

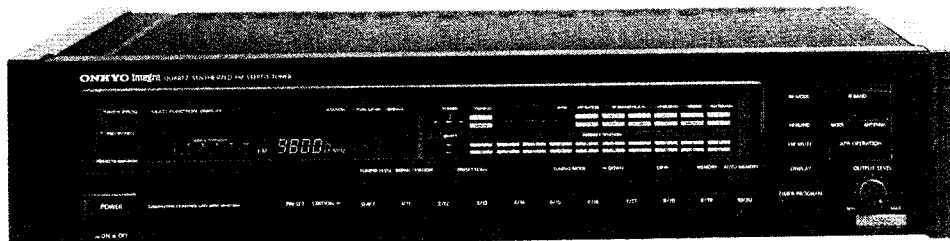
ONKY-00416

SERIAL No. 3275

# ONKYO SERVICE MANUAL

## SYNTHESIZED FM STEREO TUNER

MODEL T-9990



### SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY MARK  $\triangle$  ON THE SCHEMATIC DIAGRAM AND IN THE PARTS LIST ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE THESE COMPONENTS WITH ONKYO PARTS WHOSE PARTS NUMBERS APPEAR AS SHOWN IN THIS MANUAL.

MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DETERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE SUPPLY CIRCUIT BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

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**ONKYO**  
**AUDIO COMPONENTS**

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## SPECIFICATIONS

Tuning Range:	87.5 – 108.0MHz (AUTO MODE 50kHz steps, MANUAL MODE 25kHz steps)	AM Suppression Ratio:	60dB
Usable Sensitivity:	Mono: 0.8 $\mu$ V (S/N 26dB, 40kHz Dev.) DIN	Total Harmonic Distortion:	Mono: 0.009% (IF: wide) Stereo: 0.02% (IF: wide)
50dB Quieting Sensitivity:	Stereo: 20.0 $\mu$ V, (S/N 46dB, 40kHz Dev.) DIN	Frequency Response:	30 – 15,000Hz (+0.5dB, –1.0dB)
Capture Ratio:	1.0dB	Stereo Separation:	55dB at 1kHz (IF: wide) 33dB at 70 – 10,000Hz (IF: wide)
Image Rejection Ratio:	100dB	Output Voltage:	0 – 1.5V
IF Rejection Ratio:	100dB	Dimensions (W × H × D):	465 × 103 × 387mm 18-5/16" × 4-1/16" × 15-1/4"
Signal-to-Noise Ratio:	Mono: 95dB (IHF) Stereo: 85dB (IHF)	Weight:	8.5kg, 18.7lbs.
Selectivity:	80dB ( $\pm$ 300kHz, IF: super narrow)		

Specifications and features are subject to change without notice.

## SERVICE PROCEDURES

### 1. Replacing the lamp

This unit uses the lamp listed below.

Circuit no.	Parts no.	Description
Q754	210064A	PL 6.3V, 250mA, Dial plate illumination

### 2. Memory Preservation

This unit does not require memory preservation batteries. A built-in memory power back-up system preserves contents of the memory during power failures and even when the unit is unplugged. The unit must be plugged in and the power switch turned on and off once in order to charge the back-up system. Note that since this is not a permanent memory, the power switch must be turned on and off a few times each month to keep the back-up system operable. The period of time during which memory contents are preserved after power has last been turned off varies depending on climate and the location and placement of the unit. On the average, memory contents are protected over a period of 3 to 4 weeks (a minimum of 2 weeks) after the last time power has been turned off. This period is shorter when the unit is exposed to very high humidity or used in an area with an extremely humid climate.

### 3. Procedures for replacement of flat packaged ICs

#### 1. Tools to be used:

- (1) **Soldering iron** . . . . Grounded soldering iron or soldering iron with leak resistance of 10 Mohms or more.

Form of soldering iron's tip:

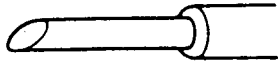


Fig. 1

- (2) **Magnifying glass** . . . for checking of finished works  
 (3) **Tweezers** . . . . . for handling of IC and forming of leads  
 (4) **Grounding ring** . . . Countermeasure for electrostatic breakdown  
 (5) **Nipper** . . . . . for removing defective IC  
 (6) **Small brush** . . . . . for application of flux

#### 2. Work Procedures:

##### (1) Remove the defective IC

Cut all leads of the defective IC one by one using a nipper and remove the IC.

##### (2) Clean the pattern surface of the PC board.

Get rid of the remaining leads and solder.

##### (3) Check and form the leads of the new flat packaged IC to be installed.

From every lead on the new IC using a pair of tweezers, so that all of them are aligned neatly without being risen, twisted or inclined toward one side. Especially the rising portion of every lead must be formed with greatest care.

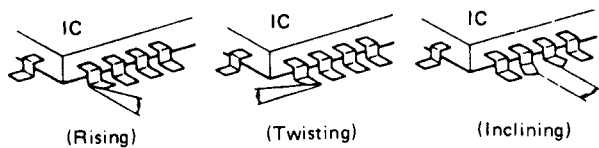


Fig. 2

##### (4) Apply flux to the PC board.

Apply flux to the pattern surface of the PC board which has been cleaned, as shown in the illustration. The area to be applied with flux is the portion of about 2.5mm in width where the IC's leads are to be soldered.

Be careful to apply minimum amount of flux required so as not to smear it on unwanted areas.

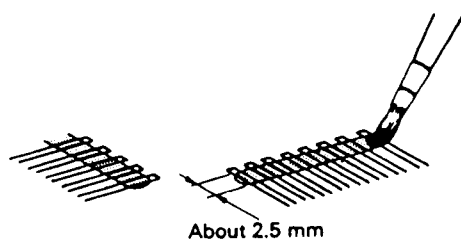


Fig. 3

##### (5) Temporarily tighten the IC

Carefully align the pattern and IC's leads, so that the IC will be temporarily tightened to the pattern on the four leads at the corners. At this time, soldering is required, but no need to apply soldering material.

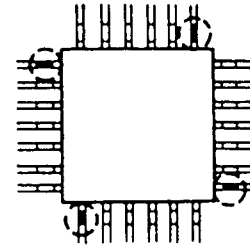


Fig. 4

##### (6) Apply flux to IC's leads

Apply flux to the areas of IC's leads where soldering is to be performed. Be careful not to smear flux on the root portion of any lead or the body of IC.

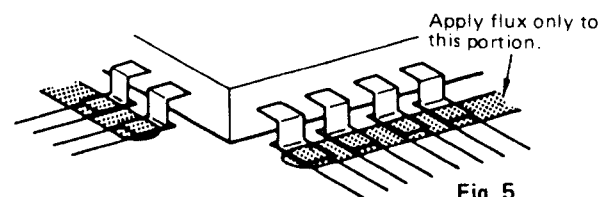


Fig. 5

##### (7) Soldering

While attaching the tip of the soldering iron to the soldering point as shown in the illustration, feed 2-5mm of soldering wire. Then, slowly move the iron in the direction indicated by the arrow in the illustration, so that the leads will be soldered to the pattern. Move the iron in the rate of approximately 1cm in 5sec. Proceed with your work while confirming a clean fillet of solder is formed on each lead, subsequent to the melting of flux.

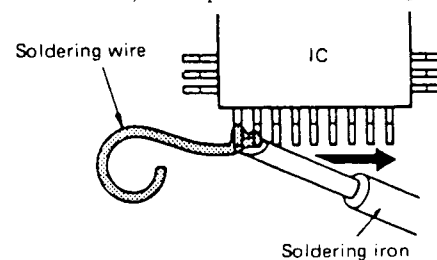


Fig. 6

#### CAUTION

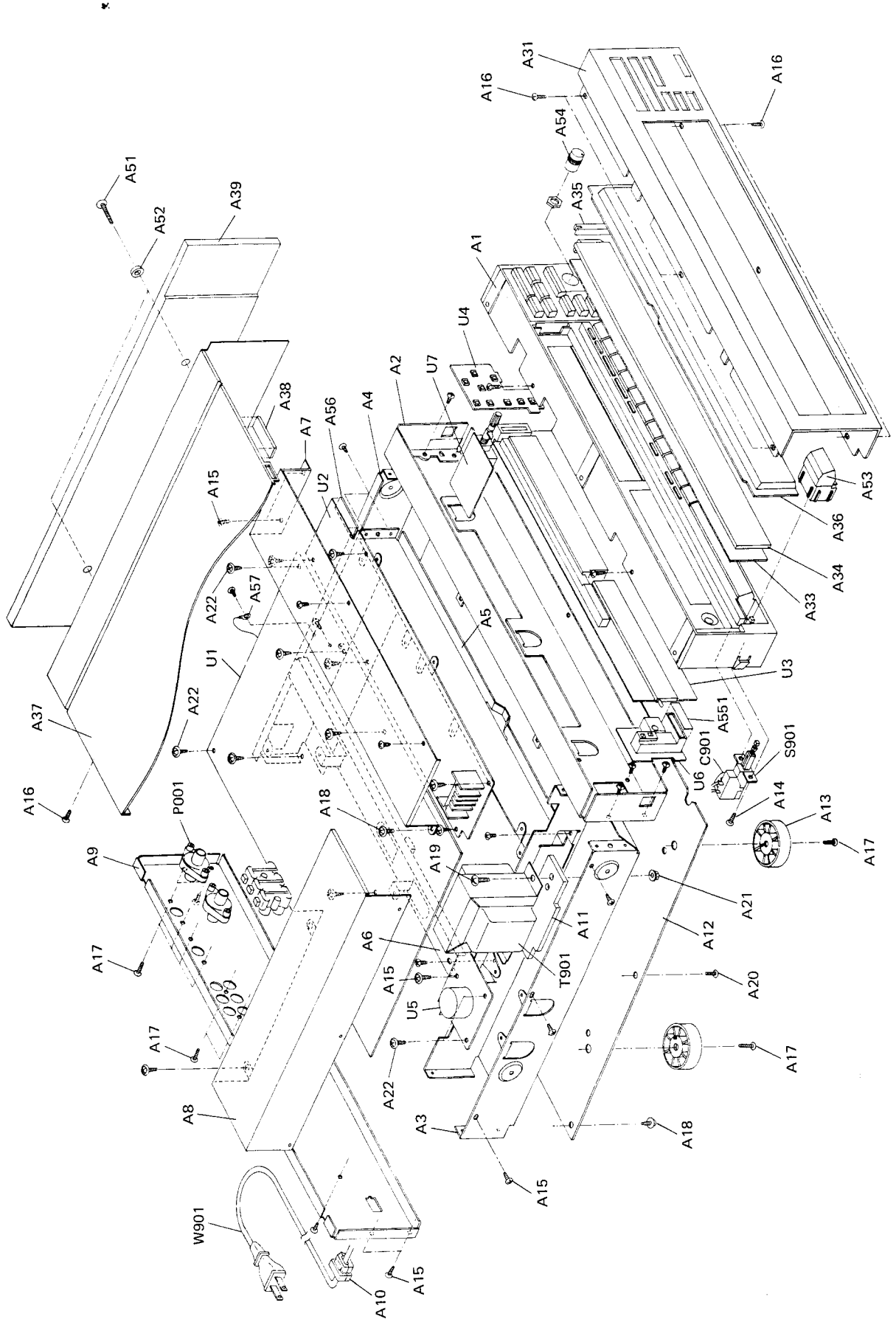
- 1) If you move the iron too quickly, loose soldering is likely to result.
- 2) Be especially careful when soldering the first lead where loose soldering is most liable to be formed.

