

Service Manual

**CIRCUIT DESCRIPTIONS
REPAIR & ADJUSTMENTS**



**ORDER NO.
ARP-326-0**

FM/AM DIGITAL SYNTHESIZED TUNER

F-90

MODEL F-90 COMES IN SEVEN VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
KU	AC120V only	U.S.A. model
HE	AC220V, 240V (switchable)	European continent model
HB	AC220V, 240V (switchable)	United Kingdom model
S	AC110V, 120V, 220V, 240V, 240V (switchable)	General export model
S/G	AC110V, 120V, 220V, 240V (switchable)	U.S. Military model
SS	AC110V, 120V, 220V, 240V (switchable)	South Africa model
HEZ	AC220V, 240V (switchable)	West Germany model

- This service manual is applicable to the KU type. For servicing of the HE and HB types, please refer to the pp. 44 – 50.
For servicing of the other types, please refer to the Additional Service Manual.
- Ce manuel d'instruction se réfère au mode de réglage, en français.
- Este manual de de servicio trata del método de ajuste escrito en español.

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1. SPECIFICATIONS

FM Tuner Section

Frequency range	87.5 MHz to 108 MHz
Usable Sensitivity	10.8 dBf, IHF (0.95 μ V/75 Ω)
50 dB Quieting Sensitivity	
	Mono; 16.2 dBf, IHF (1.8 μ V/75 Ω)
	Stereo; 37.7 dBf, IHF (21.0 μ V/75 Ω)
Sensitivity (DIN)	Mono; 0.75 μ V/75 Ω
	Stereo; 22.0 μ V/75 Ω
Signal-to-Noise Ratio	Mono; 93 dB (at 80 dBf)
	Stereo; 86 dB (at 80 dBf)
Signal-to-Noise Ratio (DIN)	Mono; 83 dB
	Stereo; 77 dB
Distortion (at 80 dBf)	
WIDE	Mono; 0.0095% (100 Hz)
	0.0095% (1 kHz)
	0.01% (10 kHz)
	Stereo; 0.02% (100 Hz)
	0.02% (1 kHz)
	0.07% (10 kHz)
NARROW	Mono; 0.09% (1 kHz)
	Stereo; 0.5% (1 kHz)
Capture Ratio	0.8 dB (WIDE)
Alternate Channel Selectivity	85 dB (400 kHz) (NARROW)
Stereo Separation	
WIDE	65 dB (1 kHz)
	50 dB (20 Hz to 10 kHz)
NARROW	40 dB (20 Hz to 10 kHz)
Frequency Response	20 Hz to 15 KHz \pm $\frac{1}{2}$: $\frac{2}{3}$ dB
Muting Threshold	25.2 dBf (5 μ V/75 Ω)
Antenna Input	300 Ω balanced
	75 Ω unbalanced

AM Tuner Section

Frequency range	522 kHz to 1,611 kHz
	(When 10 kHz step) 520 kHz to 1,610 kHz
Sensitivity (IHF, Loop antenna)	150 μ V/m
Signal-to-Noise Ratio	50 dB
Antenna	Loop Antenna

Audio Section

Output (Level/Impedance)	
FM (100% MOD) FIXED	650 mV/900 Ω
AM (30% MOD) FIXED	150 mV/900 Ω

Miscellaneous

Power Requirements	
HE model	a.c. 220 Volts \sim , 50/60 Hz
HB model	a.c. 240 Volts \sim , 50/60 Hz
YP model	a.c. 240 Volts \sim , 50 Hz
KU and KC models	AC 120 V, 60 Hz
S, SS and S/G models	AC 110/120/220/240 V (switchable) 50/60 Hz

Power Consumption	
HE model	14 W
HB model	14 W
YP model	14 W
KU and KC models	14 W
S, SS and S/G models	14 W
Dimensions	420(W) x 61(H) x 317(D) mm
	16-9/16(W) x 2-3/8(H) x 12-1/2(D) in
Weight (without package)	4.5 kg(9 lb 15 oz)

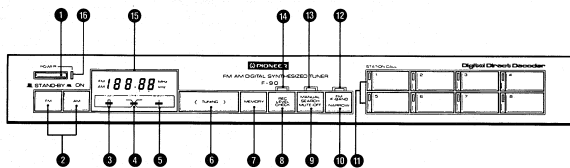
Furnished Parts

FM T-type Antenna	1
AM Loop Antenna	1
Connection Cord with Pin Plugs	1
F-type plug (except HE, HB and YP models)	1
Operating Instructions	1

NOTE:

Specifications and design subject to possible modification without notice.

2. FRONT PANEL FACILITIES



1 POWER SWITCH (POWER)

When this switch is set to the ON position, the POWER indicator lights up, and power is supplied to the tuner's main circuits. The unit's POWER switch is geared to selecting the transformer's secondary and so even at the STAND-BY position, the unit's circuitry will work as long as the power cord is connected to power outlet. Disconnect the power cord from the power outlet when you do not plan to use the unit for a long period of time.

2 FUNCTION SWITCHES

These are used to select either the FM or AM broadcasting bands. The frequency indicating portion of the display will also change.

FM: Push to receive FM band broadcasts.
AM: Push to receive AM band broadcasts.

3 TUNED INDICATOR

This lights up to indicate when finest tuning of a station has been achieved.

4 FM STEREO INDICATOR

This lights when a stereo program has been picked up during an FM broadcast.

5 MEMORY INDICATOR

This lights up when the MEMORY switch is depressed.

6 TUNING SWITCHES

These are used to locate stations. Push the left half of this switch "<" to locate a station broadcasting on a lower frequency and the right half of this switch ">" to locate a station broadcasting on a higher frequency.

7 MEMORY SWITCH

This is used to memorize stations. Once a station has been memorized using the STATION CALL switches, all that is necessary to recall the station of your choice is to press the appropriate STATION CALL switch. The MEMORY completely does away with the need for manual tuning when selecting your favorite stations.

8 RECORDING LEVEL CHECK SWITCH (REC LEVEL CHECK)

Press this switch to check the recording level when recording FM broadcasts on tape.
When the REC LEVEL CHECK switch is pressed (ON), the REC LEVEL CHECK indicator will light up and FM recording reference level signals of about 330 Hz, FM 50% modulation or equivalent will be emitted from the OUTPUT terminals. (The same signals are emitted in case of recording AM broadcasts.) Adjust the recording level of the tape deck when it is in recording mode. For the cassette tape deck set the LEVEL METER indicator to 0~ +2 dB.
When the RECORDING LEVEL CHECK is completed, return the switch to the OFF position. (The indicator goes off.) If this switch is left in the ON position, a "beep" sound will occur and the broadcasts cannot be received.

9 MANUAL SEARCH MUTE-OFF SWITCH

This is the switch that allows you to choose between AUTO SEARCH and MANUAL tuning. FM MUTING functions when the AUTO SEARCH is in use, but does not function during MANUAL tuning. The indicator lights up during MANUAL tuning. The purpose of FM MUTING is to eliminate static occurring between FM stations. However, reception of your desired station may sometimes not be possible when receiving over long distances or when signals are weak if the FM MUTING switch is in the ON position. In such cases, cancel FM MUTING and select the desired station manually. When the FM MUTING switch is in the OFF position, it will only be possible to receive in MONO not in STEREO. It is recommended that you leave the FM MUTING switch ON for your normal listening enjoyment, especially when receiving from stations with weak input signals. MUTING only works for FM broadcasts. The position of this switch will not affect AM broadcasts.

10 FM IF-BAND SWITCH

This switch makes it possible to change passing bands for signals of intermediate frequencies during FM broadcasts. Press once for NARROW BAND reception. The FM IF indicator will light up. Press again for WIDE BAND reception and the indicator will go out.

NARROW BAND:

If there are other stations located near the station of your choice, you may find you are receiving interference from them and reception is poor. In such a case, turn on to NARROW BAND to effectively eliminate any interference.

WIDE BAND:

If there are no other stations located near the station of your choice and you are in a good area for reception, turn on to WIDE BAND for high-quality tone and superb reception.

11 STATION CALL SWITCHES

These are used to preset and recall broadcasting stations thereby eliminating the necessity of using the TUNING switches to locate your favorite stations.

12 FM IF-BAND NARROW INDICATOR

13 MANUAL SEARCH MUTE-OFF INDICATOR

14 RECORDING LEVEL CHECK INDICATOR


15 FREQUENCY DISPLAY

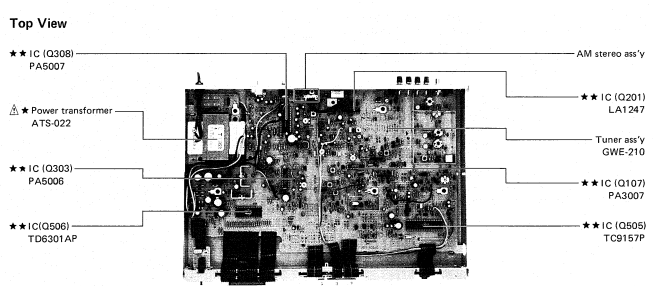
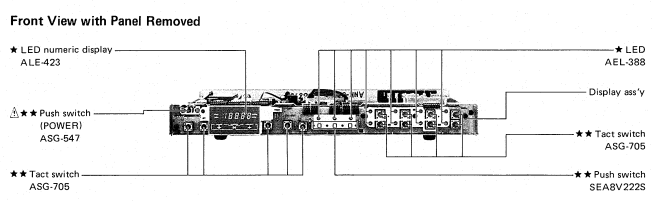
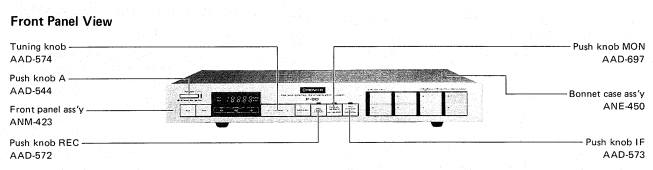
This shows the frequency of the station currently being received in digital form. The FM band is indicated by MHz, and the AM band is by kHz.

16 POWER INDICATOR

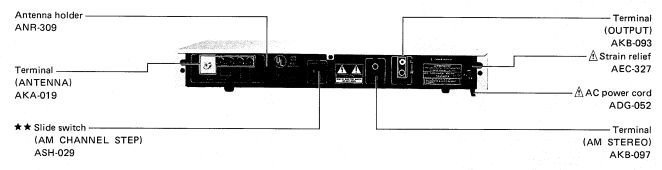
3. PARTS LOCATION

NOTES:

- The  mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
- For your Parts Stock Control, the fast moving items are indicated with the marks ****** and *****.
- ** GENERALLY MOVES FASTER THAN ***
- This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.



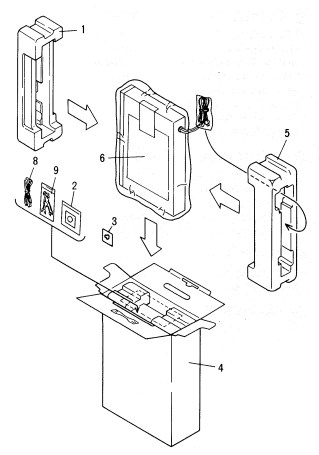
Rear Panel View



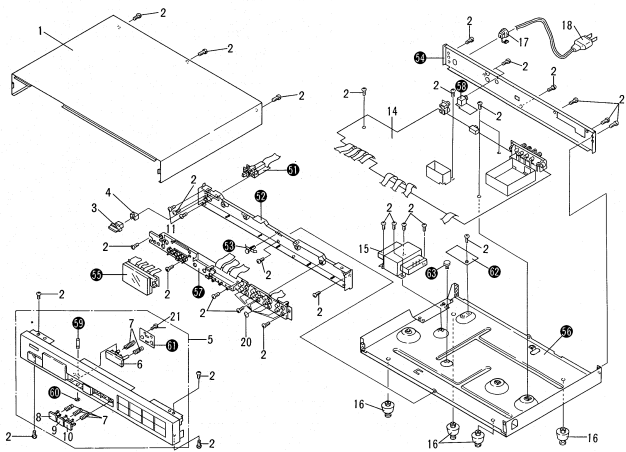
4. PACKING

Parts List

Mark	No.	Part No.	Description
	1	AHA-248	Front pad
	2	ATB-086	AM loop antenna ass'y
	3	AKX-066	Cosial connector
	4	AHE-210	Packing case
	5	AHA-249	Rear pad
	6	ARB-562	Operating instructions
	7	ADH-005	FM antenna
	9	ADE-015	Connection cord



