

ONKYO® SERVICE MANUAL

QUARTZ SYNTHESIZED

FM STEREO TUNER

MODEL T-9060

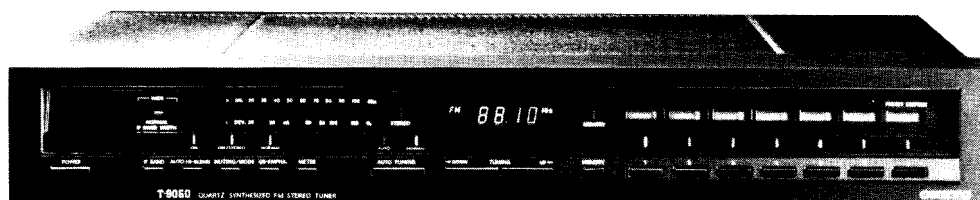


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ONKYO® AUDIO COMPONENTS

SPECIFICATIONS

D model

Tuning Range:	87.9 – 107.9 MHz (200 kHz steps)
Usable Sensitivity:	Mono: 10.3 dBf, 1.8 μ V Stereo: 17.2 dBf, 4.0 μ V
50 dB Quieting Sensitivity:	Mono: 14.7 dBf, 3.0 μ V Stereo: 36.1 dBf, 35 μ V
Capture Ratio:	1.0 dB
Image Rejection Ratio:	100 dB
IF Rejection Ratio:	100 dB
Signal-to-Noise Ratio:	Mono: 81 dB (IHF) Stereo: 73 dB (IHF)
Alternate Channel Att.:	80 dB IHF ($\pm$ 400 kHz IF: Normal)
AM Suppression Ratio:	55 dB
Total Harmonic Distortion:	Mono: 0.05% (IF: Wide) Stereo: 0.13% (IF: Wide)
Frequency Response:	30 – 15,000 Hz (+ 0.5 dB, –1.5 dB)
Stereo Separation:	45 dB at 1 kHz (IF: Wide) 33 dB at 70 – 10,000 Hz (IF: Wide)
Output Voltage:	0–1.5V
Muting Level:	17.2 dBf, 4.0 μ V
General	
Power Supply:	AC 120V, 60Hz
Antennas:	300 ohms balanced and 75 ohms unbalanced
Semiconductors:	8 FETs, 43 transistors, 18 ICs, 61 diodes, 30 LEDs
Dimensions (W x H x D):	450 x 74 x 355 mm (17-3/4" x 2-29/32" x 13-31/32")
Weight:	5.6 kg, 12.3 lbs.

Specifications and features are subject to change without notice.

G/W model

Tuning Range:	87.5 – 108.0 MHz (50 kHz steps)
Usable Sensitivity:	Mono: 10.3 dBf, 1.8 μ V, IHF 1.4 μ V (S/N 26 dB, 40kHz Dev.) DIN Stereo: 17.2 dBf, 4.0 μ V, (IHF) 50 μ V (S/N 46 dB, 40 kHz Dev.) DIN
50 dB Quieting Sensitivity:	Mono: 14.7 dBf, 3.0 μ V Stereo: 36.1 dBf, 35 μ V
Capture Ratio:	1.0 dB
Image Rejection Ratio:	100 dB
IF Rejection Ratio:	100 dB
Signal-to-Noise Ratio:	Mono: 81 dB (IHF) Stereo: 73 dB (IHF)
Selectivity:	70 dB DIN ($\pm$ 300 kHz, 40 kHz Dev.) (IF: Normal)
AM Suppression Ratio:	55 dB
Total Harmonic Distortion:	Mono: 0.05% (IF: Wide) Stereo: 0.13% (IF: Wide)
Frequency Response:	30 – 15,000 Hz (+ 0.5 dB – 1.5 dB)
Stereo Separation:	45 dB at 1 kHz (IF: Wide) 33 dB at 70 – 10,000 Hz (IF: Wide)
Output Voltage:	0 – 1.5 V
Muting Level:	17.2 dBf, 4.0 μ V
General	
Power Supply:	AC 120/220 Volts, 50/60Hz AC 220 Volts, 50Hz
Antennas:	300 ohms balanced and 75 ohms unbalanced
Semiconductors:	8FETs, 43 transistors, 18 ICs, 62 diodes, 30 LEDs
Dimensions (W x H x D):	450 x 74 x 355 mm (17-3/4" x 2-29/32" x 13-31/32")
Weight:	5.6 kg, 12.3 lbs.

Specifications and features are subject to change without notice.

PRECAUTIONS

1. Handling precautions of CMOS IC

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 handling devices, since a worker can be statically charged with respect to the bench surface.
3. Nylon clothing should not 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 or functional testing.
6. All unused device inputs should be connected to V_{DD} or V_{SS} .

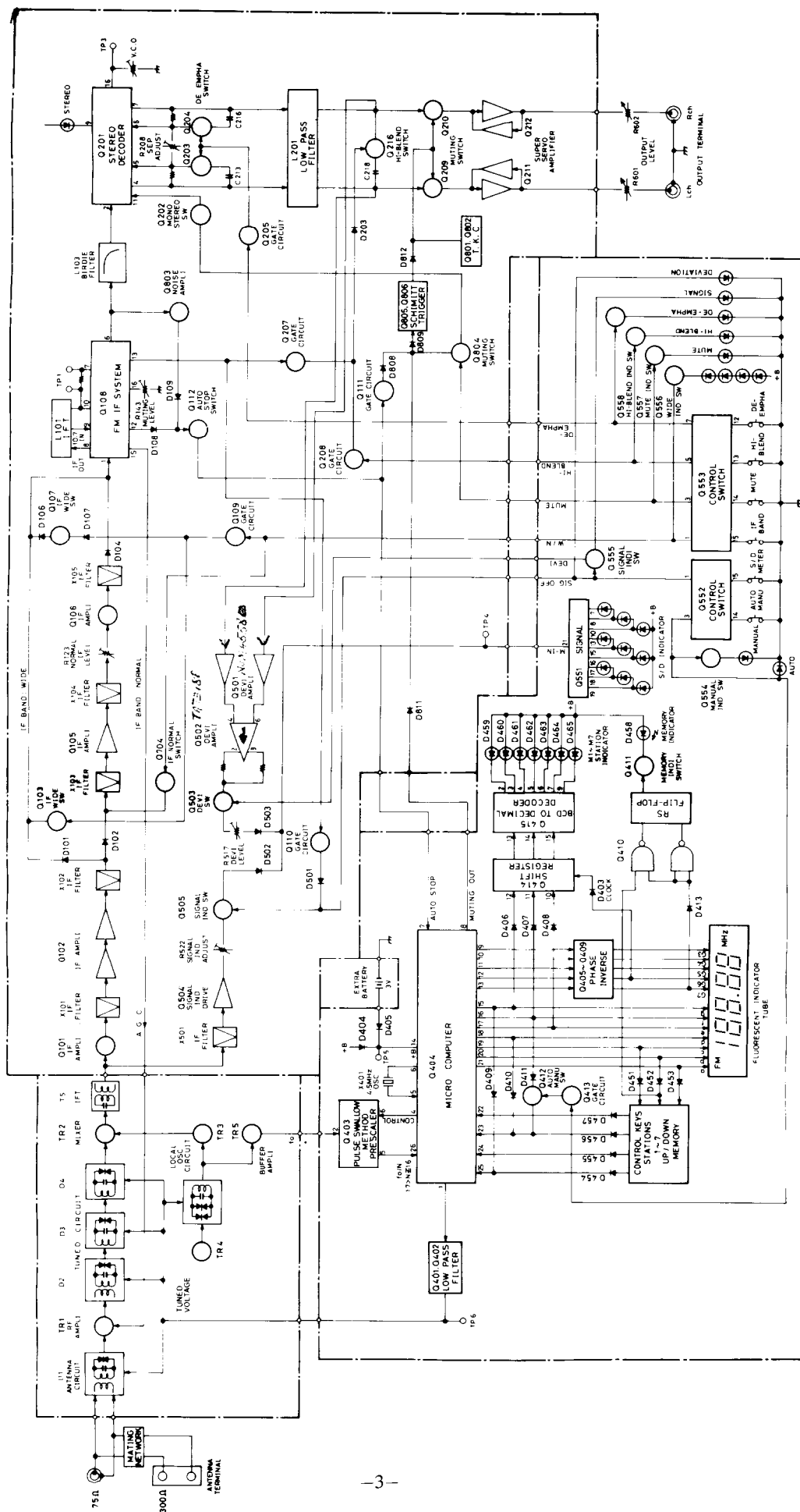
2. De-Emphasis Switch (bottom panel)

W models are equipped with a 50 μ sec – 75 μ sec selector switch. This is set to 50 μ sec at the factory, but may have to be reset to 75 μ sec depending on the area where the unit is used.

Europe:	50 μ sec
U.S.A.:	75 μ sec

3. FM Tuning Step Frequency Switch (back panel)

W models are equipped with a switch to change the FM tuning step frequency from 50 kHz to 200 kHz. These units are set to 50 kHz at the factory; change to 200 kHz if this gives better results in your locality.



