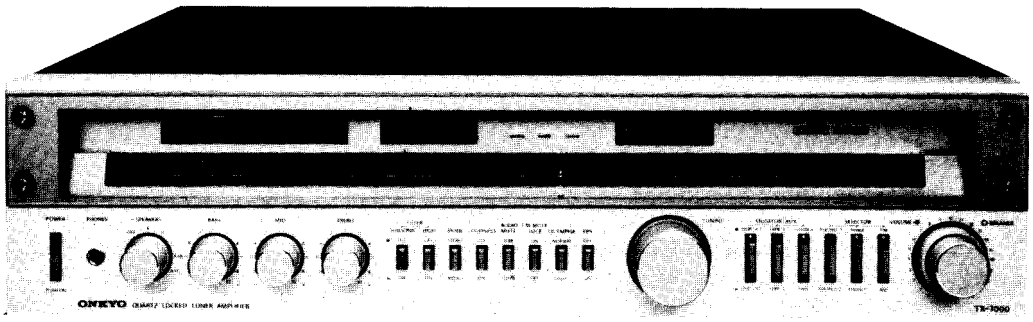
SERIAL NO. 3080

ONKYO® SERVICE MANUAL

QUARTZ LOCKED
FM/AM STEREO RECEIVER
MODEL TX-7000



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ONKYO®
AUDIO COMPONENTS

SPECIFICATIONS

AMPLIFIER SECTION

Output Power:	90 watts per channel, min, RMS, at 8 ohms both channels driven, from 20 Hz to 20,000 Hz with no more than 0.02% total harmonic distortion.	
Total Harmonic Distortion:	0.02%, at rated power 0.018% at 1 watt output	
IM Distortion:	0.02% at rated power 0.018% at 1 watt output	
Damping Factor:	50 at 8 ohms	
Frequency Response:	10 Hz – 30,000 Hz (±1 dB)	
RIAA Deviation:	20 Hz – 20,000 Hz (±0.3 dB)	
Sensitivity & Impedance:	Phono:	2.5 mV, 50 kohms
	Tape Play:	150 mV, 50 kohms
	Tape Rec:	150 mV, 3.5 kohms (PH)
Phono Overload:	200 mV RMS at 1 kHz, 0.02% T.H.D.	
Signal-to-Noise Ratio:	Phono:	76 dB (IHF A weighted, 1 watt output, 5 mV input) 86 dB (A weighted, 10 mV input)
	Tape:	80 dB (IHF A weighted, 1 watt output, 0.5 V input) 96 dB (A weighted)
Residual Hum & Noise:	0.5 mV at min. volume level (A weighted)	
Tone Controls:	Bass:	±12 dB at 100 Hz
	Mid:	±5 dB at 1 kHz
	Treble:	±10 dB at 10 kHz
Filters:	High:	6 kHz, 12 dB/oct.
	Subsonic:	10 Hz, 12 dB/oct.
Loudness (–40 dB):	+8 dB at 40 Hz +5 dB at 20 kHz	

TUNER SECTION

FM:

Tuning Range:	88 – 108 MHz	
Usable Sensitivity:	Mono:	9.8 dBf, 1.7μV
	Stereo:	17.2 dBf, 4.0μV
50 dB Quieting Sensitivity:	Mono:	14.7 dBf, 3.0μV
	Stereo:	35 dBf, 31μV
Capture Ratio:	1.3 dB	
Image Rejection Ratio:	90 dB	
IF Rejection Ratio:	100 dB	
Spurious Rejection Ratio:	95 dB	
Signal-to-Noise Ratio:	Mono:	74 dB
	Stereo:	68 dB
Alternate Channel Att:	70 dB	
AM Suppression Ratio:	55 dB	
Harmonic Distortion:	Mono:	0.15%
	Stereo:	0.3%
Frequency Response:	30 Hz – 15,000 Hz (±1.5 dB)	
Stereo Separation:	40 dB at 1 kHz 34 dB at 100 Hz – 10,000 Hz	
Muting Level:	17.2 dBf, 4μV	
Stereo Threshold:	17.2 dBf, 4μV	
Quartz Lock Level:	17.2 dBf, 4μV	

AM:

Tuning Range:	525 – 1,620 kHz
Usable Sensitivity:	25μV
Image Rejection Ratio:	45 dB
IF Rejection Ratio:	40 dB
Signal-to-Noise Ratio:	40 dB
Harmonic Distortion:	0.8%

GENERAL

Power Supply:	AC 120 volts, 60 Hz
Outputs:	Speaker A, B, C, Phones, Tape Rec Out 1 & 2, EPS OUT (PRE OUT), AC Outlets (Switched x 1, Unswitched x 2)
Inputs:	Phono 1& 2, Tape Play 1 & 2, EPS IN (MAIN IN), FM and AM Antennas
Antennas:	FM: 300 ohms balanced and 75 ohms unbalanced AM: built-in ferrite core antenna and external terminal
Semiconductors:	2 FETs, 63 transistors, 18 ICs, 47 diodes
Dimensions (WxHxD):	575 x 146 x 462 mm 22-5/8" x 5-3/4" x 18-3/16"
Weight:	19 kg, 41.8 lbs

Specifications and features are subject to change without notice.

CIRCUIT DESCRIPTIONS

TUNER SECTION

A major feature of the FM tuner section of the TX-7000 is the Quartz Locked system which detects any difference in frequency between the IF signal and the reference signal generated by the crystal osillator.

Another important feature of this equipment is the Touch sensor circuit.

When the TUNING knob is touched by hand, the quartz locked circuit is deactivated, permitting the tuned frequency to be freely varied just as in conventional equipment.

POWER AMPLIFIER SECTION

A major feature of the power amplifier section is the servo operational amplifier system.

1. QUARTZ LOCKED CIRCUIT

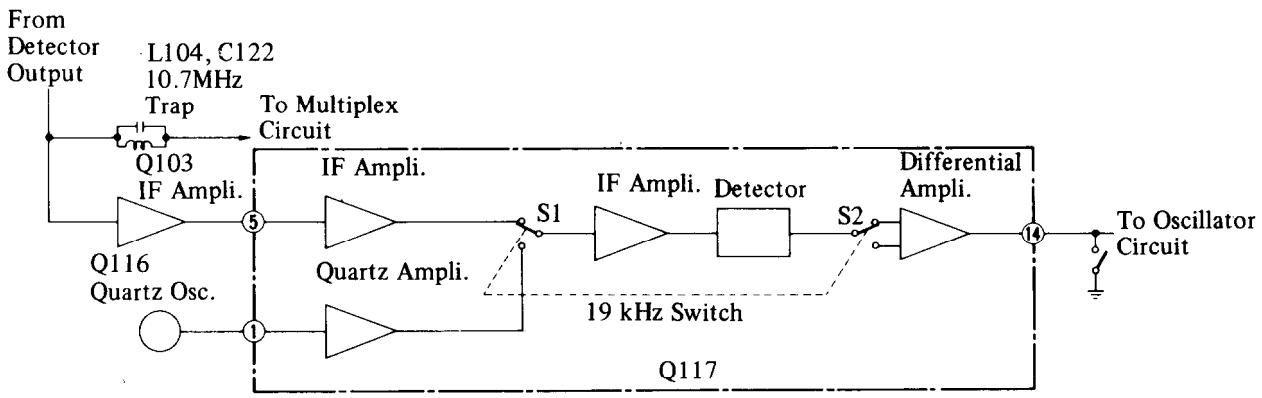


Fig. 1

The quartz locked circuit compares the frequency difference between the 10.7MHz reference signal and the IF signal, the difference being used to subsequently drive the AFC circuit.

A 10.7MHz component is extracted from the quadrature detector output by the L104 and C122 trap circuit, amplified by the Q103 IC, and applied to pin no. 5 of the Q117 IC. An accurate 10.7MHz reference signal is generated by the quartz oscillator, and applied to pin no. 1 of the same IC. A 19kHz square wave is obtained from pin no. 10 of the PLL IC, and applied to pin no. 3 of Q117. The IF signal and the quartz oscillator reference signal are switched back and forth in a 19kHz cycle, and passed on the detector and amplification stages. When S1 and S2 and both connected to the IF signal line, the IF frequency is detected, resulting is the generation of a voltage whose level corresponds to the IF frequency. This voltage is then applied to one of the differential amplifier inputs. When S1 and S2 are then both switched across to the quartz oscillator signal line, the quartz oscillator reference signal is detected, converted into the corresponding voltage, and applied to the other input of the differential amplifier. The difference between the IF detector DC component and quartz oscillator detector component is then amplified, appearing at pin no. 14 of the IC. This voltage serves as the AFC circuit control voltage. Any slight drift or deviation in the detector transformer will therefore result in the same amount of drift in both lines, thereby maintaining a constant difference. Precise local oscillator frequency will thus be kept at all times.

2. MUTING CITCUIT

The muting circuit is activated by the combined effects of the IF component, noise component, and zero cross detector output. The IF level detector and zero cross detector circuit are incorporated in the quadrature IC, the output appearing at pin no. 12. This pin is switched to high level when the IF level drops below the muting level, but is switched back to low level when the IF level exceeds the muting level again. The detection of noise above 100kHz in the composite signal will also result in pin no. 12 being switched to high level. Consequently, when all detector circuit outputs are switched to low level, the Q110 transistor is cut off, and the Q112 transistor turned on, followed by the LOCKED lamp turning on. At the same time, Q111 is also turned on, and Q205 turned off, resulting in the STEREO lamp turning on (if the tuned station is broadcasting in stereo). Q209 and Q210 are also turned off, resulting in the appearance of an FM broadcast output signal at the receiver's output terminals.

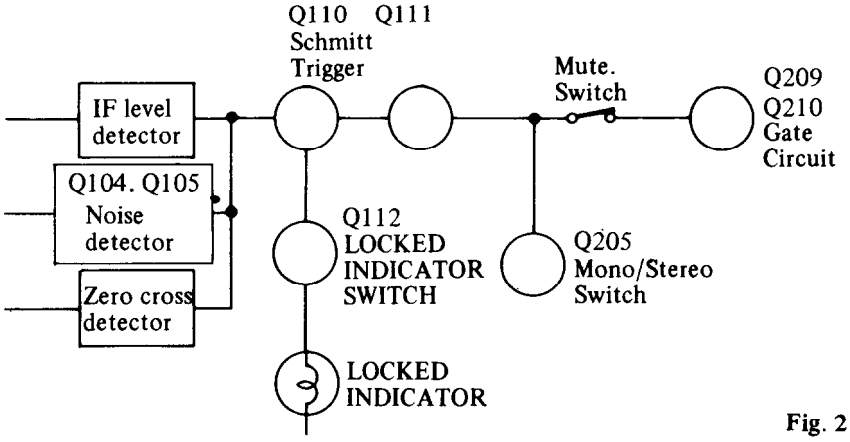


Fig. 2

3. TOUCH SENSOR CIRCUIT

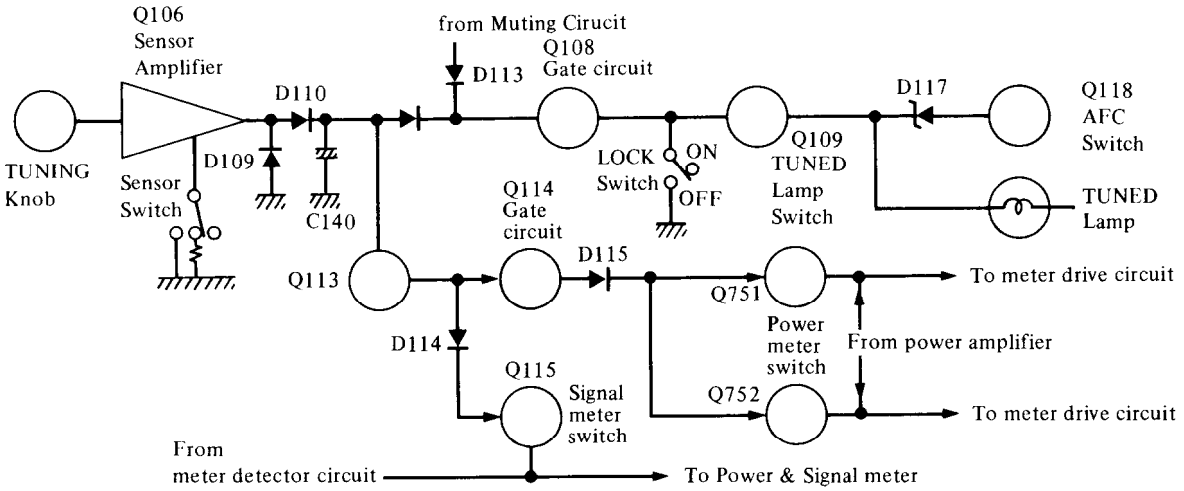


Fig. 3

The purpose of this circuit is to operate both the power/signal strength meter and quartz locked circuit switching transistors.