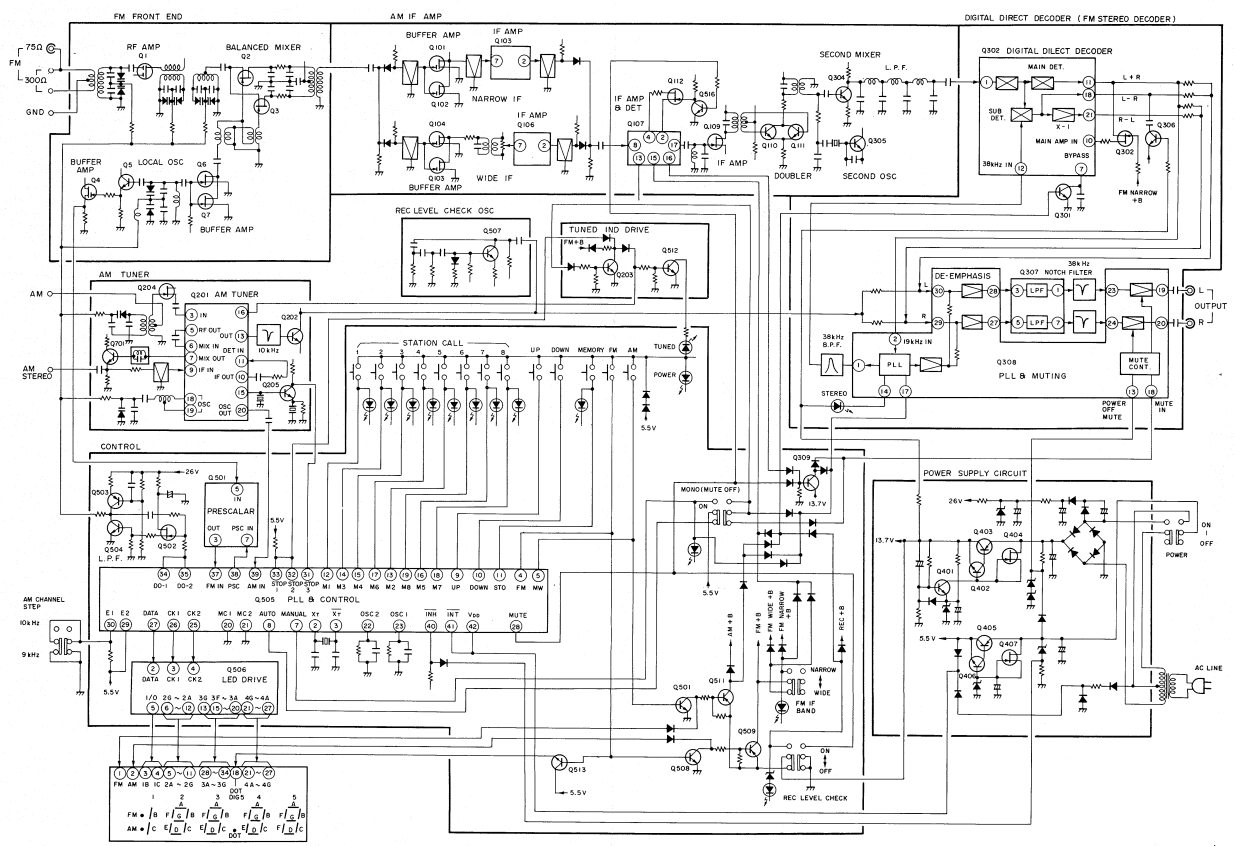
5. EXPLODED VIEW



NOTES:
 • Parts without part number cannot be supplied.
 • The Δ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
 • For your Parts Stock Control, the fast moving items are indicated with the marks *** and *.
 • ** GENERALLY MOVES FASTER THAN *
 This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.

Mark	No.	Part No.	Description	Mark	No.	Part No.	Description
	1	ANE-450	Bonnet case ass'y		51		Switch ass'y
	2	BBZ30P080FZK	Screw (3x8)		52		Front stay
	3	AAAD-544	Push knob A		53		P.C. Board spacer
	4	AEC-743	Flexible ring		54		Rear panel
	5	ANM-423	Front panel ass'y		55		LED ass'y
	6	AAAD-574	Tuning knob		56		Chassis
	7	ABH-095	Coiled spring		57		Display ass'y
	8	AAAD-572	Push knob REC		58		AM stereo ass'y
	9	AAAD-697	Push knob MON		59		Shaft
	10	AAAD-573	Push knob IF		60		C ring
	11	VMZ30P060FMC	Screw (3x6)		61		Bracket
	12	.....	.....		62		Terminal ass'y
	13	.....	.....		63		Spacer
	14	GWE-210	Tuner ass'y				
Δ	*	ATS-022	Power transformer				
	16	AEP-016	Foot ass'y				
Δ	17	AEC-327	Strain relief				
Δ	18	ADG-073	AC power cord				

6. BLOCK DIAGRAM



7. CIRCUIT DESCRIPTIONS

7.1 OUTLINE OF THE TC9157P

Pin No.	Symbol	I/O	Name	Function	
1	GND	—	GND terminal		
2	XT	—	Crystal oscillator terminal	Connect to a 7.2MHz reference frequency crystal oscillator.	
3	XT				
4	FM	I/O	FM band selector input	Reciprocally reset type FM/MW/LW band switching (LW not used).	
5	MW	I/O	MW band selector input		
6	LW	I/O	LW band selector input		
7	MANUAL	I/O	Manual tuning mode selector input	Reciprocally reset type UP/DOWN tuning manual and auto search mode switching.	
8	AUTO	I/O	Auto search tuning mode selector input		
9	UP	I	UP operation key input	Connect push-button keys for UP/DOWN tuning operation.	
10	DOWN	I	DOWN operation key input		
11	STO	I/O	Memory storage instruction input	Preset memory write status set by this input.	
12~19	MI~M8	I/O	Preset memory channel selector input	Control of 16-station preset memory write/read in combination with the MC1/MC2 input.	
20	MC1	I/O	Memory control input	16 preset memories can be fixed at 8 stations each for AM and FM respectively, or set to random selection (total of 16 FM/AM stations).	
21	MC2				
22	OSC2	—	AM oscillator input	CR connection for oscillator used to set scanning speed during AM search mode.	
23	OSC1	—	FM oscillator input	CR connection for oscillator used to set scanning speed during FM search mode.	
24	O/5	O	FM 50kHz output	Display output of FM band in 50kHz steps (Europe). "H" output for 50kHz.	
25	CK2	O	Tuned frequency data serial output	Output passed to tuned frequency digital display driver (TD6301AP). Output of serial data and timing clock.	
26	CK1				
27	DATA				
28	MUTE	O	Muting signal output	"H" output when switching band, during tuning search mode, and during STATION CALL operation.	
29	E2	I	Region designation input	Designation of Japan, USA, and Europe regions	
30	E1				L South L Africa	L Europe H	H USA L (AM9kHz)	H USA H (AM10kHz)
31	STOP3	I	AM-IF signal input	Counting of the 450kHz signal during AM mode, and stopping of auto search.	
32	STOP2	I	Auto search signal input	Auto search scanning speed reduced by half when "H" input is applied.	
33	STOP1	I	Slow scanning speed input		
34	DO-2	O	Phase comparator output	Two parallel tri-state buffer outputs obtained from one phase comparator.	
35	DO-1				
36	TEST	I	Test terminal	Switch to test mode by "H" level input.	
37	FM IN	I	FM counter input	Connect prescaler (TD6104P) output.	
38	PSC	O	Prescaler control	Control selection of prescaler (TD6104P) 1/30 and 1/32 frequency division.	
39	AM IN	I	AM counter input	AM local oscillator input.	
40	INH	I	Inhibit input	Normal operation when at "H" level, inhibited status when at "L" Level.	
41	INT	I	Initialization input	Normal operation when at "H" level, initialization of internal status when at "L" level.	
42	VDD	—	Power supply input terminal	Application of 5 ±0.5V. Back-up up to 2V possible.	

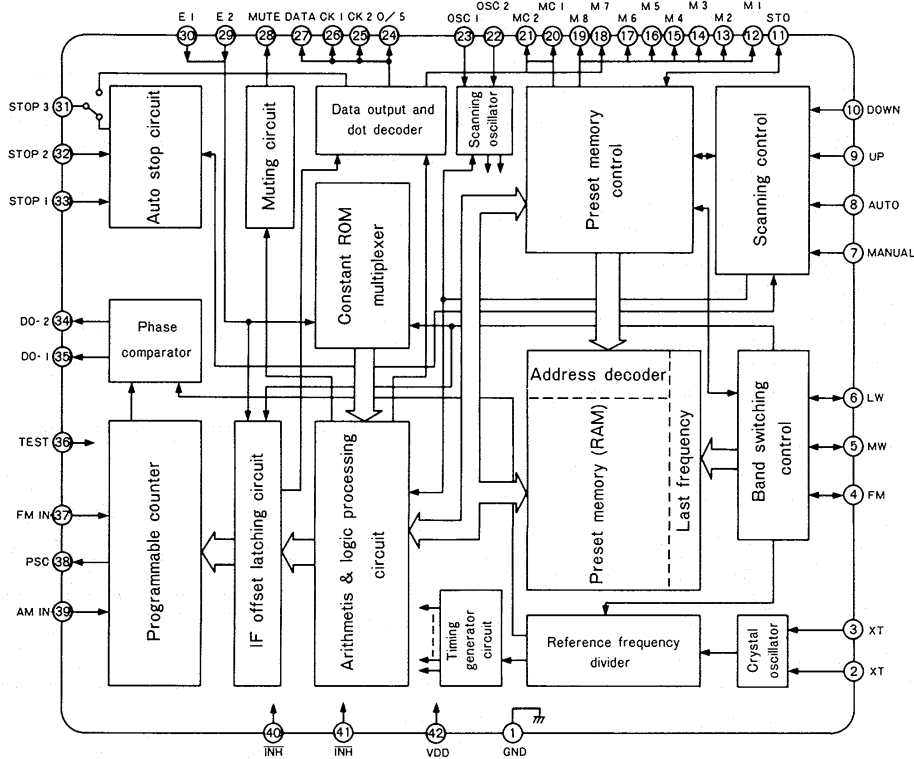
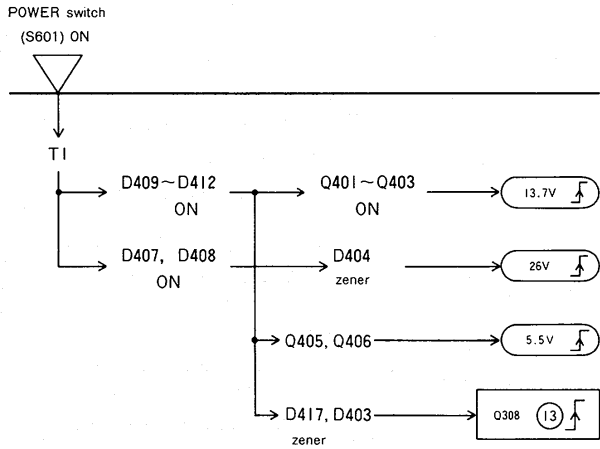
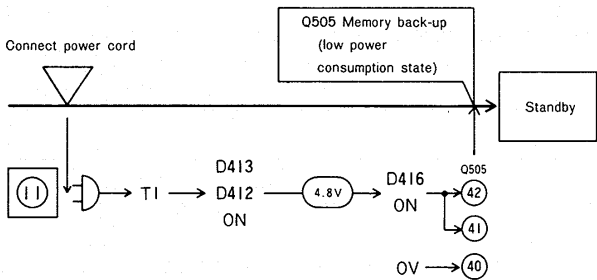


Fig. 7-1 TC9157P Block Diagram

7.2 OPERATION FLOWCHARTS

Power switch ON (1)

Connect power cord to mains socket (Fig. 7-2)



Disconnect power cord from mains socket (Fig. 7-2)

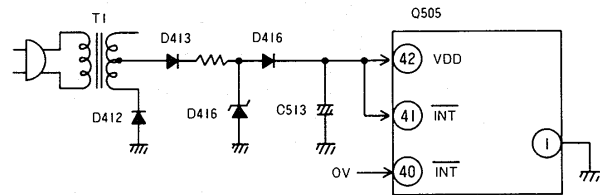
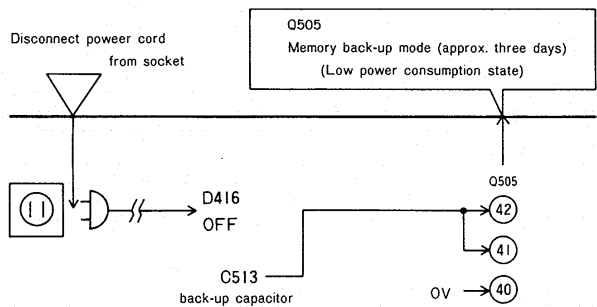


Fig. 7-2 Power Supply Circuit (1)

Power switch ON (2)