CIRCUIT DESCRIPTION AND IC BLOCK DIAGRAMS

1. Micro Computer Operation

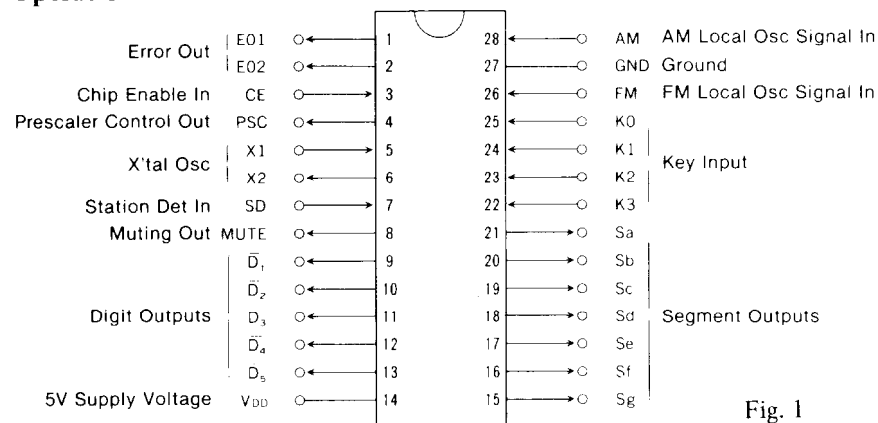


Fig. 1

Pin. No.	Symbol	Terminal	Description
1 2	E01 E02	Error Outputs	Charge pump output of the phase detector which constitutes the PLL. HIGH level is output when the divided oscillation frequency is higher than the reference frequency. In the opposite case, LOW level is output. Floating occurs when the frequencies match. The output is applied to the variable capacitor in the front end through low pass filters Q401 and Q402. The output from both terminals is the same, but only E01 is used.
3	CE	Chip Enable Input	Device selection signal input terminal. HIGH level...normal operation; LOW level...memory preservation.
4	PSC	Prescaler Control Output	This terminal outputs a signal that switches the prescaler division ratio to 1/16 or 1/17 when the pulse swallow method is used for division (FM only).
5 6	X1 X2	X'tal	Connected to the 4.5MHz crystal oscillator.
7	SD	Station Detector Input	Input terminal for detecting whether or not a broadcast signal is being received during auto-tuning. Stopped by the HIGH level.
8	MUTE	Muting Output	Output terminal which mutes the shock noise occurring when the PLL is released; active HIGH.
9—13	D1—D5	Digit Outputs	Display digit output signal terminals; active LOW.
14	VDD	Supply Voltage	Device power terminal; supplies 5V during normal operation and 3V from the external power source (two batteries) for memory preservation.
15—21	Sa—Sg	Segment Outputs	Display tube segment signal output, key return signal source and station display signal terminals; active HIGH. Since these terminals can handle 30V, they are connected directly to the segment terminals of the fluorescent display tubes.
22—25	K0—K3	Key Return Signal Inputs	Terminals for input of the key return signals from the external key matrix.
26	FM	FM Local Oscillator Signal Inputs	FM signals received are divided by 1/16 or 1/17 by prescaler μ PB553AC for input to this terminal.
27	GND	Ground	
28	AM	AM Local Oscillator Signal Input	Terminal for input of AM broadcast signal. (not used.)

2. Control Key Connections

UP, DOWN.....Pressing the UP or DOWN key will cause the frequency to be shifted upward or downward (in 200kHz steps with the D model and in 50kHz steps with the W/G model). If the key is pressed for more than 0.5 seconds, the frequency will be shifted 50kHz every 40ms until it is released. (manual operation)

If the key is pressed, the frequency will be shifted until the terminal SD becomes the high level. (auto operation)

MW, FM, LW.....The MW, FM, LW band switches.

MEMORY.....Pressing this key causes the memory to be placed in the write-enabled state. The frequency displayed will be stored in one of the memories 1–7 if the corresponding memory key is then pressed within 5 seconds. The write-enabled state will be cleared after 5 seconds if none of the memory keys are pressed, or if the UP/DOWN keys are pressed.

M1—M7.....These keys are used to preset and recall the contents of the memory. Positions are provided for keys for reading/writing up to 7 frequencies. See the paragraph on MEMORY for writing frequencies. Pressing one of the keys M1—M7 once will cause the contents of signal of about 0.45 seconds duration is output at this time.

TPP (Tracking Point Preset).....Switch is used to write adjustment frequencies into preset memory during set production. Not used with the T-9060. When the IC V_{DD} is first inserted, the lowest FM frequency is placed in the memory.

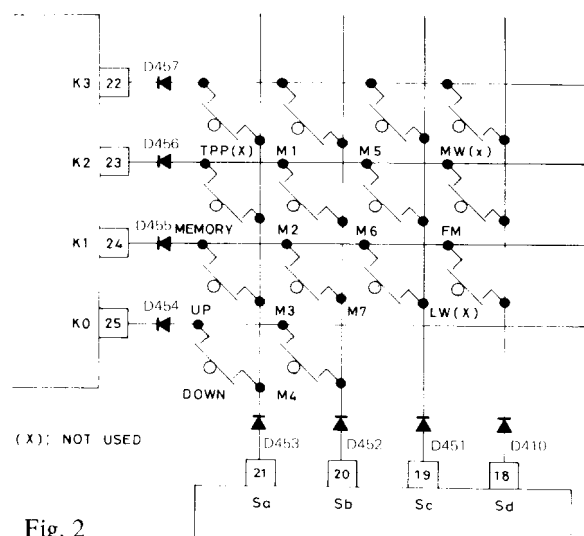


Fig. 2

one of the keys M1—M7 once will cause the contents of the corresponding memory (a frequency) to be read. A muting signal of about 0.45 seconds duration is output at this time.

TPP (Tracking Point Preset).....Switch is used to write adjustment frequencies into preset memory during set production. Not used with the T-9060. When the IC V_{DD} is first inserted, the lowest FM frequency is placed in the memory.

3. Key Matrix Connections

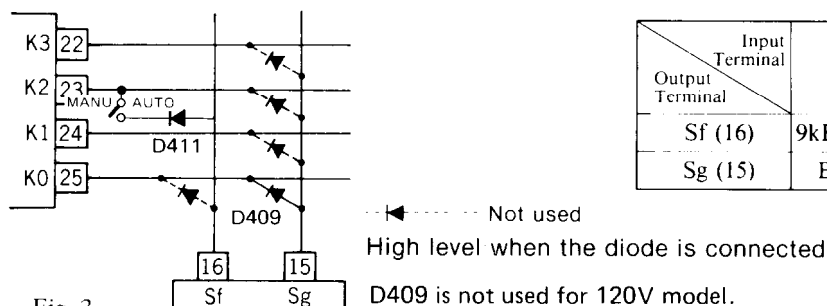


Fig. 3

IF1, IF0.....IF offset value settings for FM. See Table 2.

BAND1, BAND0.....Geographical FM band settings. See Table 3.

9kHz, 10kHz.....MW band settings. See Table 4. (not used)

AUTO/MANUAL.....Auto tuning for 1, manual tuning for 0.

Input Terminal Output Terminal	K0 (25)	K1 (24)	K2 (23)	K3 (22)
Sf (16)	9kHz/10kHz		AUTO/MANU	
Sg (15)	BAND 0	BAND 1	IF 1	IF 0

table 1

IF 1	IF 0	IF Frequency
0	0	10.700MHz
0	1	10.675MHz
1	0	10.750MHz
1	1	10.725MHz

table 2

BAND 1	BAND 0	Band	Frequency Range	Channel Space
0	0	120V model	87.9~107.9MHz	200kHz
0	1	220V model	87.50~108.00MHz	50kHz
1	0	Japan	76.1~89.9MHz	100kHz

table 3

9kHz/10kHz	Frequency range	Channel Space	Reference Frequency
0	530~1620kHz	10kHz	10kHz
1	522~1611kHz	9kHz	9kHz

table 4

4. Auto/Manual tuning circuit

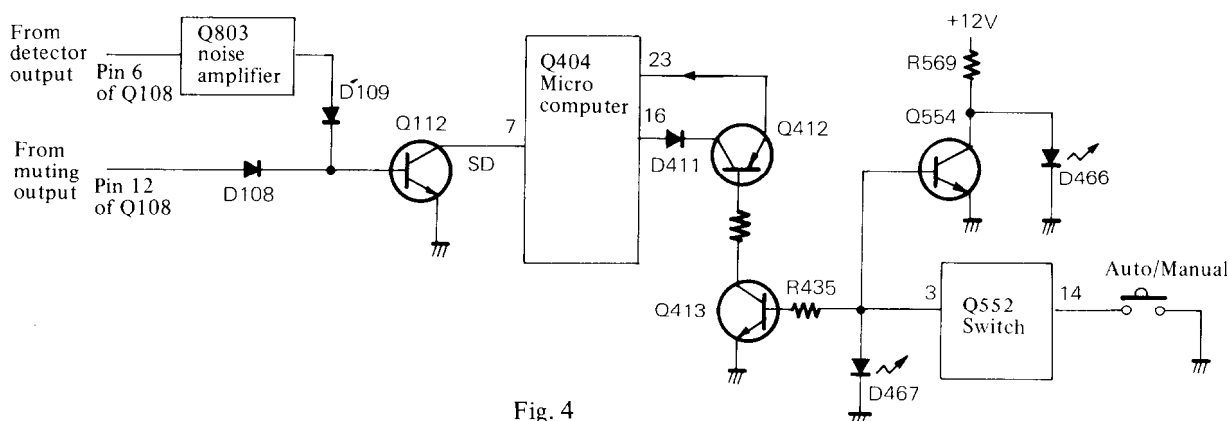


Fig. 4

Detector section

The auto stop detector circuit is activated by the combined effects of the IF level, zero cross detector and noise component. The IF level and zero cross detectors are incorporated in the quadrature IC Q108; output is from pin 12. When the sufficiently strong broadcast is received during the auto tuning, the outputs of noise amplifier and muting of Q108 go the low level and transistor Q112 is turned OFF. The terminal SD goes the high level and auto tuning stop

Switch section

When the power switch is turned on, the pin 3 of Q552 goes the low level and the tuning switch goes in the manual mode. The pin 3 goes the high level when the auto tuning button is pressed, the transistors Q413 and Q412 are turned on and the tuning becomes the auto mode.