(1) Servo locked circuit switching circuit

In order to ensure accurate tuning, the quartz locked circuit is turned off automatically once the tuning knob is touched, and also when the muting circuit is switched off.

When a station is turned, Q108 will turn off and Q109 turn on (since Q110 will already be off and Q111 on), resulting in the TUNED lamp turning on. And since Q118 will turn off when Q109 turns on, the quatz locked circuit will also begin to operate.

When the tuning knob is touched, a certain amount of hum is induced.

This hum is amplified by Q117, rectified by 109 and D110 into a DC signal, and applied to Q108 is consequently turned on, resulting in the quartz locked circuit being switched off. If, however, the hum level is rather low, the tuned lamp might not turn on even when the tuning knob is touched. If this happens reset the back panel sensor switch to either the Normal or High position.

(2) Power signal strength meter

When the tuning knob is not being operated, this meter displays the level of power applied to be right speaker system. The instant the tuning knob is touched, the meter changes to display the signal strength of the radio broadcast.

When the tuning knob is touched, Q113 turns on. And since Q114 and Q115 turn off and Q751 and Q752 turn on, and power/signal strength meter is changed to signal strength meter from power meter.

4. SERVO OPERATIONAL AMPLIFIER

In order to achieve a greater degree of fidelity in waveform transmission, and to remove the large capacitance capacitors (which have questionable effect on the quality of sound) from the NFB, DC amplifier designs are being more and more widely used in amplifiers today. The TX-5000, however, has advanced even further by adopting the recently developed Servo Operational Amplifier which features a truly superb quality of sound, and performs considerably better than the now conventional DC amplifiers.

The major circuit feature of the Servo Operational Amplifier (see outline in Fig. 4) is the servo feedback loop which has no effect whatsoever on the main signal. In other words, if the signal feedback factor is β_1 and the servo feedback factor β_2, the $0 \fallingdotseq \beta_2 \ll \beta_1 \ll 1$ relation holds true within the signal bandwhdth, while $\beta_2 \gg 1$ holds true in the subsonic region down to DC. For this purpose, a servo feedback amplifier was necessary. And since it was also necessary to include a high-cut filter, and suppress signal amplifier drift at higher DC gain plus 1/f noise and other subsonic region components, a -6dB/oct high-cut mirror integrating circuit (see Fig. 4) has been

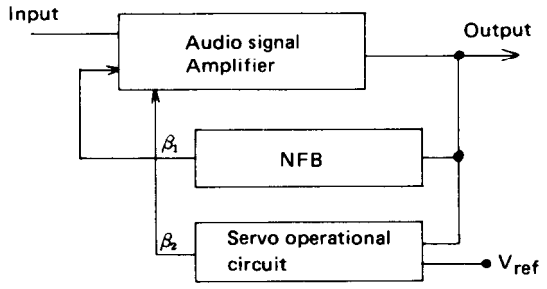


Fig. 4

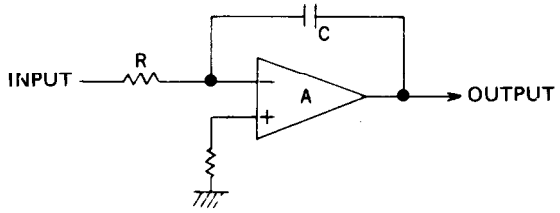


Fig. 5

employed. The Vref in Fig. 1-1serves as the input voltage required to keep the system output DC voltage at OV.

In the block diagram for the actual Servo Operational amplifier (see Fig. 6), Rf and RB constitute the signal feedback loop, while A2 and A3 form the servo feedback loop.

Hence, the subsonic frequencies are effectively cut just as if by coupling capacitor. But unlike capacitors, the output impedance of the servo operational amplifier decreases at lower frequencies (coupling capacitor impedance increases at corresponding frequencies) due to a greater amount of feedback. Since, however, in actual circuits the second stage is driven at a suitable impedance level, and the output impedance of the amplifier itself is made sufficiently large enough (to improve stability) by connecting a resistance γ_o in series, the output impedance is kept constant at γ_o with coupling capacitors, on the other hand, the increased impedance at lower frequencies naturally results in an increase in thermal noise (directly related to effective impedance) in the low frequency region.

Although servo feedback circuit integrating capacitors of large leakage current, or high DC resistance and inductance are undesirable, the effects are nowhere near as serious as the insertion of a capacitor in the signal path.

Assuming that A1, A2, A3 $\gg$ 1, the input/output characteristics $T(\omega)$ may be expressed as,

$$T(\omega) = \frac{R_N(Rf + R_B)}{A2 \cdot Rf \cdot R_B} \left[\frac{1 + \frac{j\omega}{\omega_1}}{1 + \frac{j\omega}{\omega_2}}\right]$$

where $\omega_0 = \frac{1}{CR}$, $\omega_1 = \frac{\omega_0}{A_2}$, $\omega_2 = \frac{R_F}{R_N}\omega_0$

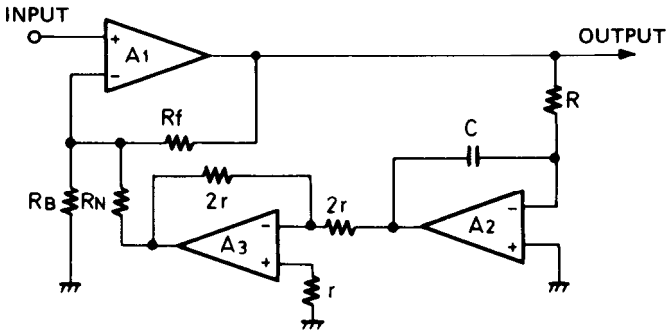


Fig. 6

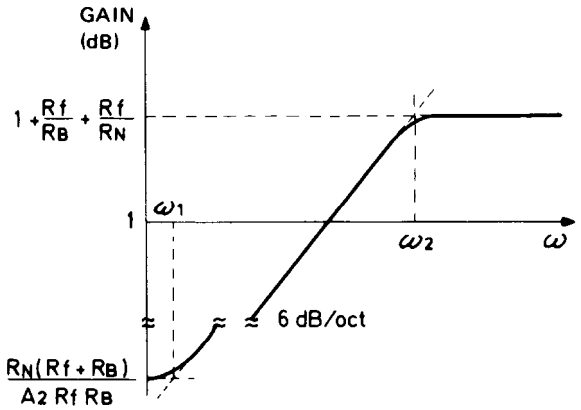


Fig. 7

The frequency response is a shown in Fig. 7, $\omega 2$ being about 0.3Hz ~ 2Hz. A3 is phase inverted in order to prevent positive feedback in the DC region.

5. PROTECTION CIRCUIT

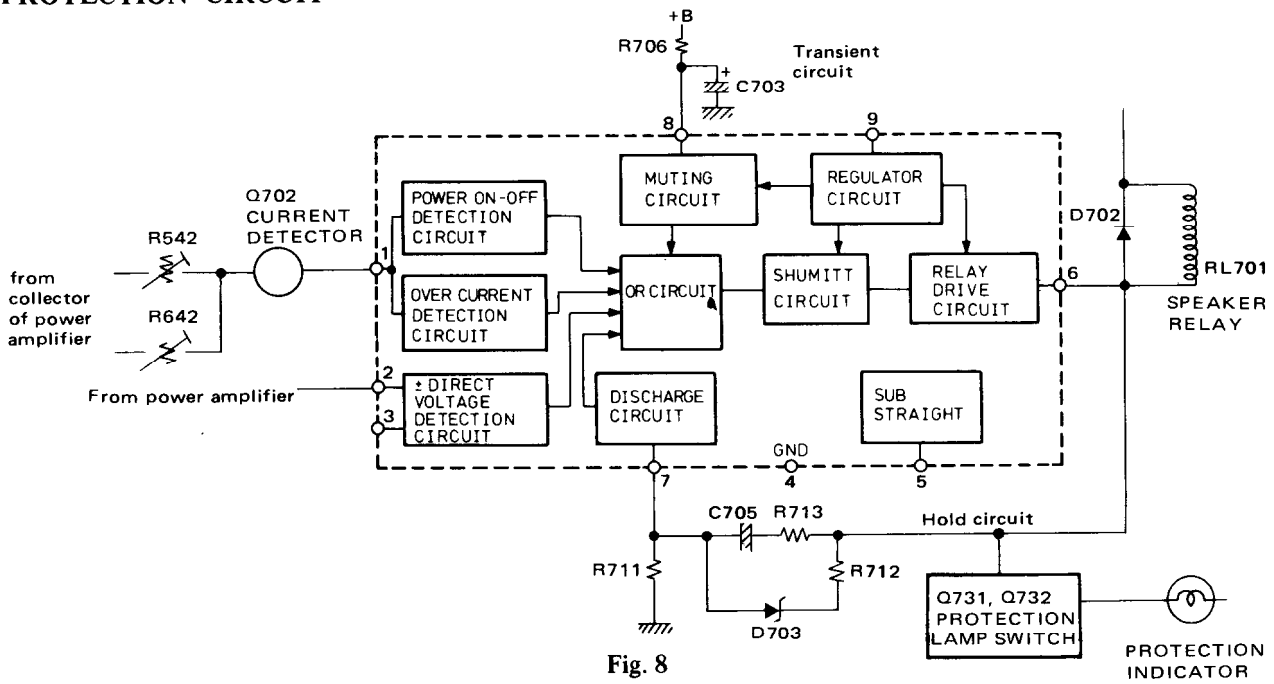


Fig. 8

The protection circuit is operated:

(1) when the B circuit is unstable when the power is turned ON (approximately 5 seconds)

(2) when the speaker terminals are shorted and abnormal current has flowed in the power amplifier thru this low impedance.

(3) when the center voltage has increased because of trouble at the differential amplifier, etc.

5. AUTO HI-BLEND CIRCUIT

The auto hi-blend circuit is activated by the IF level. The IF level detector is in corporated in the quadrature IC, the output appearing at pin No. 13. When the IF level drops below 40dBf (35 dB), the Q206 transistor is cut off and the Q207 transistor turned on, followed by the auto hi-blend circuit turning on.

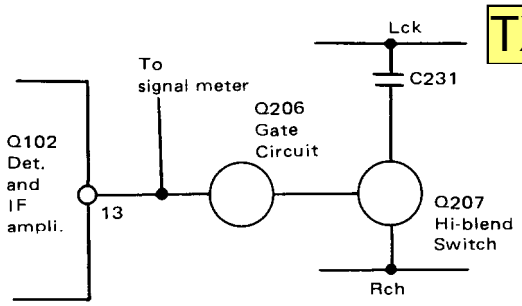


Fig. 9

EXPLODED VIEW

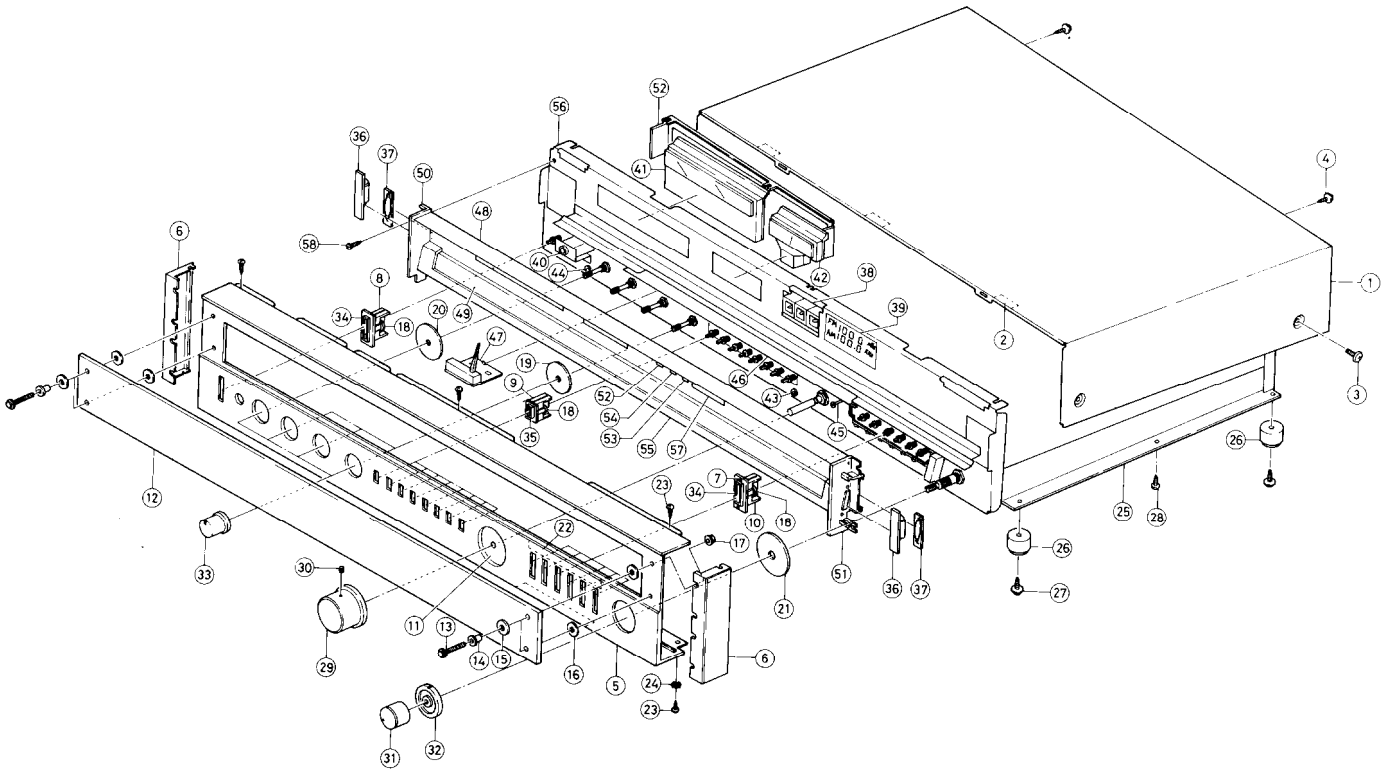


Fig. 10

DISASSEMBLY

Top Cover

Remove the four screws (3) holding the top cover and side bracket.

