PIONEER®

Service Manual

ORDER NO.
ART-611-0

FM/AM DIGITAL SYNTHESIZED TUNER

F-9

MODEL F-9 COMES IN SIX VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
KU	120V only	U.S.A. model
S	110V, 120V, 220V and 240V (Switchable)	General export model
S/G	110V, 120V, 220V and 240V (Switchable)	U.S. Military model
HE	220V and 240V (Switchable)	Europe model
HB	220V and 240V (Switchable)	United Kingdom model
KC	120V only	Canada model

- **This service manual is applicable to the KU type. When repairing the HE, HB types, please see the additional service manual (ART-613), and see the ART-614 for S, S/G types and ART-612 for KC type.**
- **Ce manuel d'instruction se refère au mode de réglage, en français.**
- **Este manual de servicio trata del método de ajuste escrito en español.**

CONTENTS

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1. SPECIFICATIONS

FM Tuner Section

Usable Sensitivity ..... Mono; 10.8 dBf (0.95 μV)
50 dB Quieting Sensitivity ..... Mono; 15 dBf (1.55 μV)
Stereo; 37 dBf (19.5 μV)
Signal-to-Noise Ratio ..... Mono; 90 dB (at 85 dBf)
Stereo; 85 dB (at 85 dBf)

Distortion (at 85 dBf)		WIDE	NARROW
Mono	100 Hz;	0.03%	—
	1 kHz;	0.03%	0.05%
	10 kHz;	0.03%	—
Stereo	100 Hz;	0.05%	—
	1 kHz;	0.05%	0.5%
	10 kHz;	0.1%	—

Capture Ratio ..... 1.0 dB 2.5 dB
Alternate Channel
Selectivity ..... 400 kHz; 40 dB 85 dB
300 kHz; — 60 dB
Stereo Separation ..... 1 kHz; 55 dB 40 dB
50 Hz to 10 kHz; 48 dB —
Frequency Response ..... 20 Hz to 15 kHz $^{+0.2}_{-0.5}$ dB
Spurious Response Ratio ..... 80 dB
Image Response Ratio ..... 70 dB
IF Response Ratio ..... 100 dB
AM Suppression Ratio ..... 65 dB
Subcarrier Product Ratio ..... 70 dB
SCA Rejection Ratio ..... 65 dB
Muting Threshold ..... 25.2 dBf (5 μV)
Antenna Input ..... 300 ohms balanced, 75 ohms unbalanced

AM Tuner Section

Sensitivity
IHF, ferrite antenna ..... 300 μV/m
IHF, external antenna ..... 15 μV
Selectivity ..... 10 dB (WIDE)
50 dB (NARROW)
Signal-to-Noise Ratio ..... 50 dB
Image Response Ratio ..... 60 dB
IF Response Ratio ..... 80 dB
Antenna ..... Built-in ferrite loopstick antenna

