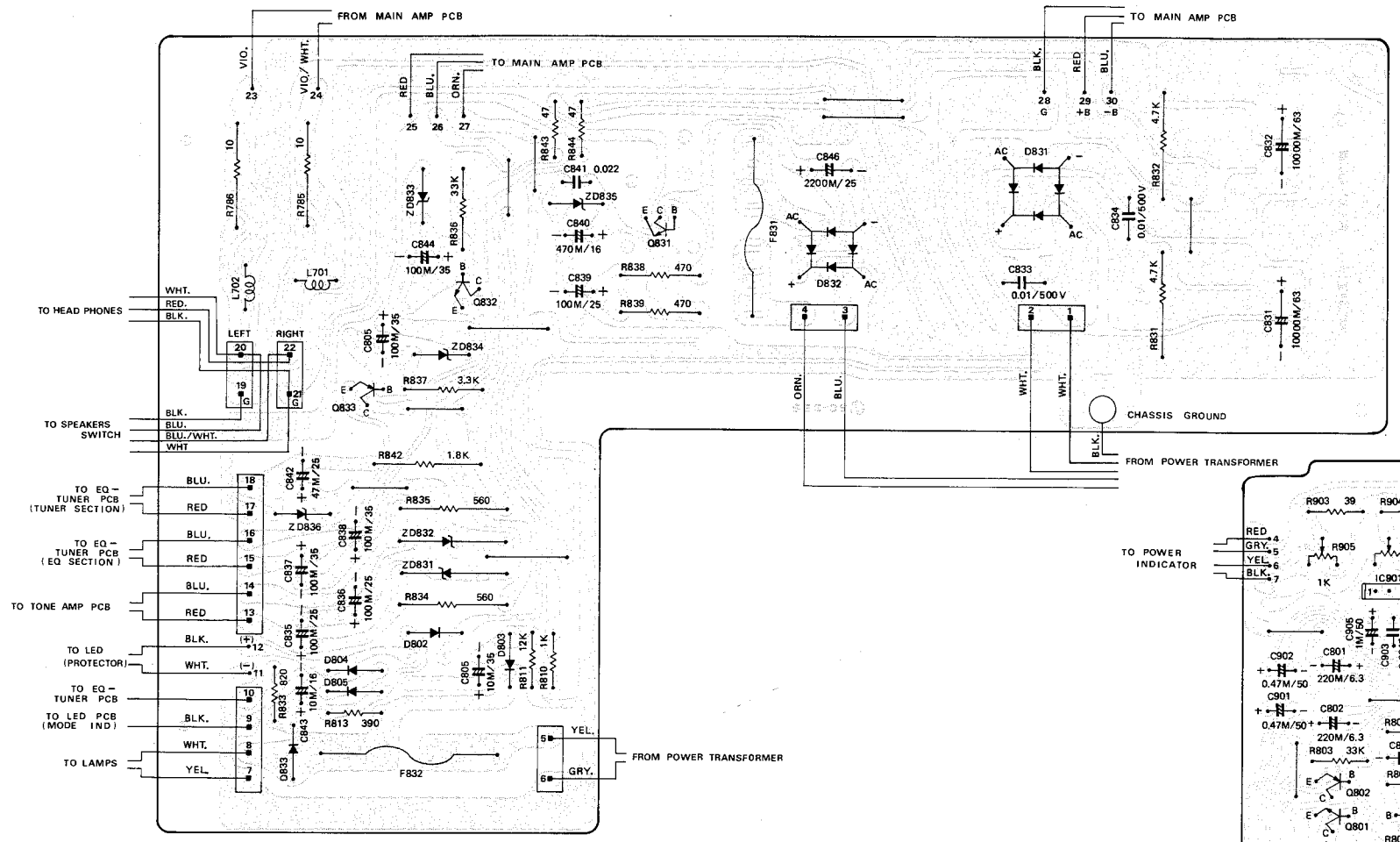
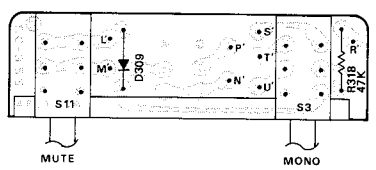


Figure 11 AMP SECTION ADJUSTMENT POINT

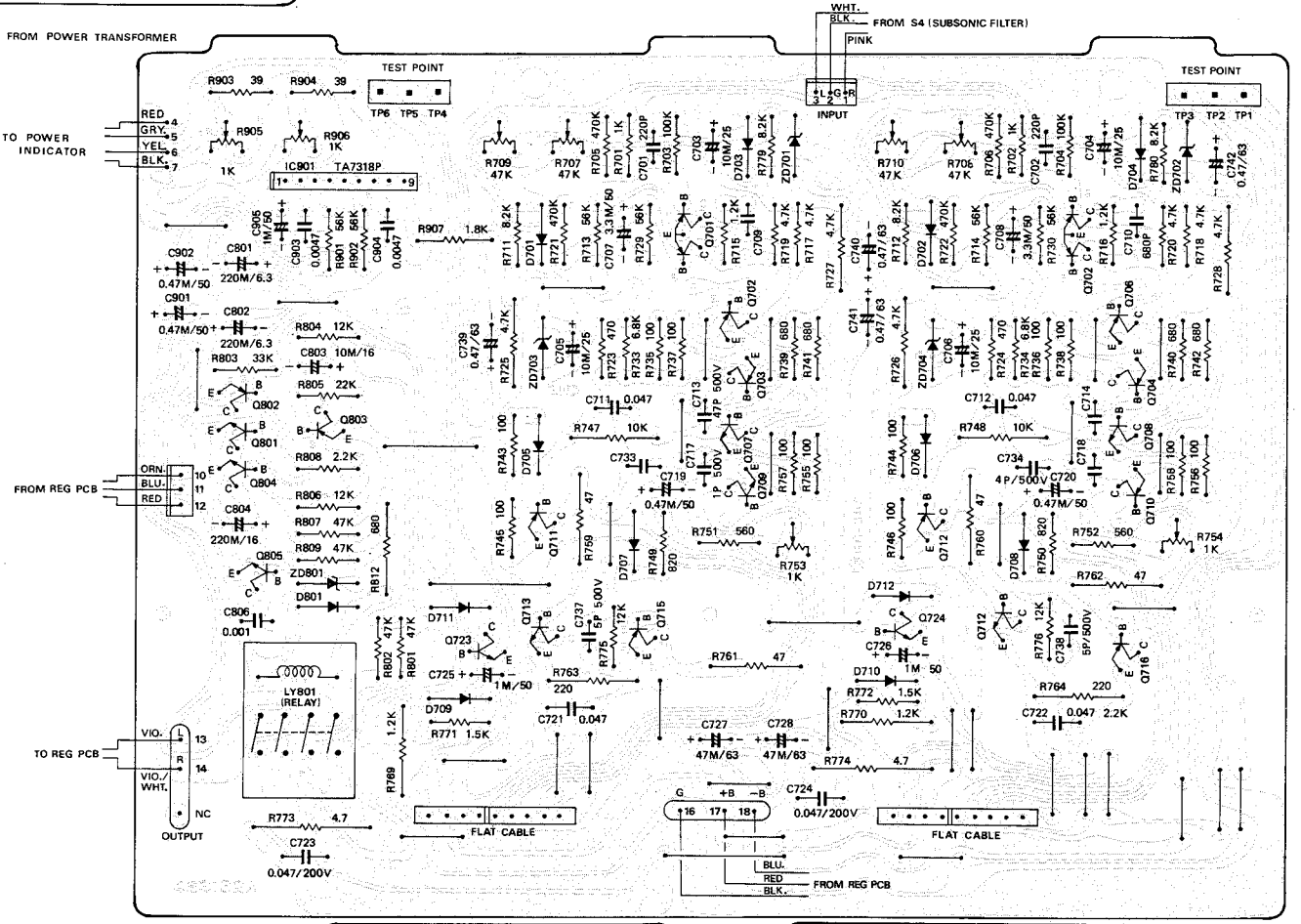
REGULATOR PCB



FM MODE PCB



MAIN AMP PCB



POWER TRANSISTORS MOUNTING ASSEMBLY

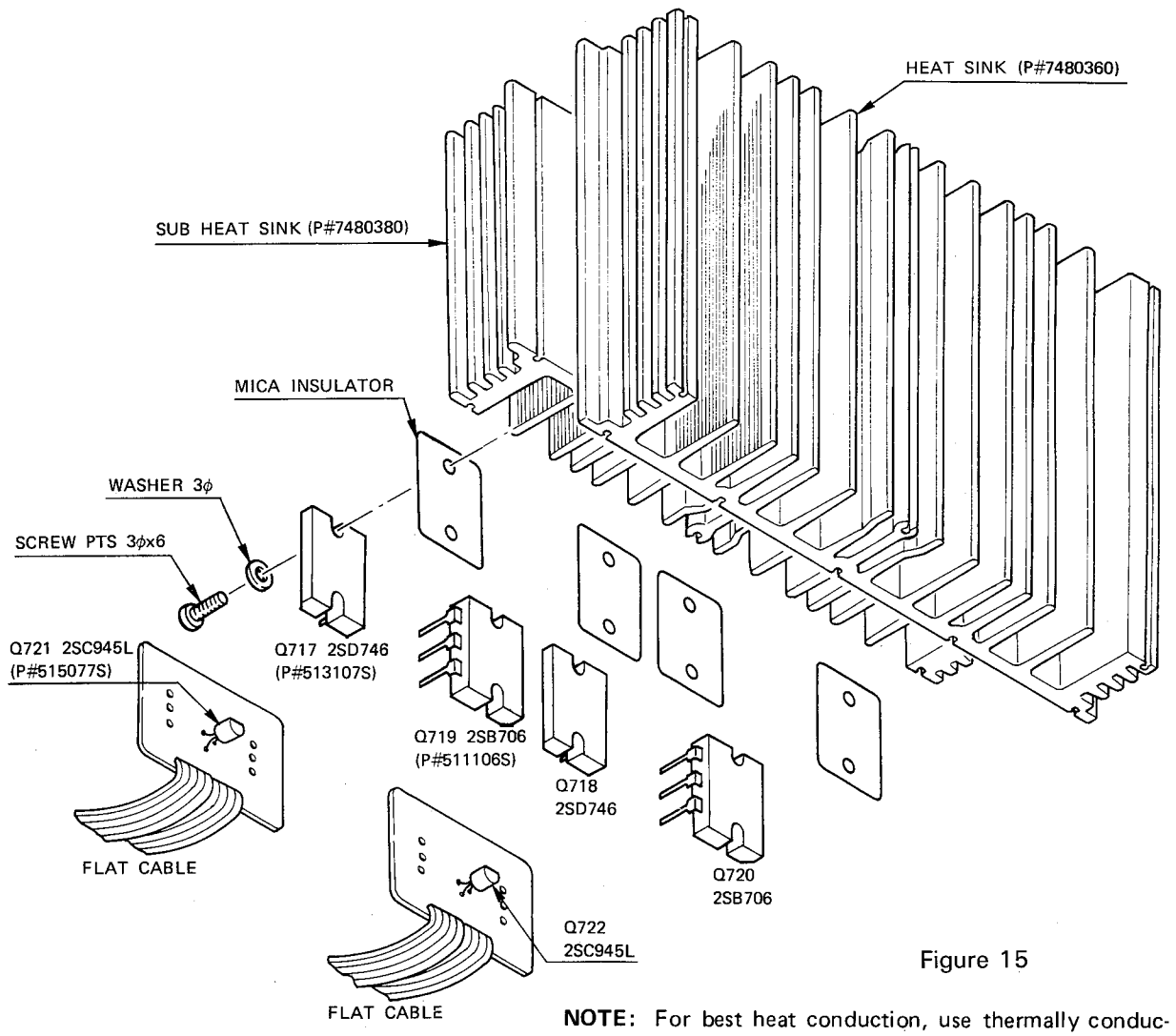


Figure 15

NOTE: For best heat conduction, use thermally conductive silicon grease between the power transistor and the mica insulator and between the insulator and the heat sink.

PRECAUTIONS FOR REPAIR SERVICE

Many of these items are included just as a reminder — they are normal procedures for experienced technicians. Short-cuts can be taken: but, often they cause additional damage to transistors, circuit components or the printed circuit board.

1. **Do not** bridge electrolytic capacitors with AC power. The resultant surges may damage solid state devices.
2. **Do not** bias the base of any transistor while voltage is being applied to its collector.
3. Replacements for output and driver transistors, if necessary, must be made from the same **hfe** group as the original type. Be sure to include this information when ordering replacement transistors.
4. If one output transistor burns out (open or shorts), always remove **all** output transistors in that channel and check the bias adjustment, the control and other parts in the network with an ohmmeter before inserting a new transistor. All output transistors in one channel will be destroyed if the base biasing circuit is open in the emitter end.
5. Replacement of transistors and components in the front-end, IF stage and multiplex decoder will not normally require realignment of these circuits, unless absolutely necessary. **Do not** attempt a realignment unless the required test equipment is available and the alignment procedure is thoroughly understood.