Remove the two screws (4) holding the top cover and back panel.

Front Panel

Remove the top cover.

Lossen the enamel screw on the tuning shaft.

Remove the TUNING knob.

Remove the six screws holding the front panel and front bracket.

Bottom board

Remove the four screws (27) holding the bottom board and chassis.

Remove the four screws (28) holding the bottom board and legs.

Meters

Remove the top panel.

Remove the two screws holding the lamp bracket and front bracket.

Dial Glass

Remove the four screws holding the dial glass and front panel.

Notes: The dial glass has been mounted by applying an 800 gr torque to the screws.

If the dial glass is removed during repairs, and a torque driver is available, apply 800 gr torque to the screws when replacing. If however, a torque driver is not available, simply tighten the screws by hand. When replacing the dial glass, insert all relevant component parts (13-17) in accordance with the exploded view.

Pointer Lamp

Remove the top cover and front panel.

Replace the pointer ass'y.

EXPLODED VIEW – PARTS LIST

REF. NO.	PARTS NO.	DESCRIPTION
1	28184086	Top cover
2	28140020	t4x10x40mm, Cushion
3	838440109	4TTB+10C(BC), Tap screw
4	834430102	3STS+10BQ(BC), Tapping screw
5	13589121	Front panel ass'y (6-11)
6	28125077	End cap
7	28198528	Facet
8	27267063	Guide for power knob
9	27267064	Guide for push knob
10	27267065	Guide for push knob
11	28140248	Cushion
12	28191058	Dial glass
13	27270014	Spacer
14	27300038B	Special screw
15	870052	10x6x1.5t, Washer
16	870051	10x3.5x1.5t, Washer
17	86213010	WN3x10FN, Nut
18	27180049	Spring
19	28140127	32, Cushion
20	28140185	40, Cushion
21	28140126	53, Cushion
22	28140260	Cushion
23	834130062	3STS+6BQ, Tapping screw
24	87313006	M3B, Toothed locked washer
25	27170078	Bottom board
26	280889	Leg
27	831130162	3STW+16BQ, Tapping screw
28	831130082	3STW+8BQ, Tapping screw
29	28320295	Knob for tuning
30	801146	4x6, Enamel screw
31	28320433	Volume knob
32	24320432	Balance knob
33	28320397	Tone knob
34	28320398	Power knob
35	28320399	Push knob
36	13589574C	NAPL-474C, Dial plate illumination lamp p.c.b.
37	13589579	NAPL-879, Protection indicator p.c.b.
38	210083	PL14V0.06AW-3, Locked/Tuned/ Stereo indicator lamp
39	212007	F1P6A8S, Fluorescent indicator tube
40	25045018	LJ-100-H, Stereo Headphone jack
41	243128	NIND-0500S128, Output/signal strength meter
42	243130	NIND-0250S130, Tuning meter
43	24185006	Dial pulley
44	27185002A	DP-16N, Dial pulley
45	27185007	Shaft
46	27130192A	Bracket for dial rail
47	13549131	Pointer ass'y
48	28133029	Back plate
49	28130095	Dial plate
50	27250043A	Lamp case (L)
51	27250044A	Lamp case (R)
52	27130193	Bracket for meter
53	28198527	Facert
	261002	Tape
54	28198527	Facet
	29110031	Tape
55	27190078	Holder for dial plate
56	27110110	Front bracket
57	28191051	Glass for lead output
58	831130082	3STW+8BQ, Tapping screw

PRECAUTIONS

1. For continued protection against fire hazard, replace only with same type and same rating fuse.
   AC fuse 8A (ST-6) PARTS NO. 252053
2. Replacement for power, complementary and driver transistors, if necessary, must be made from the same beta (HFE) group as the original type.
3. All CMOS devices have diode input protection against adverse electrical environments such as static discharge.
   Unfortunately, there can be severe electrical environments during the process of handling. For example, static voltages generated by a person walking across a common waxed floor have been measured in the 4 to 15 kV range (depending on humidity, surface conditions, etc.). These static voltages are potentially disastrous when discharged into a CMOS input considering the energy stored in the capacity ($\approx$ 300 pF) of the human body at these voltage levels.
   Present CMOS gate protection structures can generally protect against overvoltages. This is usually sufficient except in the servere cases. Following are some suggested handling procedures for CMOS devices, many of which apply to most semiconductor devices.
   1. All MOS devices should be stored or transported in materials that are somewhat conductive. MOS devices must not be inserted into conventional plastic "snow" or plastic trays.
   2. All MOS devices should be placed on a grounded bench surface and operators should ground themselves prior to handing devices, since a worker can be statically charged with respect to the bench surface.
   3. Nylon clothing should no be worn while handling MOS circuits.
   4. When lead straightening or hand soldering is necessary, provide ground straps for the apparatus used.
   5. Double check test equipment setup for proper polarity of voltage before conducting parametric of functional testing.
   6. All unused device inputs should be connected to VDD or VSS.
4. Do not activate the unit with it put up. Because, the power transistors are raised the thermo and destroy the transistors.
5. Sensor Switch (SWNSOR)
   This switch enables the quartz lock system for automatic FM tuning to be matched with the various operating conditions. Set it al LOW initially. Switch to NORM or HIGH if the TUNED lamp does not instantly turn off when you touch the tuning knob.
6. Power Meter/Signal Strength Meter
   When the tuning is not being oprated, this meter displays the level of power applied to the right speaker system. The instant the runing knob is touched, the meter changes to display the signal strength of the radio broadcase being received at that moment. Tune a station so the needle moves as far to the right as possible.

COMPONENT LOCATION

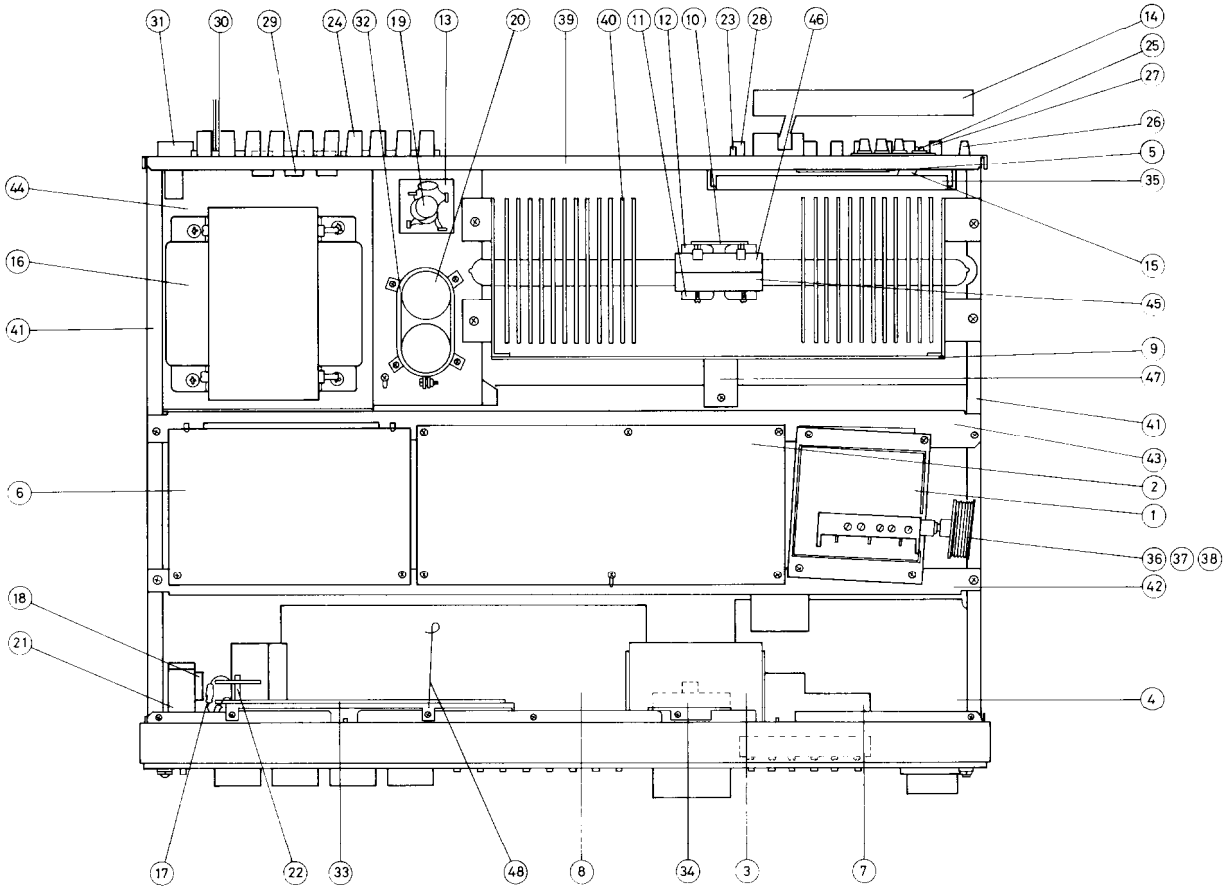


Fig. 11

COMPONENT LOCATION-PARTS LIST

REF. NO.	CIRCUIT NO.	PARTS NO.	DESCRIPTION
1	U1	13569500	NARF-800, Front end
2	U2	13589501B	NAIMX-801b, FM/AM tuner circuit p.c.b.
3	U3	13569502	NADIS-802, Frequency indicator drive circuit p.c.b.
4	U4	13589568	NAEQ-868, Equalizer amplifier p.c.b.
5	U5	13589569	NAPJ-869, Tape input/output terminal p.c.b.
6	U6	13589570	NAPCS-870, Power supply and protector circuit p.c.b.
7	U7	13589571	NASW-871, Switch circuit p.c.b.
8	U8	13589572	NAAF-872, Tone amplifier p.c.b.
9	U9	13589573	NAMA-873, Power amplifier p.c.b.
10	U10	13589574	NACC-874, Thermal detector transistor p.c.b.
11	Q513, Q613	2201194 or 2201195	2SB706(R) or 2SB706(Q) Power amplifier transistor
12	Q512, Q612	2201204 or 2201205	2SD746(R) or 2SD746(Q) Power amplifier transistor
13	D901	223852 or 223861	S5188 or KBPC10-02, Silicon diode
14	T101	232066	NMA-3012, AM bar antenna
15	T102	233026	NBLN-1, Balun transformer
16	T901	230373	NPT-705D, Power transformer
17	R560, R660	441723314	330Ω, 2W, Metal oxide film resistor
18	C901	3500057	0.01μF, 125V, CS capacitor
19	C902-C905	335251039	0.01μF, 500V, Ceramic capacitor
20	C906, C907	3504137	22,000μF, 63V, Elect. capacitor
21	S901	25035201	NPS-111-L165P, Power switch
22	S902	25030163	NRS-266-40Y, Speaker selector switch
23		25065016	NSS-2327, Sensor switch
24		25060029	NTM-4PRMN05, Speaker terminal
25		25060021B	NTM-3PUM1, Antenna terminal
26		25060008	Ground terminal
27		25045028	NPJ4PRBL06,Phono input terminal
28		25045025	NPJ4PRBL03, Pre. output/main input terminal
29		25050032	SI-6444-01, AC outlet
30		253099A	AS-UC3, Power supply cord
		270025	SP-3P-4, Strainrelief
31		250100A	SN2056#03, Fuseholder
		252053	8A(ST-6), AC fuse
32		27130153	Band for elect. capacitor
33		13549587	NAPL-787, Meter illumination lamp p.c.b.
34		27205023	Drive shaft
35		27225058	Shielded case
36		273803	SP-14A, Spring for dial drum
37		273904	150cm, Stringing
38		270760A	Dial drum
39		27120226	Back panel
40		27160071	Heat pipe
41		27115071	Side bracket
42		27130213	Bracket (F)
43		27130214	Bracket (PC)
44		27130215	Bracket (PT)
45		25160072	Radiator (U)
46		27160073	Radiator (D)
47		27140389	Bracket (D)
48		27180057	Spring