5. Preset Station Indicator Circuit

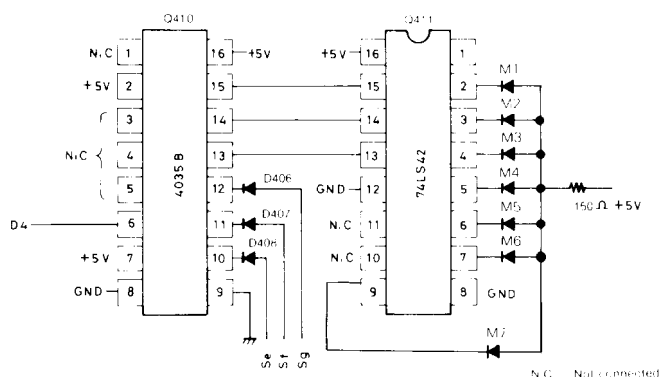


Fig. 5

Preset station indicator connections are shown in Figure 5. BCD codes are output from segment terminals Se—Sg in synchronization with the timing of digit signal $\overline{D4}$. The sequence is shown in the timing chart in Figure 6. The display signal for the "1" in the first digit of the frequency display is output from segment terminals Sb and Sc at timing T1 of digit signal $\overline{D4}$ (blank codes are output from segment terminals Se—Sg at this time). At timing T2, the BCD code

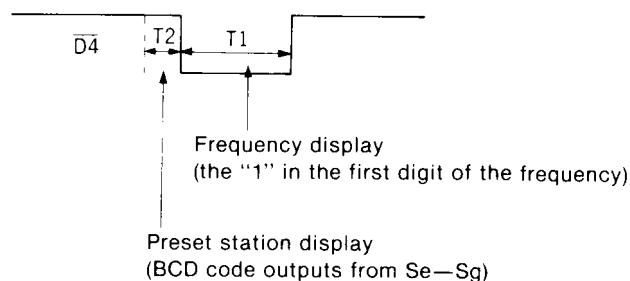
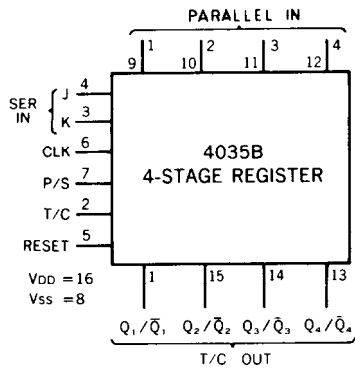


Fig. 6

for preset station display is output from segment terminals Se—Sg (at this time, blank codes are output from segment terminals Sa—Sd). Since output is timed as shown in Figure 6, it is replaced with starting output at $D=F/F$ of Q411. This is output as BCD code to the decimal counter to display the frequency.

●4035B (4-Stage Parallel-In/Parallel-Out Shift Register with J-K Input and True/Complement Output)



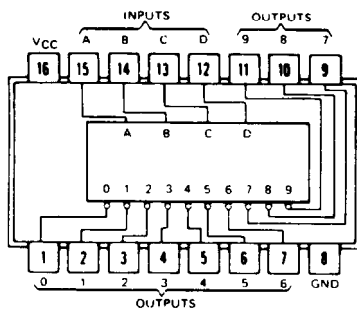
Pin Connection Diagram

Fig. 7

CL	I _{n-1} (INPUTS)				I _n (OUTPUTS)
	J	K	R	Q _{n-1}	Q _n
	0	X	0	0	0
	1	X	0	0	1
	X	0	0	1	0
	1	0	0	Q _{n-1}	Q _{n-1} TOGGLE MODE
	X	1	0	1	1
	X	X	0	Q _{n-1}	Q _{n-1}
	X	X	1	X	0

First Stage Truth Table

●74LS42 (BCD to DECIMAL Decoder)

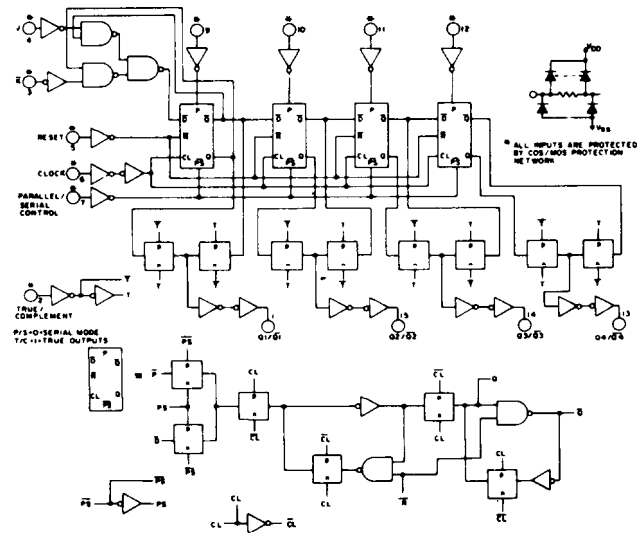


Pin Connection Diagram

Fig. 9

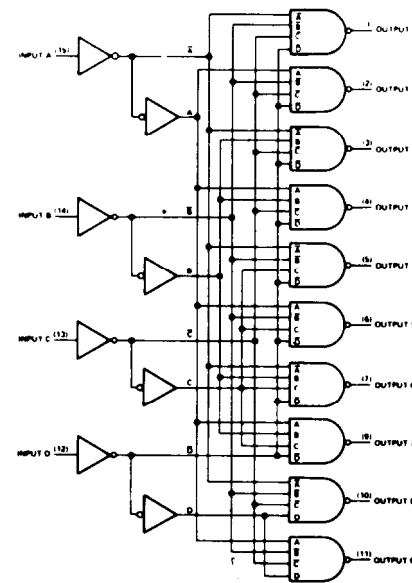
NO	INPUTS				OUTPUTS									
	D	C	B	A	0	1	2	3	4	5	6	7	8	9
0	L	L	L	L	L	H	H	H	H	H	H	H	H	H
1	L	L	L	H	H	L	H	H	H	H	H	H	H	H
2	L	L	H	L	H	H	L	H	H	H	H	H	H	H
3	L	L	H	H	H	H	L	H	H	H	H	H	H	H
4	L	H	L	L	H	H	H	L	H	H	H	H	H	H
5	L	H	L	H	H	H	H	H	L	H	H	H	H	H
6	L	H	H	L	H	H	H	H	H	L	H	H	H	H
7	L	H	H	H	H	H	H	H	H	H	L	H	H	H
8	H	L	L	L	H	H	H	H	H	H	H	L	H	H
9	H	L	L	H	H	H	H	H	H	H	H	H	L	H
INVALID	H	L	H	L	H	H	H	H	H	H	H	H	H	H
	H	L	H	H	H	H	H	H	H	H	H	H	H	H
	H	H	L	L	H	H	H	H	H	H	H	H	H	H
	H	H	L	H	H	H	H	H	H	H	H	H	H	H

Function Table



Logic Diagram

Fig. 8



Logic Diagram

Fig. 10

6. PLL Tuned Circuit

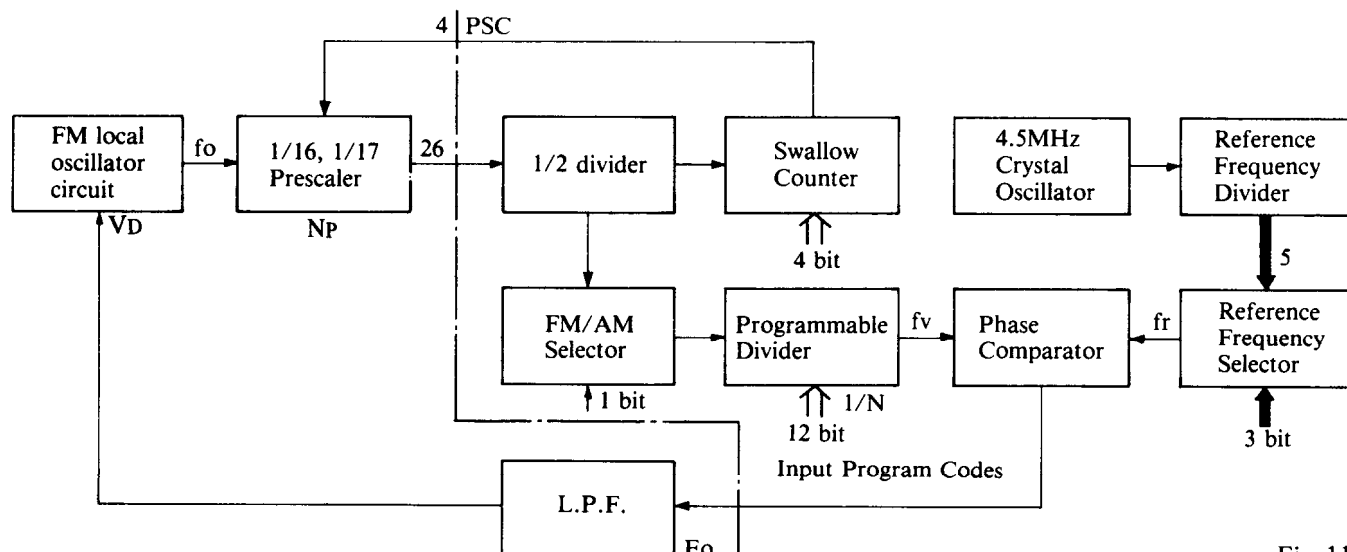


Fig. 11

A block diagram of the tuned circuit of the PLL is shown in Figure 11.