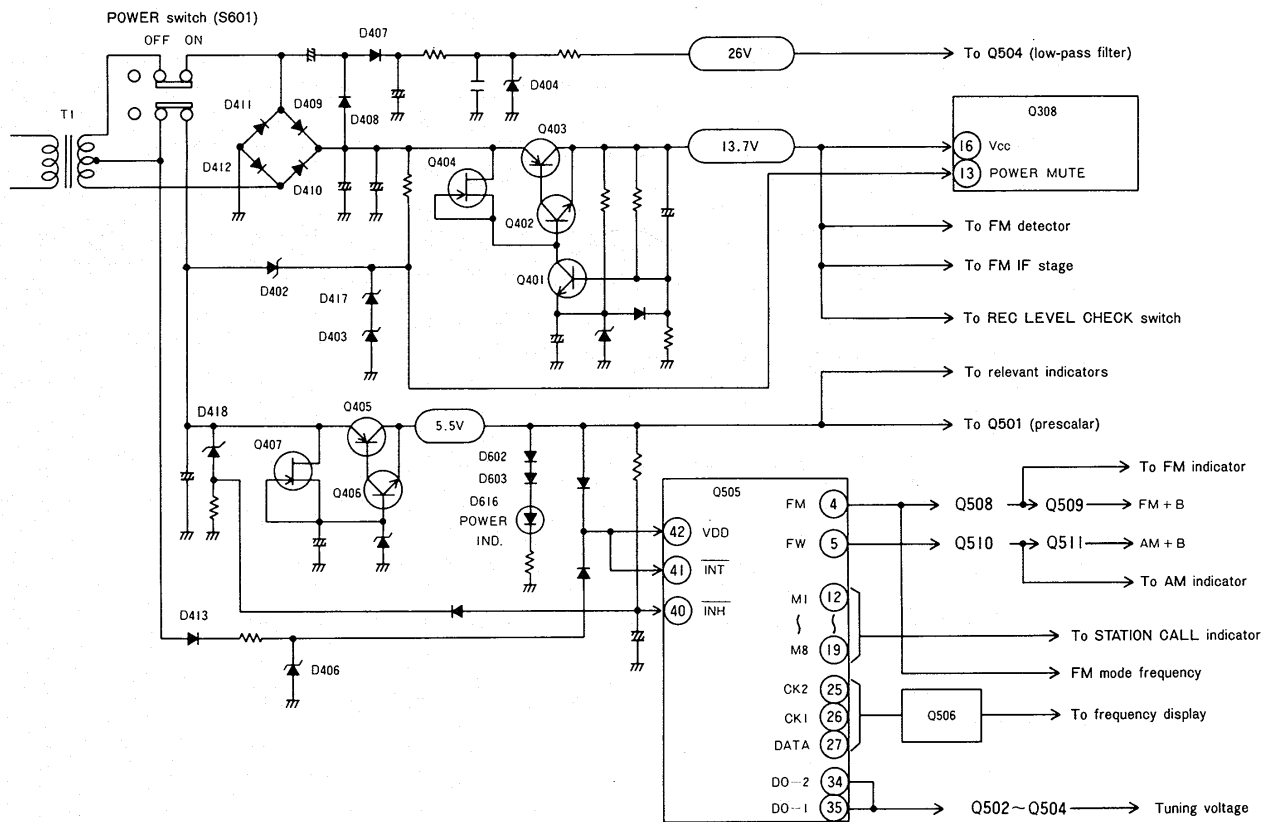
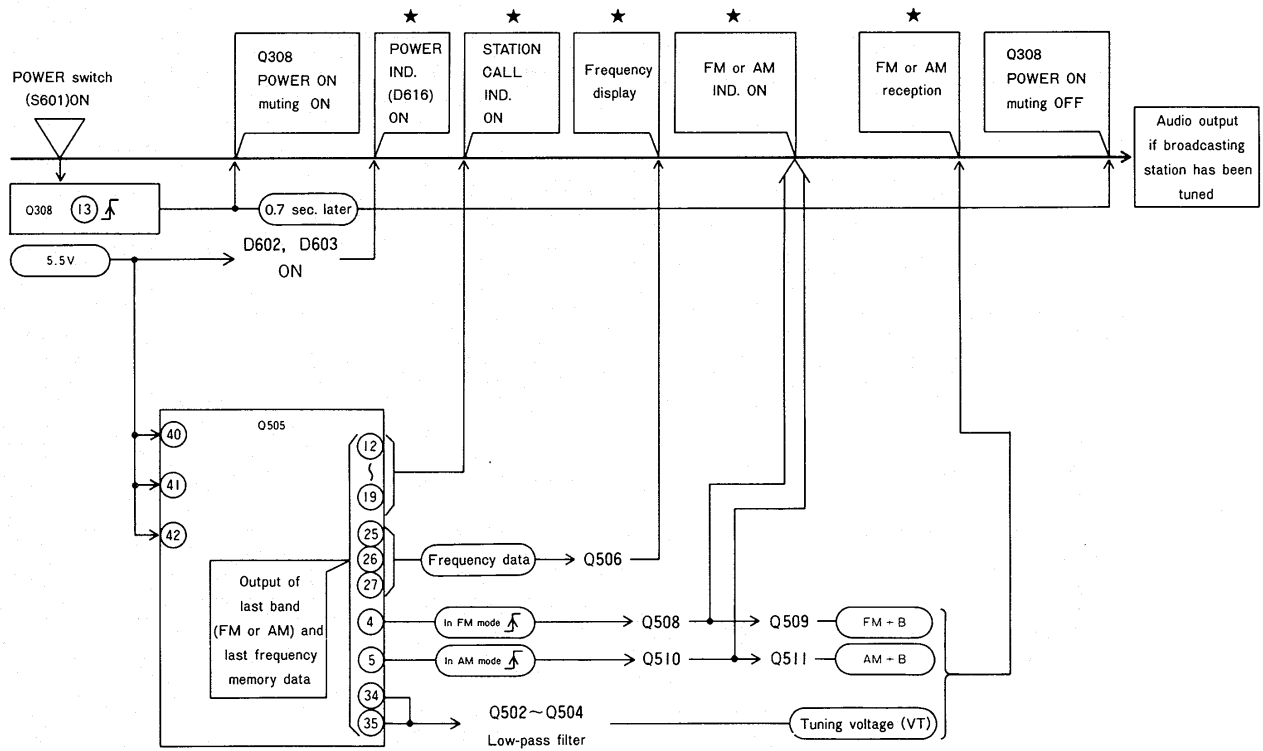
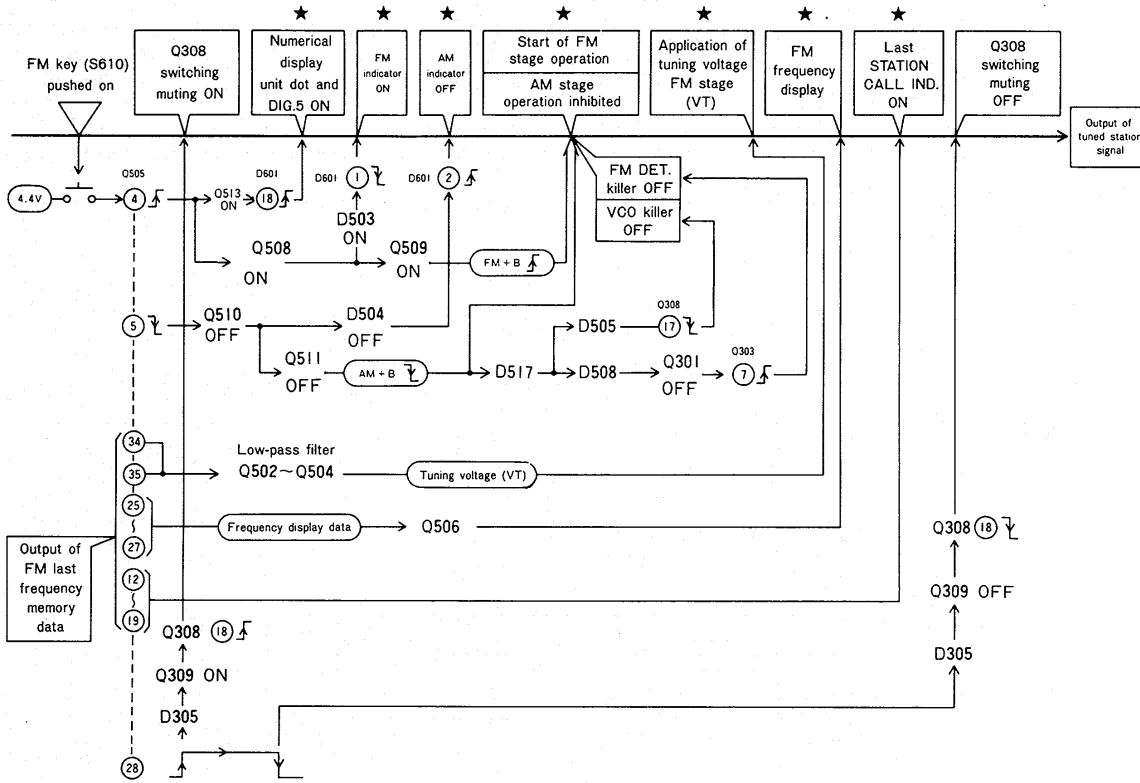
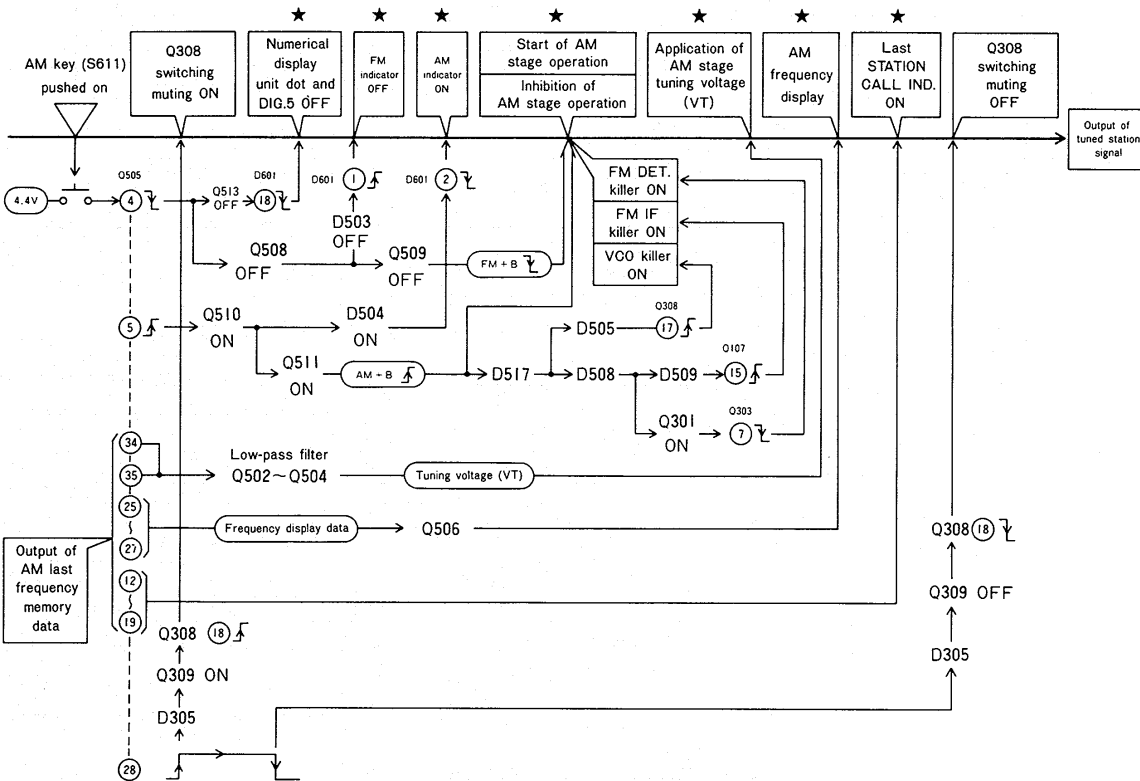


Fig. 7-3 Power Supply Circuit (2)

FM key operation (Fig. 7-4)



AM key operation (Fig. 7-4)



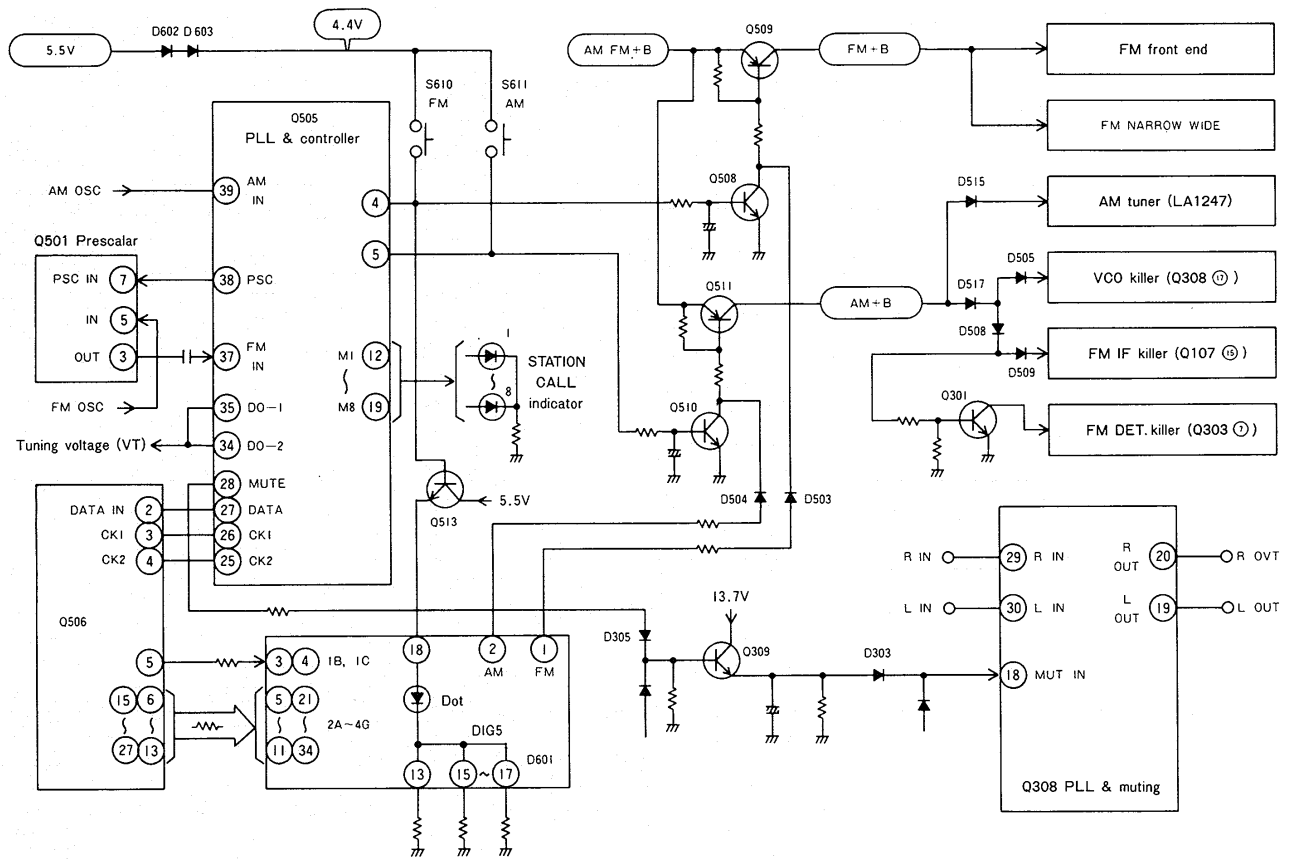


Fig. 7-4 AM/FM Switching

Symbol Description

Symbol	Description
	• Manual operation or start of operation
	• L → H
	• H → L
Q95 → 22 37 →	• Input signal to pin 38 of Q95, and output signal from pin 37
Q91 38	• Output of a single positive pulse from pin 38 of Q91
	• Intermediate circuit operation abbreviated.
	• Branching and combining
★	• More or less simultaneous operation