ALIGNMENT PROCEDURES

INSTRUMENTS REQUIRED

1. DC Voltmeter
2. AM Sweep Generator
3. AM/FM Signal Generator
4. AC VTVM
5. Oscilloscope
6. Monitorscope
7. Distortion Analyzer
8. Stereo Modulator
9. Frequency Counter

GENERAL ALIGNMENT CONDITIONS

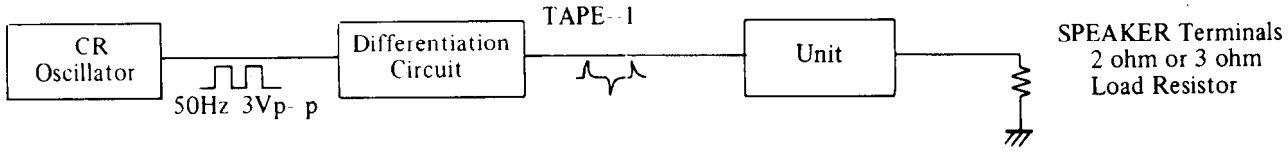
1. Signal input should be kept as low as possible.
2. Standard modulation is 400Hz 30% (AM), 1kHz 100% (FM MONO), pilot 9% sub and main 91% (FM STEREO).
3. Standard knob position

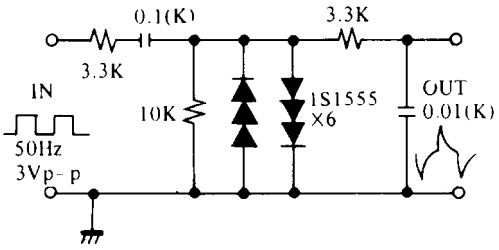
SPEAKERS	A
TONE CONTROL & BALANCE	Center
HIGH/SUBSONIC FILTER	OFF
MODE, EPS	STEREO
DE-EMPHA	NORMAL
LOUDNESS	OFF
MUTING LOCK	OFF
TAPE 1, 2	OFF (SOURCE)

(1) IDLING CURRENT ADJUSTMENT

Connect the DC Voltmeter between ID and VCT terminals.
Adjust the voltage to 13±2mV with R517. (Left channel)
Adjust the voltage to 13±2mV with R617. (Right channel)
NOTES: Adjust after switching on for 5 minutes.
Open load.
VOLUME . . . . . Minimum
TAPE MONITOR-1 . . . . . ON

(2) CURRENT DETECTOR CIRCUIT ADJUSTMENT





Differentiation Circuit

Apply a tone burst signal to the TAPE-1 terminals. Connect a 2Ω hollow resistor to the speaker terminals, and adjust variable resistor R542 (Lch) or R642 (Rch) so that the relay is operated at maximum volume. Connect a 3Ω hollow resistor to the speaker terminals. Confirm the realy is not operated at maximum volume.

NOTES: Adjust after switching on for 5 minutes.
VOLUME – Maximum

(3) CENTER VOLTAGE CHECK

When the transistor of the differential amp, the power amplifier or the constant current circuit has been replaced, check the center voltage.
Connect a DC VTVM between the CT-E terminals and check if the reading of the DC VTVM is within ±10mV.
Perform this check 5 minutes after the power switch has been set to ON..

(4) OUTPUT INDICATOR METER ADJUSTMENT

Connect the AF oscillator to the TAPE-1 input terminals, set it to 1kHz. Connect to 8Ω hollow resistor and AC VTVM to the speaker terminals. Adjust the output voltage to 20V with the VOLUME.
Adjust the semi-fixed resistor of R755 or R756 until the output meter pointer deflects to the 50W mark on the meter.

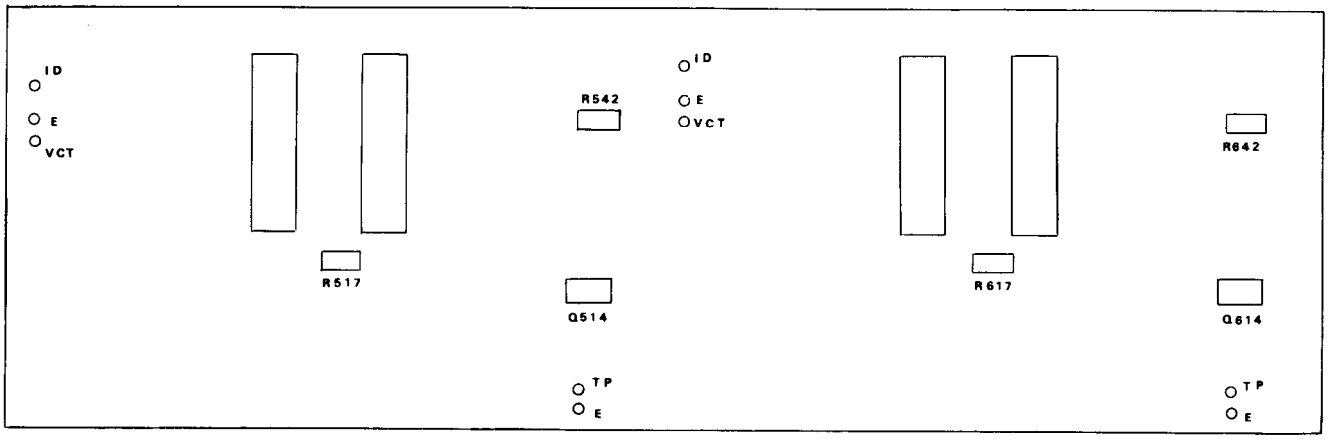
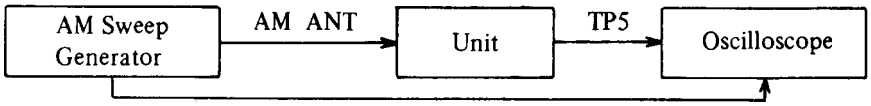


Fig. 12

(5) AM IF ALIGNMENT

1. Set SELECTOR switch to AM.
2. Set radio dial to quiet point.



Set signal	Adjust	Oscilloscope	Remarks
455kHz	X201	Maximum Symmetrical Response	Usually not necessary to adjust

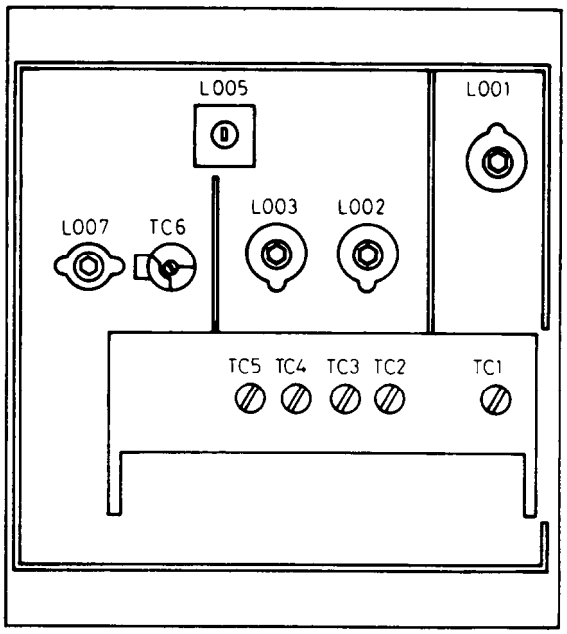
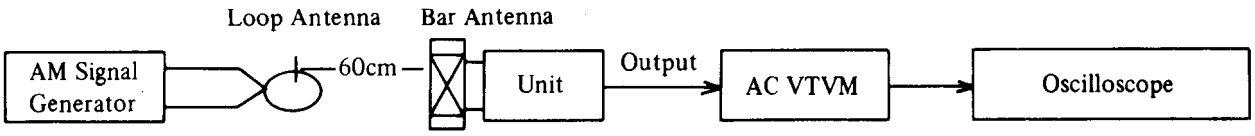


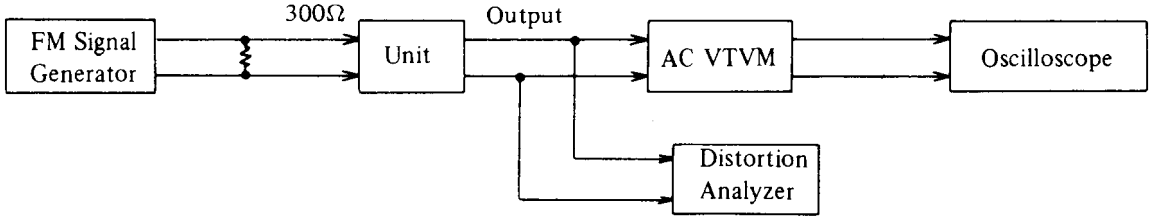
Fig. 13

(6) AM RF ALIGNMENT



Step	Set Signal	Set Radio Dial	Adjust	VTVM reading	Remarks
1	515kHz 400Hz 30%	Lower end (515kHz)	L201	Maximum	Repeat steps 1 and 2 as necessary
2	1680kHz 400Hz 30%	Upper end (1680kHz)	TC5	Maximum	
3	600kHz 400Hz 30%	600kHz	L01	Maximum	Repeat steps 3 and 4 as necessary
4	1400kHz 400Hz 30%	1400kHz	TC2	Maximum	

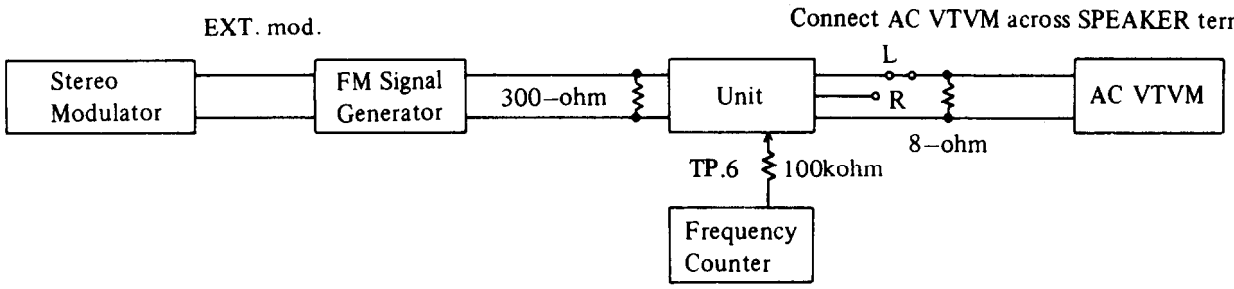
(7) FM FRONT END ALIGNMENT



Step	FM Signal Generator	Dial to set	Adjust	Output Indicator	Adjust for	Remarks
1	No signal	Quiet Point	L103 Bottom	Tuning Indicator	Center	Repeat Steps 1 and 2 as necessary
2	98MHz 65dBf (60dB) 1kHz 75kHz devi.	98MHz	L103 Top	Distortion Analyzer	Minimum	
3	90MHz 65dBf (60dB) 1kHz 75kHz devi.	90MHz	L007	Tuning Indicator	Center	Repeat Steps 3 and 4 as necessary
4	106MHz 65dBf (60dB) 1kHz 75kHz devi.	106MHz	TC6		Center	
5	90MHz 20dBf (15dB) 1kHz 75kHz devi.	90MHz	L001 L002 L003	AC VTVM or Oscilloscope	Maximum	Repeat Steps 5 and 6 as necessary
6	106MHz 20dBf(15dB) 1kHz 75kHz devi.	106MHz	TC1 TC3 TC4		Maximum	
7	98MHz 65dBf(60dB) 1kHz 75kHz devi.	98MHz	L005	Distortion Analyzer	Minimum	

(8) MULTIPLEX ALIGNMENT

TX-7000



Step	FM Signal Generator	Stereo Modulator	Dial to set	Adjust	Output Indicator	Adjust for	Remarks
1	98MHz no mod. 65dBf (60dB)	–	98MHz	R224	Frequency Counter	19000±19Hz	
2	STEREO INDICATOR should light up when stereo program is being received.						
3	98MHz EXT. Mod. 65dBf (60dB)	Pilot Sig. 9% Main & Sub Sig. 1 kHz Lch 91%	98MHz	R250	AC VTVM Right ch.	Minimum	Repeat Steps 3 & 4 as necessary Same separation
4	Same as above	Pilot Sig. 9% Main & Sub Sig. 1 kHz Rch 91%	98MHz		AC VTVM Left ch.	Minimum	

(9) QUARTZ LOCKED CIRCUIT ALIGNMENT

1. Connect the signal generator to the ANTENNA terminals and the DC voltmeter to the Q117 detector output (pin nos. 10).
2. Set the SG output to 98MHz, 1kHz, 75kHz devi. 65dBf (60dB).
3. Tune the receiver to 98MHz.
4. Adjust the voltage to 3.5V with a detector coil of L107.
5. Place a short circuit across TP3 (pin nos. 10 and 11).
6. Then adjust the semi-fixed resistor R187 to bring the TP4 (pin no. 14) output voltage to zero.
7. Remove a short circuit across TP3.
8. Adjust the semi-fixed resistor R179 to bring the TP4 output voltage to zero.