DIAL CORD INSTALLATION

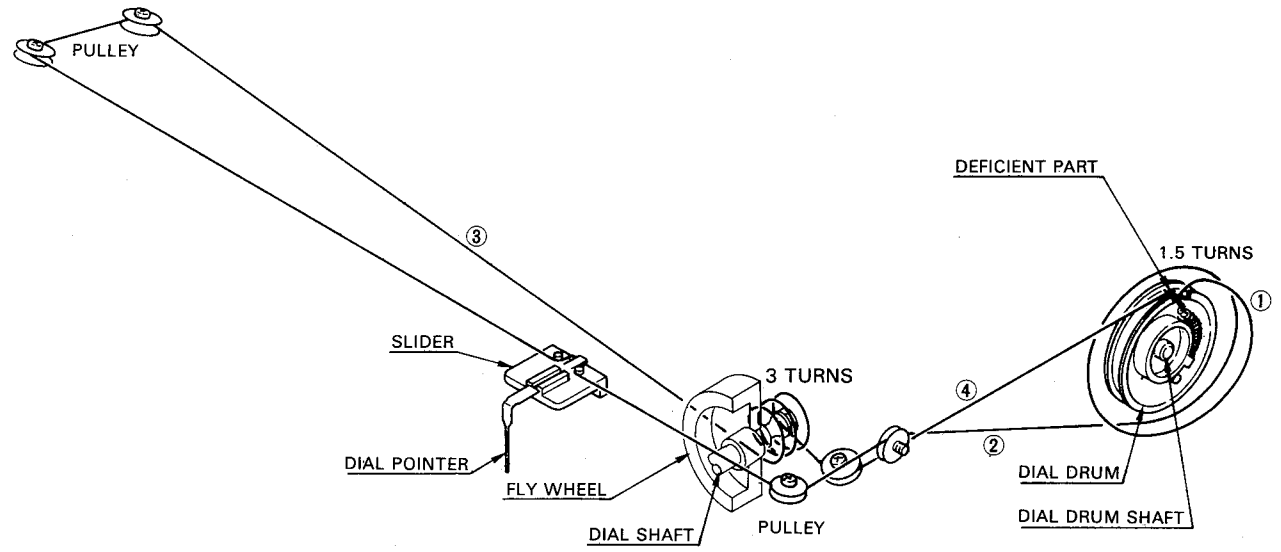


Figure 16

87MHz Position

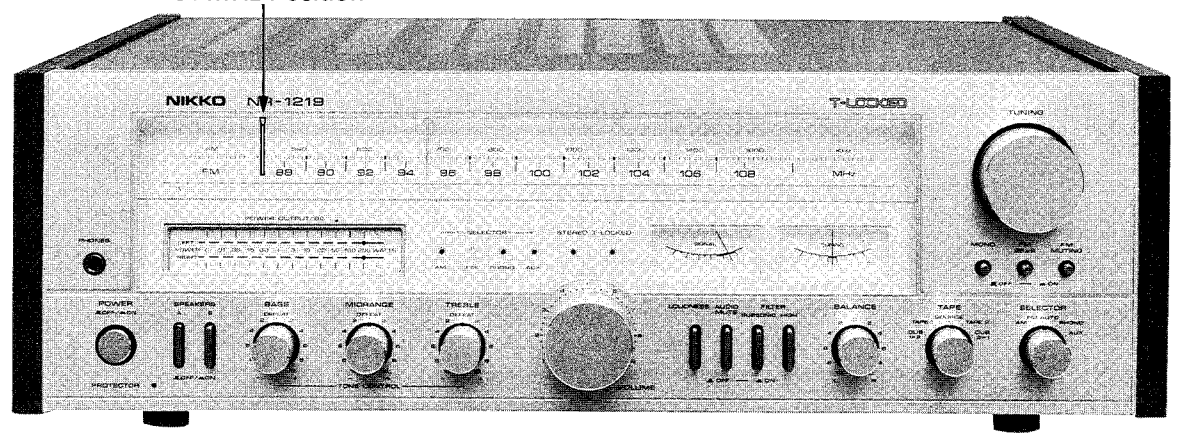


Photo 7

1. Remove an old dial cord.
2. Turn the dial drum shaft counter-clockwise until the rotor of the variable capacitor is completely out of the stator. If the deficient part of the dial drum is not in a straight line with the dial drum shaft (vertically), loosen the dial drum drive screws and adjust the dial drum to be placed on the top portion. Then re-tighten the dial drum screws.
3. String the dial drum and pulleys with a new dial cord in accordance with Fig. 16 (in circled numbered order).
4. Turn the dial shaft (Tuning knob) counter-clockwise until the rotor of the variable capacitor is fully rotated in the stator. Then fix the dial pointer to the string at a reading of 87 MHz on the dial scale. (See Photo 7)

PARTS LOCATION

NOTE: Numbers of three digits with a ⬭ are related to the KEY NUMBERS on parts list.

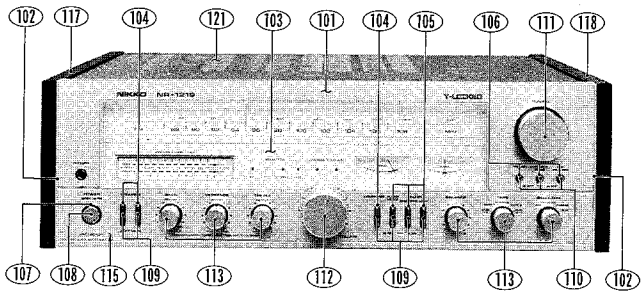


Photo 8

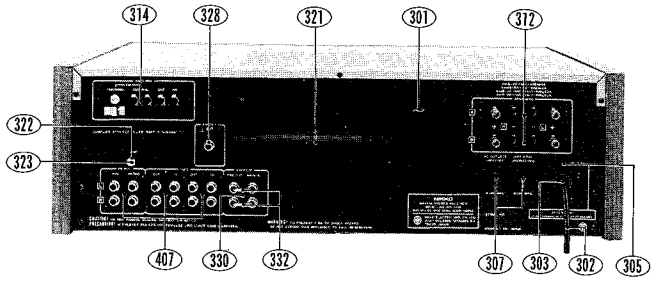


Photo 9

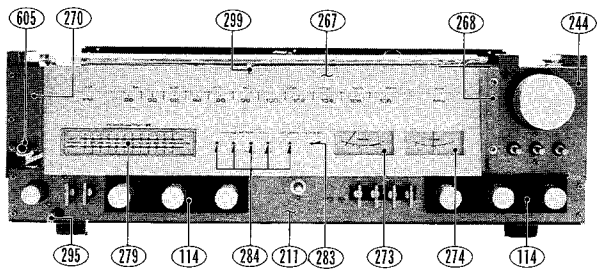


Photo 10

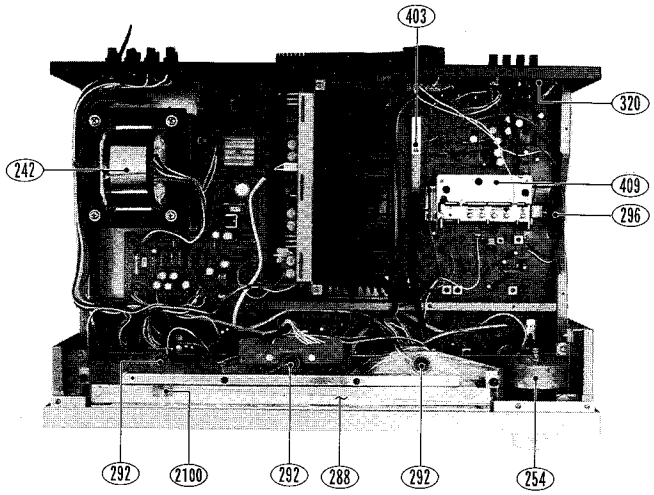


Photo 11

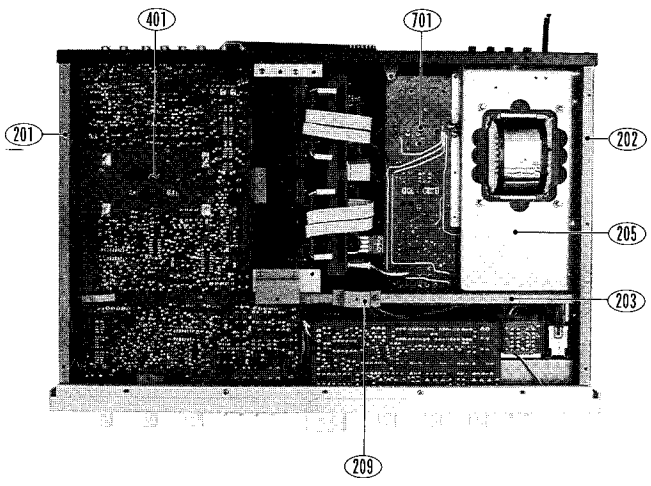


Photo 12

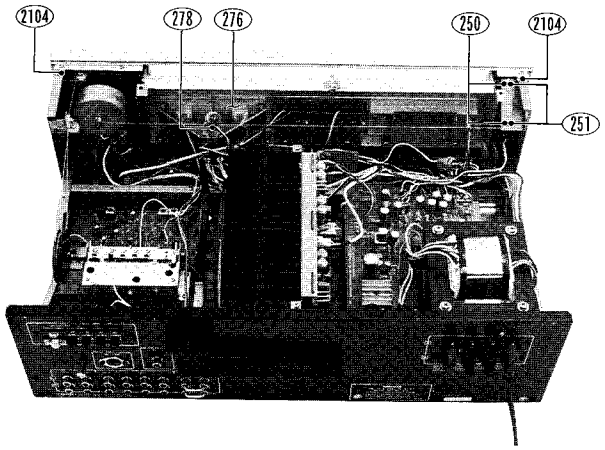


Photo 13

PARTS LIST

NOTES:

1. ★ The KEY NUMBER (#) marked with a (★) on parts list relate number of three digits with a (◯). (Photo 8 –13)
2. + Numberals in file indicate the quantity of parts used in one type.
3. ++ TR: Transistor
   FET : Field effect transistor
   VR : Volume control (Variable resistor)
   RES : Carbon film fixed resistor
   MO-RES : Metal oxide film fixed resistor
   CEM-RES : Cemented wirewound fixed resistor
   FP : Flame proof
   C-CAP : Ceramic capacitor
   E-CAP : Aluminum electrolytic capacitor
   M-CAP : Polyester film capacitor
   S-CAP : Polystyrene film capacitor
   T-CAP : Tantalum electrolytic capacitor
   BP-CAP : Bipolar electrolytic capacitor
   LC-CAP : Low current leakage electrolytic capacitor.
4. Assemblies and parts are subject to change without notice.
5. Parts ordering procedure:
   A. DO NOT USE THE "KEY" NUMBER AND "SYMBOL" NUMBER. (these are control # for the factory only)
   B. Include in any order
      a. Part number.
      b. Part description.
      c. Model number.

      (any of the above lacking from an order may delay shipment of that order.)