FM IF-BAND switch Operation (Fig. 7-5)

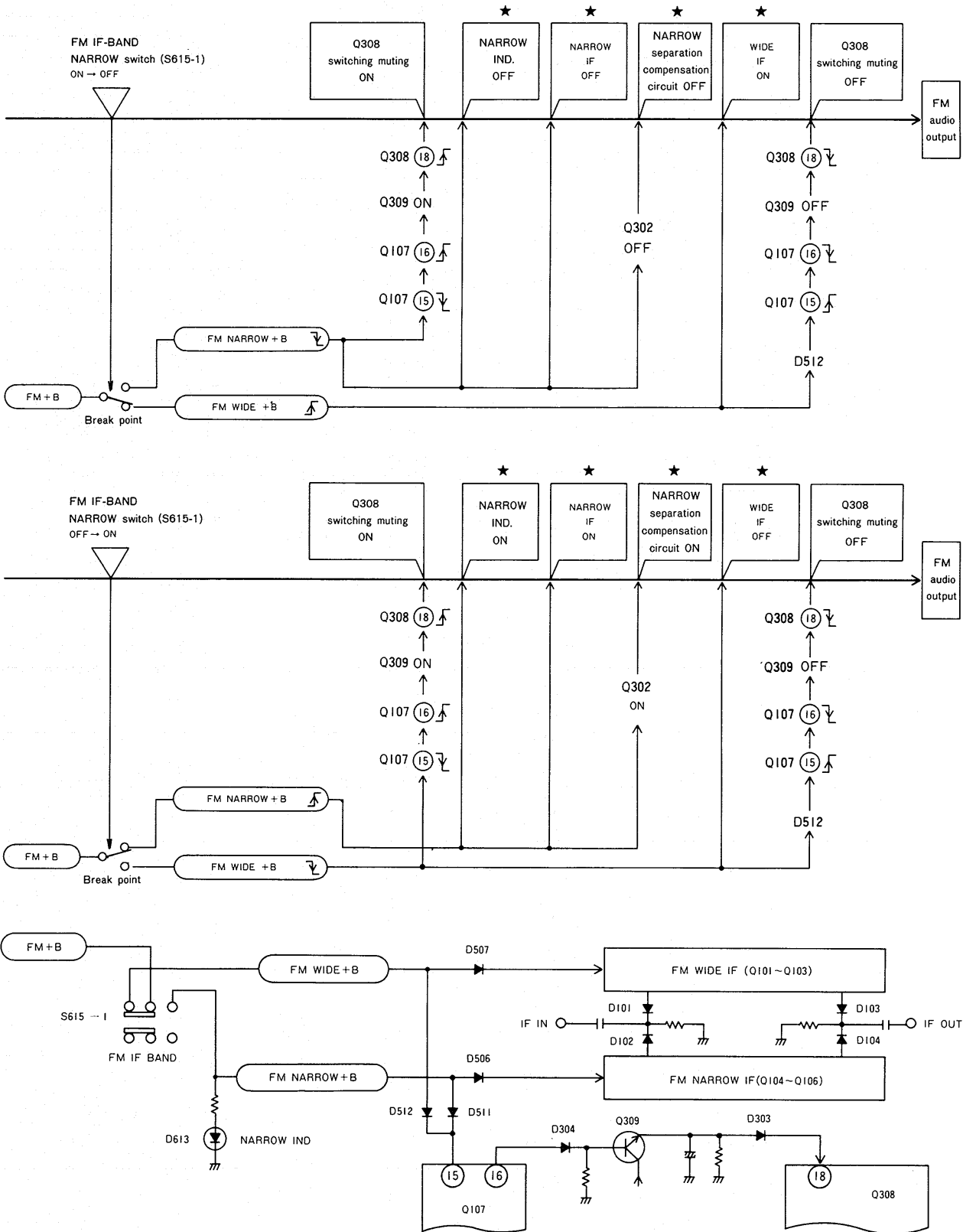


Fig. 7-5 FM IF-BAND Switching Circuit

REC LEVEL CHECK Switch Operation (Fig. 7-6)

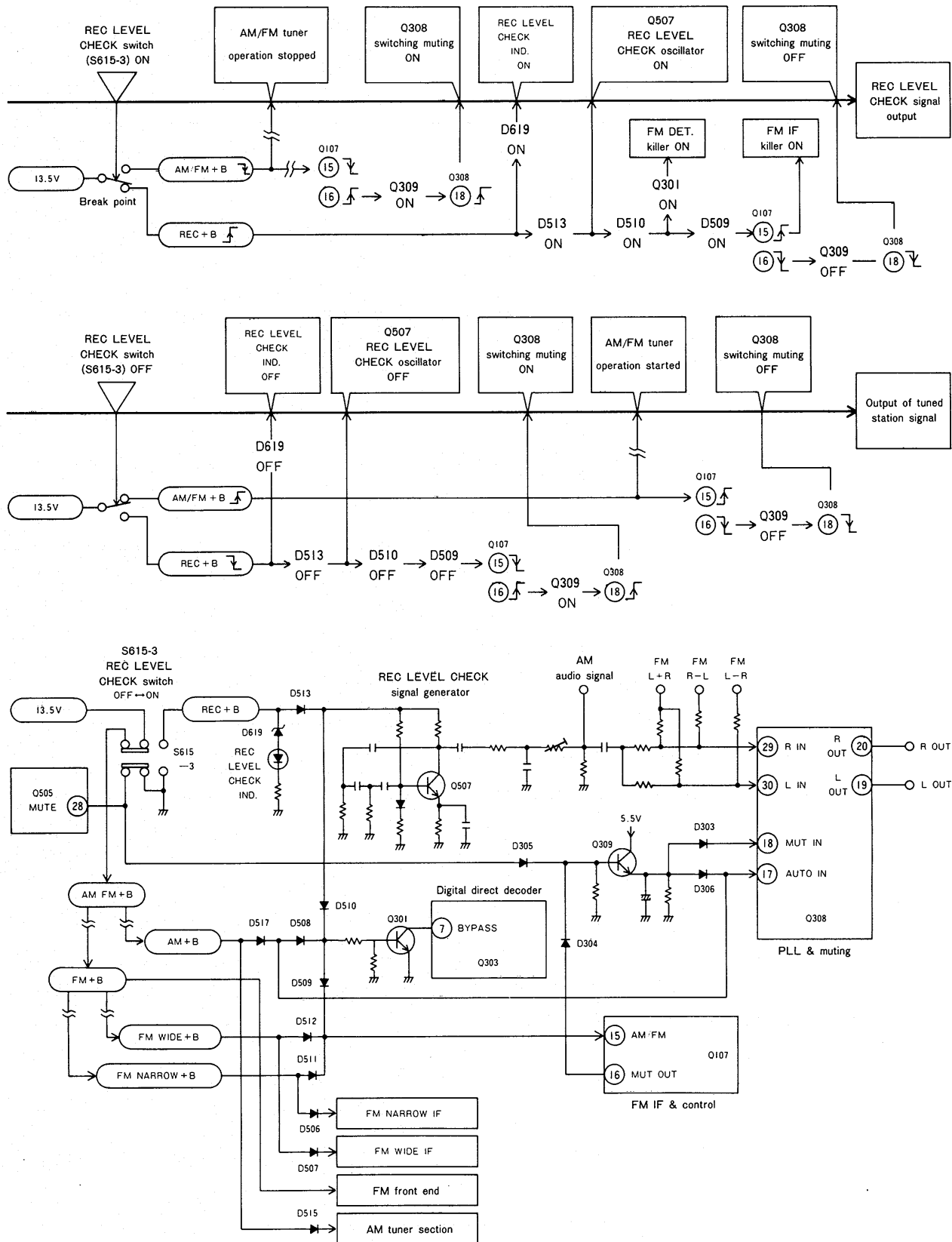


Fig. 7-6 REC LEVEL CHECK Switch Switching Circuit

Frequency conversion (Fig. 7-7)

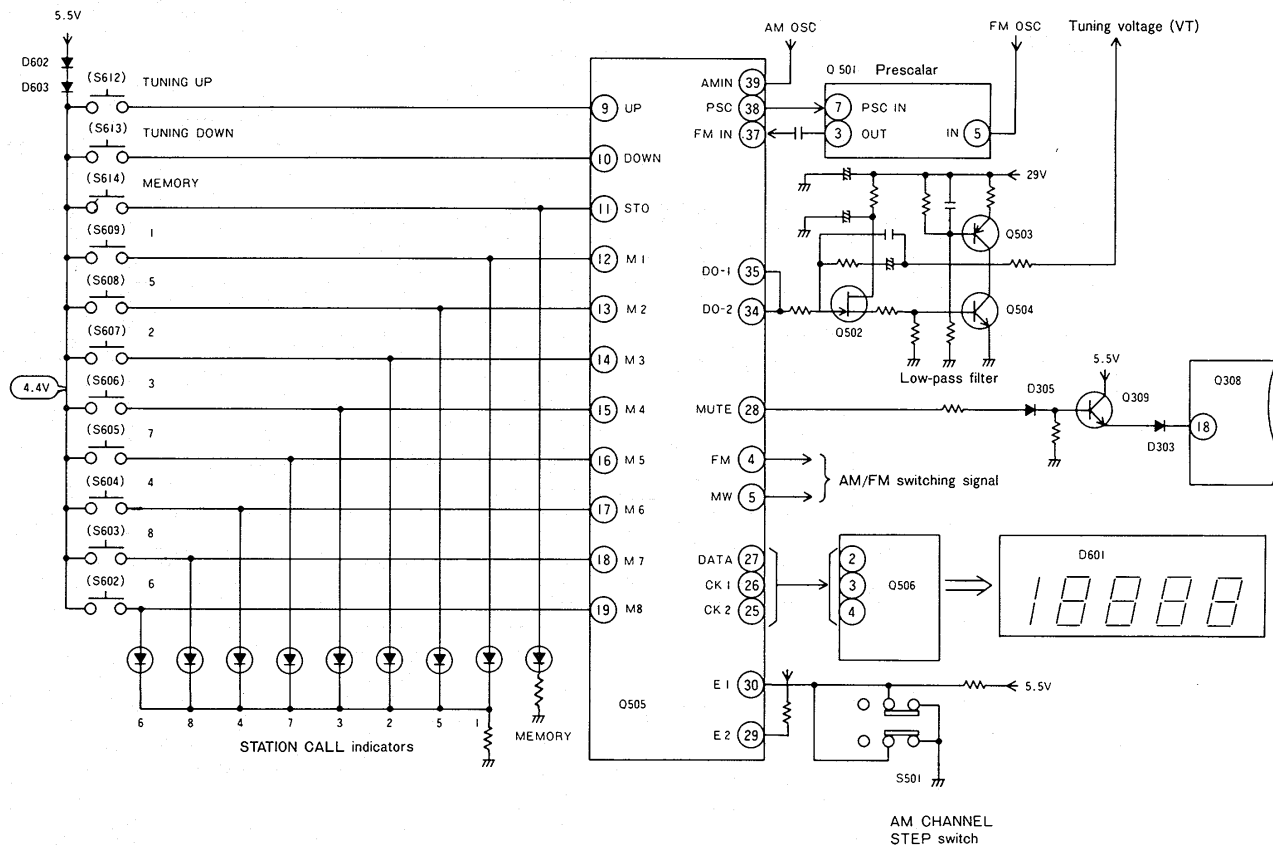
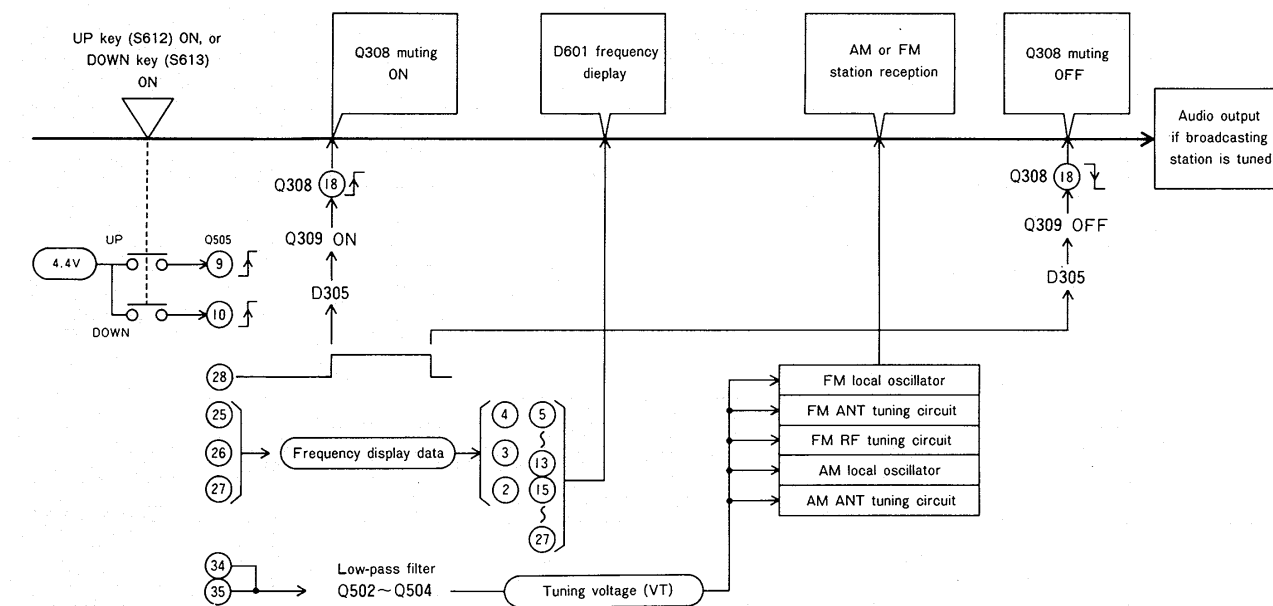
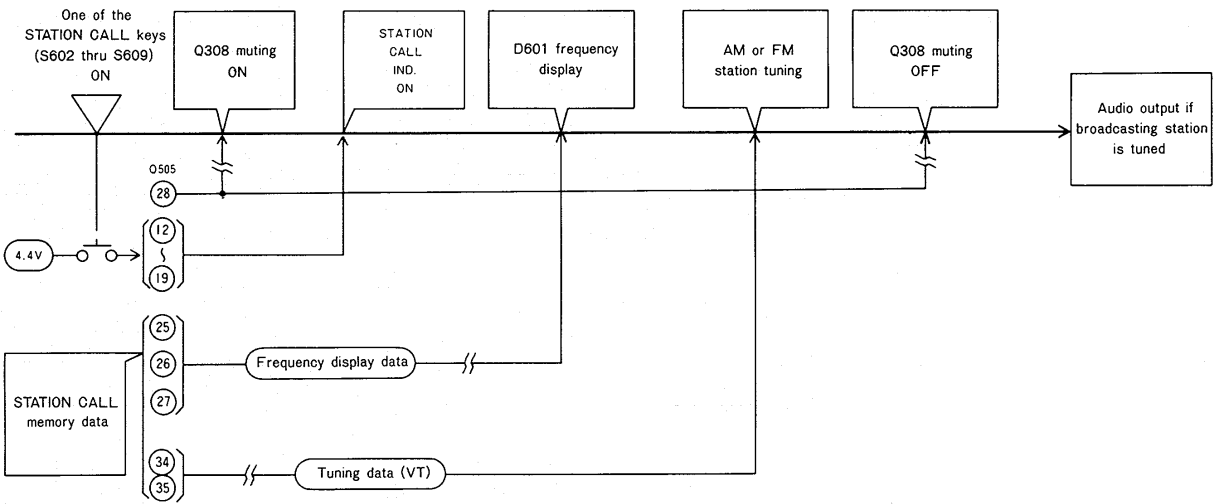
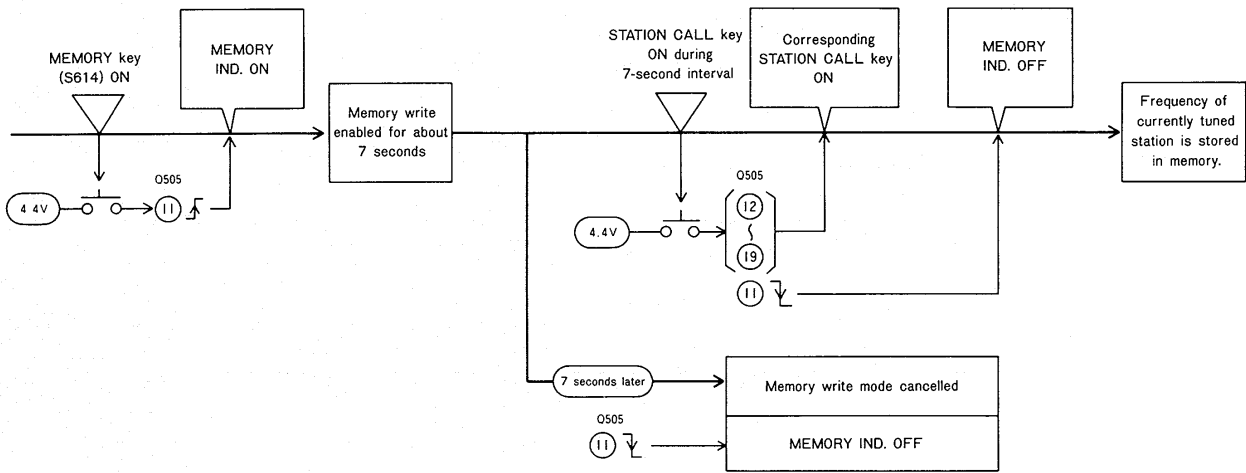