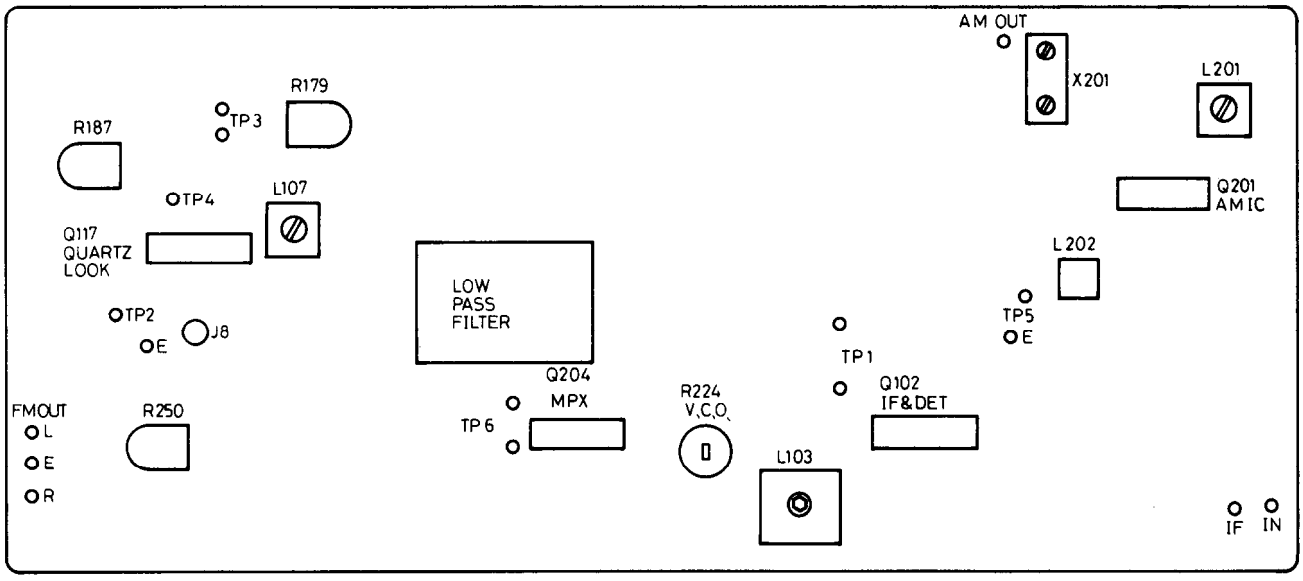


Fig. 14

LC7258 PIN ARRANGEMENT

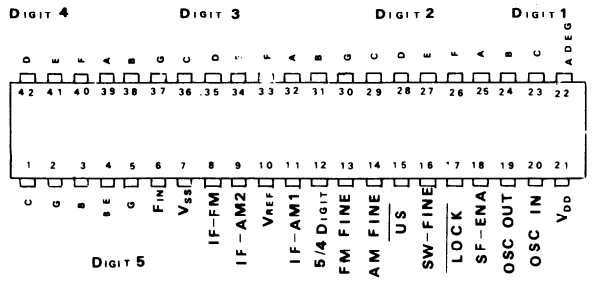


Fig. 23

BLOCK DIAGRAM

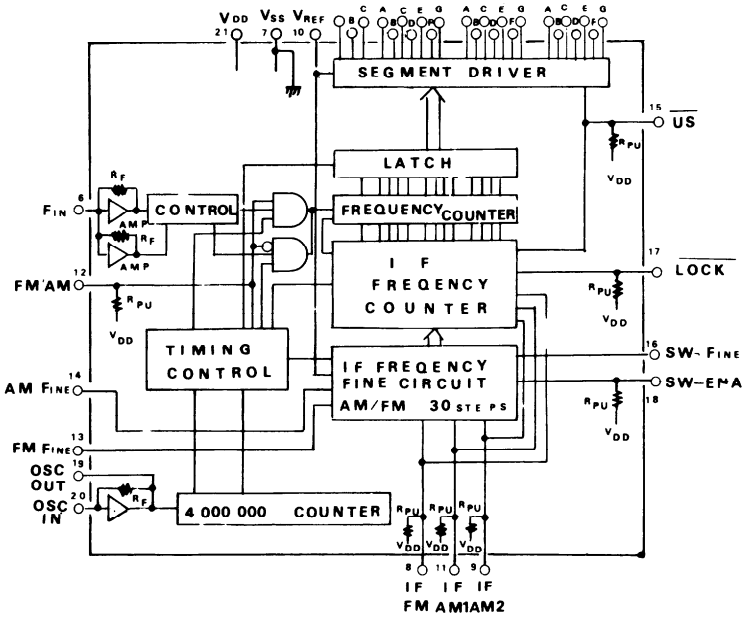
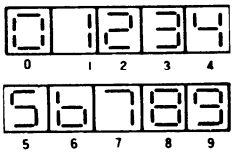


Fig. 24

OUTPUT INDICATION



SP8629 (1/100 PRESCALER)

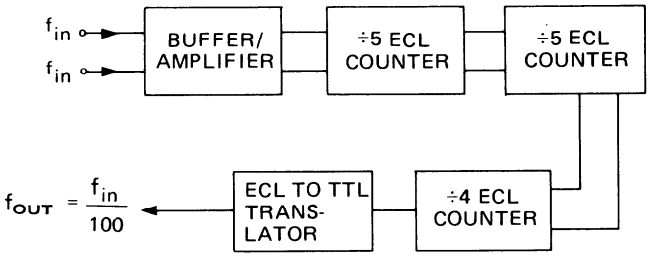


Fig. 25

PIN ARRANGEMENT

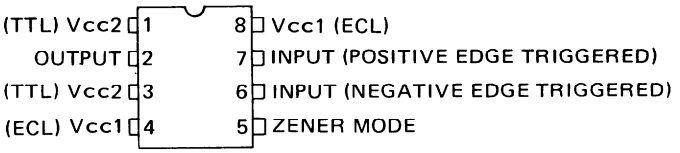


Fig. 26

HA-1457W EQUIVALENT CIRCUIT

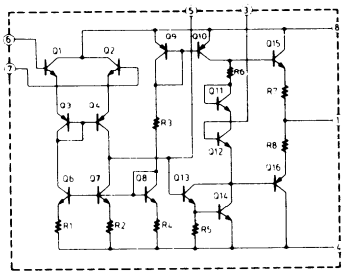


Fig. 27

TA7317P BLOCK DIAGRAM

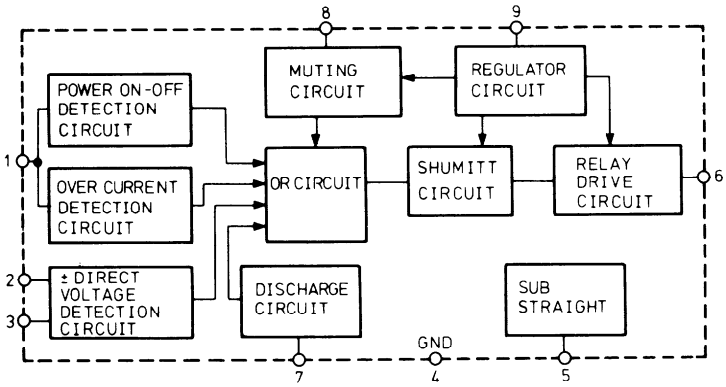


Fig. 28

PRINTED CIRCUIT BOARD—PARTS LIST

FRONT END PC BOARD (NARF-800) – PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
	Transistors	
Q001	2211012	3SK45(B)
Q002	2210882	2SC535(B)
Q003	2211342	2SC461(B)
Q004	2211815	2SK19TM(GR)
	Diode	
D001	223110	1S2687
	Coils	
L001	233224	NFA-3031
L002	233225	NFRF-3026
L003	233226	NFRF-3027
L004	233152	NFT-1503
L005	233085	NIT-0518
L006	233152	NFT-1503
L007	233090	NFO-3003
	Capacitors	
C025	352743301	33μF,16V, Elect.
VC001	3050006	NVC-20FQ 327WD02, Variable
TC6	3060009	NTC-06P08, Trimmer

AM/FM TUNER PC BOARD (NAIMX-801)– PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
	ICs	
Q101	222452	TA-7302P
Q102	222540	HA11225
Q103	222468	BA402
Q106	222465	NJM-4558D
Q117	222469	BA661
Q201	222418	HA1151
Q204	222419	HA1156W
	Transistors	
Q104, Q105	2210746	2SC945A(P)
Q107	2211256	2SC1815(BL)
Q108, Q109	2210746 or	2SC945A(P) or
	2211255	2SC1815(GR)
Q110, Q111	2210746	2SC945A(P)
Q112-Q115	2210746 or	2SC945A(P) or
	2211255	2SC1815(GR)
Q116	2211823	2SC380TM(O)
Q118	2210746	2SC945A(P)
Q202, Q203	2210746	2SC945A(P)
Q205	2210746 or	2SC945A(P) or
	2211255	2SC1815(GR)
Q206, Q207	2210746	2SC945A(P)
Q209, Q210		
Q211, Q212	2211733	2SC1845(E)
	Diodes	
D101, D102	223105	1S1555
D103-D105	223103	1N60
D106-D110	223105	1S1555
D111	223943 or	RD4. 7EB or
	224011	YZ-047
D112-D115	223105	1S1555
D116	223103	1N60
D117	224011 or	YZ047 or
	223943	RD4.7EB
D118	224060 or	05Z15-L or
	224115	GZA15-L
D201	223105	1S1555
D202	4000022	VD1212
D204-D205	223105	1S1555
	Coils	
L101	233024 or	NCCH-1501 or
	233105	NCH-1005
L102	233144	NCH-1020
L103	233143A	NFIF-6008
L104	233121	NCH-3012
L105	233122	NCH-3013
L106	233031	NMC-9-1
L108	233024 or	NCCH-1501 or
	233105	NCH-1005
L201	232065	NMO2002
L203	233032A	NMC-8-7
	Transformers	
L107	233120	NFIF-6006
L202	232041	NIT-0509
	Ceramic filters	
X101	3010018	SFJ10.7MA
X103	3010046	SFE10.7MS2GY
X104	3010015	XTL10.7M
X105	3010006	SFE-10.7MA(RED)
X201	3010012	CFT-455B
	Capacitors	
C107	352750479T	4.7μF, 25V, Elect.
C108	352784799T	0.47μF, 50V, Elect.
C110	352721019T	100μF, 6.3V. Elect.
C115	352780109T	1μF, 50V, Elect.
C124	352741009T	10μF, 16V, Elect.
C128	352783399T	0.33μF, 50V, Elect
C130, C132	352780339T	3.3μF, 50V, Elect.
C131	352721019T	100μF, 6.3V, Elect.
C136	352780109T	1μF, 50V, Elect.
C137	352742209T	22μF, 16V, Elect.
C139	352784799T	0.47μF, 50V, Elect.
C140	352741009T	10μF, 16V, Elect.
C141, C142	352741019T	100μF, 16V, Elect.
C143	352780109T	1μF, 50V, Elect.
C144	352742219T	220μF, 16V, Elect.
C145	352742209T	22μF, 16V, Elect.
C146	352784799T	0.47μF, 50V, Elect.
C147	352721019T	100μF, 6.3V, Elect.
C148	352741019T	100μF, 16V, Elect.
C153	352744709T	47μF, 16V, Elect.
C158	352471009T	10μF, 16V, Elect.
C165, C166	392880107T	1μF, 50V, LL
C167	352742209T	22μF, 16V, Elect.
C171	352741019T	100μF, 16V, Elect.
C172	352741009T	10μF, 16V, Elect.
C174	352780109T	1μF, 50V, Elect.
C202	372523614	360pF±5%, 50V, ST
C208	352741009T	10μF, 16V, Elect.
C209	352741019T	100μF, 16V, Elect.
C212	352780109T	1μF, 50V, Elect.
C213	352780339T	3.3μF, 50V, Elect.
C215	379124737T	0.047μF, 50V, DEW
C216	352741009T	10μF, 16V, Elect.
C221	352744719	470μF, 16V, Elect.
C222	372525114	510pF±5%, 50V, ST
C223	379124737T	0.047μF, 50V, DEW
C224	352741009T	10μF, 16V, Elect.
C225, C227	392884797T	0.47μF, 50V, LL
C226	392880107T	1μF, 50V, LL
C229, C230	352780229T	2.2μF, 50V, Elect.
C233, C234	379122724T	0.0027μF, 50V, DEW
C239, C240	352780109T	1μF, 50V, Elect.
C243, C244	392882297T	0.22μF, 50V, LL
C245	352744719	470μF, 16V, Elect.
	Resistors	
R179	5215022	N08HR20KBC, Semi-fixed
R187	5215020	N08HR5KBC, Semi-fixed
R224	5225019	N10HR4.7KBD, Semi-fixed
R250	5215019	N08HR2KBC, Semi-fixed
	Shielded plate	
	27150103	