KEY NO.	SYMBOL NO.	TYPE + WEND	DESCRIPTION ++	PART NO.
			PACKING MATERIALS & ACCESSORIES	
001		1111	Carton box	9825530
002		2222	Pad	9840820
003		1111	Sack, polyethyle cloth	9640670
004		111–	Sack, polyethylen cloth – #13	9640320
005		———1	Envelope – G	9690170
006a		1———	Manual, instruction – E	960274E
006b		1———	Manual, instruction – F, CANADA only	960310F
006c		–111	Manual, instruction – H	960313H
007		1———	List, service stations	9690180
008a		1———	Card, warranty	967007A
008b		1———	Card, warranty – CANADA only	967028E
009		1———	Post card	967008A
010		1111	Drier – Silica gel	969001A
011		1111	Antenna, FM – Q-MATCH	4581360
			CABINET ASSEMBLY	
★101		1111	Panel, front	7884450
★102		2222	Panel, both sides	7870400
★103		1111	Window, panel	7802430
★004		3333	Guide – P1320BK, for push button	7401670
★105		1111	Guide – P3320BK, for push buttons	7401680
★106		3333	Guide – 1P5, for push button	7401710
★107		1111	Guide – 1P16, for push button	7401720
★108		1111	Button, push – M16SL – power	7852050
★109		6666	Button, push – P320GL – speakers/loudness/ audio mute/filter	7852020
★110		3333	Button, push – P5x15 SLII – FM muting/mono/25us	7852080
★111		1111	Knob – 19SL-47R – tuning	7841260
★112		1111	Knob – 19SL-42DR – volume	7841270
★113		6666	Knob – 19SL-19DR – others	7841250
★114		2222	Dust cover, for knob	7002120
★115		1111	LED GL-2PR1 – red – protector	5060210
116		1111	Spacer, LED	7002130
★117a		111–	Side wood – L	7831490
★118a		111–	Side wood – R	7831520
★117b		———1	Side wood – L, black	7831570
★118b		———1	Side wood – R, balck	7831580
119		8888	Screw – TFTS 4φx16	887416W
120		8888	Washer – 5φ	893105W
★121a		111–	Cover, metal	7820940
★121b		———1	Cover, metal, black	7821040
122		3333	Screw – PTS 3φx6	814306W
123		1111	Plate, bottom	7325590
124		4444	Foot, polyethylen – 30φx14	7400780
125		4444	Screw – PMS 5φx16	810516S
126		111111	Screw – PTS 3φx6	814306S
127		3333	Screw – PTS 3φx8	814308S

KEY NO.	SYMBOL NO.	TYPE + WEND	DESCRIPTION ++	PART NO.
			CHASSIS ASSEMBLY	
★201		1111	Angle, right side	7226920
★202		1111	Angle, left side	7226930
★203		1111	Angle, center	7226940
204		5555	Screw – PTS 3φx6	814306S
★205		1111	Chasis, for power transformer	7226950
206		6666	Screw – PTS 3φx6	814306S
207		1111	Bracket, for heat sink	7032510
208		2222	Screw – PTS 3φx8	814308S
★209		1111	Stud, for chassis	7031270
210		2222	Screw – PTS 3φx6	814306S
★211		1111	Angle, front	7226960
212		4444	Screw – PTS 3φx6	814306S
213		1111	Holder,tuner PCB	7031140
214		1111	(TONE AMP PCB ASSEMBLY)	
215a		1———	Switch, push – SDV1P TV-5 – power	4041140
215b		–111	Switch, push – SDG5P class II – power	4040980
216a		1———	C-CAP 0.01uf AC125V	239103C
216b		–222	C-CAP 0.0047uf AC250V	239472E
217		–222	Cover, C-CAP – (M)	7400980
218		1111	(PUSH SWITCH PCB ASSEMBLY)	
219		1111	Holder, push switch PCB	7032710
220		4444	Screw – PMS 3φx6	810306S
221		2222	Screw – PTS 3φx6	814306S
222		1111	VR GJ70A 100kohm Bx2	4320950
223		1111	Switch, rotary ESA-33427B – tape, remote control	4051240
224		1111	(EQ/TUNER-TONE PCB ASSEMBLY)	
225		2222	Screw – PTS 3φx6	814306S
226		5555	Screw – PTS 3φx8	814308S
227		1111	Bracket, for front end	7032540
228		3333	Screw – PTS 3φx6	814306S
229		1111	Holder, PCB	7032550
230		3333	Screw – PTS 3φx8	814308S
231		1111	(BACK PLATE ASSEMBLY)	
232		7777	Screw – PTS 3φx6	814306W
233		6666	Screw – PTS 3φx8	814308W
234		1111	(MAIN AMP ASSEMBLY)	
235		4444	Screw – PTS 3φx8	814308S
236		1111	Bracket, ground	7032870
237		1111	(REGULATOR PCB ASSEMBLY)	
238		4444	Screw – PTS 3φx8	
239		1111	Lug, ground – 2P	4400070
240		2222	Washer – TW (I) 3φ	893403U

PART ORDERING PROCEDURE ----- DO NOT USE THE "KEY" NUMBER AND "SYMBOL" NUMBER. (these are control # for the factory only.) Include in any order: a. Part number, b. Part description, c. Model number. (any of the above lacking from an order may delay shipment of the order.)

KEY NO.	SYMBOL NO.	TYPE + WEND	DESCRIPTION ++	PART NO.
241		1111	Screw – PTS 3φx10	814310S
★242a		1 ---	Transformer, power – T-1-351 – 120V only	1103510
★242b		-111	Transformer, power – T-1-352 – 220/240V class II	1103520
243		4444	Flange nut – 5φ	7121150
★244		1111	Bracket, front	7226970
245		4444	Screw – PTS 3φx6	814306S
246		1111	Bracket, pulley – A	7032560
247		2222	Screw – PTS 3φx6	814306S
248		1111	Bracket, pulley – B	7032570
249		2222	Screw – PTS 3φx6	814306S
★250		3333	Pulley – 9φ	7400790
★251		3333	Shaft, pulley – 4L	7120980
252		1111	Holder, dial shaft	7401820
253		3333	Screw – PTS 3φx8	814308W
★254		1111	Dial shaft, with fly wheel	7152310
255		1111	Plate, ground	7032630
256		1111	Washer – SN9φ	892249S
257		1111	Washer – TW (I) 9φ	893409U
258		1111	Washer – 9φ	893109S
259		1111	Holder, push switch	7032620
260		2222	Screw – PMS 3φx6	810306S
261		1111	Plate, side	7032580
262		2222	Screw – PTS 3φx6	814306S
263		1111	Bracket, pulley – C	7032590
264		2222	Screw – PTS 3φx6	814306S
265		2222	Pulley – 9φ	7400790
266		2222	Shaft, pulley – 4L	7120980
★267		1111	Dial scale	7884470
★268		1111	Blind, dial – right	7401740
269		1111	Plate, dial blind	7002100
★270		1111	Bracket, dial scale	7226980
271		1111	(HEAD PHONES PCB ASSEMBLY)	
272		2222	Screw – PMS 3φx6	810306S
★273		1111	Meter, signal	4582490
★274		1111	Meter, tuning	4582500
275		1111	Bracket, meter	7032600
★276		1111	Reflex plate, meter	7401580
277		2222	Screw – PTS 3φx10	814310S
★278		1111	Lamp – 8V 0.3A 300L	5808120
★279		1111	Power indicator	4582540
280		1111	Bracket, power indicator	7032680
281		4444	Screw – PTS 3φx8	814308S
282		1111	(LED PCB ASSEMBLY)	
★283		1111	LED GL-2PG1 – green – T-Lock indicator	5060080
★284		5555	LED GL-2PR1 – red – function/stereo indicator	5060210
285		6666	Spacer, LED	7903140
286		1111	Bracket, LED PCB	7032610
287		2222	Rivet, push – 3φx4.5	7401240
★288		1111	Reflex plate	7401620
289		1111	Stay, reflex plate	7227020
290		2222	Rivet, push – 4φx7	7401840
291		2222	Rivet, push – 3φx6.5	7401850
★292		3333	Lamp – 8V 0.3A 300L	5808120
293		1111	(LAMP PCB ASSEMBLY)	
294		2222	Rivet, push – 3φx8	7401430
★295		1111	Socket, LED – 3021-N-2	4510090
★296		1111	Dial drum – 54φ	7401570
297		1111	Spring, dial drum – (J)	7440290
298		1111	Cord, dial	4581870
★299		1111	Needle – dial pointer	7050520
★2100		1111	Slider, needle	7401780
2101		-111	Midget fuse – (S) 4AT 250V	4720400
2102		-111	Holder, midget fuse – 1P	4581430
2103		-111	Screw – PTS 3φx8	814308S
★2104		2222	Spacer, panel	7002220
			BACK PLATE ASSEMBLY	
★301a		1 ---	Plate, back – W	7325600
★301b		-111	Plate, back – E	7325620
★302a		1 ---	Plug/Cord – DP-70	606007A
★302b		-111	Plug/Cord – CEE-2T	600510A
★303a		1 ---	Stopper, cord – SR-3P-4	7400620
★303b		-111	Stopper, cord – SR-4N-4	7400690
★304a		1 ---	Bracket, cord	7031010
★304b		-111	Bracket, cord – EH	7029800
★305		1 ---	Circuit breaker – NW-2S (N) 8.0A	4900910
306		2 ---	Screw – PTS 3φx6	814306W
★307		2 ---	Socket, AC outlet	4500150
308		1 ---	RES 2.2meg-ohm 10% ½W	325225K
309		1 ---	Lug, ground	440000D
310		1 ---	Screw – PTS 3φx6	814306S
311		1 ---	Washer – TW (I) 3φ	893403U
★312		2222	Terminal, speaker – screw type – 4P (NK)	4450480
313		4444	Screw – PTS 3φx8	814308W
★314		1111	Terminal, antenna	4450520
315		2222	Screw – PMS 3φx6	810306W
316		1111	Lug, ground	440000D
317		1111	Screw – PMS 3φx6	810306W
318		1111	Washer – IN 3φ	892013S
319		1111	Washer – TW (I) 3φ	893403U
★320		1111	Balun	1210420
★321		1111	Bar antenna, AM	1200400
★322		1111	Nut, GND terminal – MK2	7152060
★323		1111	Shaft, GND terminal – MK3	7152050
324		1111	Washer – 3φ	893203D
325		1111	Washer – IN 3φ	892013S
326		1111	Washer – TW (I) 3φ	893403U
327		1111	Lug, ground	440000D
★328		1111	Terminal, RCA phono pin jack – 1P – FM DET. OUT	4440190
329		2222	Screw – PTS 3φx8	814308W
★330		1111	Terminal, RCA phono pin jack – 2Px2 – ADAPTOR	4444010
331		2222	Screw – PTS 3φx8	814308W
★332		2222	Connective pin	4581660
333		-111	Connector, DIN type 5P	4530220
334		-222	Screw – PTS 3φx6	814306W
335		1111	Bracket, heat sink	7032510
336		2222	Screw – PTS 3φx8	814308W
337		2222	Washer – TW (I) 3φ	893403U
338		1111	Holder, tuner PCB	7031140
339		2222	Screw – PTS 3φx6	814306W

PART ORDERING PROCEDURE ----- DO NOT USE THE "KEY" NUMBER AND "SYMBOL" NUMBER. (these are control # for the factory only.) Include in any order: a. Part number, b. Part description, c. Model number. (any of the above lacking from an order may delay shipment of the order.)

KEY NO.	SYMBOL NO.	TYPE + WEND	DESCRIPTION	PART NO.
			EQUALIZER-TUNER-TONE PC BOARD ASSEMBLY	
★401a		1 ---	EQ-TUNER-TONE PCB ASSEMBLY — FM de-emphasis 75us	9492780
★401b		-1 1 1	EQ-TUNER-TONE PCB ASSEMBLY — FM de-emphasis 50us	9492790
402	S1	1 1 1 1	Switch, rotary slide — SRZW-V — selector	4055190
★403	S2	1 1 1 1	Switch, rotary slide — ESA-2634 — tape	4020540
404	S4 ~ S7	1 1 1 1	Switch, tetra push — SUE-42	4041300
405	S3,10,11	1 1 1 1	Switch, tri push — SUE-34 — FM mono/25us/muting	4041100
406		1 1 1 1	VR VM10E 250kohm — balance	4320930
★407		3 3 3 3	Terminal, RCA phono pin jack — 2Px2 — input/tape	4444070
408		1 ---	Connector, with wires — 3 pin female — MC-3PF	4570280
★409		1 1 1 1	Front end — FR-617U	4910140
			(FM IF SECTION)	
	T101	1 1 1 1	Transformer, FM descriminator — (1)	1240340
	T102	1 1 1 1	Transformer, FM descriminator — (2)	1240350
	L101	1 1 1 1	Inductor — 22uh	1210930
	L102	1 1 1 1	Inductor — 2.2uh	1210860
	CF101,102	2 2 2 2	Celamic filter — SFE 10.7MM	128033A
	CF103	1 1 1 1	Celamic filter — SFE 10.7ML	128032A
	IC101	1 1 1 1	IC HA11225	518070S
	Q101 ~ Q104	4 4 4 4	TR 2SC1675 (L or M)	515082S
	D101,102	2 2 2 2	Diode 1SS53	501023S
	C101 ~ C111	11 11 11 11	C-CAP 0.022uf +80, -20% 50V YG	231223Z
	C112	1 1 1 1	E-CAP 1uf 50V	211510Q
	C113,114		— DELETED —	
	C115 ~ C119	5 5 5 5	C-CAP 0.022uf +80, -20% 50V YG	231223Z
	C120	1 1 1 1	E-CAP 0.47uf 50V	211505Q
	C121	1 1 1 1	C-CAP 100pf 10% 50V SL	232101K
	C122	1 1 1 1	C-CAP 0.022uf +80, -20% 50V YG	231223Z
	C123	1 1 1 1	E-CAP 1uf 50V	211510Q
	C124 ~ C126	3 3 3 3	C-CAP 0.022uf +80, -20% 50V YG	231223Z
	C127	1 1 1 1	E-CAP 47uf 16V	211225Q
	C128	1 1 1 1	C-CAP 0.022uf +80, -20% 50V YG	231223Z
	R101,102	2 2 2 2	RES 22ohm 5% ¼W	328220J
	R103	1 1 1 1	RES 330ohm 5% ¼W	328331J
	R104	1 1 1 1	RES 1kohm 5% ¼W	328102J
	R105	1 1 1 1	RES 330ohm 5% ¼W	328331J
	R106,107	2 2 2 2	RES 10kohm 5% ¼W	328103J
	R108	1 1 1 1	RES 330ohm 5% ¼W	328331J
	R109	1 1 1 1	RES 1kohm 5% ¼W	328102J
	R110	1 1 1 1	RES 330ohm 5% ¼W	328331J
	R111	1 1 1 1	RES 10kohm 5% ¼W	328103J
	R112	1 1 1 1	RES 4.7kohm 5% ¼W	328472J
	R113	1 1 1 1	RES 330ohm 5% ¼W	328331J
	R114	1 1 1 1	RES 220kohm 5% ¼W	328224J
	R115	1 1 1 1	RES 100kohm 5% ¼W	328104J
	R116		— DELETED —	
	R117	1 1 1 1	RES 33kohm 5% ¼W	328333J
	R118	1 1 1 1	RES 15kohm 5% ¼W	328153J
	R119	1 1 1 1	RES 2.2kohm 5% ¼W	328222J
	R120	1 1 1 1	RES 12kohm 5% ¼W	328123J
	R121	1 1 1 1	RES 220ohm 5% ¼W	328221J
	R122	1 1 1 1	RES 33kohm 5% ¼W	328333J