##### (8) Check the results

When soldering of all leads is finished, check the soldered portion on every lead with a magnifying glass. A tester must not be used or checking of any soldered position

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**EXPLODED VIEW**



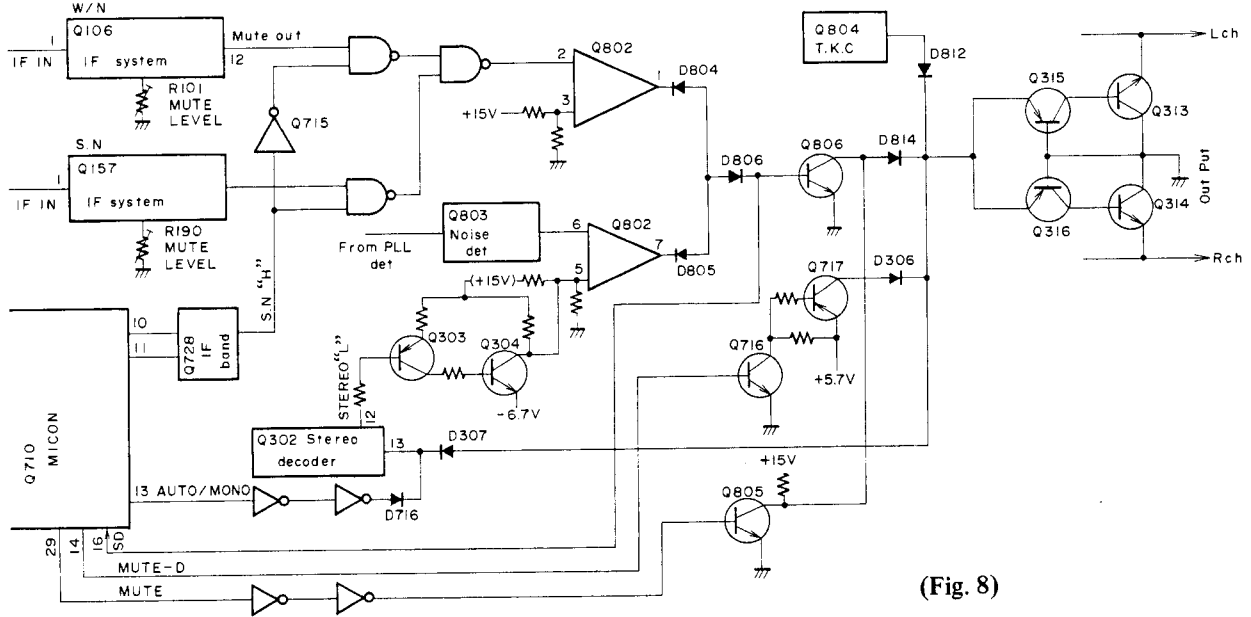
## PARTS LIST

REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
A1	27110375A	Front bracket ass'y	A39	28185255	Side panel L
A2	27110377A	Front bracket RE		28185256	Side panel R
A3	27115228A	Side bracket L	A51	386440303	4STV+30CQ(BC), Special screw
A4	27115229A	Side bracket R	A52	8700086	Special washer
A5	27130498	Bracket FR	A53	28323145A	Knob POWER
A6	27130499	Bracket RE	A54	28323031-1	Knob TONE
A7	27225085A	Shield cover FR	A55	28199172	Film
A8	27225086-1	Shield cover PT	A56	28175144	Insulated plate
A9	27121044A	Back panel	A57	223004-1	Terminal
A10	27300750	△ Strainrelief	C901	3500065A	△ 0.01μF, AC400V/125V, Capacitor IS
A11	27270214A	Spacer	C901a	27300601	△ SB-1925, Cover for C901
A12	27170242A	Bottom board	P001	25060112	NTM-1PDMR046, Antenna terminal
A13	27175152	Leg	S901	25035571	△ NPS-111-L533P, Power switch
A14	833430080	3TTP+8P(BC), Tapping screw	T901	2300261	△ NPT-973C, Power transformer
A15	834430068	3TTS+6B(BC), Tapping screw	U1	1A069590-1A	NARF-3090-1a, Main circuit pc board ass'y
A16	838430088	3TTS+8B(BC), Tapping screw	U2	1A069591-1	NADG-3091-1, Digital circuit pc board ass'y
A17	834430108	3TTS+10B(BC), Tapping screw	U3	1A069592-1	NADIS-3092-1, Display circuit pc board ass'y
A18	381430088	3TTW+8B(BC), Tapping screw	U4	1A069593-1	NASW-3093-1, Operation switch pc board ass'y
A19	838440129	4TTB+12C(BC), Tapping screw	U5	1A069594-1A	NASW-3094-1a, Power supply circuit pc board ass'y
A20	801230	3STS+8BQ(BC), Tapping screw	U6	1A069596-1	NAETC-3096-1, Remote control circuit pc board ass'y
A21	86414010	FWN4 × 10FN, Flange nut	U7	1A069597-1	NAETC-3097-1, Output volume pc board ass'y
A22	831130088	3TTW+8B, Tapping screw	W901	253127B or 253129A	△ AS-CEE, Power supply cord
A31	1A070121	Front panel ass'y			
	28135145	Badge			
A33	28133188B	Back plate			
A34	28130247A	Dial plate			
A35	27267513	Guide, dial plate			
A36	28191436	Clear plate			
A37	28184318A	Top cover			
A38	28140020	Cushion			

NOTE: THE COMPONENTS IDENTIFIED BY MARK **△** ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PART NUMBER SPECIFIED.

# CIRCUIT DESCRIPTIONS

## 1. Muting circuit



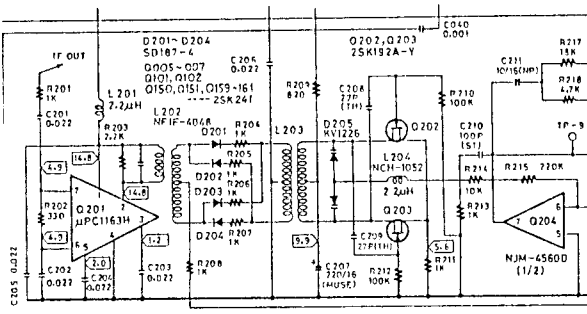
(Fig. 8)

In Q106 and Q157 FM IF system IC, the muting IF level (determined by pin 15 semi-fixed resistor) detector circuit and zero cross detector circuit are built in. At the time of tuning, this output at pin 12 becomes 0V. The Q715 NAND gate is the selector gate circuit for SUPER NARROW and WIDE/NARROW muting.

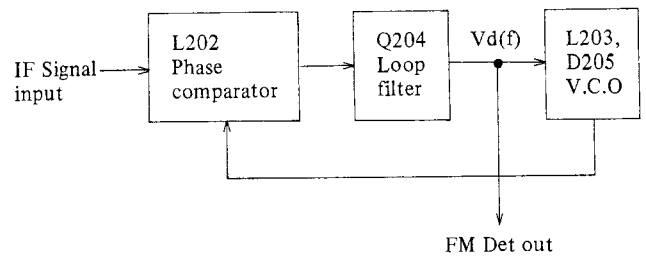
At the time of AUTO TUNING if a broadcast station is picked up, pin 12 of Q106 goes to low level and Pin 2 of Q802 goes low. Also, at the same time, when noise is not

included in the detected signal, pin 6 of Q802 goes low. Because of that, output pins 1 and 7 of Q802 have +12V, the anode side of D806 has +5V, pin 16 SD terminal of the Q710 microcomputer goes high, and the automatic tuning is completed. In addition, at the same time Q806 goes ON, Q313~Q316 are in cutoff state, and the signal is output. When the Q805 transistor muting switch is OFF (when the FM MUTE indicator is extinguished), the muting is forced to the open condition.

## 2. PLL detector circuit



(Fig. 9)



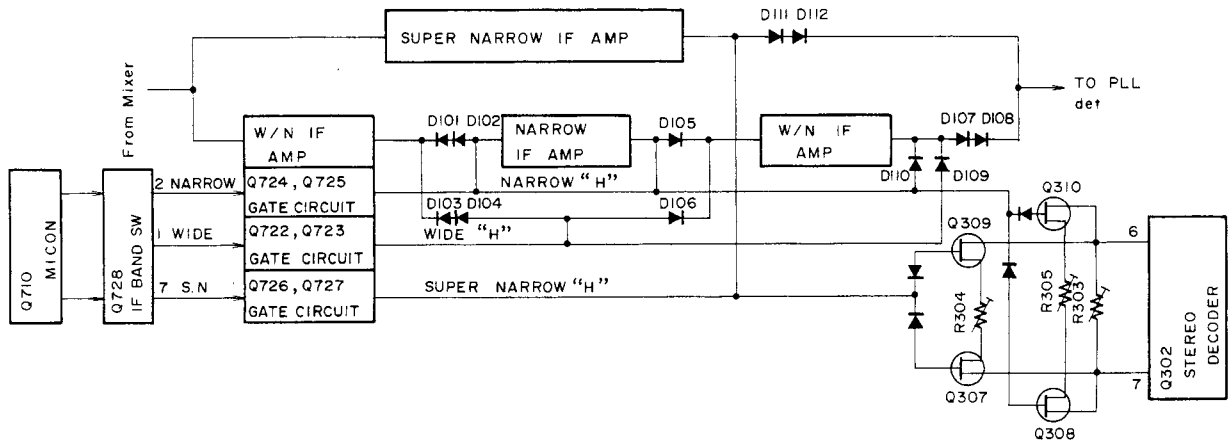
(Fig. 10)

In this device, in order to have a high S/N and low percentage of distortion, a PLL (phase locked loop) detector is used. Because the PLL detector is a closed loop detector, noise generated within the loop is suppressed, and it is an extremely good S/N detector.

With L203 and D205 as a 10.7MHz voltage controlled oscillator, and with L202, and D201~D204 as a single phase comparator, the single phase error portion of the

FM IF waveform and 10.7MHz voltage controlled oscillator signal are output at the center point of the secondary side of L202, passed through the loop filter, and the composite signal is then taken out. Also, when the 10.7MHz intermediate frequency is transferred, the amount of variation is compensated by the D205 variable capacitor diode, and the output error of the single phase comparator is always set to a zero level.

3. IF band selection circuit



(Fig. 11)

At the A/D input signal pin 63 of Q710, when the SD terminal goes low, automatically the IF band is determined. At the time of NARROW selection, the output of pin 10 goes H, and at the time of SUPER NARROW, pin 11 goes H. In Q728, at the band selection switch, pins 1, 2, and 7 respectively go high for WIDE, NARROW, and SUPER NARROW.

– Wide operation –

Q722 and Q723 go ON, the collector voltage of Q723 becomes essentially +B2, D103, D104, and D106 go ON, and the IF signal passes through D103, D104, and D106.

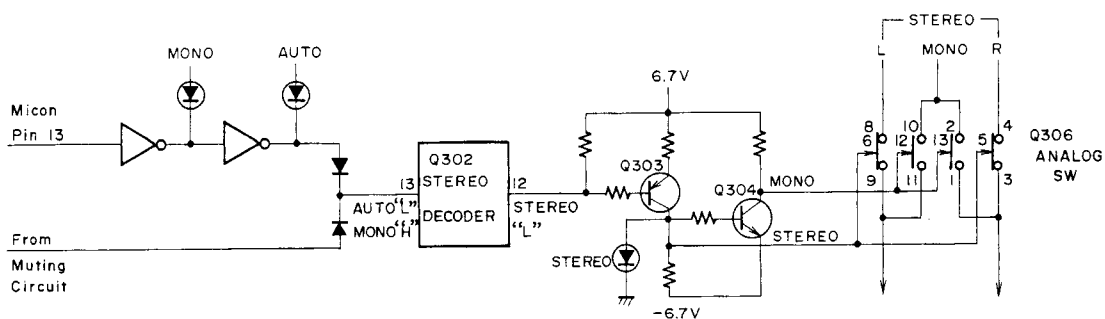
– Narrow operation –

Q724 and Q725 go ON, D102, D101, and D105 go ON, and the IF signal passes through NARROW amplifier Q104. Also, at the time of WIDE, in order to change to maximum operation, Q308 and Q310 are turned ON, and with R305, compensation of operation is carried out.

– Super Narrow operation –

Q726 and Q727 turn ON, D111 and D112 diodes go ON, and the signal passed through the super narrow IF amplifier is output in the PLL detector circuit. Also, for the alignment of narrow, Q307 and Q309 go ON, and separation is compensated by R304.

4. Stereo switch circuit



(Fig. 12)

When a stereo broadcast is received, pin 12 of Q302 goes “L”, Q303 goes ON, the collector voltage becomes H, and the stereo indicator lights. Also, pins 5 and 6 of the Q306 analog switch go H, conduction occurs between 3~4 pins and 8~9 pins, and at the Q302 stereo decoder, the L and R divided signal is output. In addition, at the

time of monaural broadcast reception, and when the MODE switch is in the MONO position, pin 12 goes H, and because Q303 and Q304 are in the cutoff condition, pins 12 and 13 of Q306 go to high level, conduction takes place between pins 10~11 and 1~2, and the detected signal passes through the AF amplifier to be output.

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5. Explanation of PLL synthesizer and controller IC

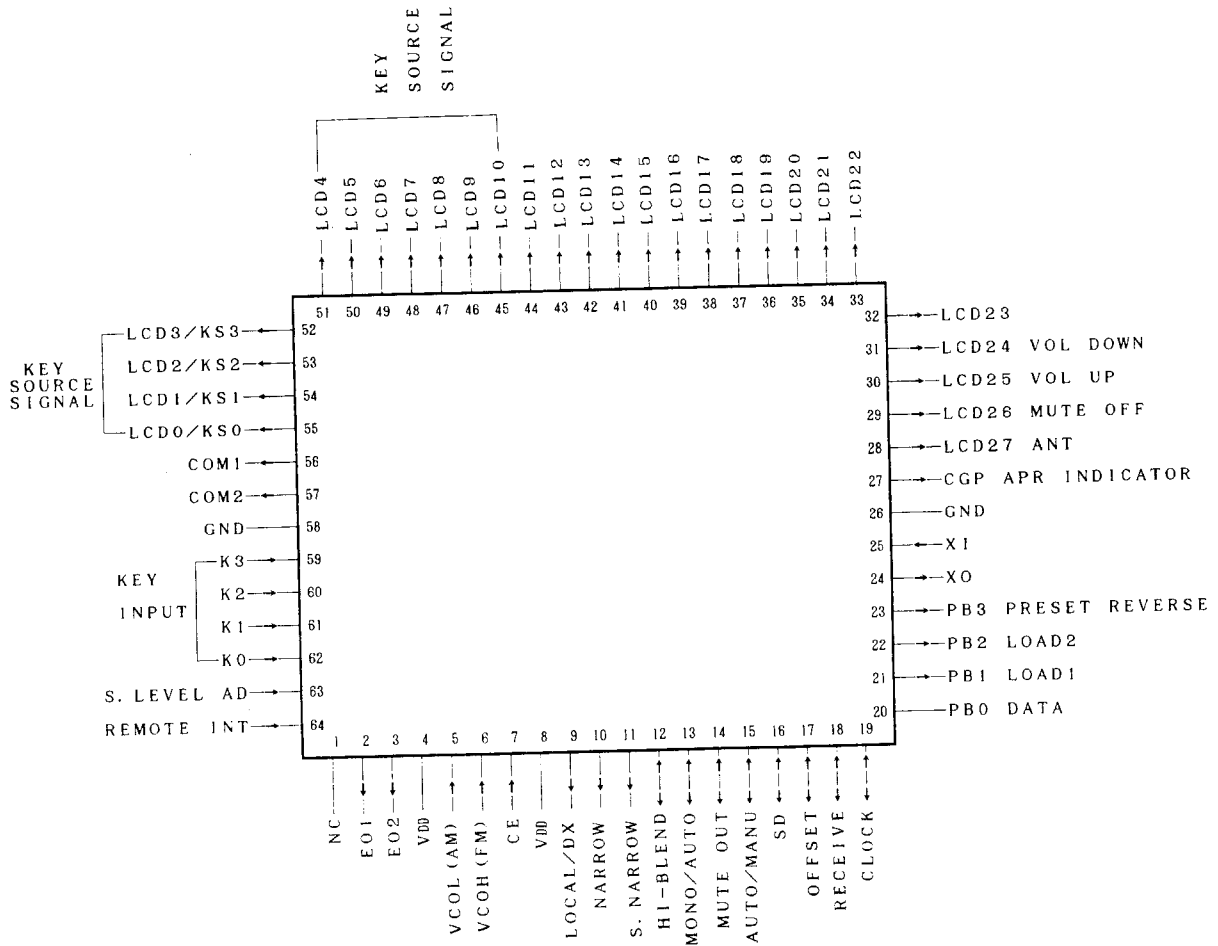
5-1. APR function (Automatic Precision Reception)

On the FM band, if there is a high level input at the SD terminal, depending upon the station signal level, there will be optimum reception function, and the output (Refer table 1) will automatically be changed.