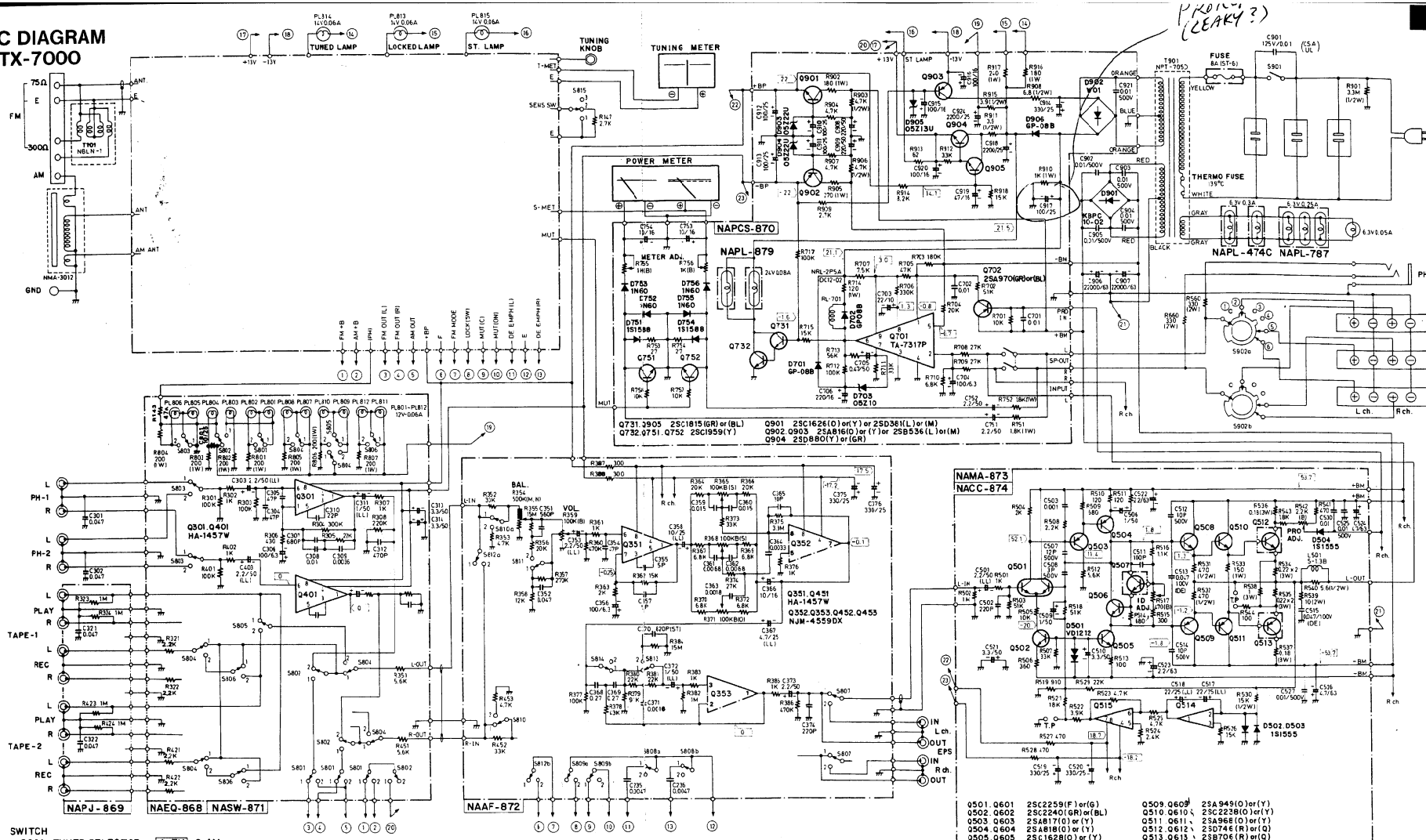
FREQUENCY INDICATOR PC BOARD (NADIS-802) – PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
	ICs	
Q261	222588	SP8629
Q263	222589	LC7258
	Transistors	
Q262	2211163 or	2SC2120(O) or
	2211164	2SC2120(Y)
Q264, Q265	2210746 or	2SC945A(P) or
	2211255	2SC1815(GR)
	Diodes	
D261, D262	223105	1S1555
	Fluorescent indicator tube	
Q266	212007	FIP6A8S
	X'tal	
X202	3010045	XTL-4.000M
	Capacitors	
C272, C273	352741009P	10μF, 16V, Elect.
	Resistors	
R277	5225015	N10HR10KBD, Semi-fixed
R280	441721514	150Ω, 2W, Metal oxide film

NOTES:

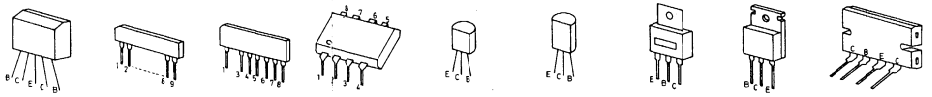
1. DC voltage are measured with V.T.V.M. to chassis at no signal applied.
2. Capacitor LL: Low leakage current type electrolytic capacitor
   ST: Polystyren film capacitor
   DEW: Non-inductive polyseter film capacitor

SCHEMATIC DIAGRAM
MODEL TX-7000



SWITCH

S801	TUNER SELECTOR	[1-FM] 2-AM
S802	SELECTOR	1-TUNER [2-PHONO]
S803	PHONO SELECTOR	[1-PHONO-1] 2-PHONO-2
S804	SOURCE SELECTOR	[1-SOURCE] 2-TAPE
S805	TAPE MONITOR	[1-TAPE-1] TAPE-2
S806	TAPE DUBBING	[1-TAPE-1→2] TAPE-2→1
S807	EPS	[1-OFF] 2-ON
S808	DE EMPH	[1-NORMAL] 2-25μSEC
S809	FM MUTING / LOCK	[1-ON] 2-OFF
S810	AUDIO MUTIG	[1-OFF] 2-ON
S811	LOUDNESS	[1-OFF] 2-ON
S812	MODE	[1-STEREO] 2-MONO
S813	HIGH FILTER	[1-OFF] 2-ON
S814	SUB FILTER	[1-OFF] 2-ON
S815	HAM SENSOR	1-HIGH [2-NORMAL] 3-LOW
S901	POWER	[1-OFF] 2-ON
S902	SPEAKERS	1-OFF [2-A] 3-B 4-C 5-A+B 6-A+C



NOTES
- ALL RESISTORS ARE IN OHMS, ¼ WATT UNLESS OTHERWISE NOTED.
- ALL CAPACITORS ARE IN μF, 50WV UNLESS OTHERWISE NOTED.
- ELECTROLYTIC CAPACITORS (+▯−) ARE IN μF/WV.
- VOLTAGE (MEASURED WITH V.T.V.M.) (NO SIGNAL INPUT.

ONKYO CORPORATION

BLOCK DIAGRAM

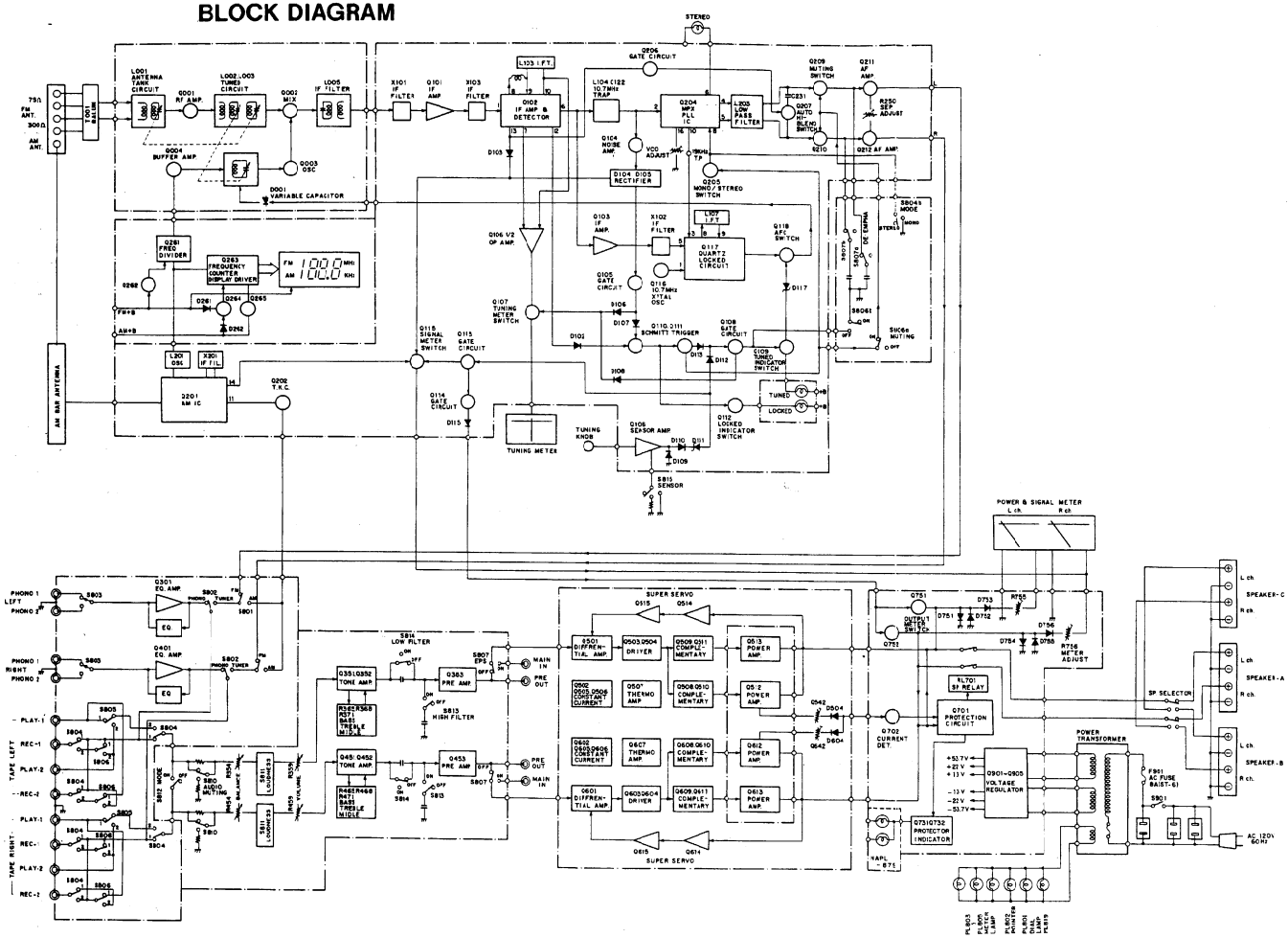


Fig. 15

HA-11255 BLOCK DIAGRAM

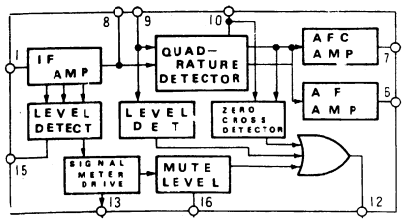


Fig. 16

HA-1156 BLOCK DIAGRAM

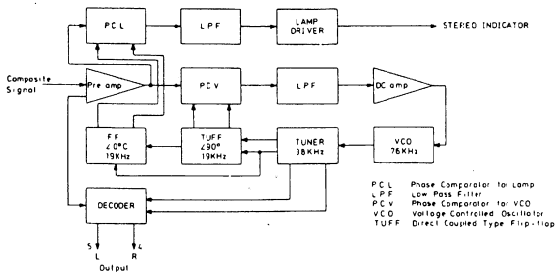


Fig. 17

HA-1151 EQUIVALENT CIRCUIT

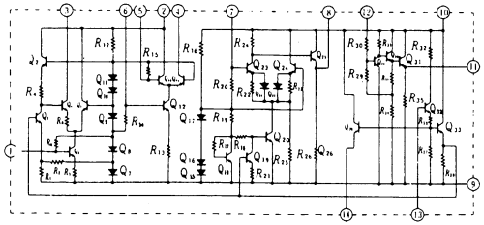


Fig. 18.