KEY NO.	SYMBOL NO.	TYPE + WEND	DESCRIPTION	PART NO.
			(MPX SECTION)	
	LPF301, LPF302	2 2 2 2	Low pass filter — KM10DB 3803	1270140
	IC301	1 1 1 1	IC HA11223W	518054S
	IC302	1 1 1 1	IC uPD4069C	518072S
	Q301 ~ Q306	6 6 6 6	TR 2SC945L (P or Q)	515077S
	Q307,308	2 2 2 2	TR 2SD655 (E or F)	513115S
	Q309 ~ Q311	3 3 3 3	TR 2SC945L (P or Q)	515077S
	Q312	1 1 1 1	FET 2SK104 (F)	516026S
	Q313,314	2 2 2 2	TR 2SC945L (P or Q)	515077S
	D301 ~ D316	14 14 14 14	Diode 1SS53	501023S
	ZD301	1 1 1 1	Zener Diode RD6.2EBI	502048S
	C301,302	2 2 2 2	E-CAP 0.47uf 50V	211505Q
	C303	1 1 1 1	E-CAP 3.3uf 35V	211413Q
	C304	1 1 1 1	E-CAP 220uf 16V	211232Q
	C305	1 1 1 1	M-CAP 0.047uf 5% 50V	222473J
	C306	1 1 1 1	S-CAP 1000pf 5% 50V	223102V
	C307	1 1 1 1	M-CAP 0.0022uf 5% 50V	222222J
	C308	1 1 1 1	T-CAP 0.47uf 35V	252405M
	C309	1 1 1 1	T-CAP 3.3uf 10V	252113M
	C310	1 1 1 1	M-CAP 0.0015uf 5% 50V	222152J
	C311	1 1 1 1	E-CAP 3.3uf 35V	211413Q
	C312	1 1 1 1	M-CAP 0.01uf 5% 50V	222103J
	C313,314	2 2 2 2	E-CAP 0.33uf 50V	211503S
	C315,316	2 2 2 2	E-CAP 1uf 50V	211510Q
	C317,318	2 2 2 2	M-CAP 0.0075uf 5% 100V	228752J
	C319,320	2 ---	M-CAP 0.022uf 5% 50V	222223J
	C319,320	-2 2 2	M-CAP 0.01uf 5% 50V	222103J
	C321,322	2 ---	M-CAP 0.0033uf 5% 50V	222332J
	C321,322	-2 2 2	M-CAP 0.0047uf 5% 50V	222472J
	C323,324	2 2 2 2	E-CAP 0.47uf 50V	211505Q
	C325,326	2 2 2 2	E-CAP 0.22uf 50V	211502S
	C327	1 1 1 1	E-CAP 220uf 16V	211232Q
	C328	1 1 1 1	M-CAP 0.01uf 5% 50V	222103J
	C329	1 1 1 1	E-CAP 1uf 50V	211510Q
	C330,331	2 2 2 2	E-CAP 0.47uf 50V	211505Q
	C332,333	2 2 2 2	E-CAP 1uf 50V	211510Q
	C334	1 1 1 1	E-CAP 10uf 16V	211220Q
	C335		— DELETED —	
	C336	1 1 1 1	E-CAP 3.3uf 35V	211413Q
	R309	1 1 1 1	Potentiometer — RG10B 3.3kohm	4300820
	R313	1 1 1 1	Potentiometer — SR19R B150kohm	4300520
	R343	1 1 1 1	Potentiometer — SR19R B47kohm	4300730
	R301	1 1 1 1	RES 82kohm 5% ¼W	328823J
	R302	1 1 1 1	RES 330kohm 5% ¼W	328334J
	R303	1 1 1 1	RES 5.6kohm 5% ¼W	328562J
	R304	1 1 1 1	RES 100ohm 5% ¼W	328101J
	R305	1 1 1 1	RES 47kohm 5% ¼W	328473J
	R306	1 1 1 1	RES 10kohm 5% ¼W	328103J
	R307	1 1 1 1	RES 3.3kohm 5% ¼W	328332J
	R308	1 1 1 1	RES 5.6kohm 5% ¼W	328562J
	R309		(Potentiometer)	
	R310	1 1 1 1	RES 220kohm 5% ¼W	328224J
	R311	1 1 1 1	RES 33kohm 5% ¼W	328333J
	R312	1 1 1 1	RES 1kohm 5% ¼W	328102J
	R313		(Potentiometer)	
	R314	1 1 1 1	RES 2.2kohm 5% ¼W	328222J
	R315	1 1 1 1	RES 1kohm 5% ¼W	328102J
	R316	1 1 1 1	RES 6.8kohm 5% ¼W	328682J
	R317	1 1 1 1	RES 22kohm 5% ¼W	328223J
	R318	1 1 1 1	RES 47kohm 5% ¼W	328473J
	R319	1 1 1 1	RES 220kohm 5% ¼W	328224J
	R320	1 1 1 1	RES 10kohm 5% ¼W	328103J
	R321,322	2 2 2 2	RES 3.3kohm 5% ¼W	328332J
	R323,324	2 2 2 2	RES 100ohm 5% ¼W	328101J

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KEY NO.	SYMBOL NO.	TYPE + WEND	DESCRIPTION	PART NO.
	R325			
	~ R328	4444	RES 3.3kohm 5% ¼W	328332J
	R329,330	2222	RES 4.7kohm 5% ¼W	328472J
	R331,332	2222	RES 180kohm 5% ¼W	328184J
	R333,334	2222	RES 18kohm 5% ¼W	328183J
	R335,336	2222	RES 68kohm 5% ¼W	328683J
	R337,338	2222	RES 680ohm 5% ¼W	328681J
	R339,340	2222	RES 5.6kohm 5% ¼W	328562J
	R341,342	2222	RES 220kohm 5% ¼W	328224J
	R343		(Potentiometer)	
	R345	1111	RES 22kohm 5% ¼W	328223J
	R346	1111	RES 1kohm 5% ¼W	328102J
	R347	1111	RES 1meg-ohm 5% ¼W	328105J
	R348	1111	RES 10kohm 5% ¼W	328103J
	R349	1111	RES 330kohm 5% ¼W	328334J
	R350	1111	RES 8.2kohm 5% ¼W	328822J
	R351	1111	RES 33kohm 5% ¼W	328333J
	R352	1111	RES 8.2kohm 5% ¼W	328822J
	R353	1111	RES 1.2kohm 5% ¼W	328122J
	R354	1111	RES 15kohm 5% ¼W	328153J
	R355	1111	RES 3.3kohm 5% ¼W	328332J
	R356	1111	RES 330kohm 5% ¼W	328334J
	R357	1111	RES 1meg-ohm 5% ¼W	328105J
	R358	1111	RES 2.2meg-ohm 5% ¼W	328225J
	R359	1111	RES 100kohm 5% ¼W	328104J
	R360	1111	RES 10meg-ohm 5% ¼W	328106J
	R361,362	2222	RES 100kohm 5% ¼W	328104J
	R363	1111	RES 1meg-ohm 5% ¼W	328105J
	R364	1111	RES 100kohm 5% ¼W	328104J
	R365	1111	RES 1meg-ohm 5% ¼W	328105J
	R366	1111	RES 2.2meg-ohm 5% ¼W	328225J
	R367	1111	RES 1kohm 5% ¼W	328102J
	R368	1111	RES 680ohm 5% ¼W	328681J
	R369,370	2222	RES 4.7kohm 5% ¼W	328472J
	R371	1111	RES 10meg-ohm 5% ¼W	328106J
			(AM SECTION)	
	T201	1111	Coil, AM oscillator	1220060
	T202	1111	Transformer, AM IF	1230160
	T203	1111	Coil, AM descriminator	1230110
	CF201	1111	Celamic filter – SFZ455A	1280310
	IC201	1111	IC HA1197	518044S
	Q201	1111	TR 2SC945L (P or Q)	515077S
	C201	1111	C-CAP 0.022uf +80, –20% 50V YG	231223Z
	C202	1111	C-CAP 0.001uf +80, –20% 50V YG	231102Z
	C203	1111	E-CAP 10uf 16V	211220Q
	C204	1111	C-CAP 0.022uf +80, –20% 50V YG	231223Z
	C205	1111	E-CAP 10uf 26V	211220Q
	C206	1111	C-CAP 0.022uf +80, –20% 50V YG	231223Z
	C207	1111	E-CAP 4.7uf 25V	211315Q
	C208	1111	E-CAP 3.3uf 35V	211413Q
	C209	1111	C-CAP 0.001uf +80, –20% 50V YG	231102Z
	C210			
	~ C212	3333	M-CAP 0.01uf 5% 50V	222103J
	C213	1111	M-CAP 0.068uf 5% 50V	222683J
	C214	1111	E-CAP 10uf 16V	211220Q
	C215	1111	S-CAP 360pf 2% 50V	223361G
	C216	1111	C-CAP 15pf 50V N750	232150U
	C217	1111	C-CAP 0.022uf +80, –20% 50V YG	231223Z
	C218	1111	C-CAP 68pf 10% 50V SL	232680K
	C219,220	2222	C-CAP 0.022uf +80, –20% 50V YG	231223Z
	R201	1111	RES 220ohm 5% ¼W	328221J
	R202	1111	RES 100ohm 5% ¼W	328101J
	R203	1111	RES 1.5kohm 5% ¼W	328152J
	R204	1111	RES 1kohm 5% ¼W	328102J
	R205,206	2222	RES 10kohm 5% ¼W	328103J
	R207	1111	RES 330ohm 5% ¼W	328331J
	R208	1111	RES 10ohm 5% ¼W	328100J
	R209	1111	RES 100ohm 5% ¼W	328101J
	R210	1111	RES 1kohm 5% ¼W	328102J
	R211	1111	RES 3.3kohm 5% ¼W	328332J
	R212	1111	RES 100kohm 5% ¼W	328104J
	R213	1111	RES 10kohm 5% ¼W	328103J
	R214	1111	RES 100kohm 5% ¼W	328104J
			(EQ AMP SECTION)	
	Q401,402	2222	TR 2SA991 (E or F)	510104S
	Q403			
	~ Q406	4444	TR 2SC1845 (E or F)	512115S
	Q407,408	2222	TR 2SA992 (E or F)	510110S
	C401,402	2222	E-CAP 3.3uf 50V	211513Q
	C403,404	2222	C-CAP 470pf 10% 50V SL	232150K
	C411,412	2222	E-CAP 10uf 25V	211320Q
	C413,414	2222	E-CAP 220uf 6.3V	211032Q
	C415,416	2222	M-CAP 0.0012uf 10% 50V	222122K
	C417,418	2222	E-CAP 3.3uf 50V	211513Q
	C419,420	22221	E-CAP 100uf 35V	211430Q
	C421,422	2222	M-CAP 0.011uf 2% 50V	228113G
	C423,424	2222	M-CAP 0.039uf 2% 50V	228393G
	C425,426	2222	E-CAP 220uf 35V	211432S
	C427,428	2222	C-CAP 680pf 10% 50V SL	232681K
	R401,402	2222	RES 47kohm 5% ¼W	328473J
	R403,404	2222	RES 47ohm 5% ¼W	328470J
	R405,406	2222	RES 470kohm 5% ¼W	328474J
	R409,410	2222	RES 33koym 5% ¼W	328333J
	R411,412	2222	RES 150ohm 5% ¼W	328151J
	R413,414	2222	RES 82kohm 5% ¼W	328823J
	R415			
	~ R418	4444	RES 12kohm 5% ¼W	328123J
	R419,420	2222	RES 2.2kohm 5% ¼W	328222J
	R421,422	2222	RES 4.7kohm 5% ¼W	328472J
	R423,424		– DELETED –	
	R425,426	2222	RES 1kohm 5% ¼W	328102J
	R427,428	2222	RES 100kohm 5% ¼W	328104J
	R429,430	2222	RES 220kohm 5% ¼W	328224J
	R431,432	2222	RES, metal film 6.8kohm 2% ¼W	304682G
	R433,434		– DELETED –	
	R435,436	2222	RES, metal film 82kohm 2% ¼W	304823G
	R437,438	2222	RES 68ohm 5% ¼W	328680J
	R439			
	~ R442	4444	RES10 100ohm 5% ¼W	328101J
	R443,444	2222	FP-MO-RES 560ohm 5% ½W	360561L
			(PUSH SWITCH SECTION & OTHERS)	
	Q806	1111	TR 2SA733A (P or Q)	514074S
	C501,502	2222	C-CAP 0.022uf +80, –20% 50V YG	231223Z
	C503,504	2222	M-CAP 0.18uf 5% 50V	222184J
	C505,506	2222	S-CAP 360pf 10% 50V	223361V
	C507,508	2222	M-CAP 0.12uf 5% 50V	222124J
	C541,542	2222	M-CAP 0.0039uf 5% 50V	222392J
	C543,544	2222	E-CAP 0.22uf 10% 50V	211502W
	C809	1111	E-CAP 47uf 25V	211325Q
	C810	1111	E-CAP 47uf 16V	211225Q
	R501,502	2222	RES 1meg-ohm 5% ¼W	328105J
	R503			
	~ R506	4444	RES 2.2kohm 5% ¼W	328222J
	R507,508	2222	RES 3.9kohm 5% ¼W	328392J
	R509,510	2222	RES 5.6kohm 5% ¼W	328562J
	R511,512	2222	RES 47kohm 5% ¼W	328473J
	R513,514	2222	RES 15kohm 5% ¼W	328153J
	R515,516	2222	RES 1meg-ohm 5% ¼W	328105J
	R517,518	2222	RES 5.6kohm 5% ¼W	328562J
	R595,596	–222	RES 330kohm 5% ¼W	328334J
	R597,598	–222	RES 100kohm 5% ¼W	328104J
	R815	2222	RES 47kohm 5% ¼W	328473J