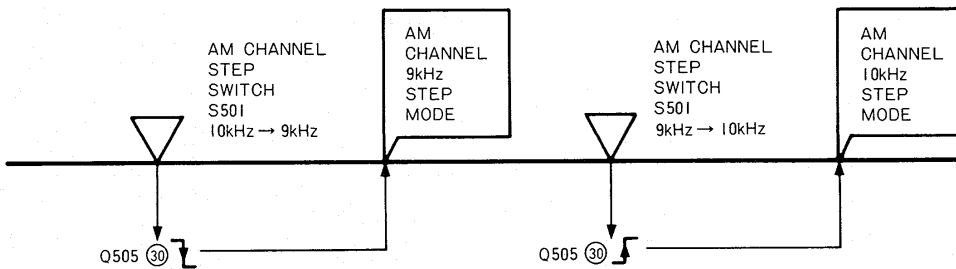
Fig. 7-7 Tuning Circuit



Memory operation (Fig. 7-7)



AM CHANNEL STEP Switch Operation (Fig. 7-7)



Indicator control (Fig. 7-8)

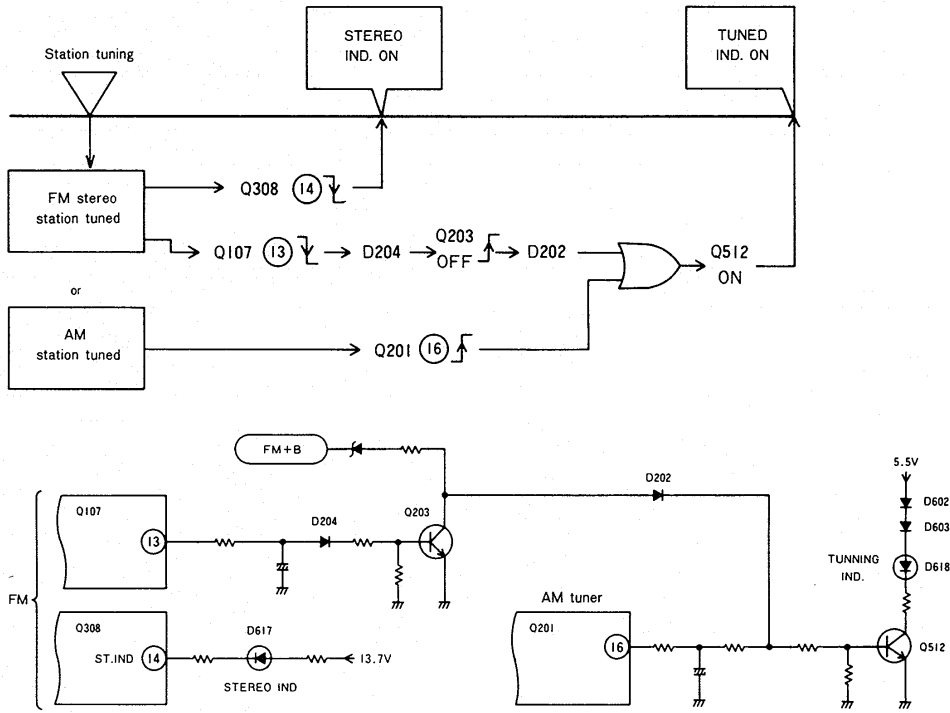


Fig. 7-8 Search mode switching circuit

Manual search / Mute off switch operation (Fig. 7-9)

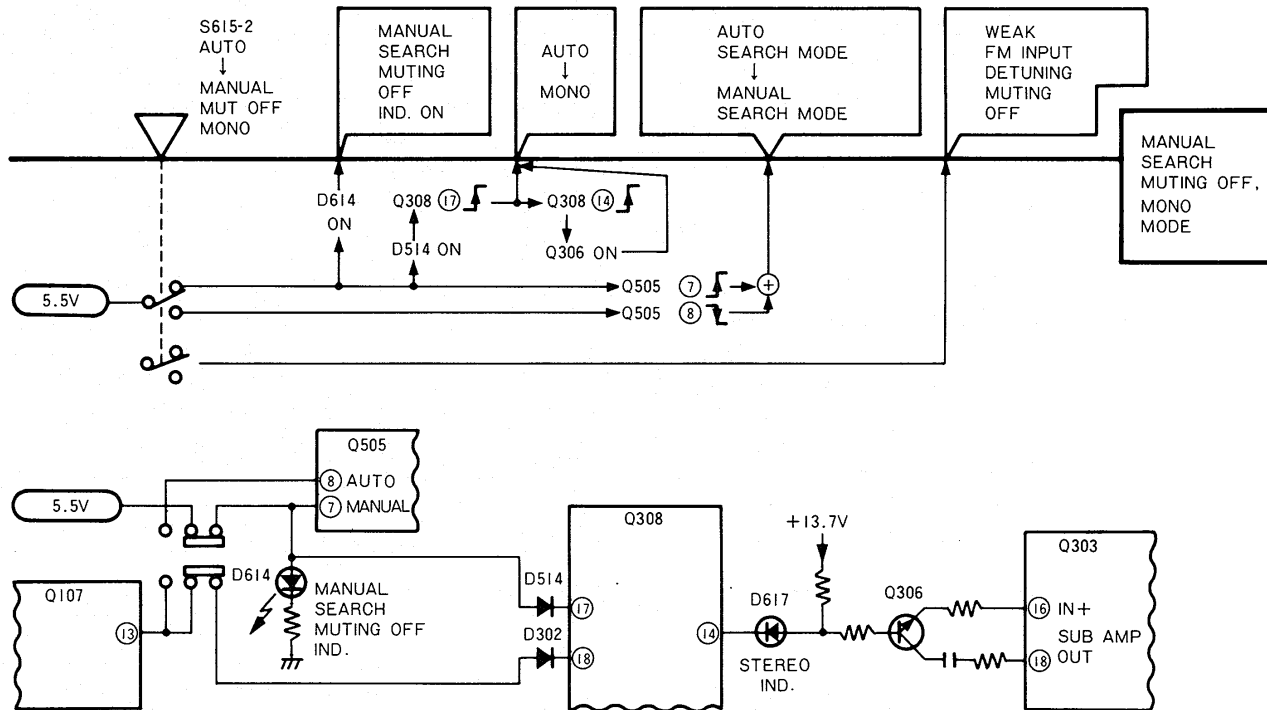


Fig. 7-9 Auto search switching circuit

FM auto search tuning (Fig. 7-10)

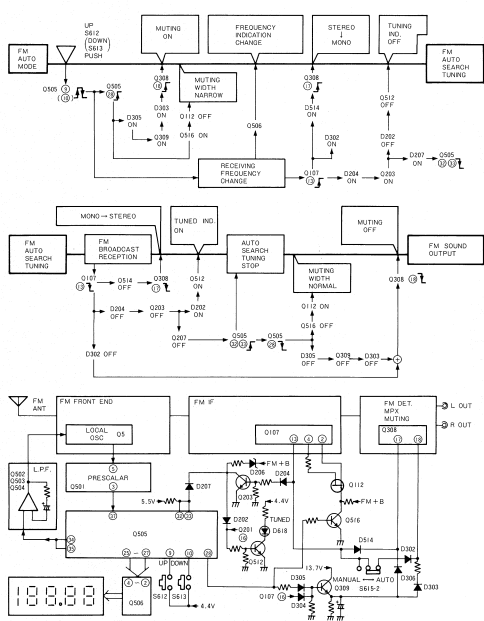


Fig. 7-10 FM auto search tuning circuit

AM auto search tuning (Fig. 7-11)

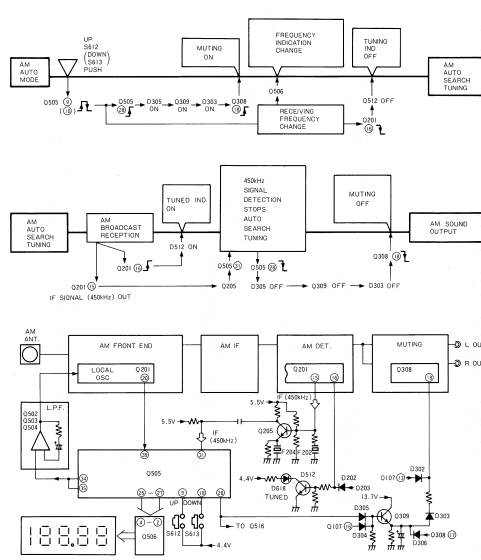


Fig. 7-11 AM auto search tuning circuit

7.3 OUTLINE OF SIGNAL PATH

Front End

In addition to conventional technology such as ID MOS FET, twin variable capacitors, and balance-hold capacitors, a recently developed source-injector type FET balanced mixer in the adjacent RF intermodulation characteristics. And a tracking coil inserted in the local oscillator stage corrects minor frequency discrepancies generated between the RF tuning stage and local oscillator, thereby reducing distortion in stereo reproduction.

IF Amplifier

This stage features a WIDE IF circuit for high quality reproduction, and a NARROW IF circuit for better selectivity, the two being switched by selector. The IF stage includes an IF system IC (PA3007).

Digital Direct Decoder

The digital direct decoder enables direct decoding of the MAIN (L+R) and SUB (L-R) signals. The 10.7MHz IF signal with maximum frequency deviation of $\pm 75\text{kHz}$ is doubled by Q110/Q111 to a frequency of 21.4MHz with maximum frequency deviation of $\pm 150\text{kHz}$. This signal is mixed with the output of the second local oscillator (20.14MHz crystal oscillator) to obtain the second IF signal of 1.26MHz and maximum frequency deviation of $\pm 150\text{kHz}$. This signal improves the decoding efficiency and obtains a high signal-to-noise ratio.