ANT	RF	IF	AUTO/MONO	HI-BLEND
A	LOCAL	WIDE NARROW	AUTO	OFF
B	DX	SUPER NARROW	MONO	ON

Table 1 Changeover key means of APR execution.

5-2. Terminal connection



Pin No.	Symbol	Description
1	NC	No connection.
2	E01	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 diode in the local oscillation circuit of FM through the low pass filter Q701, Q702 and Q703. The output from both terminals is the same, but only E01 is used.
3	E02	Same as above.
4	VDD	This is the device power source terminal. At the time of operation, the supply is 5V. The internal data memory (RAM) is maintained by means of the C712 super capacitor.
5	VCOL (AM)	AM local oscillation signal input terminal. Not used.



Pin No.	Symbol	Description
6	VCOL (FM)	At the FM local oscillation signal input terminal, there is direct input passage through the buffer.
7	CE	Chip enable input terminal. Device selection signal terminal. Normal operation at the high level and Memory preservation at the low level.
8	VDD	Device power source terminal.
9	LOCAL/DX	This is the output terminal for RF, either Local or DX. It is "H" for DX.
10	NARROW	This is the output terminal for IF, either Narrow or Wide. It is "H" for Narrow.
11	SUPER NARROW	This is the output terminal for IF, either Super Narrow or Wide. It is "H" for Super Narrow.
12	HI-BLEND	This terminal is for Hi-blend output ON or OFF. ON is "H".
13	MONO/AUTO	In the reception mode, the output terminal is either Auto or Mono. It is "H" for Mono.
14	MUTE OUT	The muting output terminal operates with the following modes. Power source ON, MANUAL/AUTO UP/DOWN, PRESET MEMORY call out, ANTENNA, RF, IF, AUTO/MONO, at time of MUTING selection, when the PROGRAM DISPLAY key is pushed, AUTO MEMORY time.
15	AUTO/MONO	This is the output terminal for Auto or Manual in the tuning mode. It is "H" for Auto.
16	SD	Station detection signal input terminal. "H" when active.
17	OFFSET	Offset output terminal when the signal input level is large. "H" when active.
18	RECEIVE	Indication output terminal when be received the code from remote control.
19	CLOCK	Clock signal output terminal to $\mu$ PD6320GC.
20	DATA	Data signal output terminal to $\mu$ PD6320GC.
21	LOAD1	Load signal output terminal to $\mu$ PD6320GC.
22	LOAD2	Load signal output terminal to $\mu$ PD6320GC.
23	PRESET	This is the output terminal for Shift indicator, either 1-10 or 11-20. 11-20 is "H".
24	XO	Connect to the 4.5MHz crystal osillator.
25	XI	
26	GND	Ground terminal.
27	APR	APR indication terminal.
28	ANT	This is the output terminal for ANT, either A or B. It is "H" for B.
29	LCD26/PL2	This is the out terminal for Muting of weak input, either ON or OFF. It is "H" for OFF.
30	VOL UP	Volume UP signal output terminal from remote control. Active high.
31	VOL DOWN	Volume DOWN signal output terminal from remote control. Active high.
32-44	LCD23-11	No connection.
45-55	LCD10/KS10 LCD0/KS0	These are the output terminals for key return signal source. "H" when active.
56, 57	COM1, COM2	Not used.
58	GND	Ground terminal.
59	K3	These are the input terminal for key return signal source and diode matrix.
60	K2	
61	K1	
62	K0	
63	SLEVEL	Station signal level input terminal.
64	REMOTE	System code input terminal from remote control. Active at the leading edge.

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### 5-3. Explanation of momentary key

Input \ Output		59	60	61	62
		K3	K2	K1	K0
55	LCD0		PRESET SCAN	AUTO MEMORY	AUTO/MENU
54	LCD1	HI-BLEND	AUTO/MONO	IF	RF
53	LCD2	ANT	SIGNAL DISPLAY	TUNING LEVEL	MEMORY
52	LCD3	M4/M14	M3/M13	M2/M12	M1/M11
51	LCD4	M8/M18	M7/M17	M6/M16	M5/M15
50	LCD5		PRESET REVERSE	M10/M20	M9/M19
49	LCD6	AM	FM	UP	DOWN
48	LCD7		PROGRAM DISPLAY	APR	PROGRAM
47	LCD8	REM10	DISPLAY	AM1	AM0
46	LCD9	PRESET16	FM ONLY	FM1	FM0
45	LCD10	SYSTEM	ANTA	ANTAPRD	ANTMEMO

#### AUTO/MANUAL

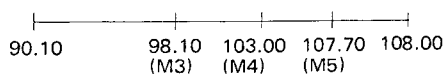
Selector key for AUTO TUNING/MANUAL TUNING  
Causes reversal of AUTO/MANU.  
"H" when AUTO.

#### AUTO MEMORY

When the AUTO MEMORY key is pushed, "MEMORY" is displayed for 5 seconds, and during this, if the PRESET STATION key is pushed, AUTO SCANNING begins. The SD signal is above the tuning level preset from memory for that station.

At this time the APR data is also stored in memory. If the station key is pushed within 5 seconds, the memory display is cleared, and the condition for memory possibility is cancelled.

Example: A 90.10MHz signal is being received. The AUTO MEMORY key is pushed, and if within 5 seconds key M3 is pushed, continuous UP feed is carried out, and if a station is received, the M3 preset channel display is executed. If there is a 1 second stop, the UP operation starts again. In the manner shown below, the data is stored in memory for M4 and successive positions in sequence up to 108.00MHz, and when scanning is completed, at the final memory station call out, the automatic memory operation is completed.



At frequencies above 90.10MHz, when there are no broadcast stations, if the data of M2 is called out, the automatic memory operation stops. In the case of starting from M1, the lower limit frequency of 87.50MHz is called out and the operation stops.

#### PRESET SCAN

Every 5 seconds the preset memory data is received with a sawtooth mode in the up direction. At this time, the preset station display (FL tube and LED) blinks at 1Hz. If at that time there is preset reception, after the next preset, if there is no preset reception, scanning occurs from M1.

If, during the above operation, any key is pushed, the scan stops, and that key's operation is carried out. When the PRESET SCAN key is pushed, the operation is cancelled.

#### RF

With the RF selector key, the LOCAL/DX output can be reversed.  
The level is "H" when in DX.

#### TUNING LEVEL – Tuning level selector key

When this key is pushed, after the display of about 1.5 seconds, the present tuning level (when RF=LOCAL, a value of 10dB) the display returns to the original value.

During the tuning level display, if the TUNING LEVEL key is pushed, the display will appear for about another 1.5 seconds. Also, during this display, the TUNING output goes "H". During this interval, when another key is pushed, the display returns, and that key's operation is carried out.

#### UP/DOWN – Receiving channel UP/DOWN key

(I) Manual tuning mode

Each time the UP(DOWN) key is pushed, the frequency is raised (lowred) one step.

Also, if the key is pushed continuously for more

than 0.5 second, up to the time the key is released, continuous stepping will be carried out at about 80msec/step (in the FM band with 25kHz step, at about 50msec/step).

(II) Auto tuning mode

When the UP(DOWN) key is pushed, continuous feeding is carried out. At that time, APR functions, and the conditions required for AUTO TUNING steps are carried out.

The scanning speed is about 100msec/step.

During scanning, if the same direction UP/DOWN key is pushed, the scanning continues, and when any other key is pushed, the scanning stops, and that key's operation is carried out.

**PROGRAM – Program mode setting key**

When the program mode is ON, at the time of power being turned ON, the preset memory (M1-M5) is called out in sequence. (After M5, the sequence is repeated starting again with M1.)

**APR – APR execution key**

Each time this key is pushed, the APR is executed one time.

**PROGRAM DISPLAY**

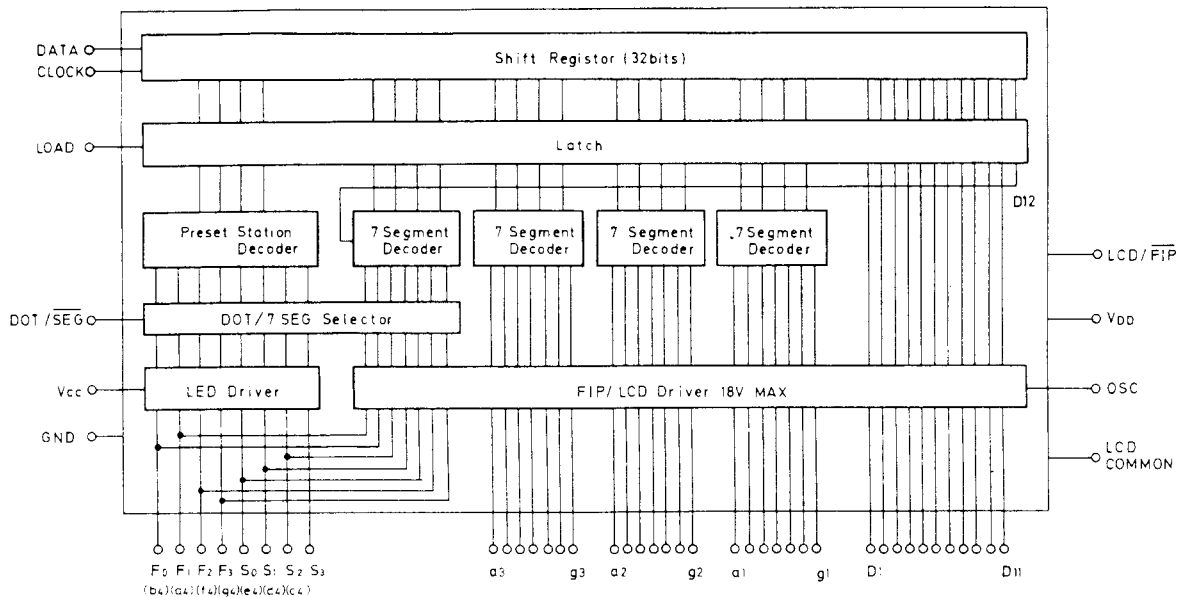
In the program mode, this key is used in order to confirm the next preset memory to be called out. Accordingly, this is used only in the program mode.

If this key is pushed while in the program mode, the preset memory to be called will be called when CE next goes from "L" to "H".