NJM4558, 4559 EQUIVALENT CIRCUIT

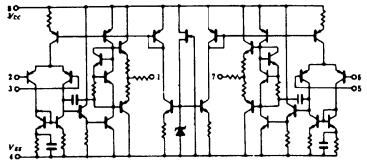


Fig. 19

BA-661 BLOCK DIAGRAM

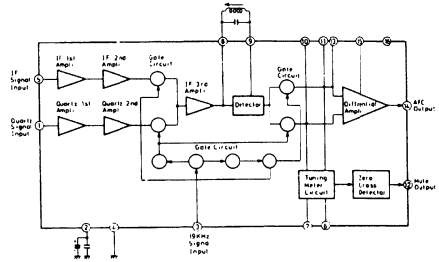


Fig. 20

TA-7302P EQUIVALENT CIRCUIT

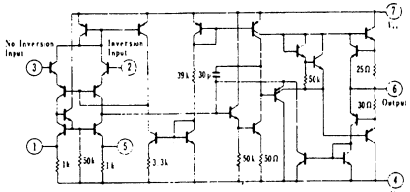


Fig. 21

BA-402 EQUIVALENT CIRCUIT

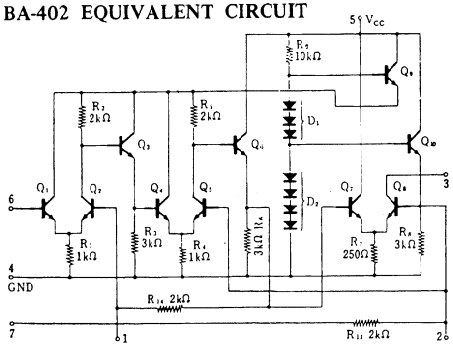
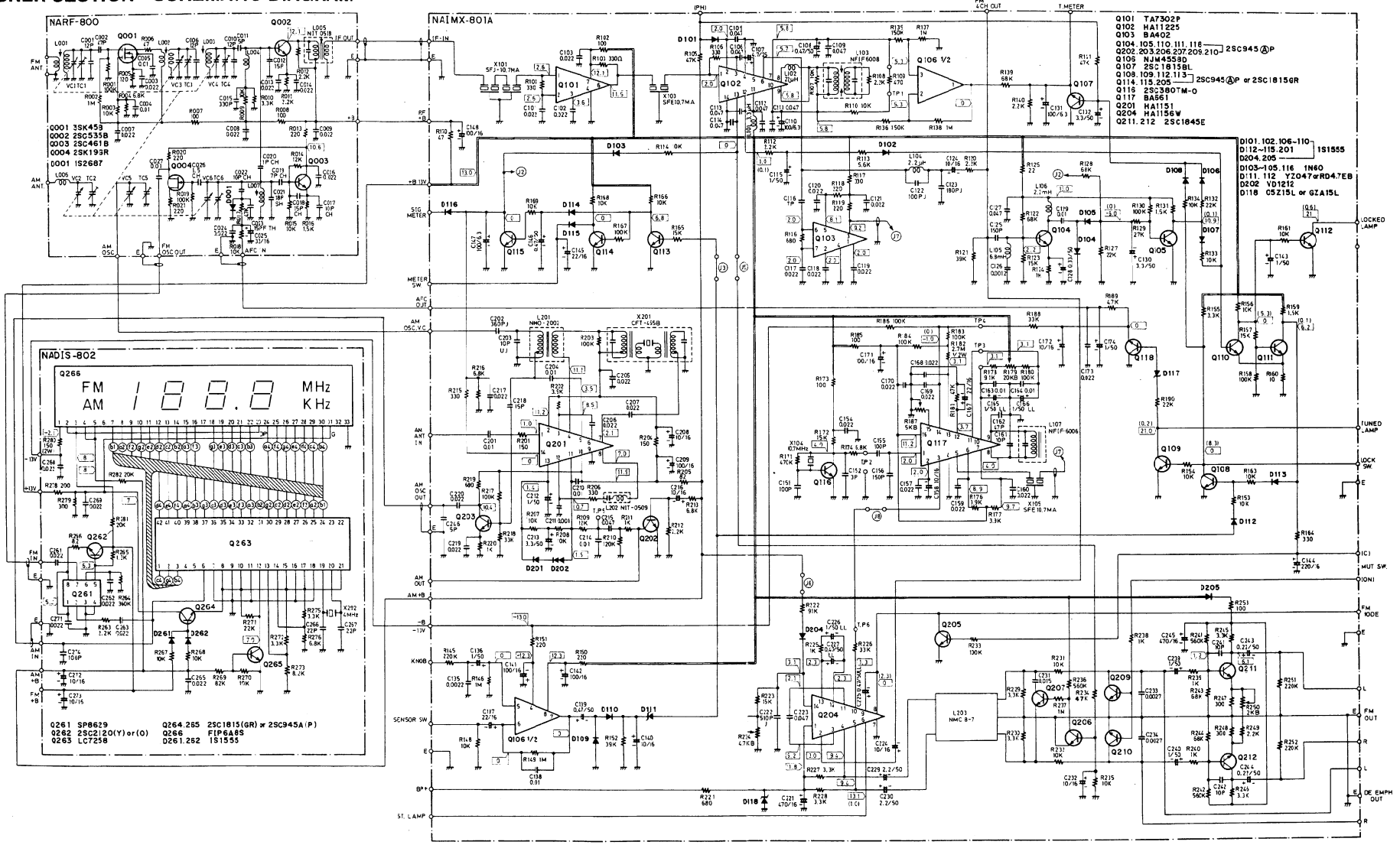


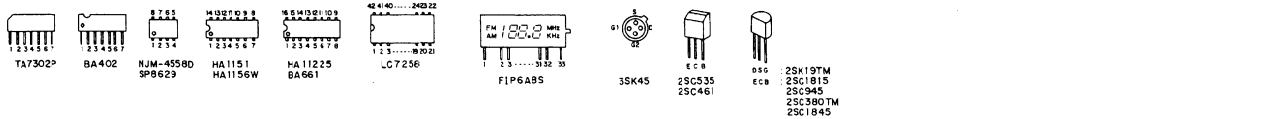
Fig. 22

ONKYO CORPORATION

TUNER SECTION—SCHEMATIC DIAGRAM



NOTES
ALL RESISTORS ARE IN OHMS, ¼WATT UNLESS OTHERWISE NOTED.
ALL CAPACITORS ARE IN μF, 50WV UNLESS OTHERWISE NOTED.
ELECTROLYTIC CAPACITORS (+⊟−) ARE IN μF/WV.
VOLTAGE (MEASURE WITH V.T.V.M.) □ V DC VOLTAGE (NO INPUT SIGNAL).
( ) V DC VOLTAGE (FM STEREO).



TONE AMPLIFIER PC BOARD VIEW FROM BOTTOM SIDE

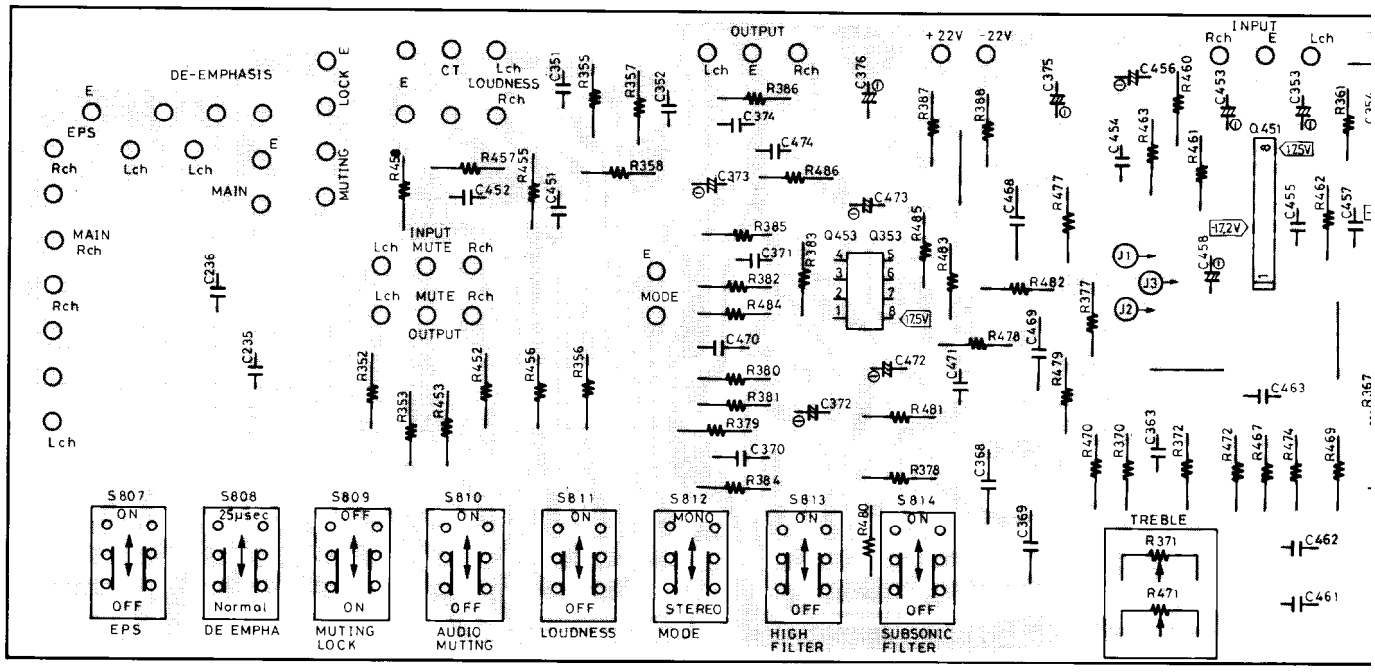


Fig. 38

PRINTED CIRCUIT BOARD—PARTS LIST

EQUALIZER AMPLIFIER PC BOARD (NAEQ-868) – PARTS LIST

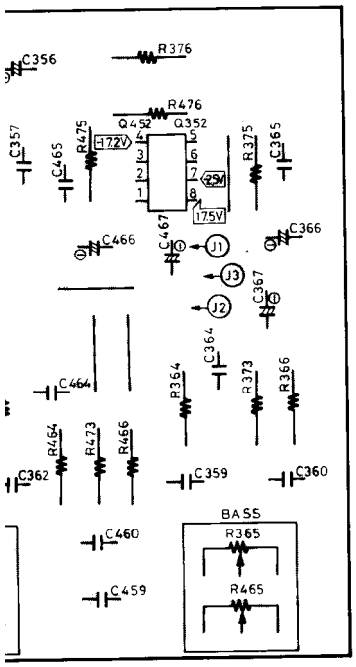
CIRCUIT NO.	PARTS NO.	DESCRIPTION
	ICs	
Q301, Q401	222471	HA-1457W
	Capacitors	
C303, C403	392880227	2.2μF, 50V, LL
C306, C406	352721019T	100μF, 6.3V, Elect.
C311, C411	392880107T	1μF, 50V, LL
C313, C314	352780339T	3.3μF, 50V, Elect.
	Resistors	
R354, R454 R359, R459	5104102	N24RDQL41C500KMN100KBTP-40H, Volume/Balance control variable
R801-R807	441622014	200Ω, 1W, Metal oxide film
	Switches	
S801-S806	25035203	NPS-422-182-L167, Selector/tape push
	Lamp case	
	27250049A	

TERMINAL PC BOARD (NAPJ-869) – PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
P813, P814	25045069	NPJ-4PDBL34, Tape input/output
	79116	JL15-340-5-5-P2.5, Wire lead

PROTECTOR AND RECTIFIER CIRCUIT PC BOARD (NAPCS-870) – PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
	IC	
Q701	222584	TA-7317P
	Transistors	
Q702	2211395 or 2211396	2SA970(GR) or 2SA970(BL)
Q731	2211255 or 2211256	2SC1815(GR) or 2SC1815(BL)
Q732, Q751 Q752	2211544	2SC1959(Y)
Q901	2200663, 2200664, 2201042 or 2201043	2SC1626(O), 2SC1626(Y), 2SD381(L) or 2SD381(M)
Q902	2200673, 2200674, 2201052 or 2201053	2SA816(O), 2SA816(Y), 2SB536(L) or 2SB536(M)
Q903	2200673, 2200674, 2201052 or 2201053	2SA816(O), 2SA816(Y), 2SB536(L) or 2SB536(M)
Q904	2201074 or 2201075	2SD880(Y) or 2SD880(GR)
Q905	2211255, 2211256 or 2210746	2SC1815(GR), 2SC1815(BL) or 2SC945A(P)



CIRCUIT NO.	PARTS NO.	DESCRIPTION
	Diodes	
D701, D702	223848 or 223849	GP-08B or ERB12-01
D703	224052 or 224053	05Z10L or 05Z10U
D751	223119	1S1588
D752, D753	223103 or	1N60 or
D755, D756	223132	1K60
D754	223119	1S1588
D902	223869	W01
D903, D904	224069	05Z22U
D905	224059	05Z13U
D906	223848 or 223849	GP-08B or ERB12-01
	Capacitors	
C703	352732209T	22μF, 10V, Elect.
C704	352721019T	100μF, 6.3V, Elect.
C705	352784799T	0.47μF, 50V, Elect.
C706	352742219	220μF, 16V, Elect.
C751, C752	352780229T	2.2μF, 50V, Elect.
C753, C754	352741009T	10μF, 16V, Elect.
C908, C909	352782219	220μF, 50V, Elect.
C910-C913	352751019T	100μF, 25V, Elect.
C914	352753319	330μF, 25V, Elect.
C915, C916	352741019T	100μF, 16V, Elect.
C917	352751019	100μF, 25V, Elect.
C918	352752229	2,200μF, 25V, Elect.
C919	352744709T	47μF, 16V, Elect.
C920	352741019T	100μF, 16V, Elect.
C924	352752229	2,2000μF, 25V, Elect.