Audio Section

FM (100% MOD) ..... FIXED 650 mV/1.1 kΩ
AM (30% MOD) ..... FIXED 200 mV/1.1 kΩ

Miscellaneous

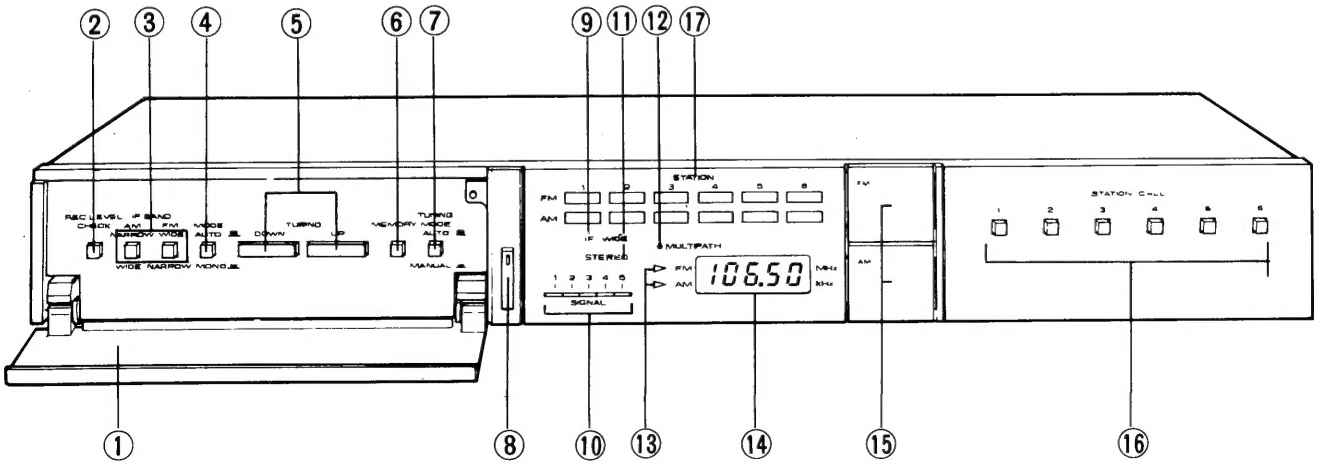
Power Requirements ..... 120 V, 60 Hz
Power Consumption ..... 17 W (UL) 17 W (CSA)
Dimensions ..... 420 (W) x 60 (H) x 380 (D) mm
16-1/2 (W) x 2-3/8 (H) x 15 (D) in
Weight (without package) ..... 4.5 kg (9 lb 15 oz)

Furnished Parts

FM T-type Antenna 1
Connection Cord with Pin Plugs 1
F-type Plug 1
Operating Instructions 1

NOTE:
Specifications and design subject to possible modification without notice.

2. FRONT PANEL FACILITIES



① DOOR

This opens when the top is pulled toward you. Keep it closed unless operating the switches inside.

② RECORDING LEVEL CHECK SWITCH (REC LEVEL CHECK)

When this switch is set to ON, a reference level signal (330 Hz, FM 50% modulation) for FM recording is continuously fed out from the OUTPUT terminals. For receiving ordinary FM or AM broadcasts, this switch is set to OFF.

③ IF BANDWIDTH SELECTOR SWITCH (IF BAND)

This switch is used to select the pass band of the intermediate frequency signal when a broadcast is being received.
Depress FM for FM reception and AM for AM reception.

NARROW: Set to this position when interference results from neighboring stations and this impairs your capacity to listen to the program. This will improve the selectivity and permit interference-free reception.

WIDE: Set to this position in areas with a strong electrical field. This will reduce the distortion and improve the quality of the reproduced sound.

④ MODE SWITCH (MODE)

The MONO mode is set at the "in" position and the AUTO mode is set at the "out" position.

AUTO: Set here to listen to FM broadcasts in stereo. With FM monaural broadcasts, reception is automatically set to mono.

MONO: Set here when listening to FM broadcasts in mono. Listen at this position if the noise is too great at the AUTO position or if you are in an area where the signals are weak.

⑤ TUNING SWITCHES (TUNING)

These are used to tune in stations. The reception frequency increases when the UP switch is depressed while it decreases when the DOWN switch is depressed.

NOTES:
The tuning mode changes as follows in accordance with the position of the TUNING MODE switch.

- **AUTO position: When the TUNING switches are given a light touch, the tuning operation continues until a broadcasting station is picked up. When the numbers on the frequency display reach either the top limit (for instance, 108.00 MHz with the FM band) or the bottom limit (for instance, 87.50 MHz with the FM band), tuning switches automatically to the other end of the frequency spectrum and the same operation continues until a station is picked up.**
- **MANUAL position: When the TUNING switches are depressed, tuning is conducted in steps (0.05 MHz or 0.1 MHz for FM and 9 kHz or 10 kHz for AM), and the tuning operation stops as soon as either switch is released. When the numbers on the frequency display reach either the top or bottom limit, tuning stops. In this case, to continue tuning depress the other TUNING switch.**

⑥ MEMORY SWITCH (MEMORY)

This is used to store (or memorize) the stations in the STATION CALL switches [1] through [6].