The pulse swallow method is used in the prescaler of the T-9060. In this type of prescaler, a supplementary number (changed according to the program code input) and the divided reception frequency from the prescaler are combined in the control counter and the prescaler's division factor is switched between 1/16 and 1/17 according to external control (1/17 when the PSC terminal is "H" and 1/16 when it is "L").

The station oscillation frequency is applied to the programmable divider, but the programmable divider has an upper frequency limit of only 30MHz, so the pulse swallow-type prescaler, which can be used up to 150MHz, is inserted for division to $1/N_p$.

The signal is then divided to $1/2$ in the microcomputer and applied to the programmable divider and divided to $1/N$.

This is applied to the phase detector where it is compared with frequency standard f_r (25kHz). If f_r and f_v differ, E_o equal to the difference in frequency is output. Since error output E_o is a pulse waveform, it is passed through the low pass filter to change it into DC voltage V_D , which is applied to the variable capacitor in the front end to change the reception frequency. This continues until f_v and f_r are the same and $E_o=0$.

μPB533AC (Prescaler)

Block Diagram

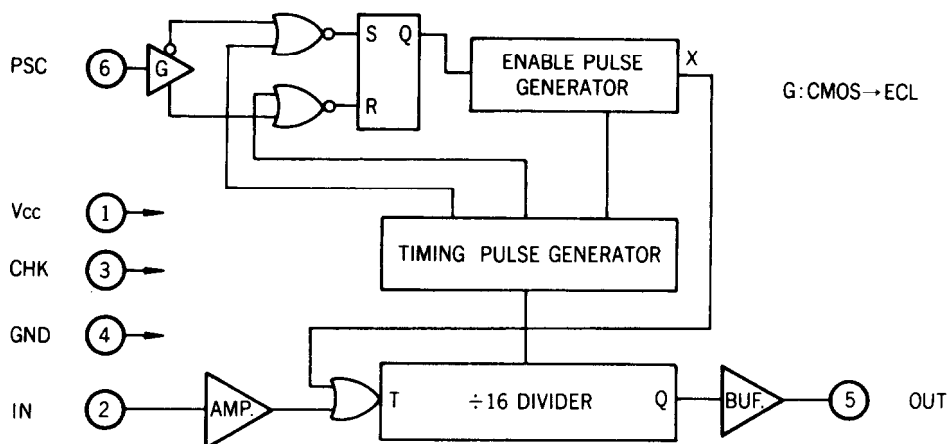


Fig. 12

Pin Connection

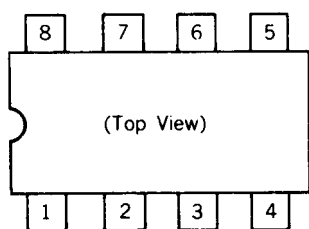


Fig. 13

1. Pin 1 (Vcc)..... + 5 volts supply
2. Pin 2 (IN).....FM local oscillator signal input
3. Pin 3 (CHK).....Check terminal
4. Pin 4 (GND).....Ground terminal
5. Pin 5 (OUT).....Prescaler terminal
6. Pin 6 (PSC).....Prescaler control terminal
7. Pin 7,8.....Not connected

Timing Chart

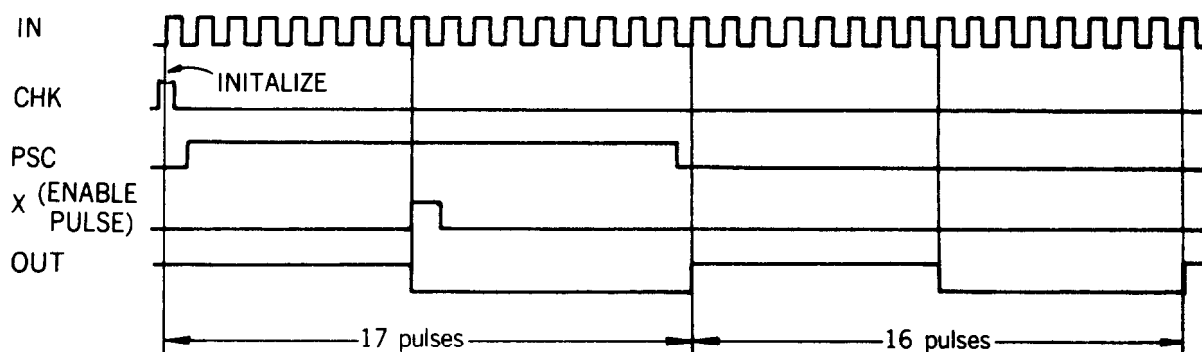


Fig. 14

LA1222 (IF ampli.)

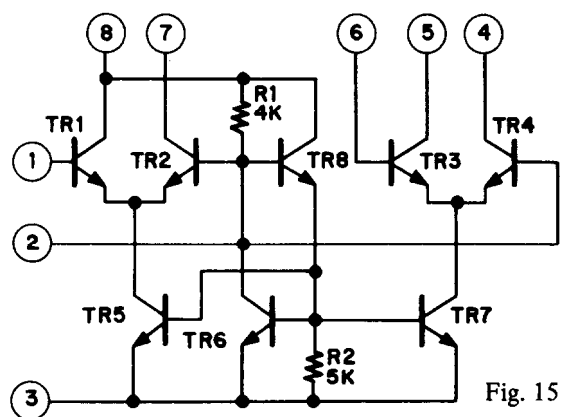


Fig. 15

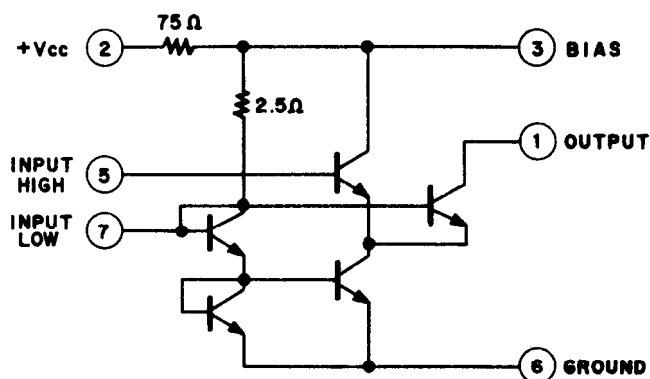
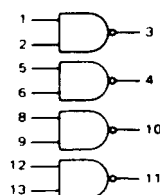
 μ PC555H (IF ampli.)

Fig. 16

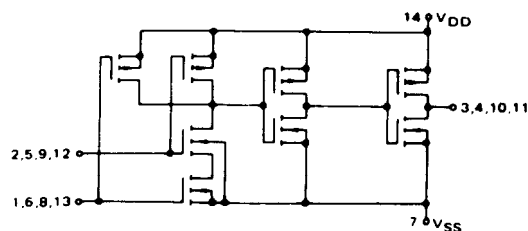
4011 (Quad, 2-Input NAND gate)