This second IF signal is applied to the digital direct decoder IC (PA5006). The MAIN signal is decoded in the same way pulse count decoding. That is, the second IF signal is adjusted to uniform amplitude by a limiter, and converted to trigger pulses by a differentiating circuit. This trigger pulse is then converted to a compressional wave pulse of constant amplitude and pulse width by a unistable multivibrator before being applied to the MAIN detector where the MAIN signal (L + R) is obtained. To obtain the SUB signal, the 194kHz pilot signal is removed from the above MAIN signal via an LC series resonator and subsequently applied to the PLL muting IC (PA5007). A 38kHz sine wave signal synchronized with the pilot signal is generated in this IC, and is passed back to PA5006 to be multiplied with the compression wave pulse for direct decoding of the SUB (L - R) signal. This SUB signal is applied to an inverting amplifier to obtain the R - L signal. Then by adding the respective L - R and R - L signals to the L + R MAIN signal, the L and R signals are obtained as indicated in the following equations.

$$(L + R) + (L - R) = 2L$$

$$(L + R) + (R - L) = 2R$$

Since these L and R signals contain various high region signals such as the subcarrier and second IF signal, these unwanted signal components are removed by a low-pass filter. The pilot signal is cancelled by an inverted phase pilot signal during the addition operation.

AM Tuner
Features two variable capacitors and an AM tuner IC (LA1247).

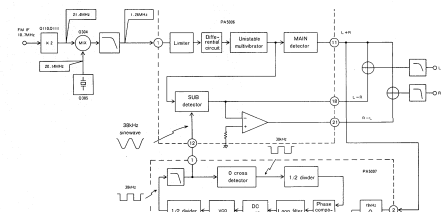
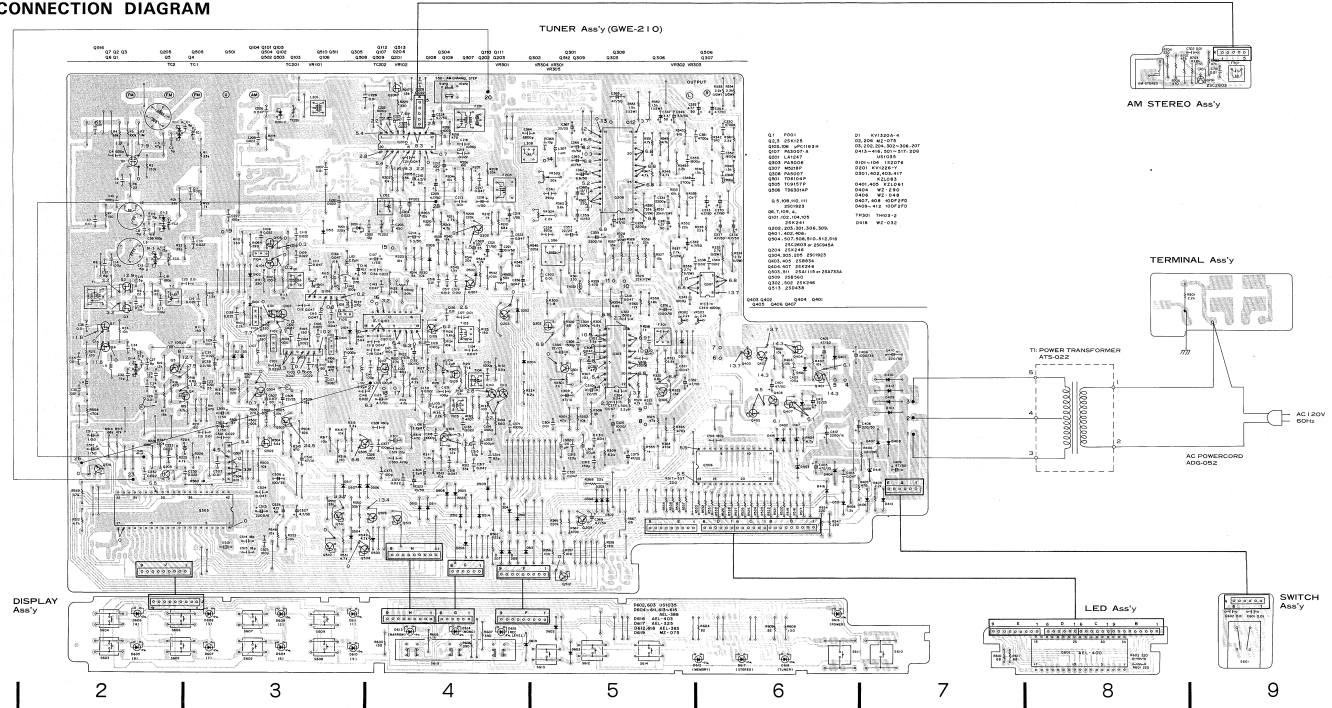


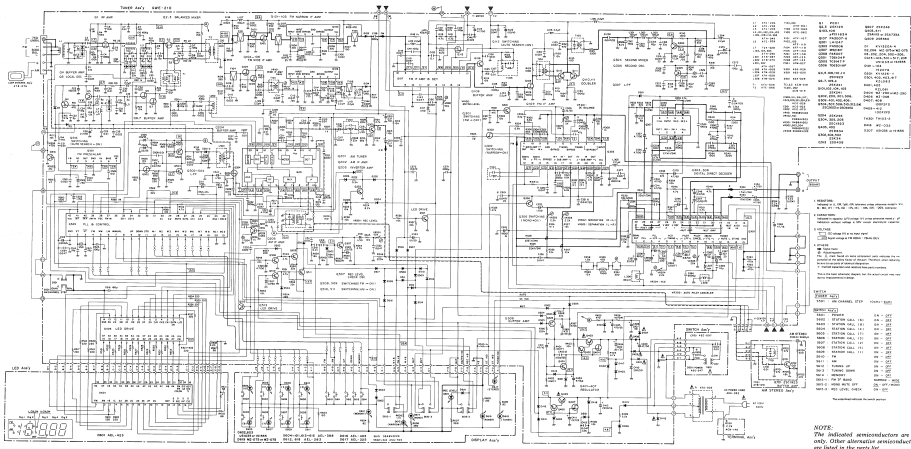
Fig. 7-12 Digital Direct Decoder

8. P.C. BOARD CONNECTION DIAGRAM

A
B
C
D

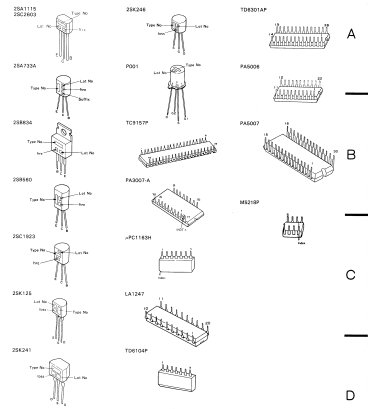


9. SCHEMATIC DIAGRAM



NOTE:
The indicated semiconductor part representative only.
Other alternative semiconductors may be used and
are listed in the parts list.

External Appearance of Transistors and ICs



MPX Section Adjustment

- Connect up as shown in Fig. 11-3.
- Press FM key ON, FM IF-BAND NARROW key OFF (WIDE), MONO/MUTE OFF key ON, and REC LEVEL CHECK key OFF.
- Set FM SG modulation mode to EXT., and connect the MPX SG to the FM SG EXT. mode terminals.
- Adjust the FM SG output precisely to 98.0MHz, and the F-90 tuned frequency display to 98.0MHz.

Step No.	MPX SG Modulation Mode	MF SG Level	Adjustment	
			Adjustment Location	Specifications
1	Modulation output OFF	100dB	VR304	Adjust the tuner ass'y TP14 frequency to 38kHz \pm 100Hz. Disconnect the frequency counter after completing this adjustment.
2	Pilot signal (19kHz) only	100dB	L306, VR305	Minimize the OUTPUT terminal 19kHz leak.
3	Standard stereo modulation	100dB	T2	Minimize OUTPUT terminal distortion.
4	Standard stereo modulation, and main signal in R.	100dB	VR302	Minimize the OUTPUT terminal left channel output.
5	Standard stereo modulation, and main signal in L.	100dB	VR303	Minimize the OUTPUT terminal right channel output.
6	Pilot signal (19kHz) only	100dB	VR305	Minimize the OUTPUT terminal 19kHz leak to the same level in both left and right channels.
7	Press the FM IF-BAND NARROW key ON			
8	Standard stereo modulation	26dB	VR102	Set to stage just prior to application of muting.

Note: Standard stereo modulation consists of main 1kHz (L+R) \pm 67.5kHz dev. and pilot (19kHz) \pm 7.5kHz dev.

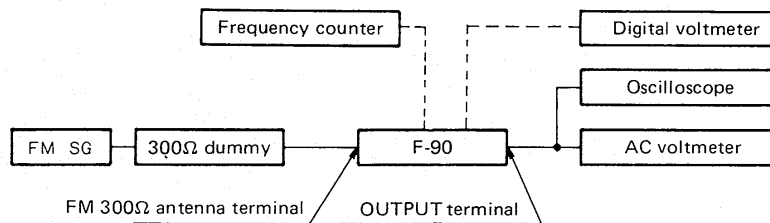


Fig. 11-2 FM Adjustment Connection Diagram

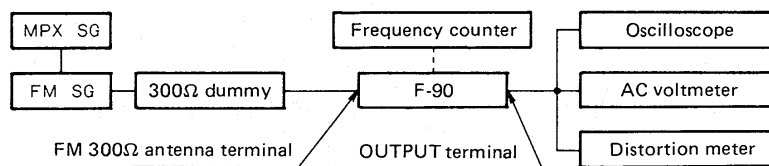


Fig. 11-3 FM MPX Adjustment Connection Diagram

REC LEVEL CHECK Signal Generator Level Adjustment

- Connect up as shown in Fig. 11-2.
- Press the FM key ON, the FM IF-BAND NARROW key OFF (WIDE), the MONO/MUTE OFF key ON, and the REC LEVEL CHECK key OFF.

Step	FM SG (400Hz, ±75kHz dev.)		F-90 Tuner Frequency Display	Adjustment	
	Frequency	Level		Adjustment Location	Specifications
1	98.0 MHz	80 dB	98.0 MHz	...	Check the OUTPUT terminal output level.
2	Press REC LEVEL CHECK key ON.			VR501	Set OUTPUT terminal output level to -6dB in respect to the step 1 level.

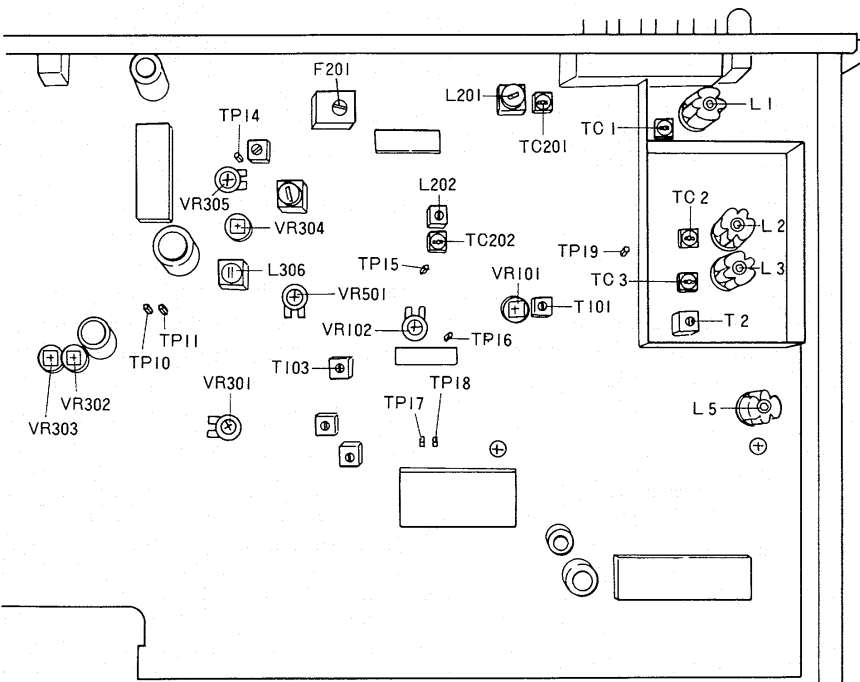


Fig. 11-4 Adjustment Locations

Adjustment Location	Adjustment Name
L1, TC1	FM ANT
L2, TC2 L3, TC3	FM RF
L5	FM OSC
T2	FM IFT
T101	FM WIDE IFT
T103	FM discrete
L306	Clean pilot
L201, TC201	AM ANT
L202, TC202	AM OSC
VR101	IF gain (WIDE)
VR102	MUTE level
VR301	V. center adjustment
VR302	Separation R → L
VR303	Separation L → R
VR501	REC LEVEL
VR304	VCO(38kHz)
VR305	Pilot cancel

11. RÉGLAGE

Réglage de la partie AM (modulation d'amplitude)

- Effectuer les branchements comme indiqué sur la Fig. 11-1.
- Mettre le commutateur AM en position marche (ON), et le commutateur vérification de niveau d'enregistrement (REC LEVEL CHECK) en position arrêt (OFF).
- Placer le commutateur de sélection de canal AM (AM CHANNEL STEP) sur la position 9kHz (types KU, S et S/G).

Phase	Générateur de signal AM (400Hz, modulation 30%)		Affichage de la fréquence d'accord du F-90	Réglage	
	Fréquence	Niveau		Position du réglage	Caractéristiques
1	Pas se signal		522kHz	L202	Régler l'élément tuner TP19 sur 2,0V CC.
2			1611kHz	TC202	Régler l'élément tuner TP19 sur 24,5V CC.
3	Se remettre sur les phase 1 et 2 et s'assure que les 2 caractéristiques sont remplies. lies.				
4	603kHz	40dB	603kHz	L201	Obtenir une lecture maximale de la tension CC au niveau de l'élément tuner TP15.
5	1395kHz	40dB	1395kHz	TC201	
6	Se remettre sur les phase 4 et 5 afin d'obtenir une tension maximale au niveau de l'élément tuner TP15.				