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KEY NO.	SYMBOL NO.	TYPE + W E N D	DESCRIPTION ++	PART NO.
			(TONE AMP SECTION)	
410	R559,560	1 1 1 1	VR V25L5G4 B100kohmx2 – bass	4320630
411	R549,550	1 1 1 1	VR V25L5G4 B100kohmx2 – mid range	4320940
412	R539,540	1 1 1 1	VR V24L5G4 B100kohmx2 – treble	4320640
	Q501,502	2 2 2 2	TR 2SA992 (E or F)	510110S
	Q503			
	~ Q508	6 6 6 6	TR 2SC1845 (E or F)	512115S
	Q509,510	2 2 2 2	TR 2SA992 (E or F)	510110S
	C509,510	2 2 2 2	E-CAP 3.3uf 50V	211513Q
	C511,512	2 2 2 2	E-CAP 220uf 6.3V	211032Q
	C513,514	2 2 2 2	C-CAP 100pf 10% 50V SL	232101K
	C515,516	2 2 2 2	C-CAP 5pf ±0.5pf 50V SL	232509D
	C517,518	2 2 2 2	E-CAP 10uf 35V	211420Q
	C519,520	2 2 2 2	M-CAP 0.001uf 5% 50V	222102J
	C521			
	~ C524	4 4 4 4	M-CAP 0.0047uf 5% 50V	222472J
	C525			
	~ C528	4 4 4 4	M-CAP 0.033uf 5% 50V	222333J
	C529,530	2 2 2 2	E-CAP 3.3uf 50V	211513Q
	C531,532	2 2 2 2	E-CAP 1uf 50V	211510Q
	C533,534	2 2 2 2	E-CAP 0.47uf 50V	211505Q
	C535,536	2 2 2 2	C-CAP 5pf ±0.5pf 50V SL	232509D
	C537,538	2 2 2 2	C-CAP 3pf ±0.5pf 50V SL	232309D
	C539,540	2 2 2 2	E-CAP 4.7uf 35V	211415Q
	C545,546	2 2 2 2	E-CAP 100uf 25V	211330Q
	C547,548	2 2 2 2	E-CAP 47uf 16V	211225Q
	C559,560	2 2 2 2	S-CAP 680pf 10% 50V	223681V
	C561,562	2 2 2 2	C-CAP 47pf 10% 50V SL	232470K
	R519,520	2 2 2 2	RES 2.2kohm 5% ¼W	328222J
	R521,522	2 2 2 2	RES 220kohm 5% ¼W	328224J
	R523,524	2 2 2 2	RES 330ohm 5% ¼W	328331J
	R525,526	2 2 2 2	RES 22kohm 5% ¼W	328223J
	R527,528	2 2 2 2	RES 120kohm 5% ¼W	328124J
	R529,530	2 2 2 2	RES 2.7kohm 5% ¼W	328272J
	R531,532	2 2 2 2	RES 680ohm 5% ¼W	328681J
	R533,534	2 2 2 2	RES 3.9kohm 5% ¼W	328392J
	R535,536	2 2 2 2	RES 100kohm 5% ¼W	328104J
	R537,538	2 2 2 2	RES 8.2kohm 5% ¼W	328822J
	R539,540		(TONE VR – treble)	
	R541,542	2 2 2 2	RES 8.2kohm 5% ¼W	328822J
	R543,544	2 2 2 2	RES 1meg-ohm 5% ¼W	328105J
	R545,546	2 2 2 2	RES 5.6kohm 5% ¼W	328562J
	R547,548	2 2 2 2	RES 10kohm 5% ¼W	328103J
	R549,550		(TONE VR – mid range)	
	R551,552	2 2 2 2	RES 10kohm 5% ¼W	328103J
	R553,554	2 2 2 2	RES 1meg-ohm 5% ¼W	328105J
	R555			
	~ R558	4 4 4 4	RES 22kohm 5% ¼W	328223J
	R559,560		(TONE VR – bass)	
	R561			
	~ R564	4 4 4 4	RES 22kohm 5% ¼W	328223J
	R565,566	2 2 2 2	RES 220kohm 5% ¼W	328224J
	R567			
	~ R570	4 4 4 4	RES 4.7kohm 5% ¼W	328472J
	R571,572	2 2 2 2	RES 47kohm 5% ¼W	328473J
	R573,574	2 2 2 2	RES 470kohm 5% ¼W	328474J
	R575,576	2 2 2 2	RES 100kohm 5% ¼W	328104J
	R577,578	2 2 2 2	RES 150kohm 5% ¼W	328154J
	R579,580	2 2 2 2	RES 82ohm 5% ¼W	328820J
	R581,582	2 2 2 2	RES 3.9kohm 5% ¼W	328392J
	R583,584	2 2 2 2	RES 220kohm 5% ¼W	328224J
	R585,586	2 2 2 2	RES 1kohm 5% ¼W	328102J
	R587,588	2 2 2 2	RES 2.2kohm 5% ¼W	328222J
	R589,590	2 2 2 2	RES 330kohm 5% ¼W	328334J
			(SPEAKERS SWITCH SECTION)	
★413	S8, 9	1 1 1 1	Switch, twin push – SUE-22	4041170

KEY NO.	SYMBOL NO.	TYPE + W E N D	DESCRIPTION ++	PART NO.
			MAIN AMP ASSEMBLY	
★501		1 1 1 1	Heat sink	7480360
★502		1 1 1 1	Heat sink, sub	7480380
503		6 6 6 6	Screw – PTS 3φx12	814312S
	Q717,718	2 2 2 2	TR 2SD746 (Q or R)	513107S
	Q719,720	2 2 2 2	TR 2SB706 (Q or R)	511106S
504		1 1 1 1	Holder, main amp PCB	7226990
505		1 1 1 1	Stay, main amp PCB	7032640
506		4 4 4 4	Screw – PTS 3φx8	814308S
			MAIN AMP PC BOARD ASSEMBLY	
601		1 1 1 1	MAIN AMP PCB ASSEMBLY	9430880
602		2 2 2 2	Connector, 3 pin male – MC-3PM	4570250
603		1 1 1 1	Connector, with wires – 4 pin female – MC-4PF	4570270
			(MAIN AMP SECTION)	
	Q701,702	2 2 2 2	TR 2SA798 (F or G)	514086S
	Q703			
	~ Q706	4 4 4 4	TR 2SA733A (P or Q)	514074S
	Q707			
	~ Q710	4 4 4 4	TR 2SC1941 (L or K)	512112S
	Q711,712	2 2 2 2	TR 2SA916 (L or K)	510108S
	Q713,714	2 2 2 2	TR 2SD669A (B or C)	513112S
	Q715,716	2 2 2 2	TR 2SB649A (B or C)	511111S
	Q721,722	2 2 2 2	TR 2SC945L (P or Q)	515077S
	Q723,724	2 2 2 2	TR 2SC1845 (E or F)	512115S
	D701			
	~ D706	6 6 6 6	Diode 1SS53	501023S
	D707,708	2 2 2 2	Diode VD1212	505016S
	D709,710	2 2 2 2	Diode 1SS55	501024S
	D711,712	2 2 2 2	Diode 1SS53	501023S
	ZD701			
	~ ZD704	4 4 4 4	Zener Diode RD24EB4	502057S
	C701,702	2 2 2 2	C-CAP 220pf 10% 50V SL	232221K
	C703			
	~ C706	4 4 4 4	E-CAP 10uf 25V	211320Q
	C707,708	2 2 2 2	E-CAP 3.3uf 50V	211513Q
	C709,710	2 2 2 2	C-CAP 680pf 10% 50V SL	232681K
	C711,712	2 2 2 2	M-CAP 0.047uf 10% 50V	222473K
	C713,714	2 2 2 2	C-CAP 47pf 10% 500V SL	234470K
	C715,716		– DELETED –	
	C717,718	2 2 2 2	C-CAP 1pf ±0.5pf 500V SL	234109D
	C719,720	2 2 2 2	E-CAP 0.47uf 50V	211505Q
	C721,722	2 2 2 2	M-CAP 0.047uf 10% 50V	222473K
	C723,724	2 2 2 2	M-CAP 0.047uf 10% 200V	227473K
	C725,726	2 2 2 2	E-CAP 1uf 50V	211510Q
	C727,728	2 2 2 2	E-CAP 47uf 63V	211625Q
	C733,734	2 2 2 2	C-CAP 4pf ±0.5pf 500V SL	234409D
	C735,736	2 2 2 2	C-CAP 27pf 10% 50V SL	232270K
	C737,738	2 2 2 2	C-CAP 5pf ±0.5pf 500V SL	234509D
	C741			
	~ C744	4 4 4 4	E-CAP 0.47uf 63V	211605S
	R707			
	~ R710	4 4 4 4	Potentiometer – SR29R 207 B47kohm	4301190
	R753,754	2 2 2 2	Potentiometer – SR29R 207 B1kohm	4300620
	R701,702	2 2 2 2	RES 1kohm 5% ¼W	328102J
	R703,704	2 2 2 2	RES 100kohm 5% ¼W	328104J
	R705,706	2 2 2 2	RES 470kohm 5% ¼W	328474J
	R707			
	~ R710		(Potentiometer)	
	R711,712	2 2 2 2	RES 8.2kohm 5% ¼W	328822J
	R713,714	2 2 2 2	RES 56kohm 5% ¼W	328563J
	R715,716	2 2 2 2	RES 1.2kohm 5% ¼W	328122J