LOGIC DIAGRAM

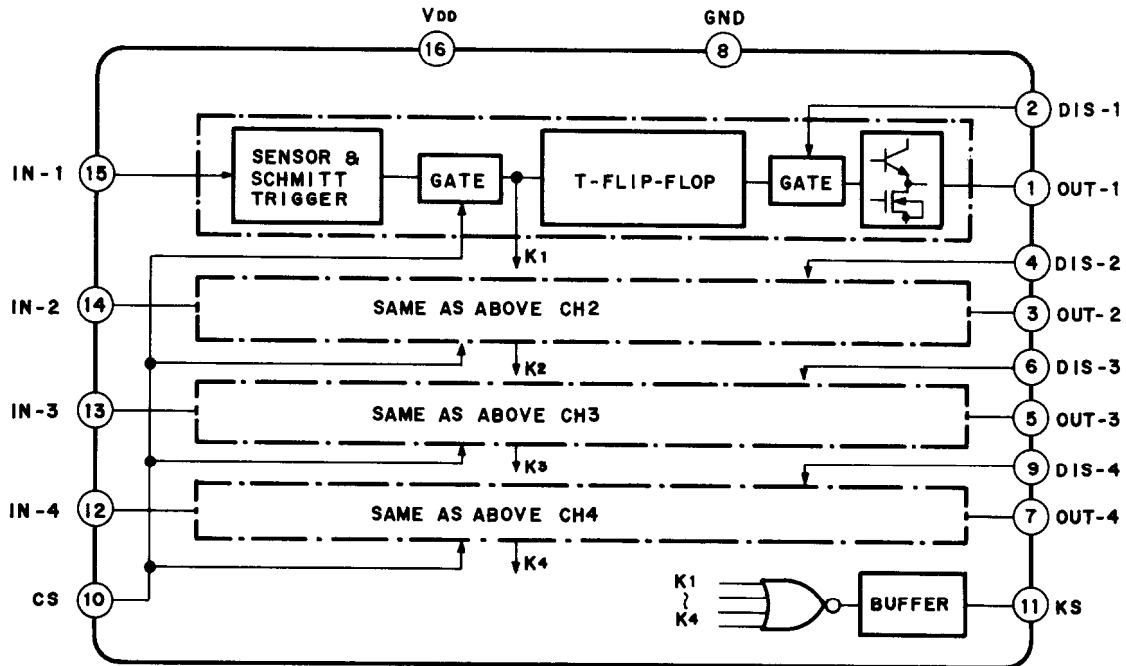


VDD = Pin 14
VSS = Pin 7

Fig. 17

CIRCUIT SCHEMATICS
(1/4 of Device Shown)

TC9130P

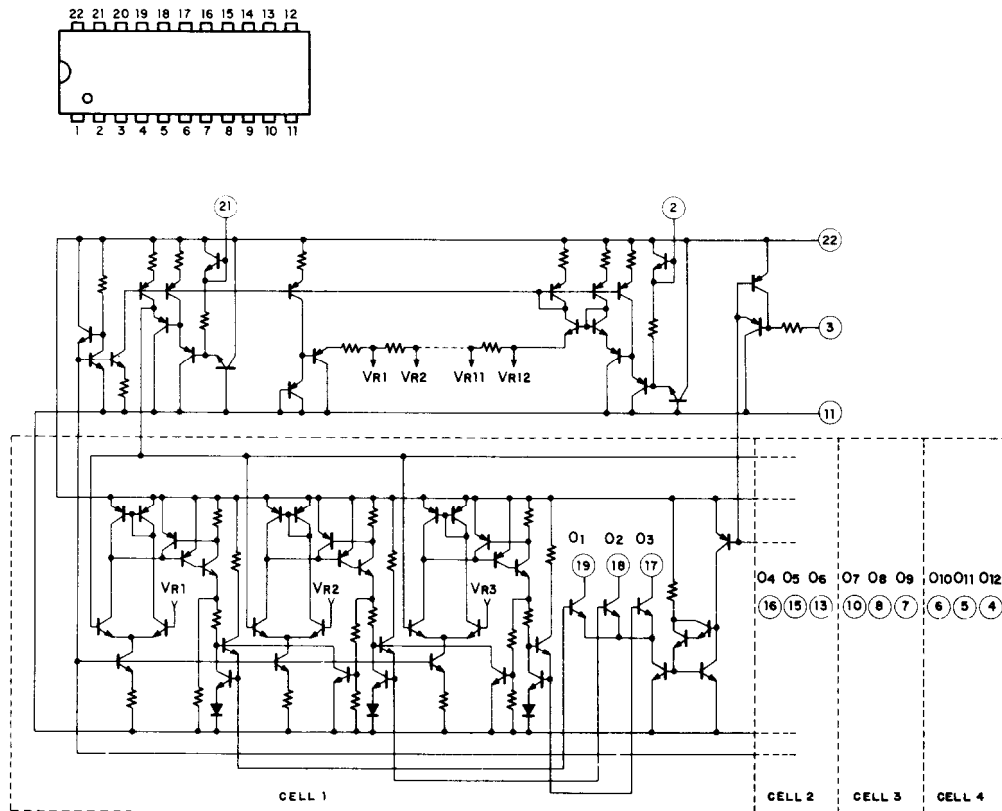


Pin nos.	Mark	Terminal	Descriptions
15 12	IN-1 IN4	Input signal	When the supply voltage of this terminal changes from the high level to low level, the output terminal does the inversion.
1,3 5,7	OUT-1 OUT-4	Output	
2,4 6,9	DIS-1 DIS-4	Output forbidden	When this terminal does the low level, the output becomes the low level.
10	CS	Input forbidden	When this terminal does the low level, the acceptions of input terminals are forbidden. And the flip-flop of inner holds the before condition.
11	KS	Input detector	When the input terminal becomes the low level, this terminal becomes the low level.
16	V _{DD}	Power supply	
8	GND	Ground	

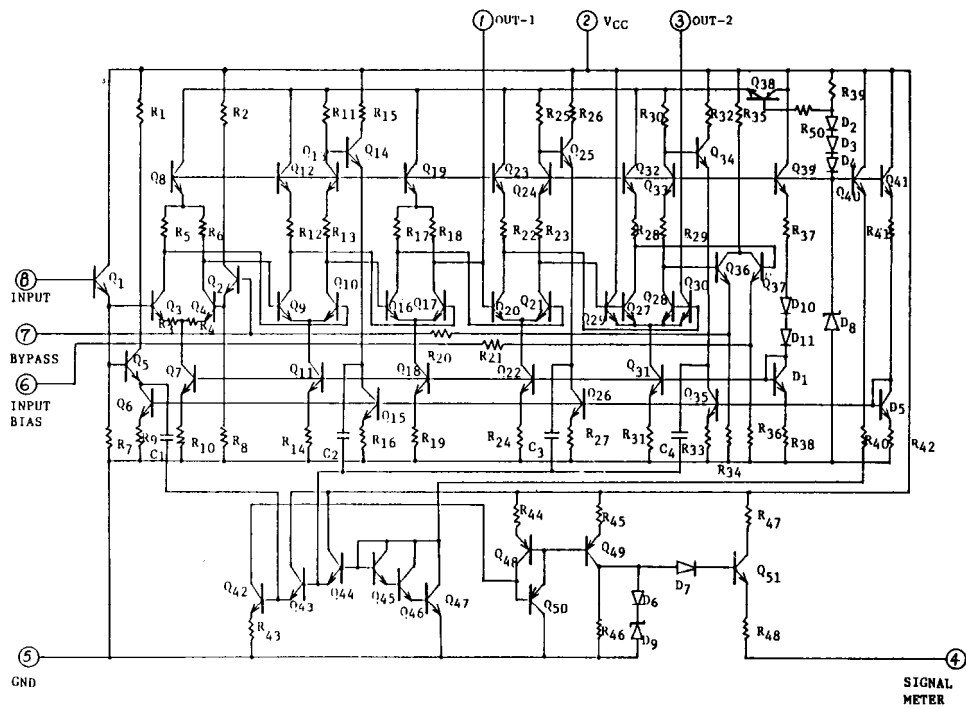
The switch mode when the power switch is turned on.

AUTO TUNING NORMAL
METER SIGNAL STRENGTH
IF BAND NORMAL
MUTING MUTE ON/STEREO
HI-BLEND ON
DE-EMPHASIS NORMAL

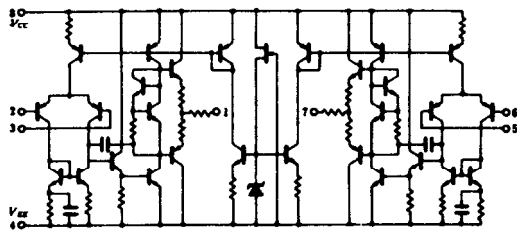
IR2433 (Output Power Indicator Drive)



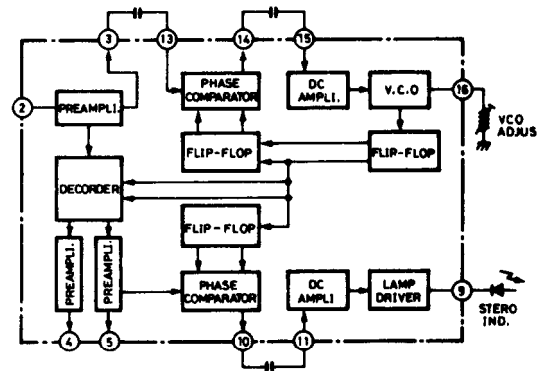
μ PC1198H (Signal Meter Driver)