Réglage de la partie FM

- Effectuer les branchements comme indiqué sur la Fig. 11-2.
- Mettre le commutateur FM en position marche (ON), le commutateur de limitation de fréquences moyennes FM (FM IF BAND NARROW) en position marche (ON), et le commutateur de vérification de niveau d'enregistrement (REC LEVEL CHECK) sur arrêt. Puis, placer les commutateurs MONO/SILENCIEUX/ARRET (MONO/MUTE/OFF) sur arrêt (OFF).

Phase	Générateur de signal FM (400Hz, déviation ± 75 kHz)		Affichage de la fréquence d'accord du F-90	Réglage	
	Fréquence	Niveau		Position du réglage	Caractéristiques
1	Pas de signal		108,0MHz	L5	Régler l'élément tuner TP19 sur 24,5V CC.
2			87,5MHz	—	Vérifier la tension de l'élément tuner TP19 (8,0V CC).
3	88,0MHz	30dB	88,0MHz	L1,L2,L3,T2	Obtenir une lecture maximale de la tension CC au niveau de l'élément tuner TP16.
4	106,0MHz	30dB	106,0MHz	TC1,TC2,TC3	
5	Se remettre sur les phase 3 et 4 afin d'obtenir une tension maximale au niveau de l'élément tuner TP16.				
6	Mettre le commutateur de limitation de fréquences moyennes FM (FM IF-BAND NARROW) en position arrêt (OFF) et faire pivoter le VR101 complètement dans le sens des aiguilles d'une montre.				
7	98,0MHz	30dB	98,0MHz	T101	Obtenir une lecture maximale de la tension CC au niveau de l'élément tuner TP16.
8	98,0MHz	60dB	98,0MHz	T103	Régler la tension entre TP10 et TP18 sur le tuner sur 0V.
9	98,0MHz	60dB	98,0MHz	VR301	Régler la tension entre TP10 et TP11 sur tuner sur 0V.
10	98,0MHz	40dB approx.	98,0MHz	VR101 (WIDE IF)	Placer le commutateur de limitation de fréquences moyennes FM (FM IF-BAND NARROW) sur marche (ON) et sur arrêt (OFF) plusieurs fois, et régler la différence de niveau de sortie LARGE/ETROITE (WIDE/NARROW) à $\pm 1,0$ dB.

Remarque : Régler la fréquence de sortie du générateur de fréquence FM avec précision.

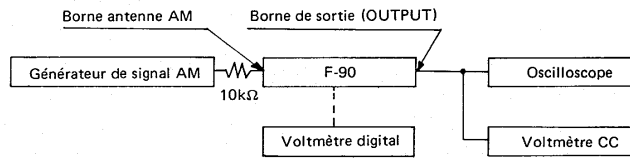


Fig. 11-1 Schéma de branchement pour le réglage AM

Réglage de la partie MULTIPLEX

- Effectuer les branchements comme indiqué sur la Fig. 11-3.
- Placer le commutateur de modulation de fréquence (FM) sur marche (ON), le commutateur de limitation de fréquences moyennes FM (FM IF-BAND NARROW) sur arrêt, le commutateur MONO/SILENCIEUX/ARRET (MONO/MUTE/OFF) sur marche, et le commutateur de vérification de niveau d'enregistrement (REC LEVEL CHECK) sur arrêt.
- Placer le sélecteur de modulation du générateur de signal FM (FM SG) sur EXT, et brancher le générateur de signal multiplex (MPX SG) sur les bornes EXT du générateur de signal FM.
- Régler la sortie du générateur de signal FM précisément sur 98,0MHz, et l'affichage de la fréquence d'accord du F-90 sur 98,0MHz.

Phase N°	Mode de modulation du générateur de signal multiplex	Niveau du générateur de signal FM	Réglage	
			Position du réglage	Caractéristiques
1	Sortie de modulation sur arrêt (OFF).	100dB	VR304	Régler la fréquence de l'élément tuner TP14 sur 38kHz \pm 100Hz. Débrancher le fréquencemètre après avoir terminé ce réglage.
2	Signal pilote (19kHz) uniquement.	100dB	L306,VR305	Réduire au minimum les fuites 19kHz au niveau de la borne de sortie (OUTPUT).
3	Modulation stéréo standard.	100dB	T2	Réduire au minimum la distortion au niveau de la borne de sortie (OUTPUT).
4	Modulation stéréo standard, le signal principal sur le canal droit (R).	100dB	VR302	Réduire au minimum le niveau de sortie du canal gauche au niveau de la borne de sortie (OUTPUT).
5	Modulation stéréo standard, le signal principal sur le canal gauche (L).	100dB	VR303	Réduire au minimum le niveau de sortie du canal droit au niveau de la borne de sortie (OUTPUT).
6	Signal pilote uniquement (19kHz).	100dB	VR305	Réduire au minimum les fuites 19kHz au même niveau sur les canaux droit et gauche.
7	Placer le commutateur de limitation de fréquences moyennes FM (FM IF-BAND NARROW) sur marche (ON).			
8	Modulation stéréo standard.	26dB	VR102	Juste avant d'utilisation du silencieux, régler l'appareil sur la position convenable.

Remarque : La modulation stéréo standard se compose d'un signal principal de 1kHz canal droit + canal gauche (L+R) d'une déviation de $\pm 67,5$ kHz, et d'un signal pilote (19kHz) d'une déviation de $\pm 7,5$ kHz.

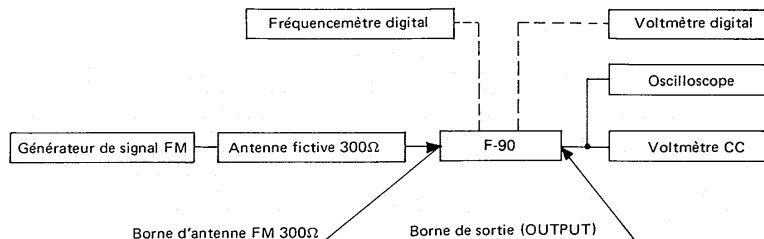


Fig. 11-2 Schéma de branchement pour le réglage multiplex

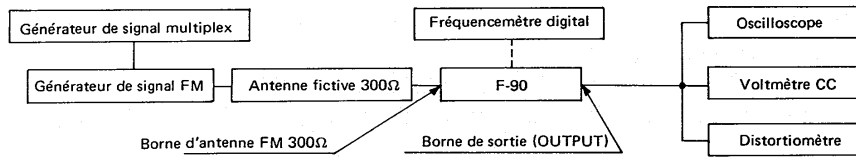


Fig. 11-3 Schéma de branchement pour le réglage FM multiplex

Réglage du niveau du générateur de signal pour vérifier le niveau d'enregistrement (REC LEVEL CHECK)

- Effectuer les branchements comme indiqué sur la Fig. 11-2.
- Placer le commutateur FM en position marche (ON), le commutateur de limitation de fréquences moyennes FM (FM IF-BAND NARROW) en position arrêt (LARGE) (OFF WIDE), le commutateur MONO/SILENCIEUX/ARRET (MONO/MUTE/OFF) en position marche (ON), et le commutateur de vérification de niveau d'enregistrement (REC LEVEL CHECK) en position arrêt (OFF).

Phase	Générateur de signal FM (400Hz, déviation de ±75kHz)		Affichage de la fréquence du tuner F-90	Réglage	
	Fréquence	Niveau		Position du réglage	Caractéristiques
1	98,0MHz	80dB	98,0MHz	—	Vérifier le niveau de la borne de sortie (OUTPUT).
2	Placer le commutateur de vérification de niveau d'enregistrement (REC LEVEL CHECK) en position arrêt (OFF).			VR501	Régler le niveau de la borne de sortie (OUTPUT) à -6dB en tenant compte du niveau de la phase 1.

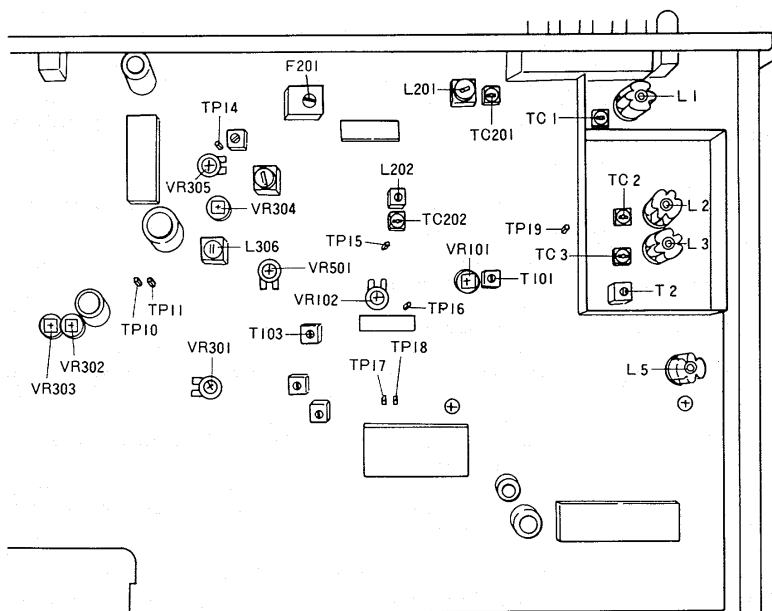


Fig. 11-4 Positions des réglages

Position du réglage	Désignation du réglage
L1, TC1	FM ANT
L2, TC2 L3, TC3	FM RF
L5	FM OSC
T2	FM IFT
T101	FM WIDE IFT
T103	FM discret (FM discrete)
L306	Atténuation du signal pilote (Clean pilot)
L201, TC201	AM ANT
L202, TC202	AM OSC
VR101	Gain fréquences moyennes (LARGE)(IF gain WIDE)
VR102	Niveau du silencieux (MUTE LEVEL)
VR301	Réglage centre V
VR302	Séparation Droite/gauche (R/L)
VR303	Séparation Gauche/droite (L/R)
VR501	Niveau d'enregistrement (REC LEVEL)
VR304	VCO (38kHz)
VR305	Elimination du signal pilote

11. AJUSTE

Ajuste de la sección de AM

- Conectar como se muestra en la Fig. 11-1.
- Presionar la tecla AM a ON y la tecla REC LEVEL CHECK a OFF.
- Poner el selector AM CHANNEL STEP en la posición de 9kHz (tipos KU, S y S/G).

Paso	Generador de señales de AM (400Hz, modulación del 30%)		Frecuencí- metro del sinto- nizador F-90	Ajustes	
	Frecuencia	Nivel		Lugar de ajuste	Especificaciones
1	Sin señal		522kHz	L202	Ajustar el conjunto sintonizador TP19 a 2V CC.
2			1611kHz	TC202	Ajustar el conjunto sintonizador TP19 a 24,5V CC.
3	Repetir los pasos 1 y 2 y cerciorarse de que se satisfacen ambas especificaciones.				
4	603kHz	40dB	603kHz	L201	Para obtener la indicación de tensión de CC máxima en TP15 del conjunto sintonizador.
5	1395kHz	40dB	1395kHz	TC201	
6	Repetir los pasos 4 y 5 para obtener la tensión máxima en TP15 del conjunto sintonizador.				

Ajuste de la sección de FM

- Conectar como se muestra en la Fig. 11-2.
- Presionar la tecla FM a ON, FM IF BAND NARROW a ON y la REC LEVEL CHECK a OFF. Luego, presionar la tecla MONO/MUTE/OFF a OFF.

Paso	Generador de señales de FM (400Hz, ± 75 kHz de desv.)		Frecuencí- metro del sinto- nizador F-90	Ajustes	
	Frecuencia	Nivel		Lugar de ajuste	Especificaciones
1	Sin señal		108,0MHz	L5	Ajustar TP19 del conjunto sintonizador a 24,5V CC.
2			87,5MHz	—	Comprobar la tensión de TP19 del conjunto sintonizador (8V CC).
3	88,0MHz	30dB	88,0MHz	L1,L2,L3,T2	Obtener la indicación de tensión de CC máxima en TP16 del conjunto sintonizador.
4	106,0MHz	30dB	106,0MHz	TC1,TC2,TC3	
5	Repetir los pasos 3 y 4 para obtener la tensión máxima en TP16 del conjunto sintonizador.				
6	Presionar la tecla FM IF-BAND NARROW a OFF, y girar VR101 completamente hacia la izquierda.				
7	98,0MHz	30dB	98,0MHz	T101	Obtener la indicación de la tensión de CC máxima en TP16 del conjunto sintonizador.
8	98,0MHz	60dB	98,0MHz	T103	Ajustar la tensión entre TP17 y TP18 del conjunto sintonizador a 0V.
9	98,0MHz	60dB	98,0MHz	VR301	Ajustar la tensión entre TP10 y TP11 del conjunto sintonizador a 0V.
10	98,0MHz	40dB aprox.	98,0MHz	VR101 (WIDE IF)	Presionar la tecla FM IF-BAND NARROW a ON y luego otra vez a OFF, ajustando la diferencia del nivel de salida de WIDE y de NARROW a ± 1 dB.

Nota: Ajustar con precisión la frecuencia de salida del generador de señales de FM.

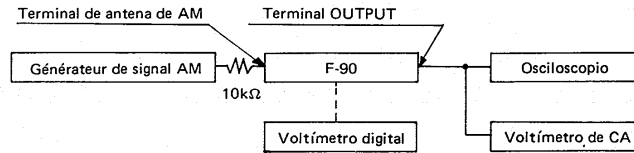


Fig. 11-1 Diagrama de conexiones para ajuste de AM

Ajuste de la sección de MPX

- Conectar como se muestra en la Fig. 11-3.
- Presionar la tecla FM a ON, la tecla FM IF-BAND NARROW a OFF (WIDE), la tecla MONO/MUTE OFF a ON, y la tecla REC LEVEL CHECK a OFF.
- Ajustar el modo de modulación del generador de señales de FM a EXT. y conectar el MPX SG (generador de señales de multiplex) a los terminales de modo FM SG EXT.
- Ajustar la salida del generador de señales de FM a 98,0MHz, y el frecuencímetro sintonizado de F-90 a 98,0MHz.