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KEY NO.	SYMBOL NO.	TYPE + W E N D	DESCRIPTION ++	PART NO.
	R717 ~ R720	4 4 4 4	RES 4.7kohm 5% ¼W	328472J
	R721,722	2 2 2 2	RES 470kohm 5% ¼W	328474J
	R723,724	2 2 2 2	RES 470ohm 5% ¼W	328471J
	R725 ~ R728	4 4 4 4	FP-MO-RES 4.7kohm 5% ½W	360472L
	R729,730	2 2 2 2	RES 56kohm 5% ¼W	328563J
	R731,732		– DELETED –	
	R733,734	2 2 2 2	RES 6.8kohm 5% ¼W	328682J
	R735 ~ R738	4 4 4 4	RES 100ohm 5% ¼W	328101J
	R739 ~ R742	4 4 4 4	RES 680ohm 5% ¼W	328681J
	R743 ~ R746	4 4 4 4	RES 100ohm 5% ¼W	328101J
	R747,748	2 2 2 2	FP-MO-RES 10kohm 5% ½W	360103L
	R749,750	2 2 2 2	RES 820ohm 5% ¼W	328821J
	R751,752	2 2 2 2	RES 560ohm 5% ¼W	328561J
	R753,754		(Potentiometer)	
	R755 ~ R758	4 4 4 4	RES 100ohm 5% ¼W	328101J
	R759 ~ R762	4 4 4 4	FP-MO-RES 47ohm 5% ½W	360470L
	R763,764	2 2 2 2	FP-MO-RES 220ohm 5% ½W	360221L
	R765 ~ R768	4 4 4 4	CEM-RES 0.33ohm 10% 5W	384339W
	R769,770	2 2 2 2	FP-MO-RES 1.2kohm 5% ½W	360122L
	R771,772	2 2 2 2	RES 1.5kohm 5% ¼W	328152J
	R773,774	2 2 2 2	FP-MO-RES 4.7ohm 5% 2W	362478L
	R775,776	2 2 2 2	RES 12kohm 5% ¼W	328123J
	R777,778	2 2 2 2	CEM-RES 0.33ohm 10% 5W	384339W
	R779,780		– DELETED –	
	R781,782	2 2 2 2	CEM-RES 0.33ohm 10% 5W	384339W
			(PROTECTOR SECTION)	
604	LY801	1 1 1 1	Relay MY4-02-US-40L	1700220
	Q801	1 1 1 1	TR 2SC945L (P or Q)	515077S
	Q802	1 1 1 1	TR 2SA733A (P or Q)	514074S
	Q803	1 1 1 1	TR 2SA992 (E or F)	510110S
	Q804	1 1 1 1	TR 2SC945L (P or Q)	515077S
	Q805	1 1 1 1	TR 2SC2003 (L or M)	512114S
	D801	1 1 1 1	Diode 1SS55	501024S
	ZD801	1 1 1 1	Zener Diode RD12EB3	502058S
	C801,802	2 2 2 2	E-CAP 220uf 6.3V	211032Q
	C803	1 1 1 1	E-CAP 01uf 16V	211220Q
	C804	1 1 1 1	E-CAP 220uf 16V	211232Q
	C806	1 1 1 1	M-CAP 0.001uf 10% 50V	222102K
	R801,802	2 2 2 2	RES 47kohm 5% ¼W	328473J
	R803	1 1 1 1	RES 33kohm 5% ¼W	328333J
	R804	1 1 1 1	RES 12kohm 5% ¼W	328123J
	R805	1 1 1 1	RES 22kohm 5% ¼W	328223J
	R806	1 1 1 1	RES 12kohm 5% ¼W	328123J
	R807	1 1 1 1	RES 47kohm 5% ¼W	328473J
	R808	1 1 1 1	RES 2.2kohm 5% ¼W	328222J
	R809	1 1 1 1	RES 47kohm 5% ¼W	328473J
	R812	1 1 1 1	FP-MO-RES 680ohm 5% 2W	362681L
			(POWER INDICATOR DRIVER SECTION)	
	IC901	1 1 1 1	IC TA7318P	518067S
	C901,902	2 2 2 2	E-CAP 0.47uf 50V	211505Q
	C903,904	2 2 2 2	M-CAP 0.047uf 10% 50V	222472K
	C905	1 1 1 1	E-CAP 1uf 50V	211510Q
	R905,906	2 2 2 2	Potentiometers – SR29R 207 – B1kohm	4300620
	R901,902	2 2 2 2	RES 56kohm 5 5% ¼W	328563J
	R903,904	2 2 2 2	RES 39ohm 5% ¼W	328390J
	R905,906		(Potentiometer)	

KEY NO.	SYMBOL NO.	TYPE + W E N D	DESCRIPTION ++	PART NO.
	R907	1 1 1 1	FP-MO-RES 1.8kohm 5% ½W	360182L
			(HEAD PHONES SECTION)	
		1 1 1 1	Jack, head phones – JL3A	4550260
*605	R783,784	2 2 2 2	FP-MO-RES 330ohm 5% 2W	362331L
			REGULATOR PCB ASSEMBLY	
*701a		1 – – –	REGULATOR PCB ASSEMBLY	9450920
*701b		– 1 1 1	REGULATOR PCB ASSEMBLY	9450930
702		1 1 1 1	Connector assembly – 3 pin	4570210
703		1 1 1 1	Connector assembly – 3pin x 2	4570290
704		1 1 1 1	Connector, 3pin female – MC-3PF	4570230
705a	F831	1 – – –	Fuse – 1A 250V	4700590
706a	F832	1 – – –	Fuse – 3A 250V	4700630
707a		4 – – –	Holder, fuse	7050420
705b	F831	– 1 1 1	Midget fuse – (S) 1AT 250V	4720330
706b	F832	– 1 1 1	Midget fuse – (S) 3.15AT 250V	4720390
707b		– 4 4 4	Holder, midget fuse	7050430
708		1 1 1 1	Heat sink, for Q831	7081820
709		1 1 1 1	Screw – PMS3ϕx6	810306S
	Q831	1 1 1 1	TR 2SD880 (Y or GR)	513106S
	Q832	1 1 1 1	TR 2SD667 (B or C)	511021S
	Q833	1 1 1 1	TR 2SB647 (B or C)	510045S
	D802	1 1 1 1	Diode 1SS55	501024S
	D803 ~ D805	3 3 3 3	Diode 1SS53	501023S
	D831	1 1 1 1	Diode S10VB20	560058S
	D832	1 1 1 1	Diode W02	560061S
	D833	1 1 1 1	Diode 1SS53	501023S
	ZD831,832	2 2 2 2	Zener Diode RD22FC	502070S
	ZD833,834	2 2 2 2	Zener Diode RD33EB3	502067S
	ZD835	1 1 1 1	Zener Diode RD13EB1	502049S
	ZD836	1 1 1 1	Zener Diode RD20EB3	502069S
	L701,702	1 1 1 1	Coil, choke	1210830
	C805	1 1 1 1	E-CAP 10uf 35V	211420Q
	C831,832	2 2 2 2	E-CAP 10000uf 63V	2100020
	C833,834	2 2 2 2	C-CAP 0.01uf 500V	238103P
	C835,836	2 2 2 2	E-CAP 100uf 25V	211330Q
	C837,838	2 2 2 2	E-CAP 100uf 35V	211430Q
	C839	1 1 1 1	E-CAP 100uf 25V	211330Q
	C840	1 1 1 1	E-CAP 470uf 16V	211235S
	C841	1 1 1 1	C-CAP 0.022uf +80, –20% 50V YG	231223Z
	C842	1 1 1 1	E-CAP 47uf 25V	211325Q
	C843	1 1 1 1	E-CAP 10uf 16V	211220Q
	C844,845	2 2 2 2	E-CAP 100uf 35V	211430Q
	C846	1 1 1 1	E-CAP 2200uf25V	211342S
	R785,786	2 2 2 2	FP-MO-RES 10ohm 5% 2W	362100L
	R810	1 1 1 1	RES 1kohm 5% ¼W	328102J
	R811	1 1 1 1	RES 12kohm 5% ¼W	328123J
	R813	1 1 1 1	RES 390ohm 5% ¼W	328391J
	R831,832	2 2 2 2	FP-MO-RES 4.7kohm 5% 2W	362472L
	R833	1 1 1 1	RES 820ohm 5% ¼W	328821J
	R834,835	2 2 2 2	FP-MO-RES 560ohm 5% 2W	362561J
	R836,837	2 2 2 2	FP-MO-RES 3.3kohm 5% ½W	360332L
	R838,839	2 2 2 2	FP-MO-RES 470ohm 5% ½W	360471L
	R842	1 1 1 1	FP-MO-RES 1.8kohm 5% 2W	362182L
	R843,844	2 2 2 2	FP-MO-RES 47ohm 5% ½W	360470L

SEMICONDUCTOR DATA

† NOTES

Ge: Germanium
Si : Sillicon

A : Alloy
B : Base
D : Diffused
Dd : Double-diffused

Df : Drift-field
E : Epitaxial
G : Grown
J : Junction

M : Mesa
P : Planer
Pc : Point-contact
Td : Triple-diffused

TRANSISTORS

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T_A = 25°C unless otherwise specified)					ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25°C unless otherwise specified)												MANUFACTURER
			Collector-to-Base Voltage V_{CBO} (V)	Emitter-to-Base Voltage V_{EBO} (V)	Collector Current I_C (mA)	Collector Dissipation P_C (mW)	Junction Temperature T_J (°C)	Collector Cutoff Current I_{CBO} (uA)	V_{CB} (V)	Static Forward-Current Transfer Ratio h_{FE}	V_{CE} (V)	I_C (mA)	Collector-Emitter Saturation Voltage $V_{CE(sat)}$ (V)	I_C (mA)	I_B (mA)	Gain-Bandwidth Product f_T $f_{\alpha b}$* (MHz)	V_{CE}	I_E I_C* (mA)	Output Capacitance C_{ob} (pF)	Others	
2SA733A (P, Q)	AF	PNP Si-E	−60	−5	−100	250	125	−0.1 max.	−60	135 ~400	−6	−1	−0.3 max.	−100	−10	450 max.	−6	10	6 max.		NEC
2SA798 (F, G)	AF, Low noise differential amp.	PNP, Dual Si-EP	−70	−5	−100	200	125	−0.1 max.	−50	250 ~800	−6	−1	−0.6 max.	−10	−1	100	−6	1	3		MITSUBISHI
2SA916 (L, K)	AF	PNP Si-E	−160	−5	−50	800	150	−0.1 max.	−160	135 ~400	−10	−10	−0.6 max.	−20	−2	80	−10	10	3.5 max.	Complementary to 2SC 1941	NEC
2SA991 (E, F)	AF, Low noise	PNP Si-E	−60	−5	−100	500	125	−0.05 max.	−60	300 ~800	−6	−1	−0.5 max.	−100	−10	90	−6	1	10 max.		NEC
2SA992 (E, F)	AF, Low noise	PNP Si-E	−120	−5	−50	500	125	−0.05 max.	−120	300 ~800	−6	−1	−0.3 max.	−10	−1	100	−6	1	3 max.	Complementary to 2SC 1845	NEC
2SB647 (B, C)	AF	PNP Si-E	−120	−5	−1A	0.9W	150	−10 max.	−100	60 ~200	−5	−150	−1 max.	−500	−50	140	−5	−150*	20	Complementary to 2SD 667	HITACHI
2SB649A (B, C)	AF, Driver	PNP Si-E	−180	−5	−1.5A	20W (Tc=25°C)	150	−10 max.	−160	60 ~200	−5	−150	−1 max.	−500	−50	140	−5	−150*	27	Complementary to 2SD 669A	HITACHI
2SB706 (Q, R)	AF, Power amp.	PNP Si-Td	−180	−5	−10A	200W (Tc=25°C)	150	−50 max.	−180	60 ~200	−5	−2A	−3 max.	−10A	−1A	14	−5	−0.2A*	450	Complementary to 2SD 746	NEC
2SC945L (P, Q)	AF	NPN Si-E	60	5	100	250	125	0.1 max.	60	135 ~400	6	1	0.3 max.	100	10	450 max.	6	−10	5 max.		NEC
2SC1675 (L, M)	RF, Mixer, Osc, (in FM/AM radio)	NPN Si-E	50	5	30	250	125	0.1 max.	50	40 ~120	6	1	0.3 max.	10	1	250	6	−1	2.2 max.		NEC
2SC1845 (E, F)	AF, Low noise	NPN Si-E	120	5	50	500	125	0.05 max.	120	300 ~800	6	1	0.3 max.	10	1	110	6	−1	2.5 max.	Complementary to 2SA992	NEC
2SC1941 (L, K)	AF	NPN Si-E	160	5	50	800	150	0.1 max.	160	135 ~400	10	10	0.6 max.	20	2	120	10	−10	3 max.	Complementary to 2SA916	NEC
2SC2003 (L, M)	AF	NPN Si-E	80	5	300	600	150	0.1 max.	80	90 ~270	1	50	0.6 max.	300	30	140	6	−10	15 max.		NEC
2SD655 (E, F)	AF	NPN Si-E	30	5	700	500	150	1	20	400 ~1200	1	150	0.5 max.	500	50	250	1	150*			HITACHI
2SD667 (B, C)	AF	NPN Si-E	120	5	1A	0.9W	150	10 max.	100	60 ~200	5	150	1 max.	500	50	140	5	150*	12	Complementary to 2SB647	HITACHI
2SD669A (B, C)	AF, Driver	NPN Si-E	180	5	1.5A	20W (Tc=25°C)	150	10 max.	160	60 ~200	5	150	1 max.	500	50	140	5	150*	14	Complementary to 2SB649A	HITACHI
2SD746 (Q, R)	AF, Power amp.	NPN Si-Td	180	5	10A	200W (Tc=25°C)	150	50 max.	180	60 ~200	5	2A	3 max.	10A	1A	15	5	0.2A*	300	Complementary to 2SB706	NEC
2SD880 (Y, GR)	AF, Power amp.	NPN Si-Td	60	7	3A	30W (Tc=25°C)	150	100 max.	60	100 ~300	5	0.5A	1 max.	3A	0.3A	3	5	−0.5A	70		TOSHIBA