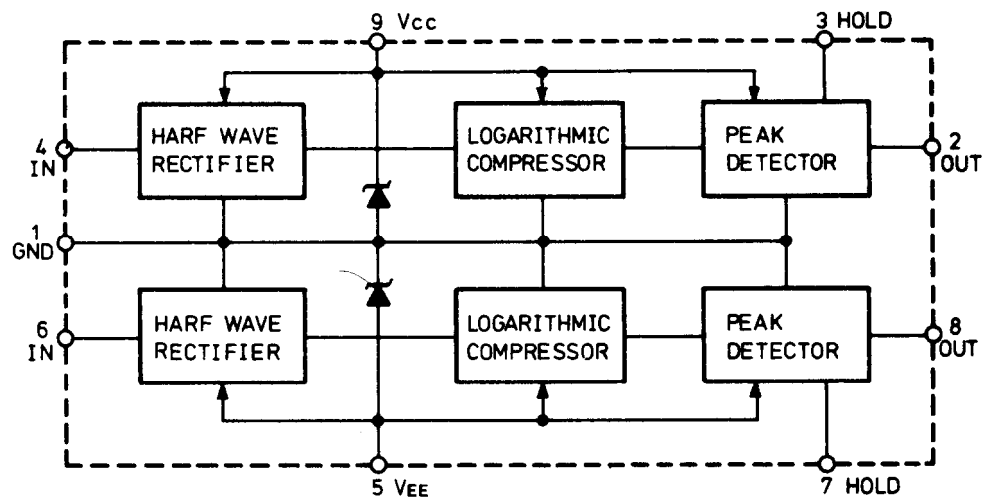
NJM4558D



HA12016 (Stereo decoder)



TA7318P (Deviation indicator driver)



ALIGNMENT PROCEDURES

INSTRUMENTS REQUIRED

1. Stereo Modulator
2. FM Signal Generator with Frequency Counter
3. Frequency Counter
4. Digital DC Voltmeter
5. DC Voltmeter
6. Distortion Analyzer
7. AC Voltmeter
8. Oscilloscope

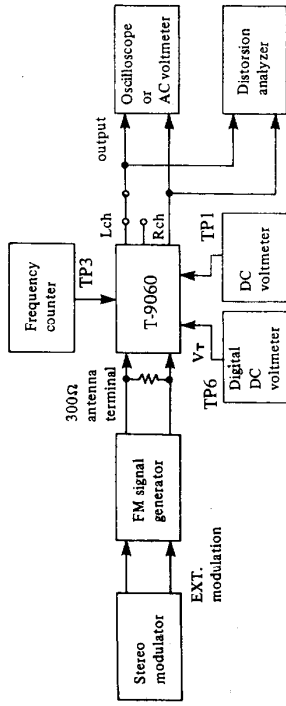
GENERAL ALIGNMENT CONDITION

1. Standard modulation is 1 kHz 100% (FM MONO), pilot 9% sub and main 91%. (FM STEREO)
2. The switches and control should be set as follows unless otherwise specifies.

IF band	Wide
Auto Hi-blend	Off
FM muting/Mode	On/Stereo
De-emphasis	Normal
Output level	Maximum
Meter	Signal strength

Item	FM signal generator	Stereo modulator	Dial to set	Adjust	Output indicator	Adjust for	Remarks
IF FM	1	98.1MHz, 65dBf, 1kHz, 75kHz devi.	98.1MHz	L101	DC voltmeter	0V	Repeat steps 1 and 2 as necessary
	2			L101	Distorsion analyzer	Minimum	
FM RF	1	88.1MHz, 65dBf 1kHz, 75kHz devi.	88.1MHz	T6	Digital DC voltmeter	3.03V	Repeat steps 1 and 2 as necessary
	2	107.9MHz, 65dBf 1kHz, 75kHz devi.	107.9MHz	TC5	Digital DC voltmeter	20.8V	
	3	88.1MHz 1kHz, 75kHz devi.	88.1MHz	T1~T4	AC VTVM	Maximum	Repeat steps 3 and 4 as necessary
	4	107.9MHz 1kHz, 75kHz devi.	107.9MHz	TC1~TC4	AC VTVM	Maximum	
	5	98.1MHz 1kHz, 75kHz devi.	98.1MHz	T5	AC VTVM	Maximum	
V.C.O	98.1MHz 65dBf	_____	98.1MHz	R217	Frequency counter	76,000±76Hz	Turn off the modulation
Stereo separation	98.1MHz 65dBf Ext. modulation	Rch	98.1MHz	R208	AC voltmeter (Lch)	Minimum	Maximum and same separation
		Lch			AC voltmeter (Rch)	Minimum	
Muting level	98.1MHz, 17dBf 1kHz, 75kHz devi.	_____	98.1MHz	R143	Oscilloscope	Signal	Set the muting switch to on position
	98.1MHz, 16dBf 1kHz, 75kHz devi.	_____				No signal	
Signal indicator	98.1MHz, 65dBf 1kHz, 75kHz devi.	_____	98.1MHz	R522	Signal indicator	8th L.E.D light on	
Deviation indicator	98.1MHz, 65dBf 1kHz, 75kHz, devi.	_____	98.1MHz	R517	Deviation indicator	8th L.E.D light on	Set the meter switch to deviation
IF level	98.1MHz, 35dBf 1kHz, 75kHz devi.	_____	98.1MHz	R123	Connect the DC voltmeter to terminal TP-2. The levels of Normal and Wide become same.		

Connection Diagram

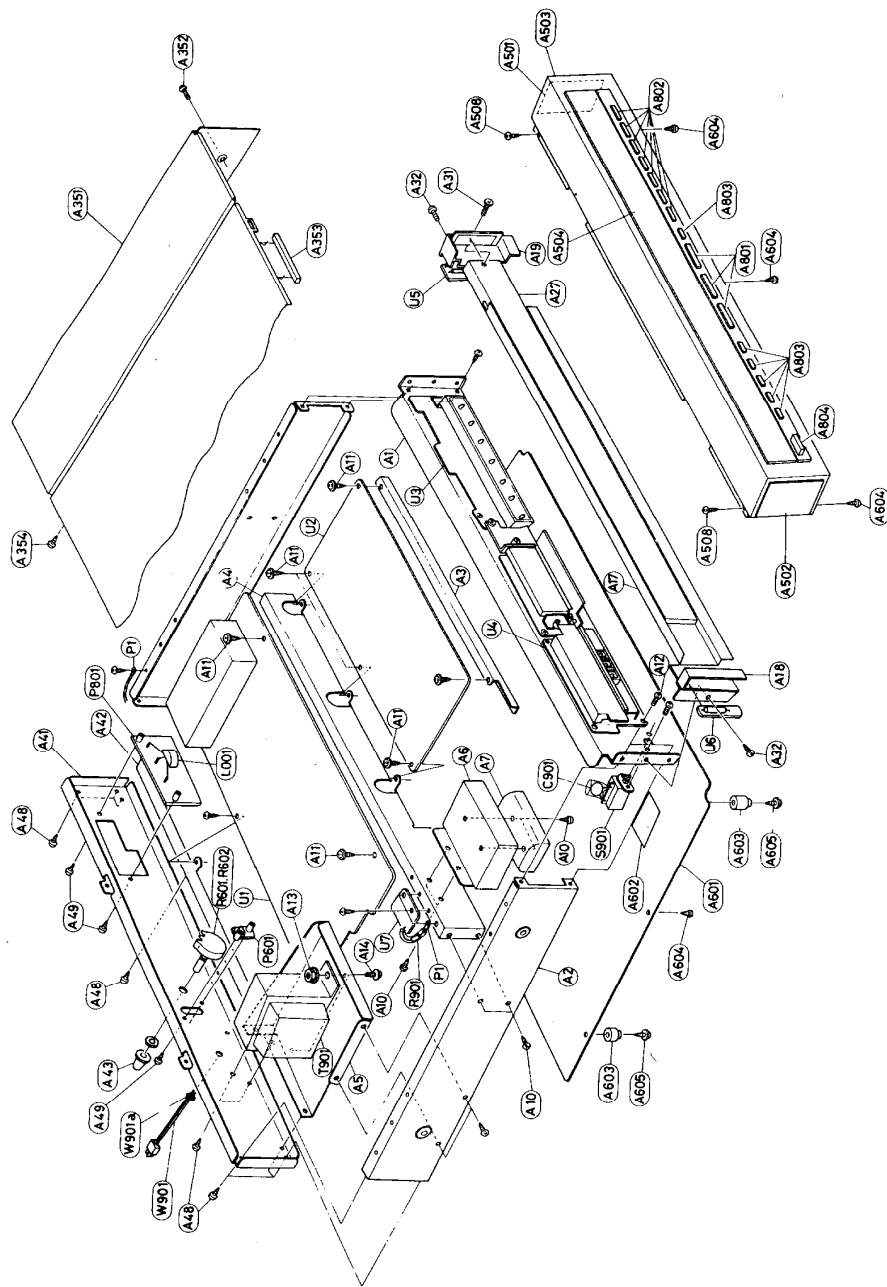


D model

REF NO.	PARTS NO.	DESCRIPTION
1	29050503	Master carton box
2	282301	Sealing hook
3	29090645	Pad (R)
4	29090644	Pad (L)
5	29100037A	650 x 850mm, Poly bag
	29095012-1	Protection sheet
6	260012	Dimpleton tape
7	29340563	Accessory bag as'y
	28365005-3	Instruction manual
	2920604A	Warranty card (V)
	29100006	5059-01, FW antenna
	253074	250 x 350mm, Poly bag
	253074	Connection cable
	25035040	Conversion plug (W)