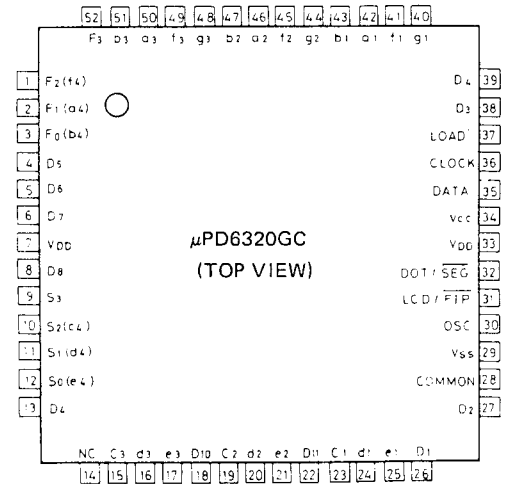
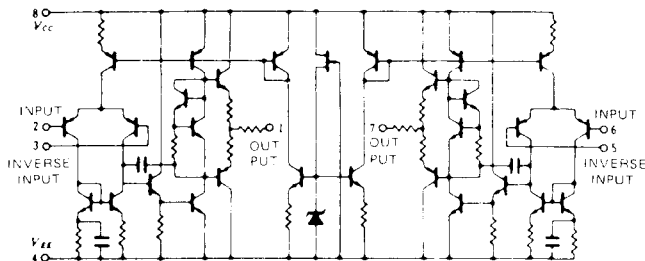
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# IC BLOCK DIAGRAM

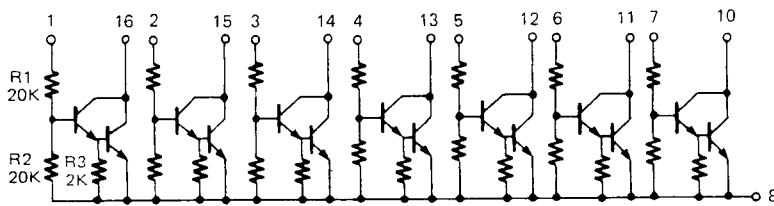
μPD6320GC (Indicator drive)



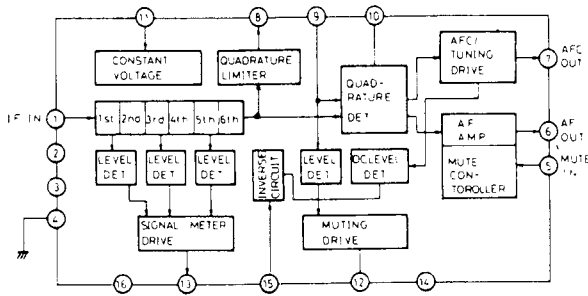
## NJM4560D (Operation amplifier)



## μPA81C (Buffer/Inverter)

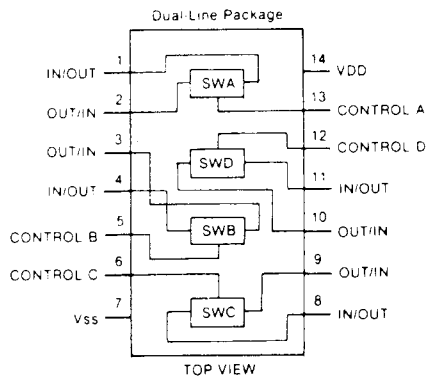


LA1235 (FM/IF system)

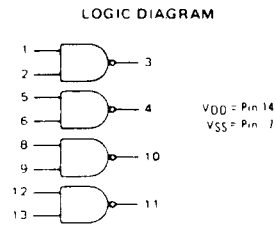


- 1. IF signal input
- 2. IF amplifier switch input  
H level: Off
- 5. Muting switch input
- 6. Composite signal output
- 7. AFC output
- 8. IF amplifier output
- 9. 10.7MHz input
- 10. Reference voltage
- 11. Power supply
- 12. Muting output  
Tuned: L level
- 13. Signal strength output
- 15. Muting level

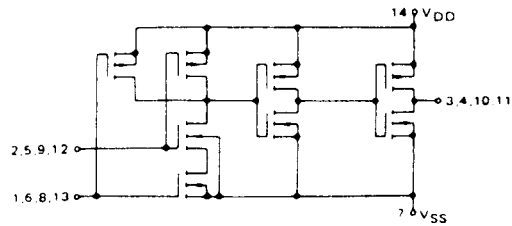
4066B (Analog switch)



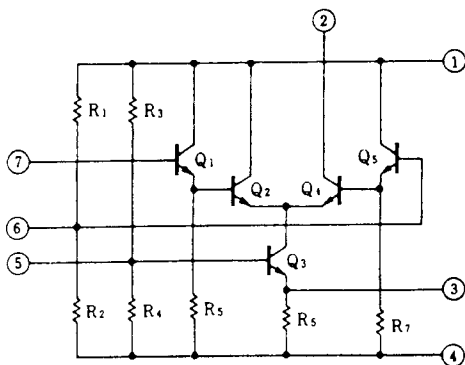
4011B (NAND gate)



CIRCUIT SCHEMATICS (1/4 of Device Shown)



μPC1163H (RF amplifier)

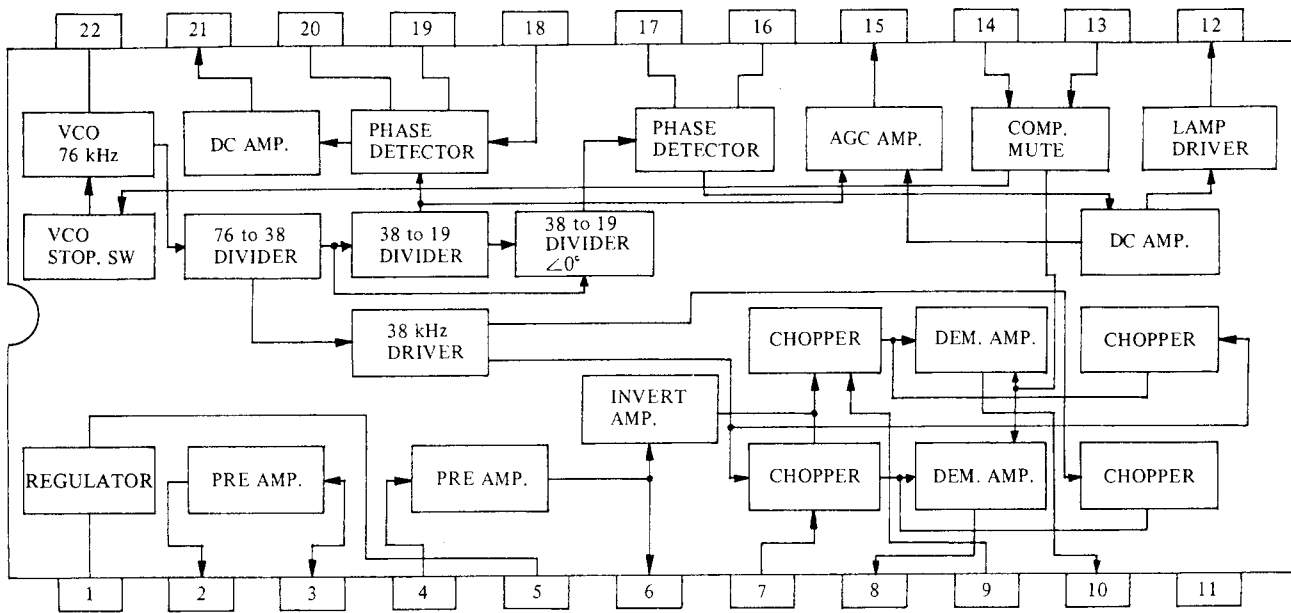


Terminal No.	Operation
1	Vcc
2	OUTPUT
3	BYPASS
4	GND
5	BYPASS
6	INPUT BIAS
7	INPUT

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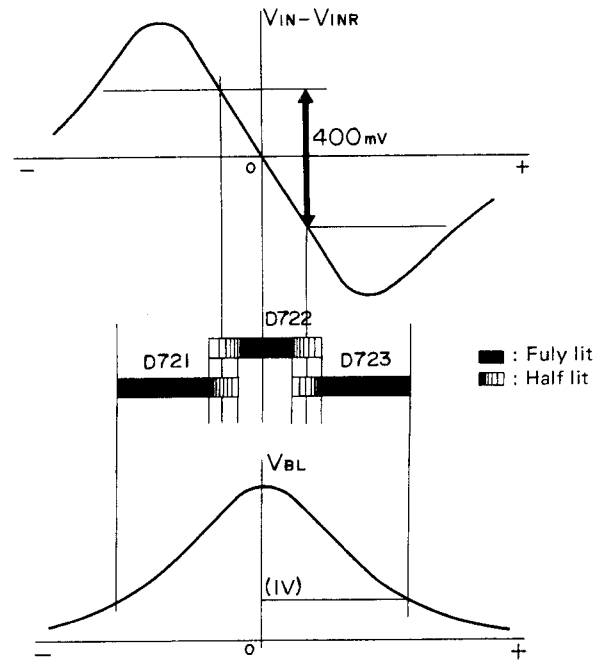
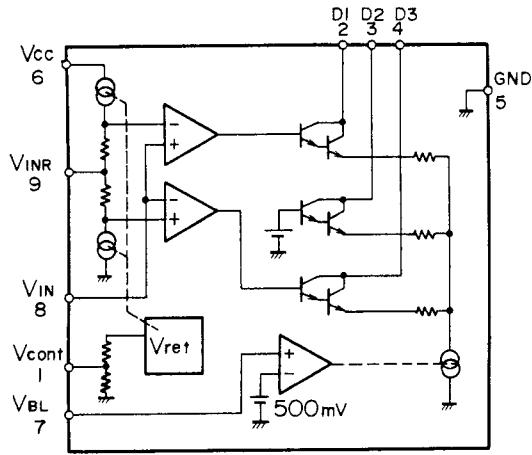
 $\mu$ PC1223C (Stereo decoder)

## Block diagram



Terminal No.	Connection	Terminal No.	Connection
1	V <sub>cc</sub>	12	ST. LAMP INDICATOR
2	PRE AMP. OUTPUT 1	13	ST-MONO SW & VCO STOP
3	PRE AMP. INPUT 1	14	MUTING SWS
4	PRE AMP. INPUT 2	15	19kHz CANCEL
5	BYPASS	16	LPF
6	PRE AMP. OUTPUT 2	17	LPF
7	POST AMP. INPUT	18	FILTER INPUT
8	L-ch OUTPUT	19	LPF
9	POST AMP. INPUT	20	LPF
10	R-ch OUTPUT	21	LPF
11	GND	22	OSC RC NETWORK

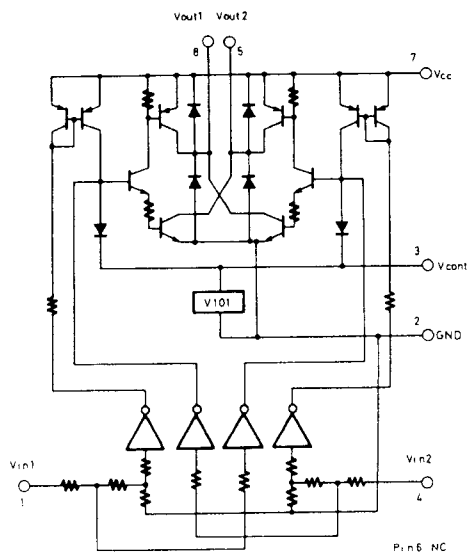
**LB1450 (Tuning indicator drive)**



(Fig. 14)

As shown in the figure 14, the difference between the AFC output terminal pin 7 of the Q157 FM IF system IC and standard voltage terminal pin 10 becomes an S-curve characteristic. Using this characteristic, the TUNING indicator is caused to light.

**LB1630 (Motor drive)**



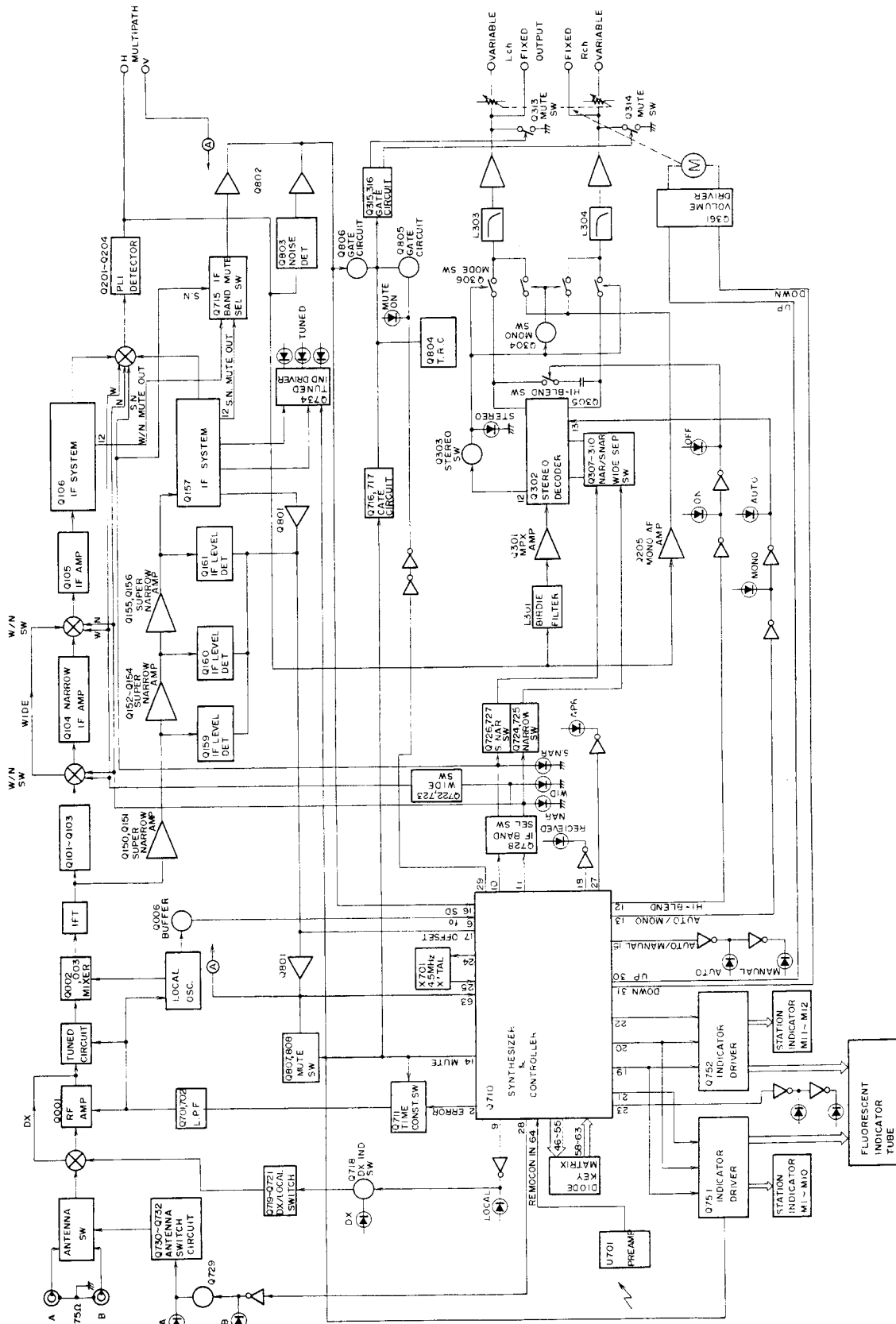
**Truth Table**

Vin 1	Vin 2	Vout 1	Vout 2	Motor
H	L	H	L	Clockwise
L	H	L	H	Counter-clockwise
H	H	OFF	OFF	Stop
L	L	OFF	OFF	Stop