FIELD EFFECT TRANSISTORS

DEVICE TYPE	APPLICATIONS	STRUCTURE †	MAXIMUM RATINGS Absolute-Maximum Values: (T_A = 25°C unless otherwise specified)						ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25° C unless otherwise specified)															MANUFACTURER
			Gate-to-Drain Voltage V_{GDO} (V)	Gate-to-Source Voltage V_{GSO} (V)	Gate Current I_G (mA)	Drain Current I_D (mA)	Total Dissipation P_D (mW)	Channel Temperature T_{ch} (°C)	Gate Leak Current Test Conditions	I_{GSS} (nA)	Gate to Drain Breakdown Voltage Test Conditions	$V_{(BR)GDO}$ (V)	Drain Current Test Conditions	I_{DSS} (mA)	Gate to Source Cutoff Voltage Test Conditions	$V_{GS(off)}$ (V)	Forward Transfer Admittance Test Conditions	$\lvert Y_{fs}\rvert$ (mS)	Feed Back Capacitance Test Conditions	C_{rss} (pF)	Power Gain (Common Source) Test Conditions	G_{PS} (dB)	Noise Figure Test Conditions	NF (dB)	
2SK104 (F)	AF, RF General	Si N-channel junction	−30	−30	10	20	250	125	V_{GS} = −30V	10			V_{DS} = 5V	1~3	V_{DS} = 5V I_D = 10mA	−1.1	V_{DS} = 5V V_{GS} = 0V f = 1 kHz	4.1	V_{DS} = 10V V_{GS} = 0 V f = 1 kHz	0.9					NEC

DIODES, LED'S

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute - Maximum Values: (T_A = 25°C unless otherwise specified)									ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25°C unless otherwise specified)							MANUFACTURER
			Reverse Surge Voltage V_{Rsurge} (V)	Peak Reverse Voltage V_{RM} (V)	Reverse Voltage V_R (V)	Peak Forward Voltage V_{FM} (V)	Peak Forward Current I_{FM} (mA)	Average Rectified Current I_O (mA)	Forward Surge Current $I_{F\,surge}$ (A)	Junction Temperature T_J (°C)	Total Power Dissipation P_D (mW)	Forward Current I_{Fmin} (mA)	Test Condition V_F (V)	Forward Voltage V_{Fmax} (V)	Test Condition I_F (mA)	Reverse Current I_{Rmax} (uA)	Test Condition V_R (V)	Others	
S10VB20	Rectifier	Si-DJ Bridge		200				10A		150									SHINDENGEN
W02	Rectifier	Si-DJ Bridge		200				1.5A	50	125				1.0	1A	10			GENERAL INSTRUMENT
1SS55	Detector, Medium speed switching	Si-EP		100	75		300	100	2	200	500			0.8 1.0	1.0 30	0.1	75		NEC
1SS53	Detector, Medium speed switching	Si-EP		35	30		300	100	2	200	500			0.8 1.0	1.0 30	0.1	30		NEC
GL-2PG1	Lamp (green)	GaP			5			I_F = 30 mA		85	85			2.8	20	10	4	I_V = 0.3 mcd (I_F = 20 mA)	SHARP
GL-2PR1	Lamp (red)	Gap			5			I_F = 10 mA		85	23			2.3	5	10	4	I_V = 0.3 mcd (I_F = 5 mA)	SHARP

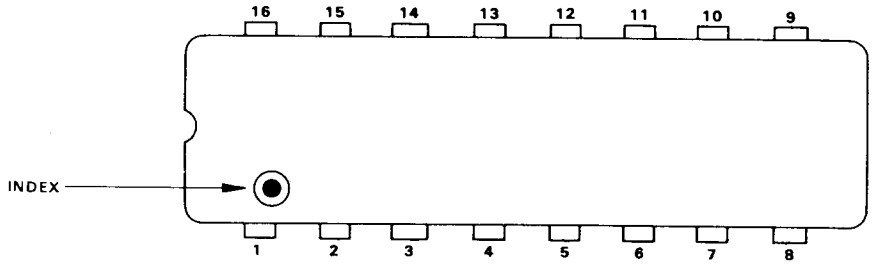
ZENER DIODES

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute - Maximum Values: (T_A = 25°C unless otherwise specified)			ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25°C unless otherwise specified)														MANUFACTURER
			Total Power Dissipation P_D (mW)	Zener Current I_Z (A)	Junction Temperature T_J (°C)	Zener Voltage V_Z MIN (V)	TYP (V)	MAX (V)	Test Conditions I_Z (mA)	Differential Resistance r_Z TYP (Ω)	MAX (Ω)	Test Conditions I_Z (mA)	Temperature Coefficient γ_Z TYP (%/°C)	MAX (%/°C)	Test Conditions I_Z (mA)	Reverse Current I_Z MAX (μA)	Test Conditions V_R (V)	Others	
RD6.2-EB1	Regulator	Si-J	400			5.78		6.09	20		20	20				5	1.5		NEC
RD12-EB3	Regulator	Si-J	400			11.74		12.35	10		20	10				2	9		NEC
RD13-EB1	Regulator	Si-J	400			12.99		13.66	10		25	10				2	10		NEC
RD20-EB3	Regulator	Si-J	400			19.23		20.22	10		55	10				2	15		NEC
RD24-EB4	Regulator	Si-J	400			23.63		24.85	5		95	5				2	19		NEC
RD33-EB3	Regulator	Si-J	400			30.9		32.5	5		160	5				2	25		NEC
RD22-FC	Regulator	Si-J	1000			22.0		24.5	10		14	10				10	17		NEC

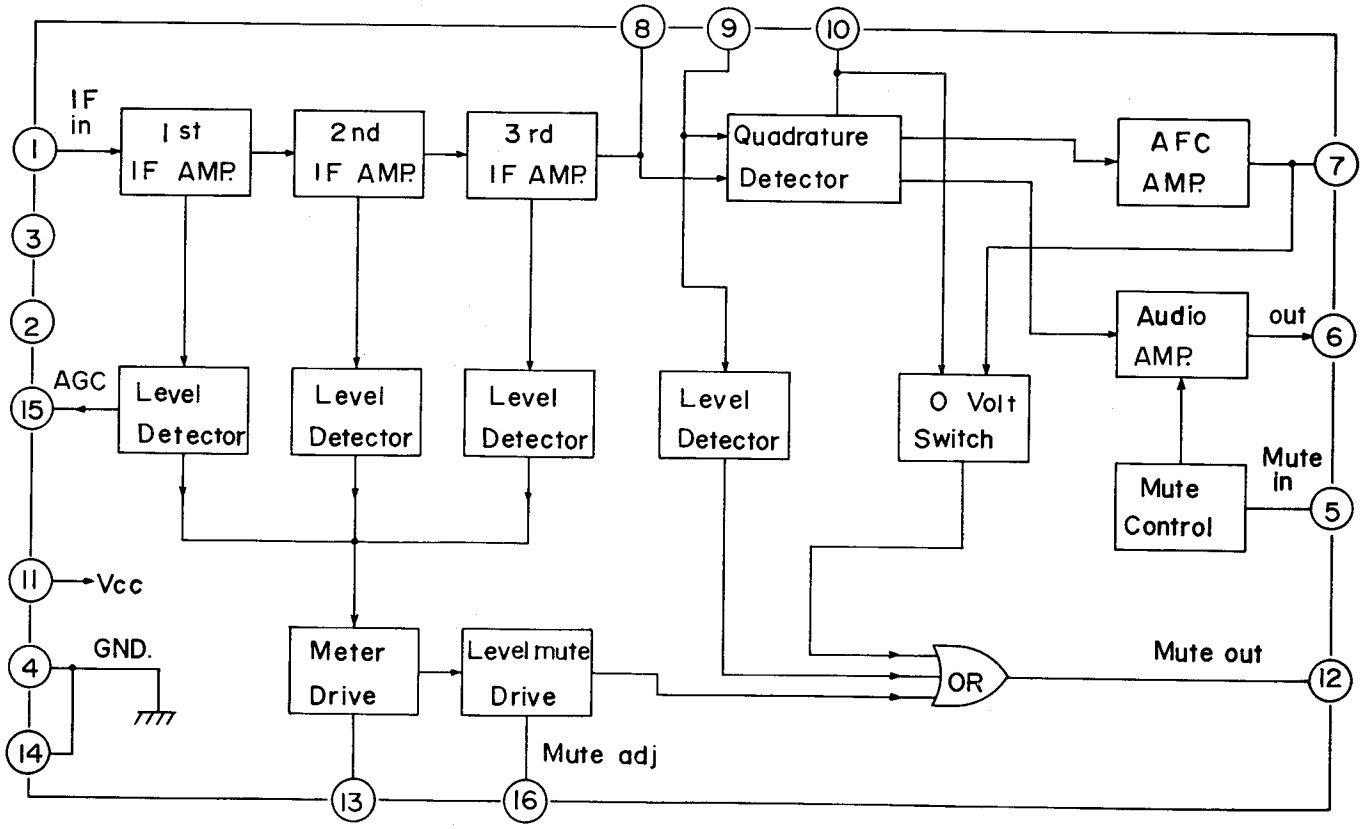
INTEGRATED CIRCUITS HA11225

DEVICE TYPE	APPLICATION	ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)				ELECTRICAL CHARACTERISTICS (T_A = 25°C) Typical Values							MANUFACTURER
		Supply Voltage Vcc (V)	Power Dissipation P_T (mW)	Operating Temperature Range Topr (°C)	Storage Temperature Range Tsig (°C)	Supply Current (mA)	Input Limiting Sensitivity Vin (lim) (μV)	AF Voltage (mVrms)	Total Harmonic Distortion (%)	Signal to Noise Ratio (dB)	AM Rejection (dB)	Muting Sensitivity (μV)	
HA11225	FM IF Amplifier, Quadrature Detector	14	590 (Ta=60°C)	−20 ~ +70	−55 ~ +125	33 max.	35 (−3dB point)	380	0.1 max.	84	54	158	HITACHI

TERMINAL GUIDE (TOP VIEW)



BLOCK DIAGRAM



INTEGRATED CIRCUIT HA11223W

APPLICATION/MANUFACTURER:
FM STEREO DEMODULATOR/HITACHI

ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

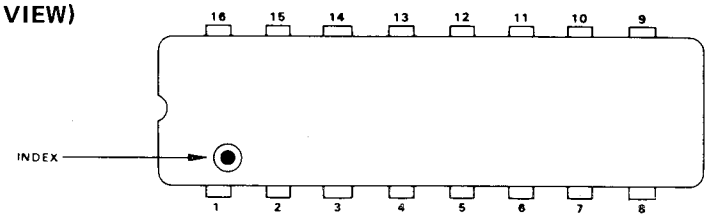
Item		Symbol	Rating	Unit
Supply Voltage		V_{CC}	16	V
Power Dissipation*		P_T	500	mW
Operating Temperature		T_{opr}	−20 to +75	°C
Storage Temperature		T_{stg}	−55 to +125	°C
Lamp Drive Current	Continuos	I_L	75	mA
	Peak		100	