⑦ TUNING MODE SWITCH (TUNING MODE)

This is used to select auto or manual tuning: manual at the "in" position and auto at the "out" position.
In the AUTO mode, the tuning operation is conducted automatically with the TUNING switches until a broadcasting station is picked up.
In the MANUAL mode, tuning is performed only as long as the TUNING switches are depressed regardless of the broadcasting stations. As soon as these switchs are released, the tuning operation stops.

⑧ POWER SWITCH (POWER)

When this switch is set to the ON position, 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 the 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.

⑨ IF WIDE INDICATOR (IF WIDE)

This lights IF bandwidth selector switch has been set to the WIDE position.

⑩ SIGNAL INDICATOR (SIGNAL)

This indicates the strength of the incoming signals with five light-emitting diodes (LEDs).

⑪ STEREO INDICATOR (STEREO)

This lights during FM stereo reception.

NOTE:
This indicator does not light when the mode switch is set to the MONO position.

⑫ MULTIPATH INDICATOR (MULTIPATH)

This lights as soon as the multipath effect is detected during FM reception. When installng the FM antenna, adjust the direction and height of the antenna so that this indicator will not light.

⑬ FM/AM INDICATORS (▷ FM; ▷ AM)

The FM indicator (▷) lights when the FM function switch is depressed; the AM indicator (▷) lights when the AM function switch is depressed.
These indicators wink for about 10 seconds when the MEMORY switch has been depressed and while they are winking they indicate that it is possible to memorize a station.

⑭ FREQUENCY DISPLAY

This indicates the frequency of the tuned-in station. The units are read out in MHz for FM and kHz for AM.

⑮ FUNCTION SWITCHES (FM, AM)

FM: Depress this switch for FM reception.
AM: Depress this switch for AM reception.

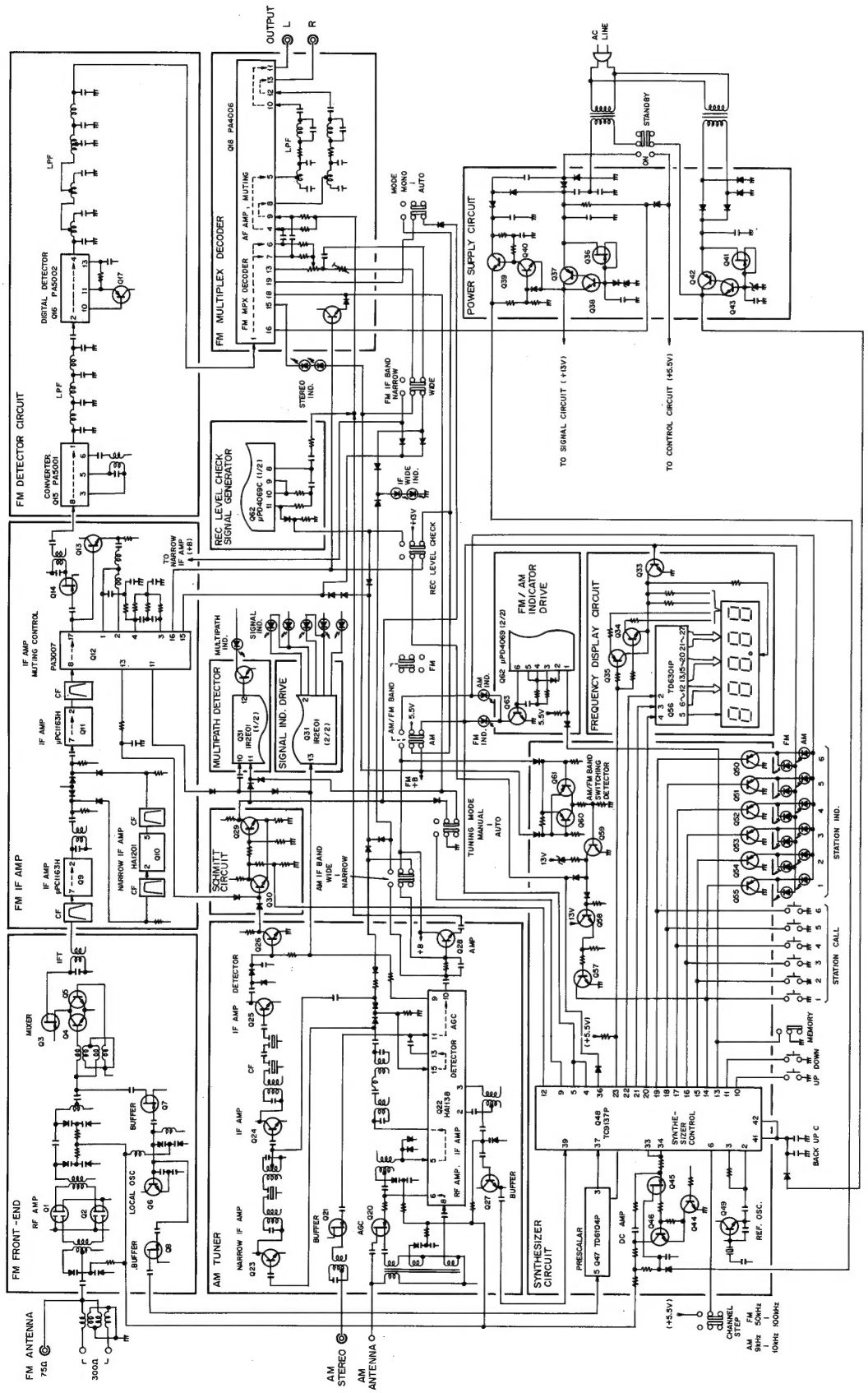
⑯ STATION CALL SWITCHES (STATION CALL)