BLOCK DIAGRAM



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# ADJUSTMENT PROCEDURES

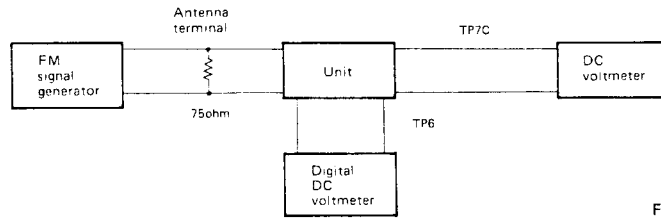


Fig. 1

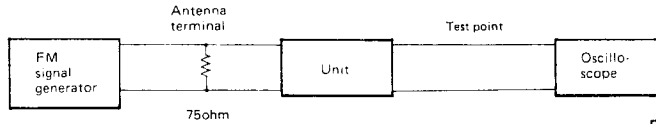


Fig. 2

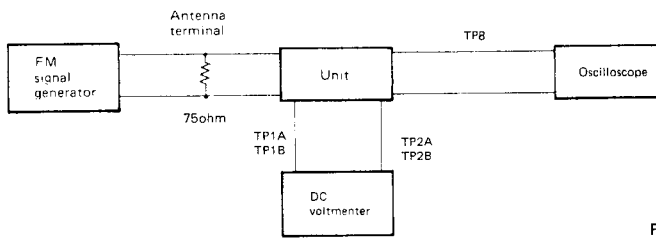


Fig. 3

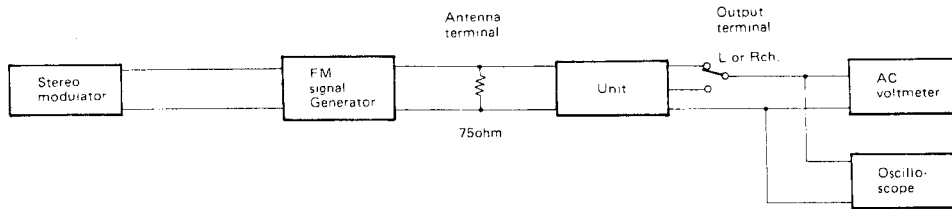
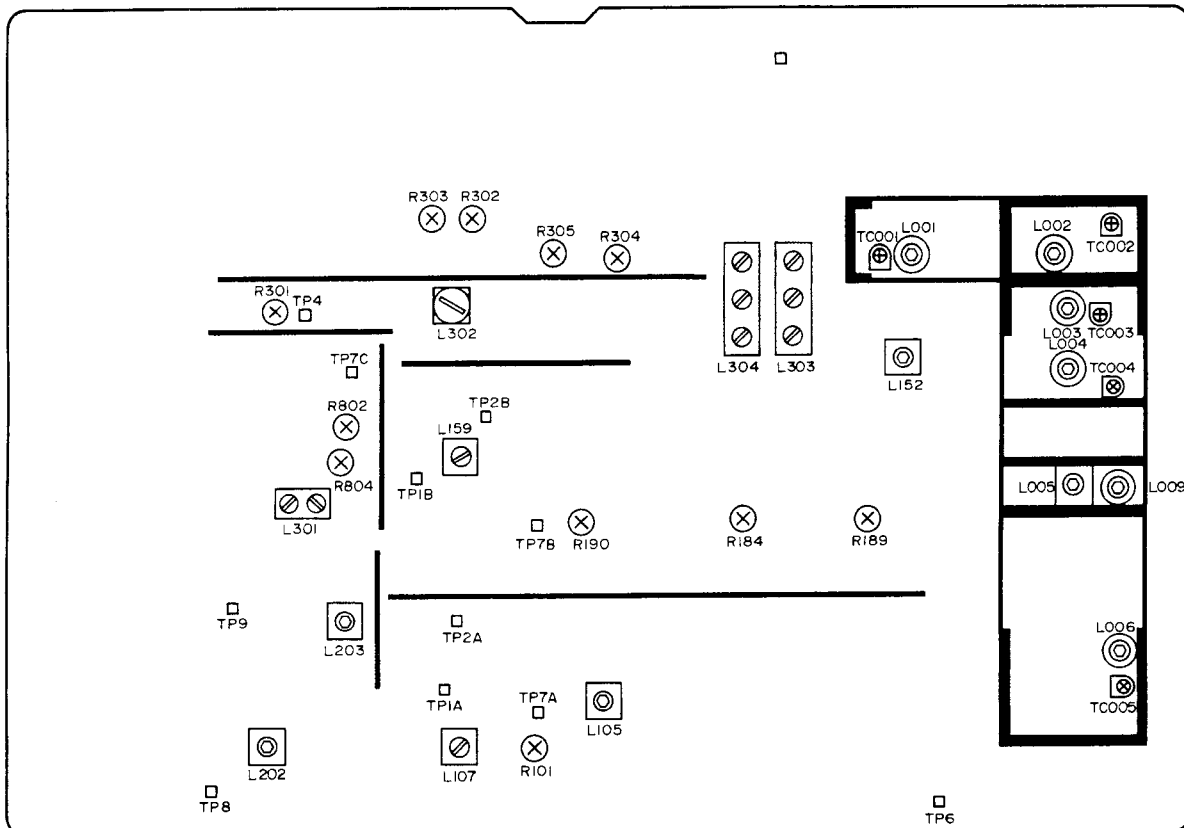