No de paso	Modo de modulación del MPX SG	Nivel del FM SG	Ajuste	
			Lugar de ajuste	Especificaciones
1	Salida de modulación OFF.	100dB	VR304	Ajustar la frecuencia de TP14 del conjunto sintonizador a 38kHz \pm 100Hz. Desconectar el frecuencímetro después de haber completado este ajuste.
2	Señal piloto (19kHz) solamente.	100dB	L306,VR305	Minimizar la pérdida de 19kHz del terminal OUTPUT.
3	Modulación estereofónica estándar.	100dB	T2	Minimizar la distorsión en el terminal OUTPUT.
4	Modulación estereofónica estándar, y señal principal en R.	100dB	VR302	Minimizar la salida del canal izquierdo en el terminal OUTPUT.
5	Modulación estereofónica estándar, y señal principal en L.	100dB	VR303	Minimizar la salida del canal derecho en el terminal OUTPUT.
6	Señal piloto (19kHz) solamente.	100dB	VR305	Minimizar la pérdida de 19kHz del terminal OUTPUT al mismo nivel en los canales izquierdo y derecho.
7	Presionar la tecla FM IF-BAND NARROW a ON.			
8	Modulación estereofónica estándar.	26dB	VR102	Ajustar a la etapa precisamente antes de aplicar el silenciamiento.

Nota: La modulación estereofónica estándar consta de la principal de 1kHz (L+R) \pm 67,5kHz de desv. y de la piloto (19kHz) \pm 7,5kHz de desv.

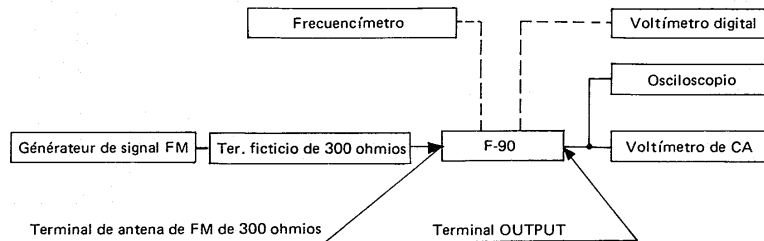


Fig. 11-2 Diagrama de conexiones para ajuste de FM

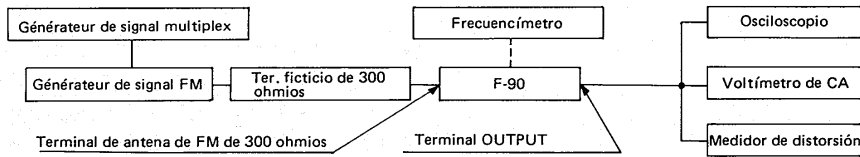


Fig. 11-3 Diagrama de conexiones para ajuste de FM MPX

Ajuste del nivel del generador de señales en REC LEVEL CHECK

- Conectar como se muestra en la Fig. 11-2.
- Presionar la tecla FM a ON, la tecla FM IF-BAND NARROW a OFF (WIDE), la tecla MONO/MUTE OFF a ON, y la tecla REC LEVEL CHECK a OFF.

Paso	Generador de señales de FM (400Hz, ±75kHz desv.)		Frecuencímetro del sintonizador F-90	Ajuste	
	Frecuencia	Nivel		Lugar de ajuste	Especificaciones
1	98,0MHz	80dB	98,0MHz	—	Comprobar el nivel de salida del terminal OUTPUT.
2	Presionar la tecla REC LEVEL CHECK a ON.			VR501	Ajustar el nivel de salida del terminal OUTPUT a -6dB con respecto al nivel del paso 1.

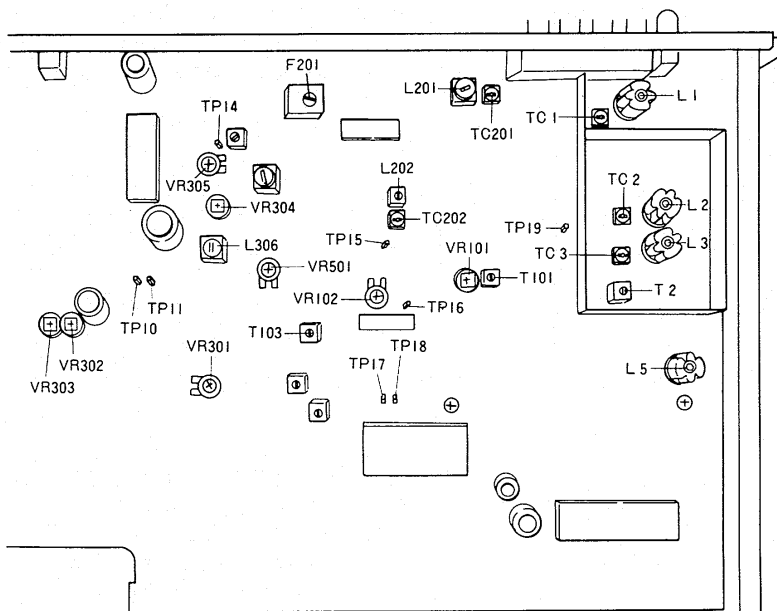


Fig. 11-4 Lugares de ajuste

Lugar de ajuste	Nombre de ajuste
L1, TC1	FM ANT
L2, TC2 L3, TC3	FM RF
L5	FM OSC
T2	FM IFT
T101	FM WIDE IFT
T103	FM discreto
L306	Piloto de cancelación
L201, TC201	AM ANT
L202, TC202	AM OSC
VR101	Ganancia de FI (WIDE)
VR102	Nivel de MUTE
VR301	Ajuste central de V
VR302	Separación de R → L
VR303	Separación de L → R
VR501	REC LEVEL
VR304	VCO (38kHz)
VR305	Cancelación de piloto

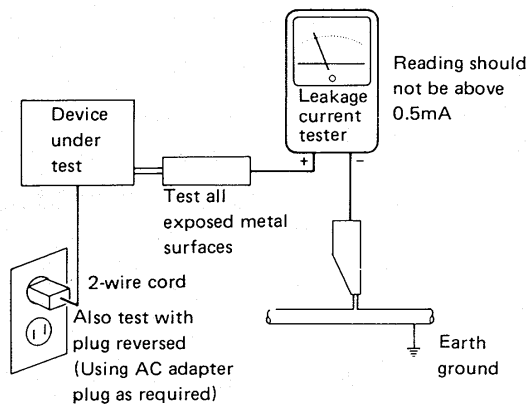
12. SAFETY INFORMATION

1. SAFETY PRECAUTIONS

The following check should be performed for the continued protection of the customer and service technician.

LEAKAGE CURRENT CHECK

Measure leakage current to a known earth ground (water pipe, conduit, etc.) by connecting a leakage current tester such as Simpson Model 229-2 or equivalent between the earth ground and all exposed metal parts of the appliance (input/output terminals, screwheads, metal overlays, control shaft, etc.). Plug the AC line cord of the appliance directly into a 120V AC 60Hz outlet and turn the AC power switch on. Any current measured must not exceed 0.5mA.



AC Leakage Test

ANY MEASUREMENTS NOT WITHIN THE LIMITS OUTLINED ABOVE ARE INDICATIVE OF A POTENTIAL SHOCK HAZARD AND MUST BE CORRECTED BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

2. PRODUCT SAFETY NOTICE

Many electrical and mechanical parts in the appliance have special safety related characteristics. These are often not evident from visual inspection nor the protection afforded by them necessarily can be obtained by using replacement components rated for voltage, wattage, etc. Replacement parts which have these special safety characteristics are identified in this Service Manual.

Electrical components having such features are identified by marking with a ⚠ on the schematics and on the parts list in this Service Manual.

The use of a substitute replacement component which does not have the same safety characteristics as the PIONEER recommended replacement one, shown in the parts list in this Service Manual, may create shock, fire, or other hazards.

Product Safety is continuously under review and new instructions are issued from time to time. For the latest information, always consult the current PIONEER Service Manual. A subscription to, or additional copies of, PIONEER Service Manual may be obtained at a nominal charge from PIONEER.

13. FOR HE AND HB TYPES

The HE and HB types are the same as the KU type with the exception of the following sections.

Contrast of Miscellaneous Parts

Mark	Symbol & Description	Part No.			Remarks
		KU type	HE type	HB type	
	Tuner ass'y	GWE-210	GWE-211	GWE-211	
	AM stereo ass'y	no supply	...	...
	Terminal ass'y	no supply	...	...
△ ★	T1 Power transformer (120V) (220V, 240V)	ATS-022	...	...
△	AC power cord	ADG-052	ADG-068	ADG-063	
	Coaxial connector	AKX-056	...	...
	Operating instructions (English)	ARB-562	...	ARB-562	
	(English, French, German, Italian)	...	ARE-074	...	
	Packing case	AHE-210	AHE-211	AHE-210	

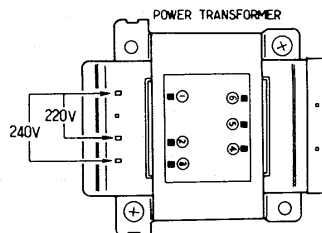
The Tuner ass'y GWE-211 (for HE and HB types) is the same as the GWE-210 (for KU type) with the exception of the following sections.

Mark	Symbol & Description	Part No.		Remarks
		GWE-210	GWE-211	
	Terminal (ANTENNA)	AKA-019	AKA-021	
	F203 10kHz filter	ATF-144	...	
	F203 9kHz filter	...	ATF-137	
★★	Q515	...	2SA1115 (2SA733A)	
	C334, C339	CQSA 222J 50	CQSA 152J 50	
	R565	...	RD¼PM 121J	
	R563, R564	...	RD¼PM 102J	
	R566	...	RD¼PM 330J	
	R567	RD¼PM 680J	...	

Line Voltage Selection

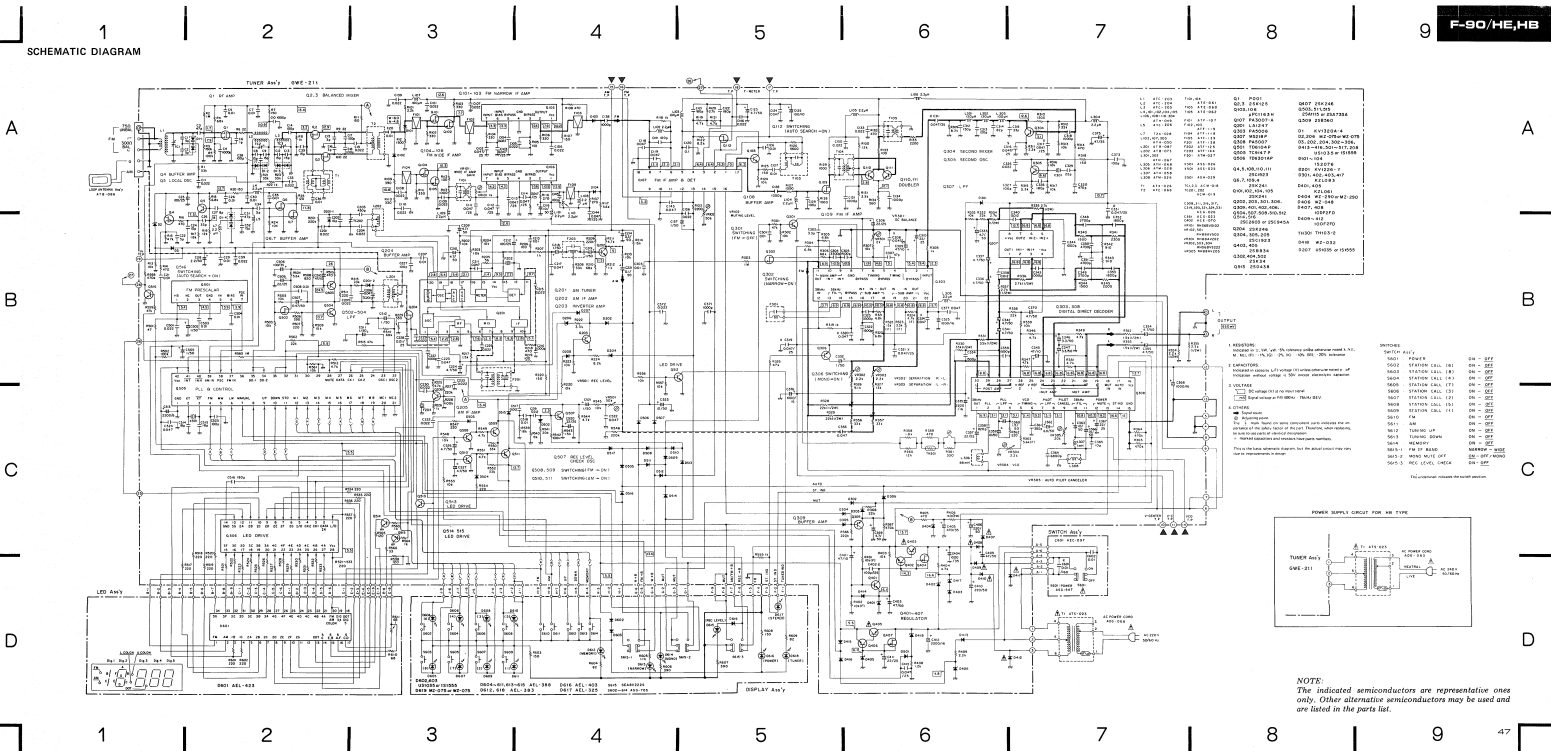
Line voltage can be changed with following steps.

1. Disconnect the AC power cord.
2. Remove the top cover.
3. Change the connection of the power transformer primary taps.
4. Stick the line voltage label on the rear panel.



Part No.	Description
AAX-193	220V label
AAX-192	240V label

SCHEMATIC DIAGRAM



NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.