-15-

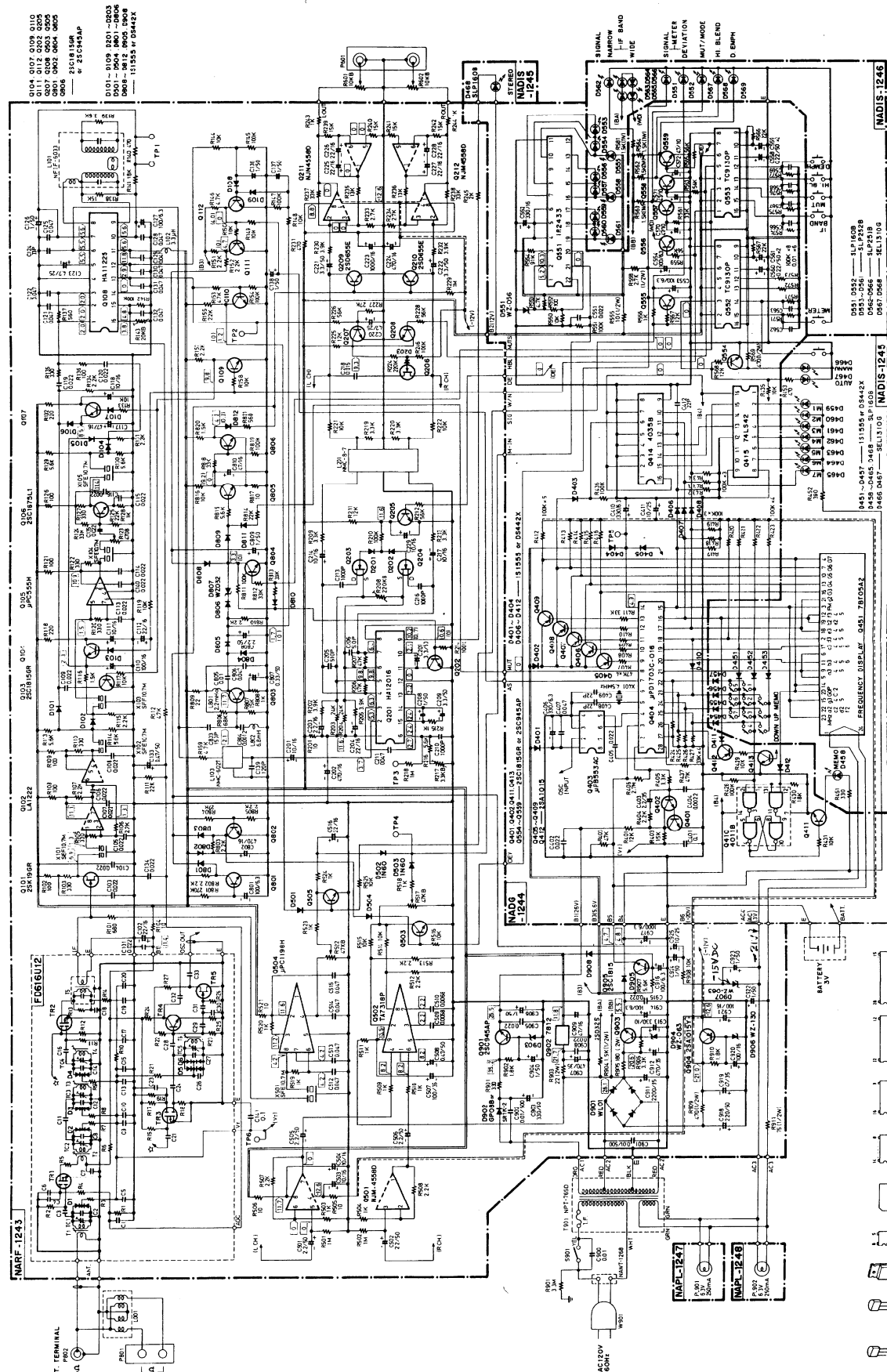
EXPLODED VIEW



PARTS LIST

REF. NO.	PARTS NO.	DESCRIPTION
A1	27110156	Front bracket
A2	27115098	Side bracket
A3	27140595	Bracket, pc board, front
A4	27140594	Bracket, pc board, middle
A5	27130286	Bracket, power transformer
A6	27140461	Bracket, battery
A7	27300360	Case, battery
A8	838130068	3TTS+6B, Tap screw
A9	831130088	3TTS+8B, Tap screw
A10	82113006	3P+6FN, Pan head screw
A11	86414010	FWN4+10FN, Flange nut
A12	838440109	4TTB+10C(BC), Tap screw
A13	838130068	3TTS+6B(BC), Tap screw
A14	838130068	W10 x 5, Nylon washer
A15	870069	
A16		
A17	13338901	Back plate ass'y
A18	28198570	Facet
A19	28198571A	Facet
A20	28191108	Clear plate (A)
A21	28191109-1	Clear plate (B)
A22	28191110-1	Clear plate (M)
A23	28191082	Clear plate (S)
A24	28130111	Clear plate
A25	28140384	Cushion
A26	28140385	Cushion
A27	28185141A	Side plate (L)
A28	28185142	Side plate (R)
A29	27120349	Back panel [D]
A30	27120350	Back panel [G]
A31	27120351	Back panel [W]
A32	27140500	Bracket, pc board, back
A33	28320540	Knob, output level control
A34	834430068	3TTS+6B(BC), Tap screw
A35	84430108	3TTS+10B(BC), Tap screw
A36	28140107	Cushion
A37	28184132	Top cover
A38	838440109	4TTB+10C(BC), Tap screw
A39	28140020	Cushion
A40	831430088	3TTS+8B(BC), Tap screw
A41	13338121	Front panel ass'y
A42	28125107	End cap (L)
A43	28125108	End cap (R)
A44	28191107	Clear plate

REF. NO.	PARTS NO.	DESCRIPTION
A50	27267162	Guide
A51	28140066	Cushion
A52	834430062	3TTS+6B(BC), Tap screw
A53	27170118	Bottom board
A54	27300359	Lid
A55	27175018	Leg
A56	831430088	3TTS+8B(BC), Tap screw
A57	834130128	3TTS+12B, Tap screw
A58	28320688	Knob (A)
A59	28320689	Knob (B)
A60	28320690	Knob (C)
A61	28320691	Knob, power
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A63	28320690	Knob, power
A64	28320690	Knob, power
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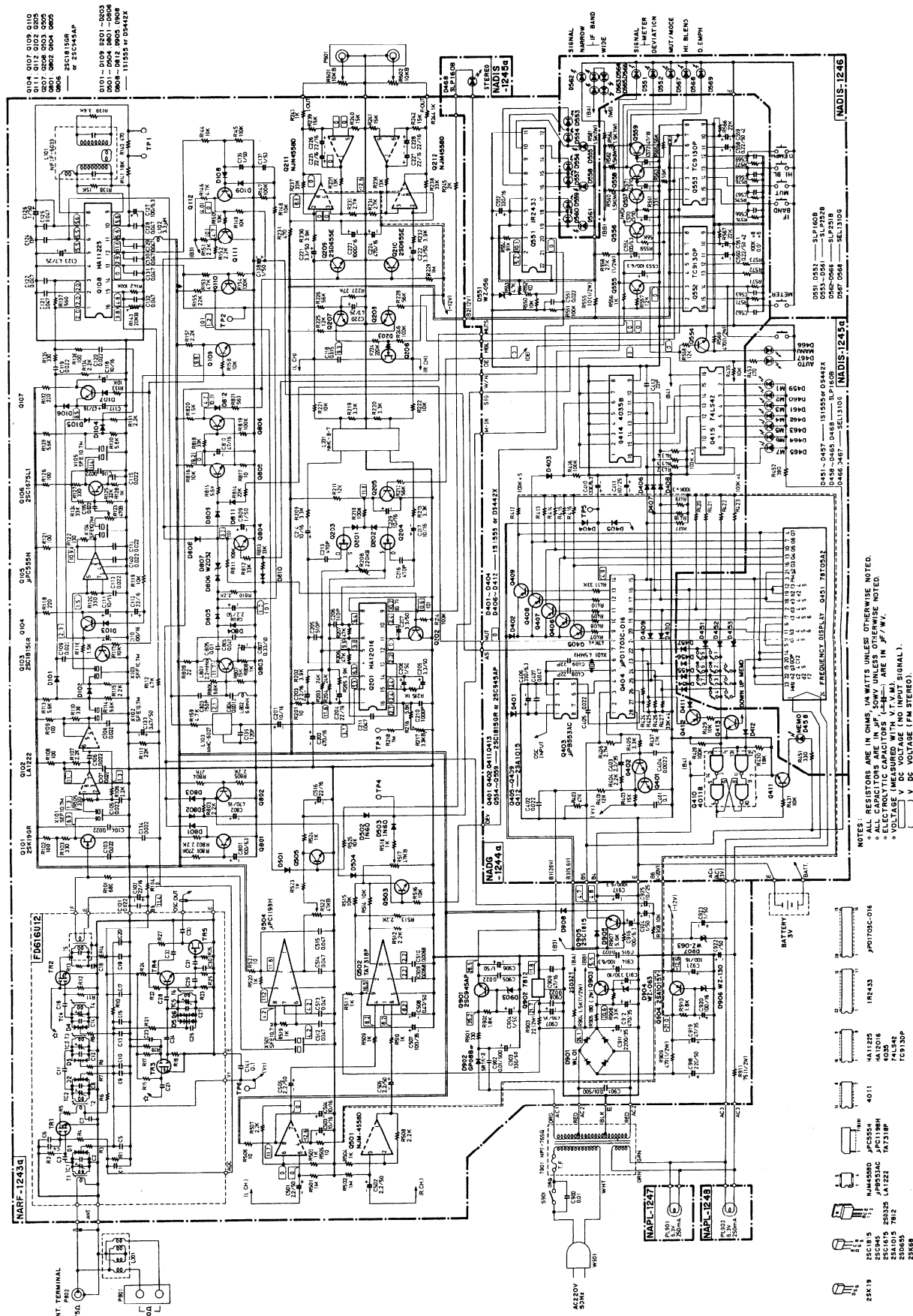


RESISTORS ARE IN OHMS, 1/4 WATTS UNLESS OTHERWISE NOTED.
ALL CAPACITORS ARE IN μ F, 50V UNLESS OTHERWISE NOTED.
ELECTROLYTIC CAPACITORS ($\frac{H}{-}$) ARE IN μ F / W.V.
VOLTAGE (MEASURED WITH V.T.V.M.).
() V DC VOLTAGE (FM INPUT SIGNAL).
() V DC VOLTAGE (FM STEREO).