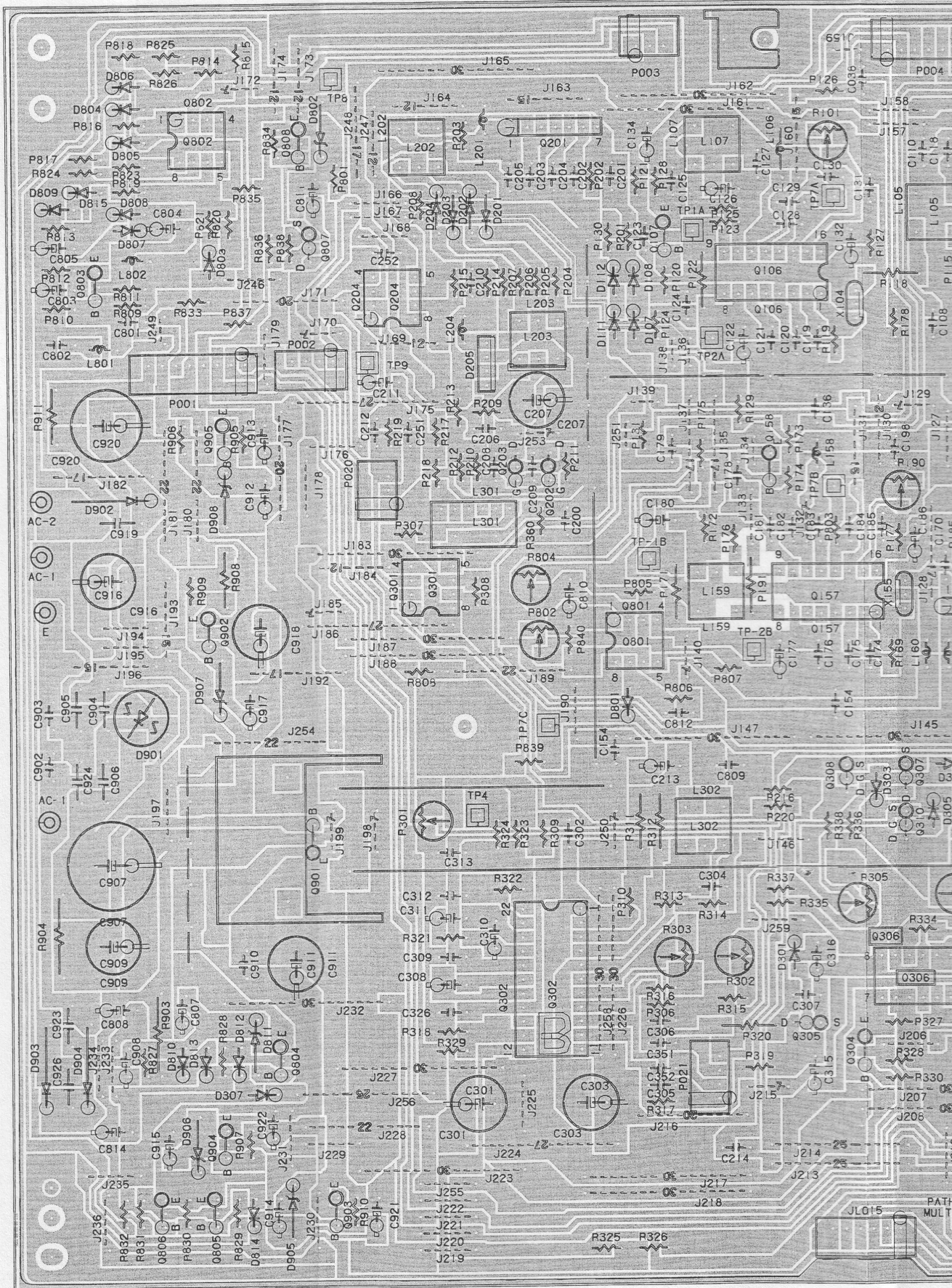
Fig. 4



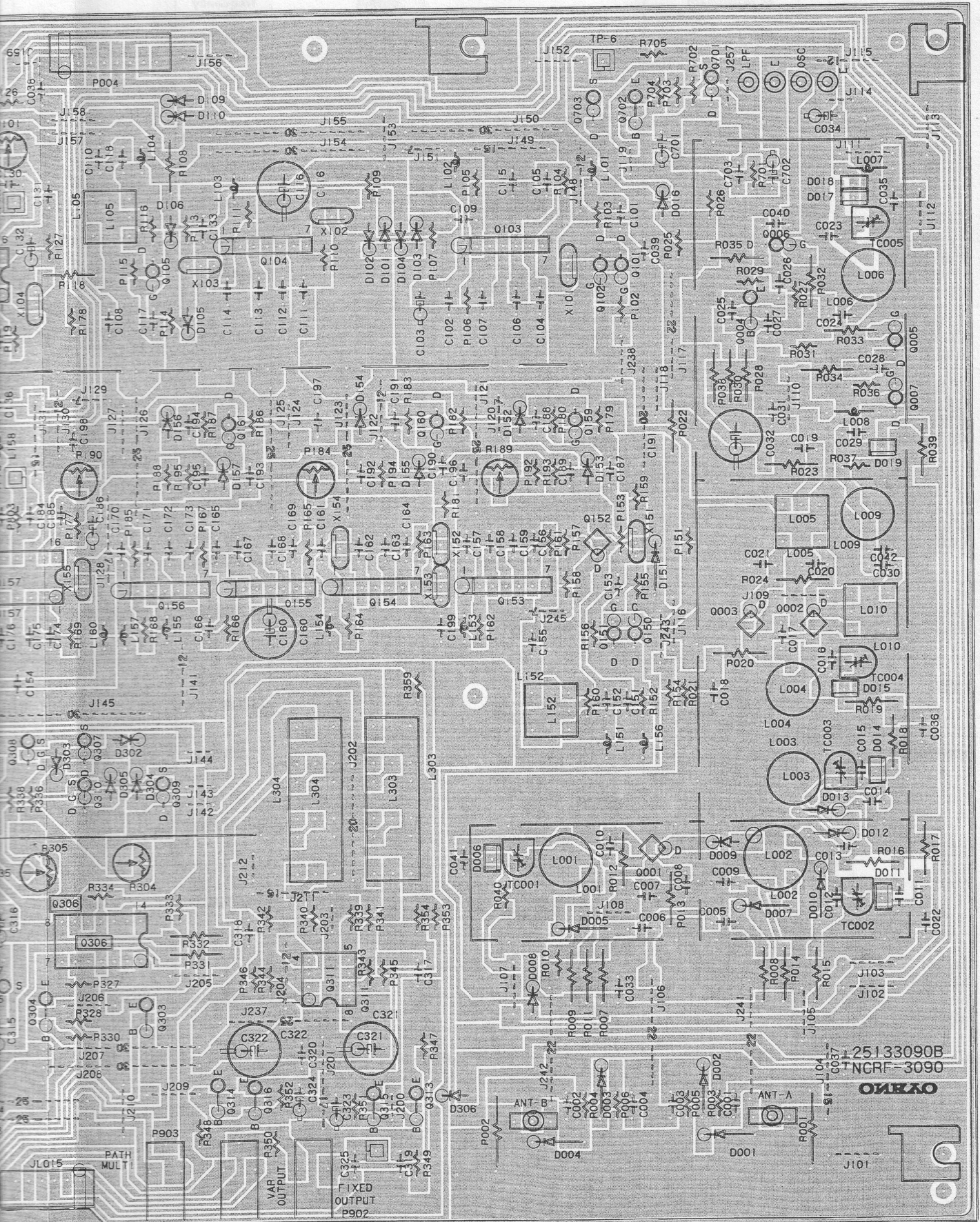
Item	Step	Connection of instrument	FM SG output	Stereo modulator output	Tuned frequency	Output indicator
Front End adjustment	1	Fig. 1		—————	108.000MHz	Digital DC voltmeter
	2			—————	87.500MHz	
	3		108MHz 1kHz, 75kHz devi. 10dB/ $\mu$ V (15.2dBf)	—————	108.000MHz	DC voltmeter
	4		87.5MHz 1kHz, 75kHz devi. 10dB/ $\mu$ V (15.2dBf)	—————	87.500MHz	
	5					
IF adjustment of wide & narrow		Fig. 2 TP7A	99MHz 1kHz, 75kHz devi. 10dB/ $\mu$ V (15.2dBf)	—————	99.000MHz	Oscilloscope DC: 500mV
IF level adjustment of super narrow		Fig. 2 TP7C	99MHz 1kHz, 75kHz devi. 10dB/ $\mu$ V (15.2dBf)	—————	99.000MHz	Oscilloscope DC: 500mV
Muting adjustment of wide and narrow	1	Fig. 3 TP1A, 2A	99MHz 1kHz, 75kHz devi. 80dB/ $\mu$ V (65dBf)	—————	99.000MHz	DC voltmeter
	2		99MHz 12dB/ $\mu$ V (17.5dBf)		99.000MHz	Oscilloscope
Muting adjustment of super narrow	1	Fig. 3 TP1B, 2B	99MHz 1kHz, 75kHz devi. 60dB/ $\mu$ V (65dBf)		99.000MHz	DC voltmeter
	2		99MHz 12dB/ $\mu$ V (17.5dBf)		99.000MHz	Oscilloscope
PLL detector adjustment		Fig. 2 TP-9	99MHz 1kHz, 75kHz devi. 80dB/ $\mu$ V (85dBf)		99.000MHz	DC voltmeter (TP-9)
VCO		Connect the frequency counter to TP4	99MHz 1kHz, 75kHz devi. 80dB/ $\mu$ V (85dBf)		99.000MHz	Frequency counter
Separation	1	Fig. 4	99MHz Ext. modulation 80dB/ $\mu$ V (85dBf)	L channel	99.000MHz	AC voltmeter or Oscilloscope
				R channel		
	2		99MHz Ext. modulation 80dB/ $\mu$ V (85dBf)	L channel	99.000MHz	AC voltmeter or oscilloscope
		R channel				
	3		99MHz Ext. modulation 80dB/ $\mu$ V (85dBf)	L channel	99.000MHz	AC voltmeter or oscilloscope
				R channel		
Signal indicator level adjustment	1		99MHz, 0dB/ $\mu$ V		99.000MHz	SIGNAL indicator
	2		99MHz, 40dB/ $\mu$ V			
	3		80dB/ $\mu$ V			
	4		100dB/ $\mu$ V			

Output indicator	Adjustment point	Adjust for	Remarks
Digital DC voltmeter	TC005	$24.0 \pm 0.2V$	Repeat the steps 1 and 2 until no further adjustment is necessary. IF Band: Super Narrow
	L006	$4.0 \pm 0.1V$	
DC voltmeter	TC001, TC002, TC003, TC004	Maximum	Repeat the steps 3 and 4 until no further adjustment is necessary. IF Band: Super Narrow
	L001, L002, L003, L004	Maximum	
	L005, L009	Maximum	
Oscilloscope DC: 500mV	L105	Maximum	IF Band: Wide
Oscilloscope DC: 500mV	L152	Maximum	IF Band: Super Narrow
DC voltmeter	L107	0V	IF Band: Wide
Oscilloscope	R101	Variable point.	
DC voltmeter	L159	0V	IF Band: Super Narrow
Oscilloscope	R190	Variable point.	
DC voltmeter (TP-9)	L203	$0 \pm 0.1V$	IF band:Wide RF:DX
Frequency counter	R301	$76kHz \pm 76Hz$	Use the high Impedance probe (10:1).
AC voltmeter or Oscilloscope	R303	Output of right channel becomes minimum	IF band: Wide.
	R302	Output of left channel becomes minimum	
AC voltmeter or oscilloscope	R305	Separation of L and R are same and maximum.	IF band:Narrow
AC voltmeter or oscilloscope	R304	Separation of L and R are same and maximum.	IF band:Super narrow
SIGNAL indicator	R804	5 (dBf)	Before adjustment, turn the semi-fixed resistors R802 and R804 fully clockwise. Proceed to adjustment during press the signal button.
	R802	45 (dBf)	
	R184	85 (dBf)	
	R189	105 (dBf)	

# PRINTED CIRCUIT BOARD VIEW FROM BOTTOM SIDE



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MAIN CIRCUIT PC BOARD

## PRINTED CIRCUIT BOARD-PARTS LIST

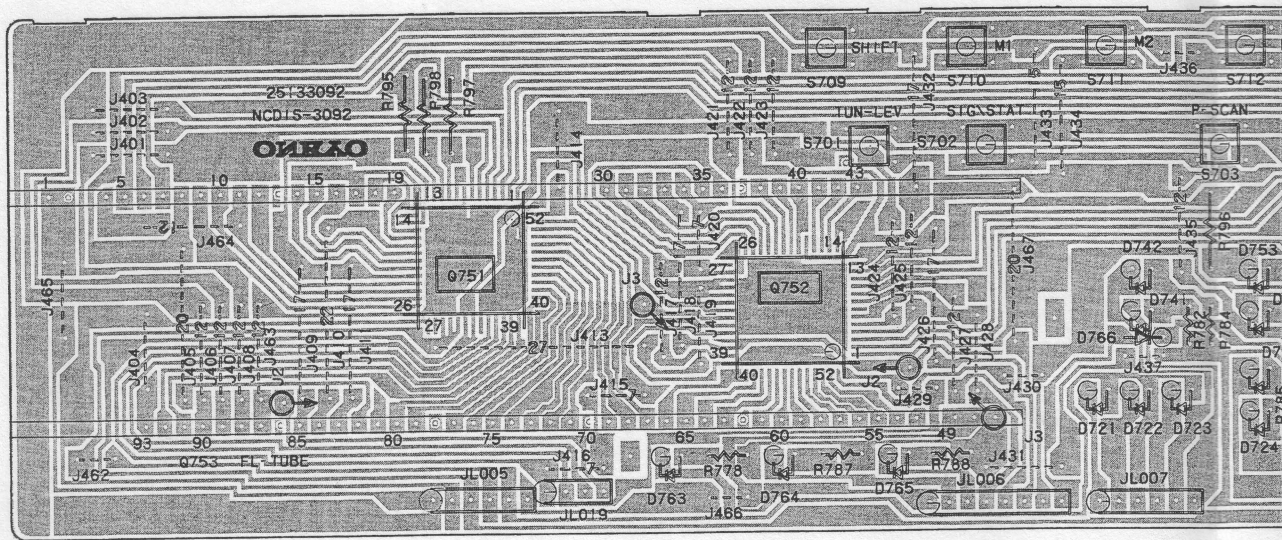
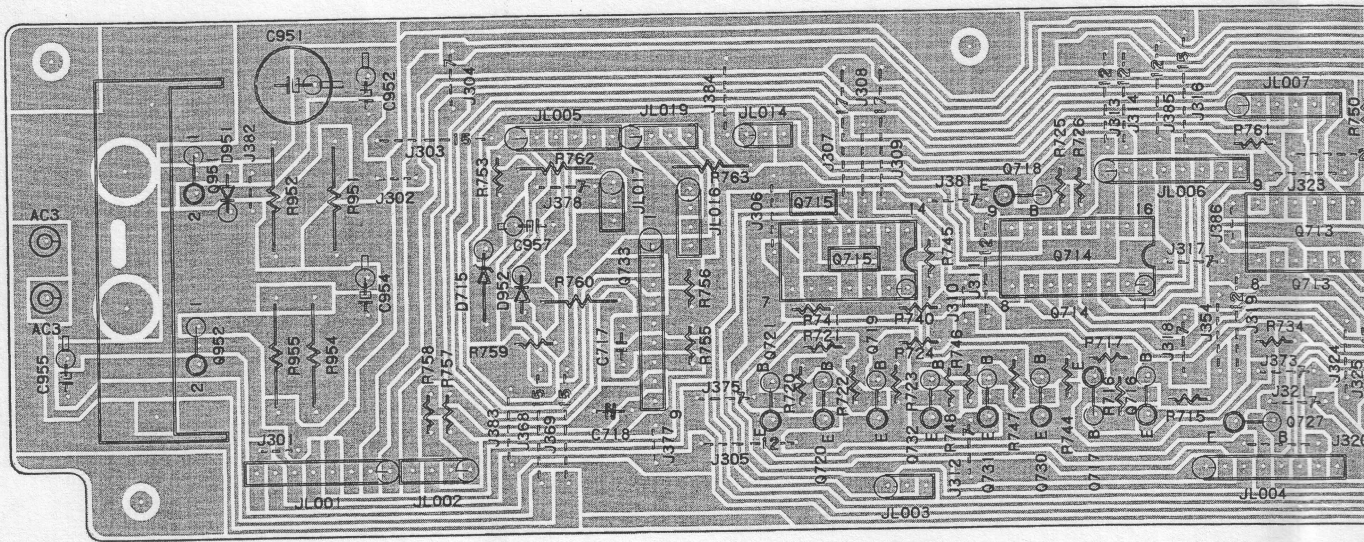
### MAIN CIRCUIT PC BOARD (NARF-3090-1A)

CIRCUIT NO.	PART NO.	DESCRIPTION	CIRCUIT NO.	PARTS NO.	DESCRIPTION
	ICS		D301-D307	223163	1SS133
Q103, Q104	222474	$\mu$ PC1163H, RF amp	D801	223163	1SS133
Q106, Q157	222680	LA1235, IF system	D802	2239452 or	RD5. 1EB2 or
Q153-Q156	222474	$\mu$ PC1163H, RF amp		224650512	HZ5. 1EB2
Q201	222474	$\mu$ PC1163H, RF amp	D803-D810	223163	1SS133
Q204, Q301	222579	NJM4560D, Op amp	D811	2239492 or	RD6. 2EB2 or
Q302	222732	$\mu$ PC1223C, Stereo decoder		224650622	HZ6. 2EB2
Q306	222840661	4066B, Analog switch	D812-D815	223163	1SS133
Q311	222579	NJM4560D, Op amp	D901	223862 or	WL01 or
Q801, Q802	222579	NJM4560D, Op amp		223890	WO1RL
Q901	222780151NEC	78M15, Regulator	D902-D904	223880 or	GP101N4003 or
				223848	GP08B
	TRANSISTORS		D905, D906	2239532 or	RD7. 5EB2 or
Q001-Q003	2212514	3SK114-Y		224650752	HZ7. 5EB2
Q004	2211723	2SC1923-0	D907	2239672 or	RD15EB2 or
Q005-Q007	2212195	2SK241-GR		224651502	HZ15EB2
Q101, Q102	2212195	2SK241-GR	D908	2239812 or	RD30EB2 or
Q105	2212274	2SK192A-Y		224653002	HZ30EB2
Q107	2211723	2SC1923-0			
Q150, Q151	2212195	2SK241-GR		COILS	
Q152	2212514	3SK114-Y	L001	233321	NFA-3053
Q158, Q304	2211255 or	2SC1815-GR or	L002	233322	NFRF-3038
	2210746	2SC945A-P	L003	233324	NFRF-3040
Q159-Q161	2212195 or	2SK241-GR or	L004	233323	NFRF-3039
	2212194	2SK241-Y	L006	233325	NFO-3033
Q202, Q203	2212274	2SK192A-Y	L007, L008	233359	NCH-2163
Q303	2211455 or	2SA1015-GR	L009	233326	NFRF-3041
	2210803	2SA733-P	L010	233212	NFRF-4021
Q305	2211945	2SK246-GR	L101-L104	233359	NCH-2163
Q307-Q310	2211945	2SK246-GR	L105	233318	NFIF-4053
Q313, Q314	2211704 or	2SD655-D or	L106	233359	NCH-2163
	2211705	2SD655-E	L107	233378	NFIF-4063
Q315, Q316	2211454	2SA1015-Y	L151	233359	NCH-2163
Q701	2212294	2SK108-D	L152	233318	NFIF-4053
Q702	2211255	2SC1815-GR	L153-L158	233359	NCH-2163
Q703	2211945	2SK246-GR	L159	233378	NFIF-4063
Q803	2211255	2SC1815-GR	L160	233365	NCH-2169
Q804	2211256	2SC1815-BL	L201	233359	NCH-2163
Q805, Q806	2211255	2SC1815-GR	L202	233296	NFIF-4048
Q807	2211945	2SK246-GR	L203	233297	NFIF-4049
Q808	2211255 or	2SC1815-GR or	L204	233365	NCH-2169
	2210746	2SC945A-P	L301	233379	NMC-5066
Q902	2200792 or	2SB649-B or	L302	233303	NMC-5042
	2200793	2SB649-C	L303, L304	233380	NMC-5067
Q903	2211256	2SC1815-BL	L801	233122	NCH-3013
Q904	2211455 or	2SA1015-GR or	L802	231081	NCH-2129
	2210803	2SA733-P			
Q905	2211255	2SC1815-GR		TRANSFORMER	
	DIODES		L005	233317	NFIF-4052
D001-D005	223165	BA282		CERAMIC FILTERS	
D006	223154	1SV103	X101, X104	3010085	SFE-10.7MXK-A
D007	223165	BA282	X102	3010131	SFE-10.7MX2K-A
D008	223163	1SS133	X103	3010086	SFE-10.7MS3G-A
D009, D010	223165	BA282	X151-X154	3010130	SFE-10.7MZ2K-A
D011	223154	1SV103	X155	3010132	SFE-10.7MJK-A
D012, D013	223149	1SS85			
D014, D015	223154	1SV103			
D016	223163	1SS133			
D017-D019	223154	1SV103			
D101-D112	223163	1SS133			
D151	223165 or	BA282 or			
	223149	1SS85			
D152-D157	223163	1SS133			
D201-D204	223170	SD187-4			
D205	223136	KV1226			