*Value at Ta=75°C

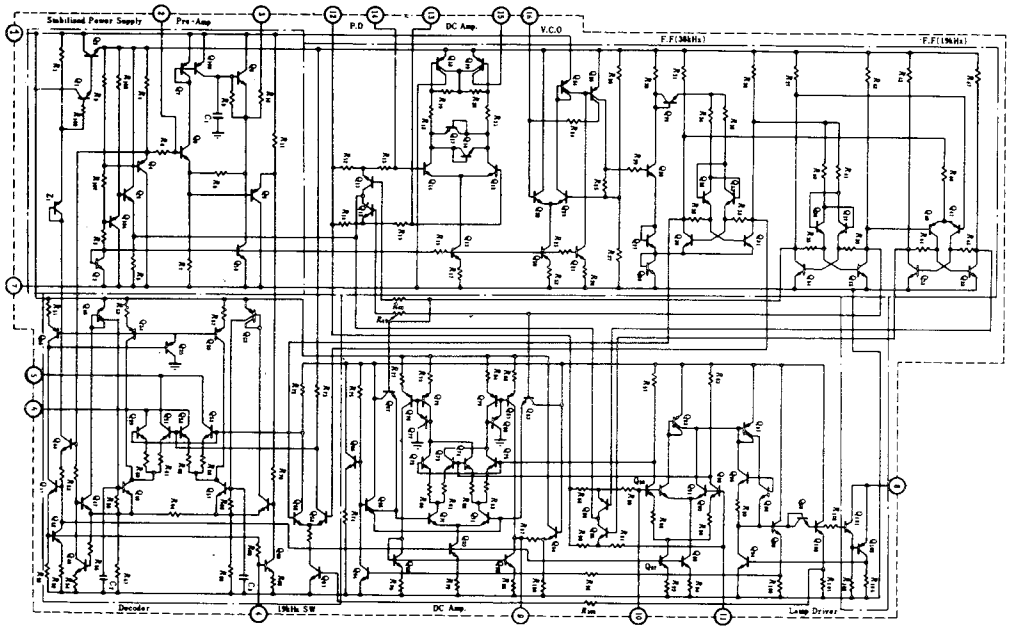
ELECTRICAL CHARACTERISTICS (V_{CC}=13V, f=1kHz, Ta=25°C unless otherwise noted)

Item	Symbol	Test Condition		min	typ	max	Unit
Input Impedance	Z_{in}			30	75	—	kΩ
Channel Separation	Sep	P=30mV, $L+R$=270mV	100Hz	—	40	—	dB
			1kHz	35	45	—	
			10kHz	—	40	—	
Stereo Total Harmonic Distortion	$ST, T.H.D$	P=30mV, $L+R$=270mV	100Hz	—	0.04	—	%
			1kHz	—	0.02	0.08	
			10kHz	—	0.05	—	
Output Voltage	V_{out}	V_{in}=300mV		185	240	310	mV
Channel Balance	$C.B$	V_{in}=300mV		—	0	—	dB
Monaural Total Harmonic Distortion	$M_{ono}, T.H.D$	V_{in}=300mV		—	0.01	0.08	%
Pilot Level for Lamp ON	L_{ON}			8	11.5	15	mV
Stereo Lamp Hysteresis				—	4	—	dB
Carrier Leak	$C.L$	P=30mV, $L+R$=270mV	19kHz	55	60	—	dB
			38kHz	—	35	—	
SCA Rejection Ratio	$SCA\ R_{ej}$	P=30mV, $L+R$=270mV; SCA=30mV, f_{SCA}=67kHz		—	80	—	dB
Signal-to-noise Ratio	S/N	V_{in}=300mV, R_g=4.7kΩ		80	86	—	dB
Capture Range	$C.R$	P=30mV		—	±3.5	—	%
Max Input Signal	Vin	P=10%, $L+R$=90%, $T.H.D \leq 0.5\%$		—	1.2	—	V
Total Current Drain	I_T			—	17	—	mA

TERMINAL GUIDE (TOP VIEW)



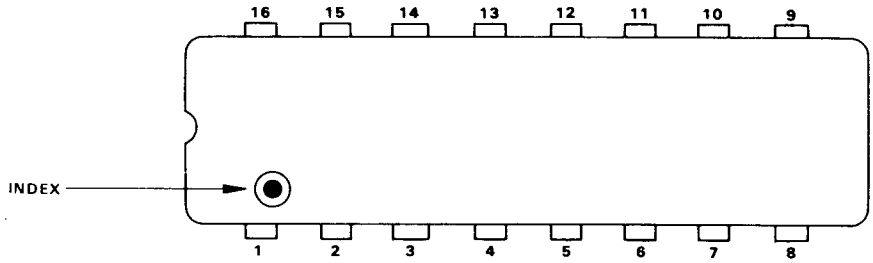
SCHEMATIC DIAGRAM



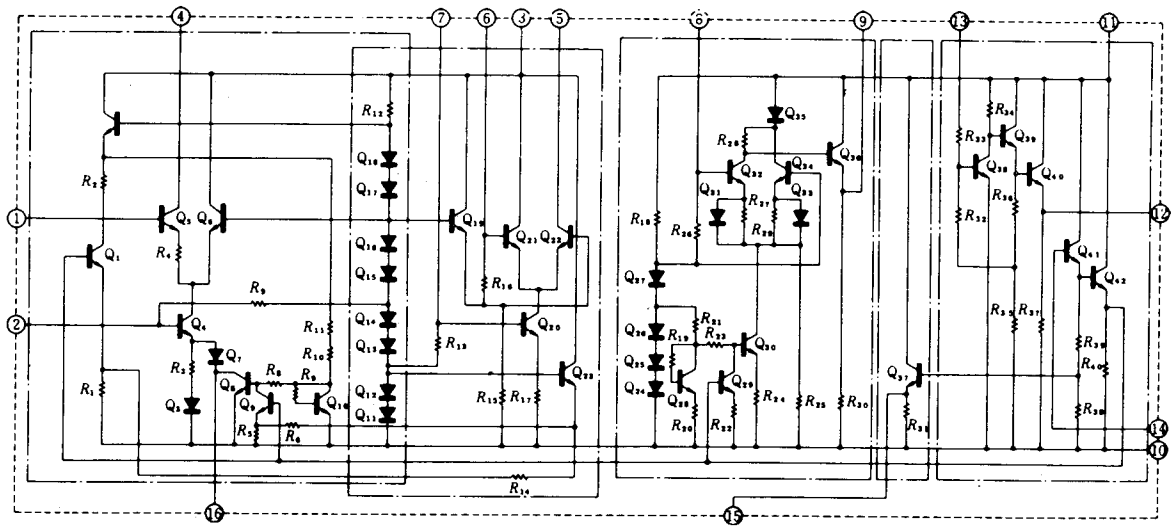
INTEGRATED CIRCUITS HA1197

DEVICE TYPE	APPLICATION	ABSOLUTE MAXIMUM RATING (T_A = 25°C)				ELECTRICAL CHARACTERISTICS (TYPICAL VALUES) T_A=25°C				MANUFACTURER
		Voltage Supply Vcc (V)	Power Dissipation Pd (mW)	Operating Temp Range Topt (°C)	Storage Temp Range Tstg (°C)	Signal to Noise Ratio Input=74dBμ Mod = 30% (dB)	Distortion Input=100dBμ Mod = 30% (%)	Output Voltage Input=74dBμ Mod = 30% (mV)	Quiescent Current (mA)	
HA1197	AM Radio	15	450 (Ta = 70°C)	−20 ~ +70	−55 ~ +125	53	0.4	212	14.5	HITACHI

TERMINAL GUIDE (TOP VIEW)



SCHEMATIC DIAGRAM

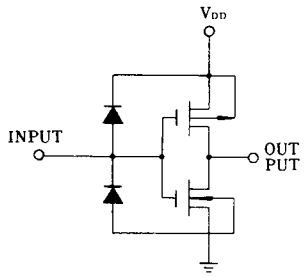


INTERGRATED CIRCUITS μPD4069C

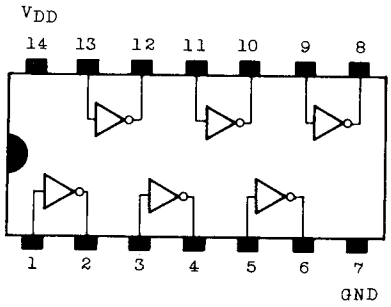
FUNCTION/MANUFACTURER

- **Hex Inverter/NEC**

EQUIVALENT CIRCUIT AND CONNECTION INFORMATION



(1/6 CIRCUIT SHOWN)



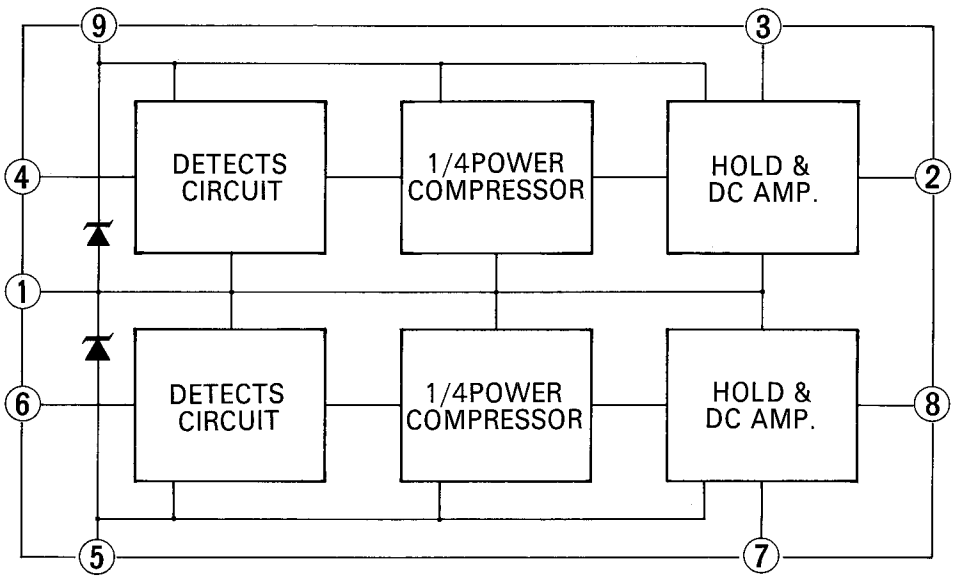
TOP VIEW

INTERGRATED CIRCUITS TA-7318P

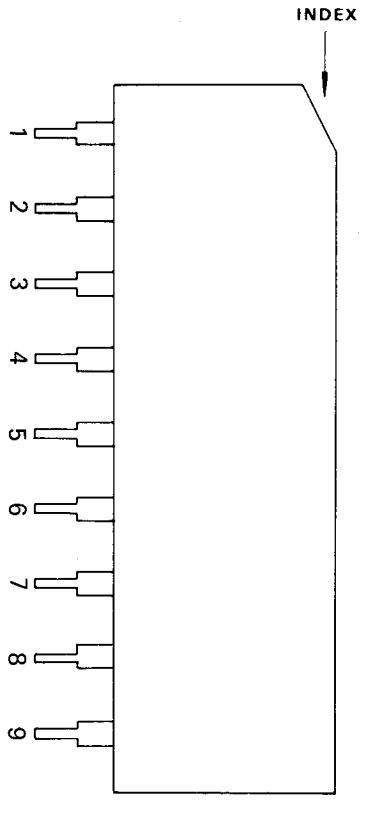
FUNCTION/MANUFACTURER

- **Dual Linear-to-Log Converter for Peak Power Meter/Toshiba**

BLOCK DIAGRAM AND CONNECTION INFORMATION



BLOCK DIAGRAM



TERMINAL GUIDE (SIDE VIEW)

MEMO

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RD22FC

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2SB649A
2SD669A

2SB706
2SD746

2SK104

2SA733A
2SA991
2SA992
2SB647
2SC945L
2SC1675
2SC1845
2SC2003
2SD655
2SD667

2SA916
2SC1941

2SA798

NOTES:

1. SCHEMATIC IS SUBJECT TO CHANGE WITHOUT NOTICE.

UNLESS OTHERWISE SPECIFIED:

2. RESISTANCE VARUES ARE IN OHMS. K = 1.000: M = 1.000.000
3. CAPACITANCE VALUES 1.0 AND ABOVE ARE IN pF OR µF (P = pF. M = µF). LESS THAN 1.0 ARE IN µF. (ELECTROLYTIC CAPACITANCE VALUES ARE IN µF/WV.)
4. VOLTAGES ARE MEASURED TO CHASSIS GROUND WITH A "DC VOLTMETER." V: VOLTAGES MEASURED WITH NO SIGNAL APPLIED.

SCHEMATIC SYMBOLS:

Ⓜ POLYESTER FILM CAPACITOR
Ⓢ POLYSTYRENE FILM CAPACITOR
Ⓣ TANTALUM ELECTROLYTIC CAPACITOR
• NONFLAMMABLE RESISTOR

M901

ADV106M

TYPE	W	E.N.D
C319, 320	0.022	0.01
C321, 322	0.0033	0.0047

SCHEMATIC DIAGRAM
NIKKO NR-1219
AM/FM STEREO RECEIVER