25C1815	NU4550	4011	HA11225	IR2433	μ PD103C-016
25C945	μ PC555H		HA12016		
25C1675	μ PC1198H				
25A1013	μ FB553AC				
25D635	LA1222	TAT318P			
25K68		7812	74LS42		
			TC9130P		

SCHEMATIC DIAGRAM

G model



NOTES:

ALL RESISTORS ARE IN OHMS UNLESS OTHERWISE NOTED.

ALL CAPACITORS ARE IN μ F UNLESS OTHERWISE NOTED.

ALL ELECTROLYTIC CAPACITORS ARE IN μ F UNLESS OTHERWISE NOTED.

VOLTAGE MEASUREMENTS ARE IN VDC UNLESS OTHERWISE NOTED.

VOLTAGE MEASUREMENTS ARE IN VDC UNLESS OTHERWISE NOTED.

VOLTAGE MEASUREMENTS ARE IN VDC UNLESS OTHERWISE NOTED.

VOLTAGE MEASUREMENTS ARE IN VDC UNLESS OTHERWISE NOTED.

VOLTAGE MEASUREMENTS ARE IN VDC UNLESS OTHERWISE NOTED.

25K19

25K44

25K45

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25K50

25K51

PRINTED CIRCUIT BOARD-PARTS LIST**FM TUNER AND POWER SUPPLY PC BOARD (NARF-1243)**

CIRCUIT NO.	PARTS NO.	DESCRIPTION	CIRCUIT NO.	PARTS NO.	DESCRIPTION
TU001	Front end		C123	352750479	4.7 μ F, 25V, Elect.
	240048	FD616U12	C126	352780109	1 μ F, 50V, Elect.
	ICs		C127	352721019	100 μ F, 6.3V, Elect.
Q102	222577	LA1222, IF amplifier	C133	352784799	0.47 μ F, 50V, Elect.
Q105	222591	μ PC555H, IF amplifier	C136-C138	352780109	1 μ F, 50V, Elect.
Q108	222540	HA11225, FM IF system	C201	352741009	10 μ F, 16V, Elect.
Q201	222593	HA12016, Stereo decoder	C202	352744719	470 μ F, 16V, Elect.
Q211, Q212	222465	NJM4558D, Super servo amplifier	C203, C204	352742209	22 μ F, 16V, Elect.
Q501	222465	NJM4558D, Deviation indicator amplifier	C205, C206	372525114	510pF $\pm$ 5%, 50V, St
Q502	222529	TA7318P(R), Deviation indicator amplifier	C207, C209	352780339	3.3 μ F, 50V, Elect.
Q504	222657	μ PC1198H, Signal indicator amplifier	C208	352780109	1 μ F, 50V, Elect.
Q902	222780120	7812, Voltage regulator	C210	372521024	1,000pF $\pm$ 5%, 50V, St
	Transistors		C213, C216	372521024	1,000pF $\pm$ 5%, 50V, St [D]
Q101	2211815	2SK19TM (GR)	C213, C216	372524714	470pF $\pm$ 5%, 50V, St [G/W]
Q103	2211255	2SC1815 (GR)	C212, C215	372525114	510pF $\pm$ 5%, 50V, St [W]
Q104, Q107	2211255 or	2SC1815 (GR) or	C214, C217	352741009	10 μ F, 16V, Elect.
Q109-Q112	2210746	2SC945A(P)	C218	379121534	0.015 μ F $\pm$ 5%, 50V, DEW
Q106	2210823	2SC1675 (L-1)	C220	352750479	0.47 μ F, 25V, Elect.
Q202, Q205	2211255 or	2SC1815 (GR) or	C221, C222	352780339	3.3 μ F, 50V, Elect.
Q207, Q208	2210746	2SC945A (P)	C223	352741029	1,000 μ F, 16V, Elect.
Q203, Q204	2211303	2SK68A(M)	C224	352744709	47 μ F, 16V, Elect.
Q206	2211303	2SK68A (M)	C225-C228	352742209	22 μ F, 16V, Elect.
Q209, Q210	2211705	2SD655 (E)	C229	352741009	10 μ F, 16V, Elect.
Q503, Q505	2211255 or	2SC1815 (GR) or	C501, C502	352780229	2.2 μ F, 50V, Elect.
Q801, Q802	2210746	2SC945A (P)	C503, C504	352741009	10 μ F, 16V, Elect.
Q804-Q806			C505, C506	352780229	2.2 μ F, 50V, Elect.
Q803, Q901	2210746	2SC945A (P)	C507	352761010	100 μ F, 35V, Elect.
Q903	2201034 or	2SD325 (D) or	C508	352784799	0.47 μ F, 50V, Elect.
	2201035	2SD325 (E)	C516	352742209	22 μ F, 16V, Elect.
Q904	2211454	2SA1015 (Y)	C801	352721019	100 μ F, 6.3V, Elect.
Q905	2211254 or	2SC1815 (Y) or	C802	352744719	470 μ F, 16V, Elect.
	2211255	2SC1815 (GR)	C807	352783399	0.33 μ F, 50V, Elect.
	Diodes		C808	352780229	2.2 μ F, 50V, Elect.
D101-D109	223105 or	1S1555 or	C809	352780109	1 μ F, 50V, Elect.
D201-D203	223133	DS442X	C810	352744709	47 μ F, 16V, Elect.
D501, D504	223105 or	1S1555 or	C903	352783319	330 μ F, 50V, Elect.
D801-D812	223133	DS442X	C904, C906	352780109	1 μ F, 50V, Elect.
D502, D503	223103	1N60	C907	352764719	470 μ F, 35V, Elect.
D901	223862	WL0	C909	352744709	47 μ F, 16V, Elect.
D902	223848 or	GP08B or	C911	352762229	2,200 μ F, 35V, Elect.
	223804	SR1K-2	C912	352764719	470 μ F, 35V, Elect.
D903	223979	RD27EB	C913	352733319	330 μ F, 10V, Elect.
	223922	WZ270	C914, C916	352721019	100 μ F, 6.3V, Elect.
D904	224020	WZ063	C917	352721029	1,000 μ F, 6.3V, Elect.
D905, D908	223105 or	1S1555 or	C918	352782219	220 μ F, 50V, Elect.
	223133	DS542X	C919	352764709	47 μ F, 35V, Elect.
D906	223924	WZ-130	C920, C921	352741019	100 μ F, 16V, Elect.
D907	224020	WZ-063	C922-C924	352780109	1 μ F, 50V, Elect.
	Transformer		C925	352780339	3.3 μ F, 50V, Elect.
L101	233255	NFIF-6033, IFT		Resistors	
	Coils		R123	5225026	N10HR470BD, Narrow IF level adjust. semi-fixed
L102	233105 or	NCH-1005 or	R143	5215003	N08HR20KBC, Muting level adjust. semi-fixed
	233024	NCCH-1501	R208	5225037	N10HR220KBD, Stereo separation adjust. semi-fixed
L103	233236	NMC-6027	R217	5225029	N10HR3.3KBD, V.C.O. (76kHz) adjust. semi-fixed
L201	233032A	NMC-8-7	R517, R522	5225034	N10HR47KBD, Deviation/signal indicator level adjust. semi-fixed
L801	233031	NMC-9-1	R903	441722204	22 Ω , 2W, Metal oxide film
L802	233122	NCH-3013	R904	441521524	1.5k Ω , 1/2W, Metal oxide film
	Ceramic filters		R905	441721814	180 Ω , 2W, Metal oxide film
X101, X102	3010041	SFE10, 7MX	R909	441524714	470 Ω , 1/2W, Metal oxide film
X103-X105	3010043	SFE10, 7MM	R911	441527504	75 Ω , 1/2W, Metal oxide film
X501	3010006	SFE10, 7MA			
	Capacitors				
C102	352742209	22 μ F, 16V, Elect.			
C110	352741019	100 μ F, 16V, Elect.			
C111, C118	352741009	10 μ F, 16V, Elect.			
C112	352742209	22 μ F, 16V, Elect.			
C117	352744709	47 μ F, 16V, Elect.			

DIAL LAMP INDICATOR PC BOARDS (NAPL-1247/1248)

CIRCUIT NO.	PARTS NO.	DESCRIPTION
PL901, PL902	210064A	250mA, 6.3V, Lamp