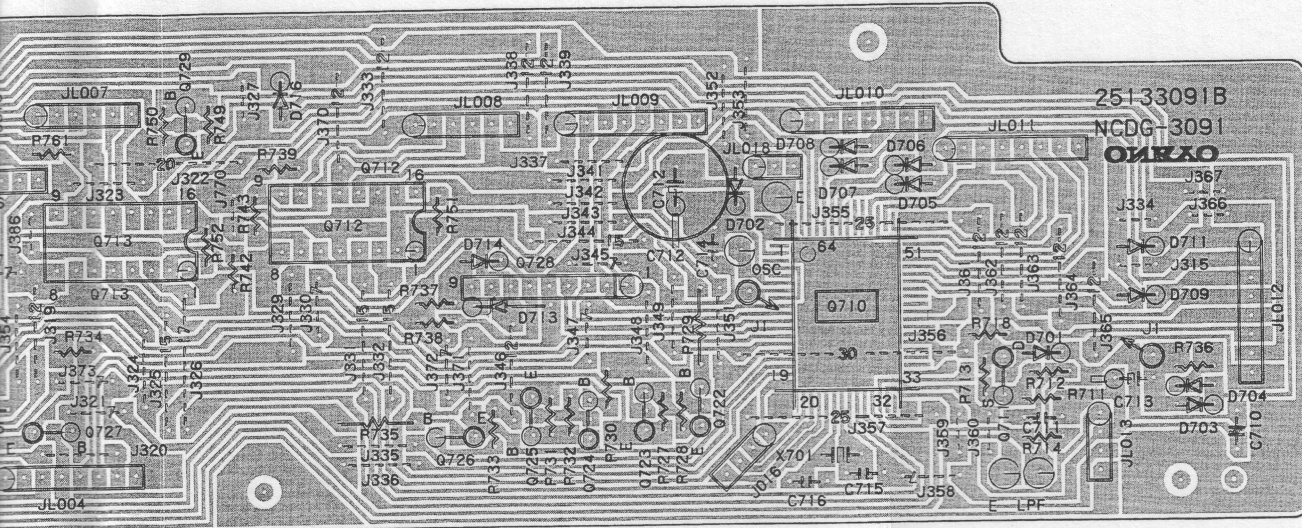
# PRINTED CIRCUIT BOARD VIEW FROM BOTTOM SIDE



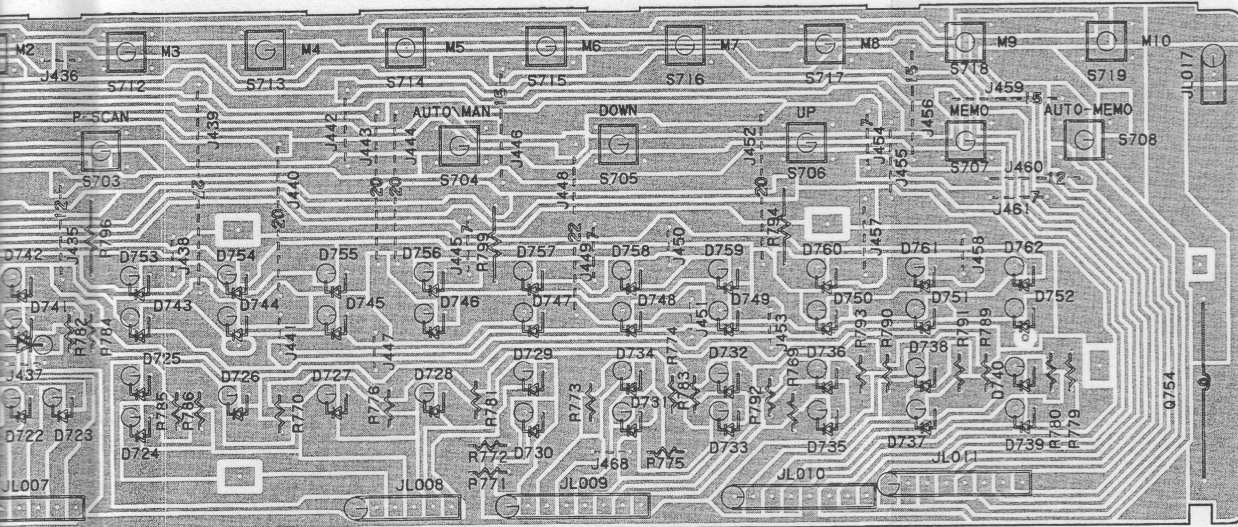
## PRINTED CIRCUIT BOARD-PARTS LIST

### DIGITAL CIRCUIT PC BOARD (NADG-3091-1)

CIRCUIT NO.	PART NO.	DESCRIPTION	CIRCUIT NO.	PART NO.	DESCRIPTION
	ICs			DIODES	
Q710	22240106	$\mu$ PD1719G-520-12, Micon	D701-D709	223163	1SS133
Q712-Q714	222807	$\mu$ PA81C, Buffer	D711, D714	223163	1SS133
Q715	222840111	4011B, NAND gate	D713	2239632 or	RD12EB2 or
Q728	222992	LA7910, Band switch		224651202	HZ12EB2
Q733	22240107	LB1450, Tuning indicator drive	D715	2241291	RD3.3EB1
Q951	222780052	78M05, Regulator	D716, D717	223163	1SS133
Q952	222780055	78M05HF, Regulator	D951	223163	1SS133
	TRANSISTORS			X'TAL	
Q711	2211945	2SK246-GR	X701	3010091	XTL-4.5M
Q716, Q718	2211255 or	2SC1815-GR or		CAPACITORS	
Q720, Q722	2210746	2SC945A-P	C710	352921016	100 $\mu$ F, 6.3V, Non-polar elect.
Q724, Q726	2211255 or	2SC1815-GR or	C711	371121225	1,200pF $\pm$ 10%, 50V, Mylar
Q729, Q731	2210746	2SC945A-P	C712	3020027,	0.047F, 5V
Q717, Q719	2211455 or	2SA1015-GR or		3000051 or	0.047F, 5.5V or
Q721, Q723	2210803	2SA733-P		3000050	0.047F, 5.5V, Super
Q725, Q727	2211455 or	2SA1015-GR or	C713	354784799	0.47 $\mu$ F, 50V, Elect.
Q730, Q732	2210803	2SA733-P	C718	354741009	10 $\mu$ F, 16V, Elect.



DIGITAL CIRCUIT PC BOARD



DISPLAY CIRCUIT PC BOARD

CIRCUIT NO.	PART NO.	DESCRIPTION
C951	354764719	470µF, 35V, Elect.
C952, C955	354741009	10µF, 16V, Elect.
C954	354781009	10µF, 50V, Elect.
RESISTORS		
R951, R952	441622204	22ohm, 1W, Metal oxide film
R954, R955		

**DISPLAY CIRCUIT PC BOARD (NADG-3092-1)**

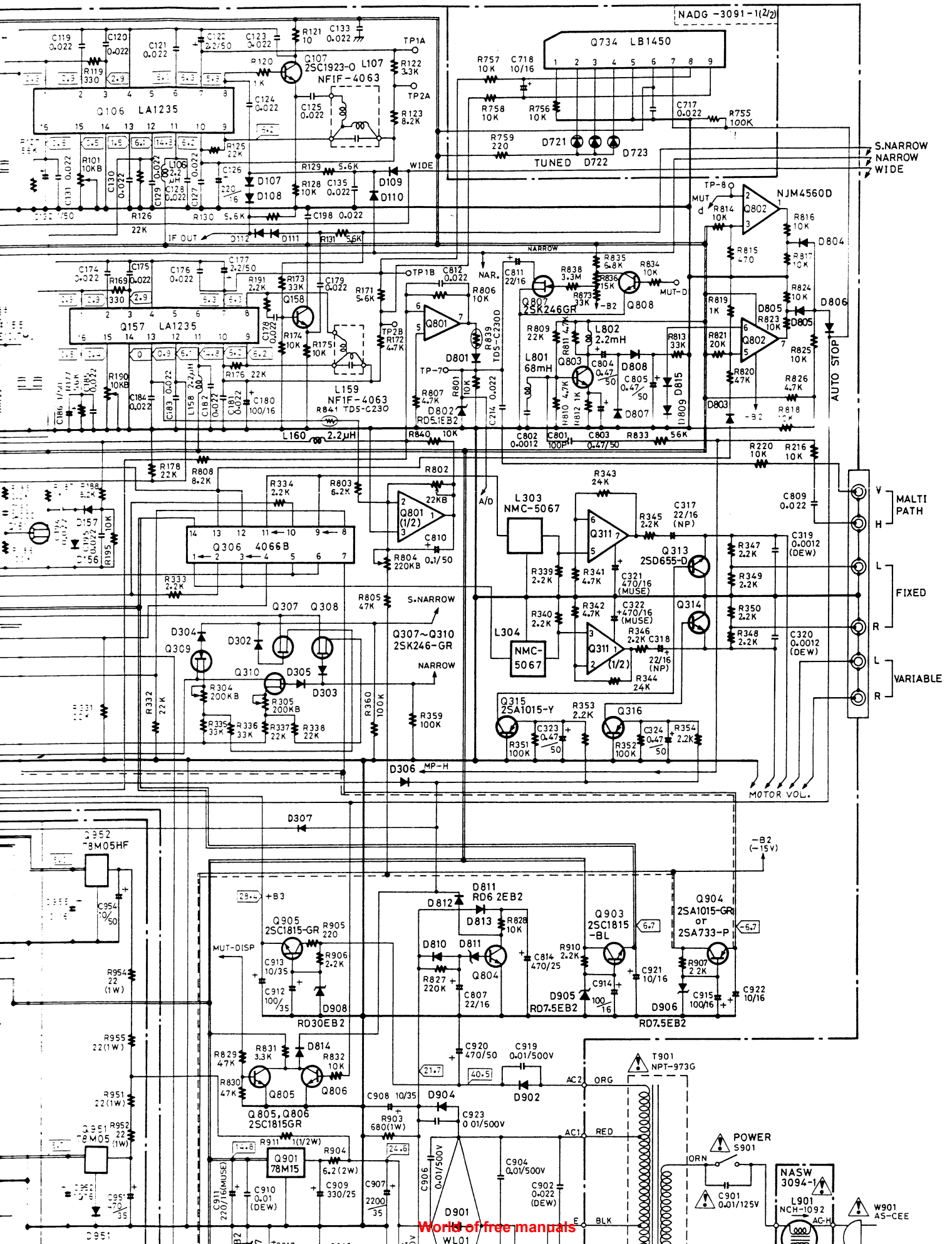
CIRCUIT NO.	PART NO.	DESCRIPTION
ICS		
Q751, Q752	2227701	µPD6320GC
FLUORESCENT TUBE		
Q753	212048	FIP12AMW7S
LAMP		
Q754	210064A	PL6.3V, 250mA