CIRCUIT NO.	PARTS NO.	DESCRIPTION
	Resistors	
R714	441621214K	120Ω, 1W, Metal oxide film
R751, R752	441621824K	1.8kΩ, 1W, Metal oxide film
R755, R756	5215018	N08HR1KBC, Semi-fixed
R902	441621814K	180Ω, 1W, Metal oxide film
R905	441622714K	270Ω, 1W, Metal oxide film
R908	441520684K	6.8Ω, ½W, Metal oxide film
R910	441621024K	1kΩ, 1W, Metal oxide film
R911, R915	441520394K	3.9kΩ, ½W, Metal oxide film
R916	441621814K	180Ω, 1W, Metal oxide film
R917	441622414K	240Ω, 1W, Metal oxide film
	Relay	
RL701	25065037	NRL02P5A-DC12-02
	Radiator	
	27160042	RAD-05B
	27160029	RAD-07

SWITCH CIRCUIT PC BOARD (NASW-871) – PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
PL801-PL812	210082	PL12V0.06AW2, Indicator lamps

TONE CONTROL CIRCUIT PC BOARD (NAAF-872) – PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
	ICs	
Q351, Q451	222471	HA-1457W
Q352, Q353	222534	NJM-4559DX
Q452, Q453		
	Capacitors	
C353, C453	392880227T	2.2μF, 50V, LL
C356, C456	352721019T	100μF, 6.3V, Elect.
C358, C458	392851007T	10μF, 25V, Elect.
C366, C466	352741009T	10μF, 16V, Elect.
C367, C467	392850477T	4.7μF, 25V, LL
C370, C470	372528214	820pF±5%, 50V, ST
C372, C472	392880107T	1μF, 50V, LL
C373, C473	352780229T	2.2μF, 50V, Elect.
C376, C375	352753319	330μF, 25V, Elect.
	Resistors	
R365, R465	5148048	N16RGM11C100KBS-40, Bass control variable
R368, R468	5148048	N16RGM11C100KBS-40, Middle control variable
R371, R471	5148049	N16RGM11C100KB40, Treble control variable
	Switches	
S807-S814	25035202	NPS-822-L166

POWER AMPLIFIER PC BOARD (NAMA-873) – PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
	Transistors	
Q501, Q601	2211371 or 2211372	2SC2259(F) or 2SC2259(G)
Q502, Q602	2211405 or 2211406	2SC2240(GR) or 2SC2240(BL)
Q503, Q603	2211423 or 2211424	2SA817(O) or 2SA817(Y)
Q504, Q604	2210772 or 2210774	2SA818(O) or 2SA818(Y)
Q505, Q605	2210782 or 2210784	2SC1628(O) or 2SC1628(Y)
Q506, Q606	2211255 or 2211256	2SC1815(GR) or 2SC1815(BL)

CIRCUIT NO.	PARTS NO.	DESCRIPTION
Q508, Q608	2211633 or 2211634	2SC2229(O) or 2SC2229(Y)
Q509, Q609	2211353 or 2211354	2SA949(O) or 2SA949(Y)
Q510, Q610	2200863 or 2200864	2SC2238(O) or 2SC2238(Y)
Q511, Q611	2200873 or 2200874	2SA968(O) or 2SA968(Y)
Q513, Q613	2201194 or 2201195	2SB706(R) or 2SB706(Q)
Q512, Q612	2201204 or 2201205	2SD746(R) or 2SD746(Q)

CAUTION: Replacement for power, complementary and drive transistor, if necessary, must be made from the same beta group (H_{FE}) as the original type.

	ICs	
Q514, Q614 Q515, Q615	222502	NJM-4558DX
	Diodes	
D501, D601	4000022	VD1212
D502-D504 D602-D604	223105	1S1555
	Coils	
L501, L601	231001	S-1.3B
	Capacitors	
C501, C601	392880227T	2.2μF, 50V, LL
C506, C606 C509, C609	352780109T	1μF, 50V, Elect.
C510, C610	352780339T	3.3μF, 50V, Elect.
C517, C518 C617, C618	392852207T	22μF, 25V, LL
C519, C520	352753319	330μF, 25V, Elect.
C521, C621	352780339T	3.3μF, 50V, Elect.
C522, C523 C622, C623	352770229T	2.2μF, 63V, Elect.
C524, C624	352770479T	4.7μF, 63V, Elect.
C526, C626	352770479T	4.7μF, 63V, Elect.
	Resistors	
R517, R617	5221019	N10HR470BE, Semi-fixed
R531, R631 R532, R632	441524714	470Ω, ½W, Metal oxide film
R533, R633	441621514	150Ω, 1W, Metal oxide film
R534, R634 R535, R635	4000069	RGC33K0.22x2, Metal plate
R536, R636 R537, R637	4000070	RGC3K-0.18, Metal plate
R538, R638	4000071	RGC3K-1.0, Metal plate
R539, R639	451731004	10Ω, 2W, Metal
R540, R640	451530564	5.6Ω, ½W, Metal
R542, R642	5221007	R-HK2.2KB, Semi-fixed
	Radiator 27160011	

THERMAL DETECTOR PC BOARD (NACC-874) – PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
Q507, Q607	2211255 or 2211256	2SC1815(GR) or 2SC1815(BL)

LAMP PC BOARD (NAPL-747c/NAPL-879) – PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
PL801	210095	PL6.3V, 0.3A, Lamp
	210088	PL24V, 0.08A, Lamp

METER ILLUMINATION LAMP PC BOARD (NAPL-787) – PARTS LIST

CIRCUIT NO.	PARTS NO.	DESCRIPTION
PL803–PL805	210054B	PL6.3V, 0.25A, Lamp

NOTES:
1. DC voltage are measured with V.T.V.M. to chassis at no signal applied.
2. Capacitor LL: Low leakage current type electrolytic capacitor
   ST: Polystyren film capacitor

STRINGING DIAGRAM

1. Close the variable capacitor complete and tie the dial cord to the spring of the drum.
2. Thread the dial cord in the direction of arrow from ① to ⑤ and wind the dial cord three turns around the tuning shaft counter – clockwise.
3. Thread the dial cord in the direction of arrow from ⑥ to ⑦.
4. Wind the dial cord 1½ turns around the dial drum.

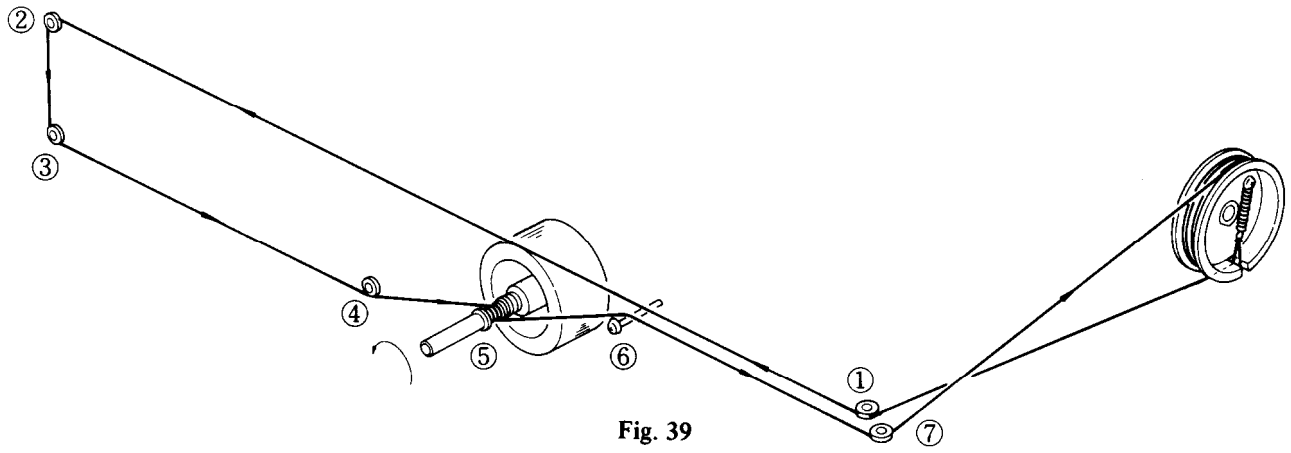


Fig. 39

PACKING PROCEDURES

TX-7000

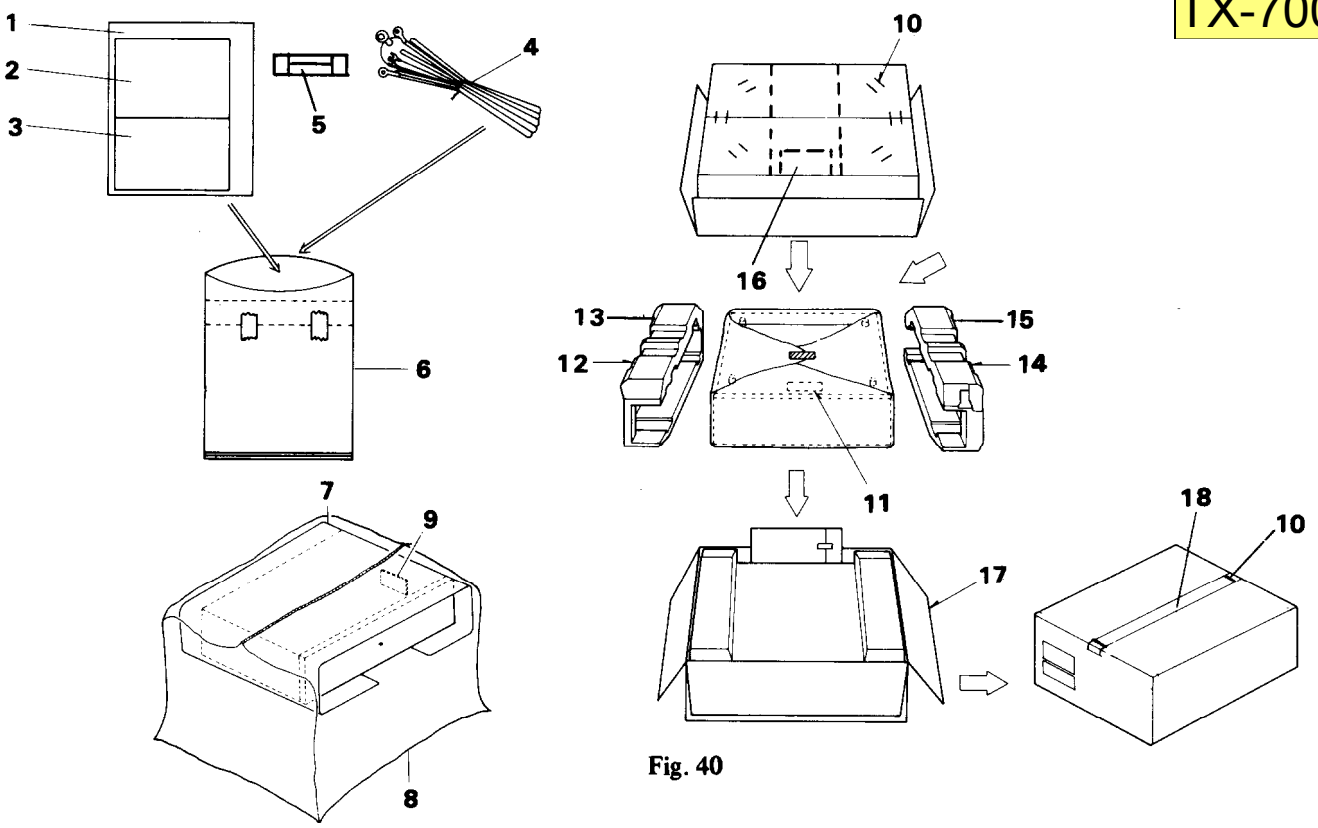


Fig. 40

PACKING PROCEDURES – PARTS LIST

REF. NO.	PARTS NO.	DESCRIPTION	REF. NO.	PARTS NO.	DESCRIPTION
1	29340421	Instruction manual	11	29360363	Caution label
2	29358002	Service station list	12	29090505	Pad (RF)
3	29365006	Warranty card	13	29090506	Pad (RB)
4	292064	FM antenna	14	29090507	Pad (LF)
5	252053	8A(ST-6), Fuse	15	29090508	Pad (LB)
6	29100006	250x350mm, Poly bag	16	29090531	Pad (B)
7	290008-1	500x1,000mm, Protection sheet	17	29050361	Master carton box
8	29100035A	720x1,020mm, Poly bag	18	260012	W50x170mm, Tape
9	29360362	Label		29355045	Sensor tag (Power supply cord)
10	282301	Sealing hook		250153	Shorted pin (Phono/tape playback)

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