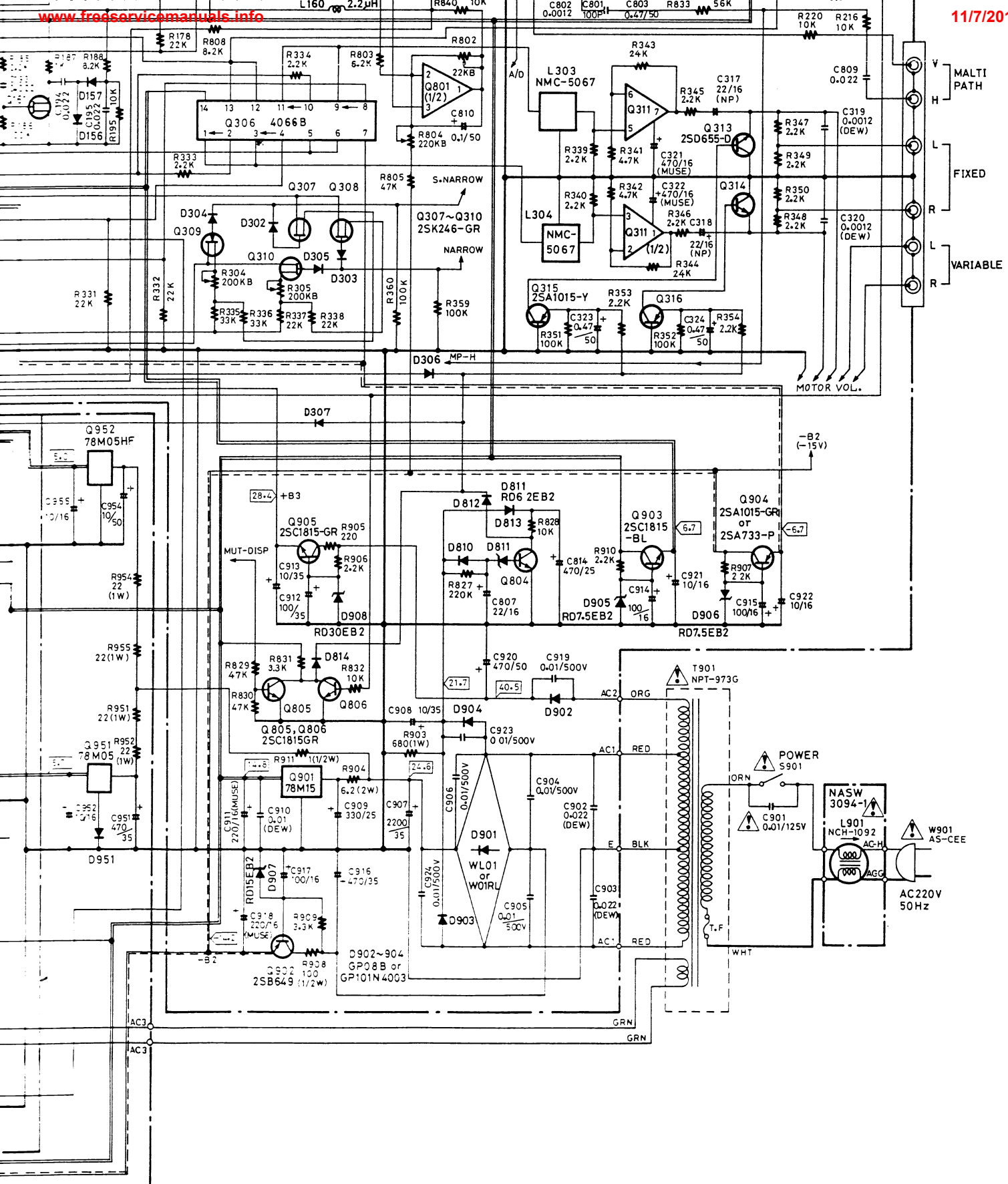
CIRCUIT NO.	PART NO.	DESCRIPTION
DIODE		
D721-D724	225137CG,	SEL2413ECG,
D727, D728	225137DG or	SEL2413EDG or
D730, D731	225137DY,	SEL2413EDY
D733, D735	225137CG,	SEL2413ECG,
D737	225137DG or	SEL2413EDG or
D739-D765	225137DY	SEL2413EDY
D725, D726	225142	SEL2913K
D729, D732	225142	SEL2913K
D734, D736	225142	SEL2913K
D738	225142	SEL2913K

DIODE		
D766	223163	1SS133
SWITCHES		
S701-S719	25035548	NPS-111-S510
HOLDERS		
	27190561A	L.E.D
	27190500	Lamp



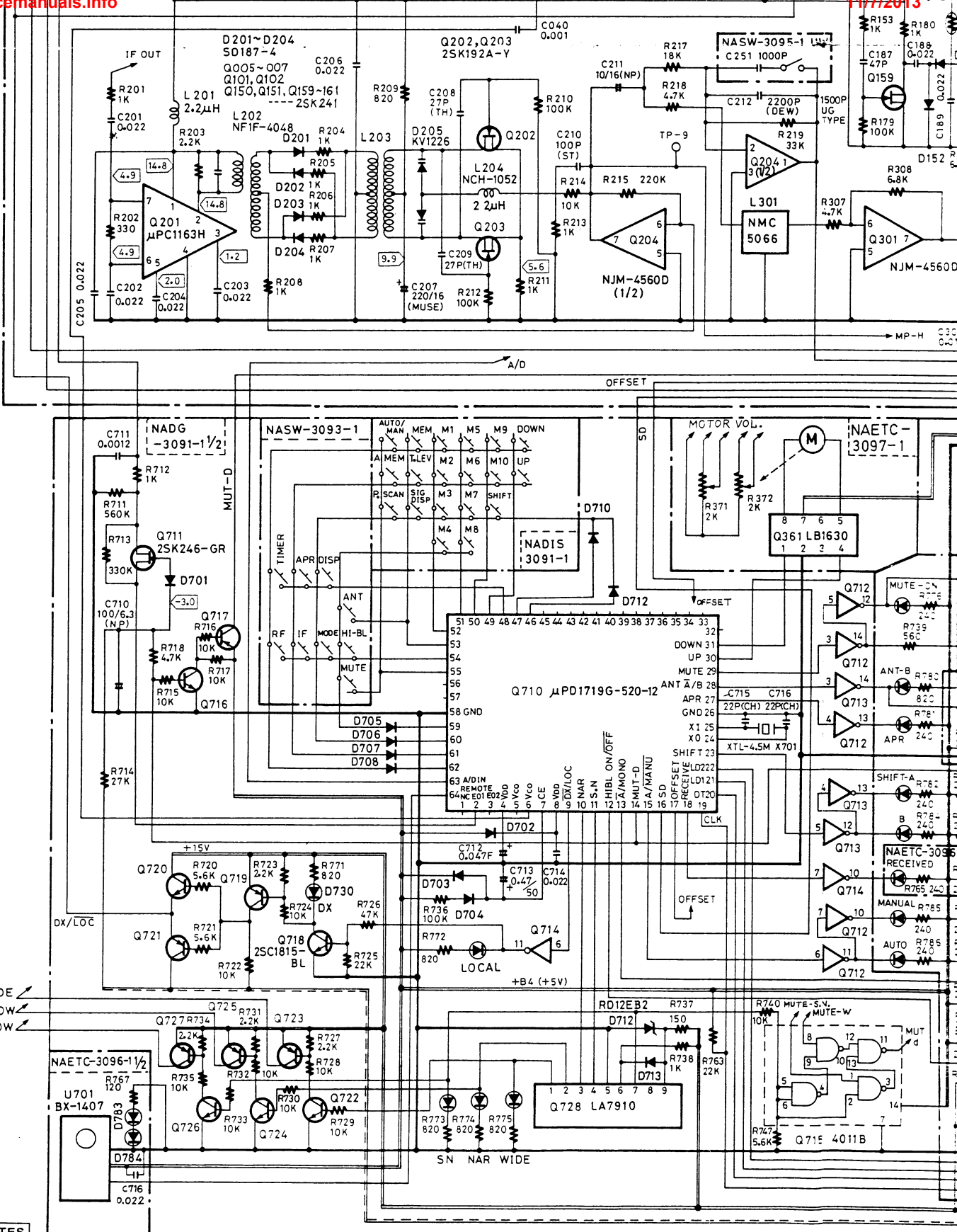






• ALL NPN TRANSISTORS ARE 2SC1815-GR or 2SC945A-P UNLESS OTHERWISE NOTED.  
 • ALL PNP TRANSISTORS ARE 2SA1015-GR or 2SA733-P UNLESS OTHERWISE NOTED.





**NOTES**

- THE COMPONENTS IDENTIFIED BY MARK  $\Delta$  ARE CRITICAL FOR SAFETY. REPLACE ONLY WITH PART NUMBER SPECIFIED.
- VOLTAGE (MEASURED WITH V. T. V. M.)  $\square$  V IS DC VOLTAGE. (NO INPUT SIGNAL)
- ELECTROLYTIC CAPACITORS  $\square$  ARE IN  $\mu$ F/WV.
- ALL CAPACITORS ARE IN  $\mu$ F/50WV UNLESS OTHERWISE NOTED.
- ALL RESISTORS ARE IN OHMS 1/4 WATTS UNLESS OTHERWISE NOTED.
- ALL DIODES ARE IS2473, IS2076, US1040 or ISS133 UNLESS OTHERWISE NOTED.
- CIRCUIT IS SUBJECT TO CHANGE FOR IMPROVEMENT.

- LED : D721~724, 727, 728, D730, 731, 733, 735, D737, 739, 740~765 } SEL2413E (GREEN)
- D725, 726, 729, 732, D734, 736, 738, 781, D782~784 } SEL2913K (ORANGE)
- D781 -----SEL2213C (PINA)

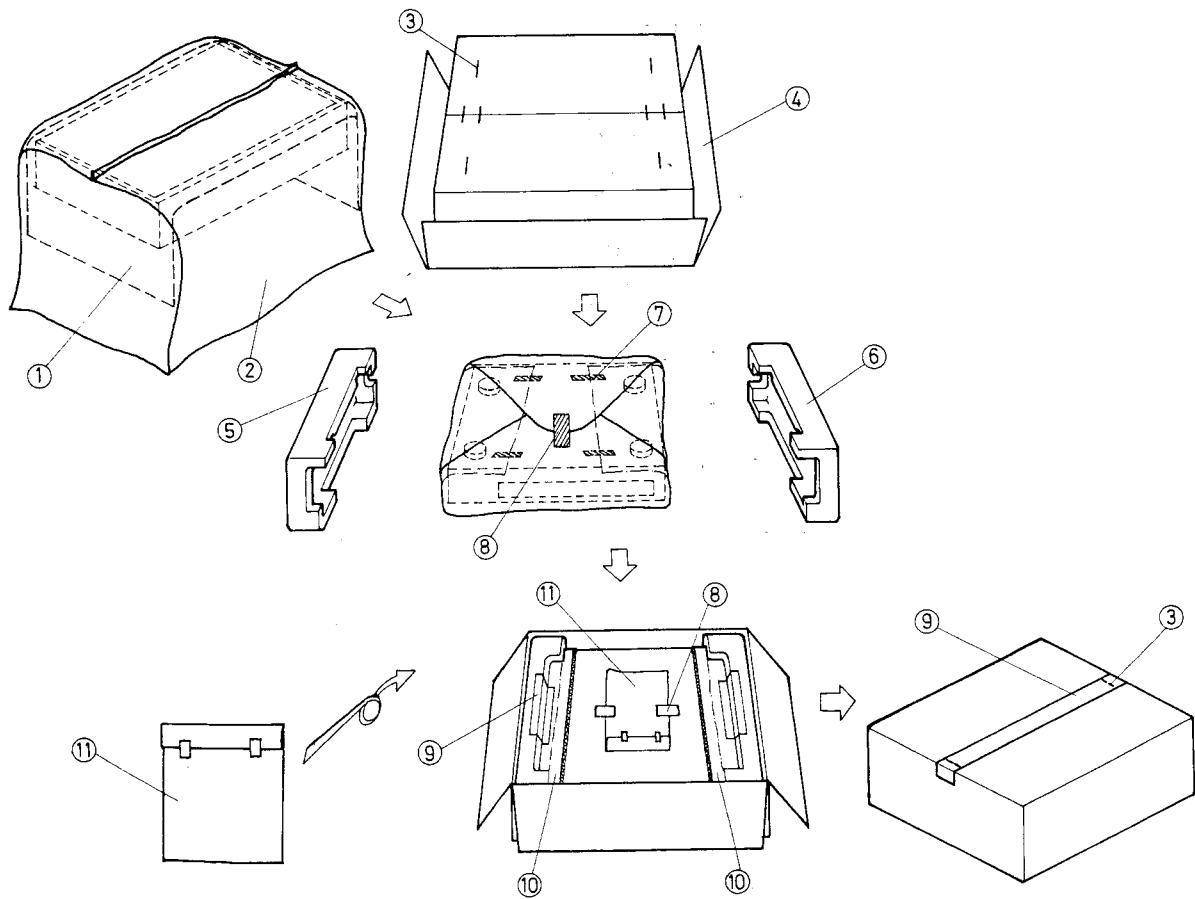
TIMER	S'ATION	TUN.L.	SIG.L.	AUTO	STER
D782	D763	D764	D765	D724	D7
RECEIVED	$\square$	$\square$	$\square$	MANUAL	MU
D781	D721	D722	D723	D725	D7
SHFT-A	M1	M2	M3	M4	M
D741	D743	D744	D745	D746	D7
	M11	M12	M13	M14	M
D742	D753	D754	D755	D756	D7





T-9990

## PACKING VIEW



REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
1	29095318	500 × 800mm, Protection sheet		2010097	Connection cord
2	29100038A	720 × 950mm, Poly-vinyl bag		24140013	RC-113T, Remote control unit
3	282301	Sealing hook		25060088	Two adaptors for FM antenna
4	29051605	Master carton box		291064A	FM antenna
5	29091197	Pad R		29341193	Instruction manual
6	29091196	Pad L		3010054	UM3, Two batteries
7	262037	200mm, Drafting tape		29365020	Warranty card
8	261504	30mm, Tape		29100097	250 × 350mm, Poly-vinyl bag
9	260012	100cm, Damplon tape		29341059	Instruction manual for side panel
10	29095491	Aheet P		838440089	4TTB + 8C (BC), Four tapping screws for top cover
11		Accessory bag ass'y		29100026	Poly-vinyl bag for tapping screws

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