When the frequency of a broadcasting station has been programmed (memorized), depress the corresponding switch to recall that station.

⑰ STATION INDICATORS (STATION)

When a STATION CALL switch has been depressed, the indicator corresponding to the same number lights. The top row is for FM reception and the bottom row for AM reception.

3. BLOCK DIAGRAM



4. CIRCUIT DESCRIPTIONS

This circuit description is a brief summary of the circuitry depicted in the block diagram on page 4. For more complete details, please refer to the block diagram.

4.1 MAJOR FUNCTIONS

The F-9 is a PLL digital synthesized tuner referenced to a crystal oscillator. Its main functions are as follows:

1. Frequency Range

When the AM CHANNEL STEP switch is set to the 10kHz position.

AM: 520kHz to 1610kHz in 10kHz step.

FM: 87.5MHz to 108.0MHz in 100kHz step.

When the AM CHANNEL STEP switch is set to the 9kHz position.

AM: 522kHz to 1602kHz in 9kHz step.

FM: 87.5MHz to 108.0MHz in 50kHz step.

2. Tuning

- Tuning is by an UP or DOWN key. Pressing the key once changes frequency 1 step (9kHz or 10kHz in the AM band, 50kHz or 100kHz in the FM band). Holding the UP or DOWN key depressed causes the frequency bands to be scanned.
- Positioning the TUNING MODE switch to AUTO and pressing the UP or DOWN key once causes the unit to go into the auto search tuning mode. In this mode, the unit automatically scans the frequency band, with scan stopping at, and tuning into any broadcast station transmitting a signal exceeding a prescribed level of strength.
- Pressing the STATION CALL key causes the unit to directly tune to a frequency preset into the unit.

3. Memory

- Up to 6 FM and 6 AM frequencies can be preset into the memory.
- A special memory holds the frequency of the station tuned at the time the power supply is cut OFF. When power is restored to the unit, tuning is automatically made to that station.

4. Indicators

- Frequency is displayed by a 7-segment LED numeric display. Five digits are used for FM tuning and four digits for AM tuning.
- Signal strength is indicated by a LED 5-point indicator.
- FM and AM band indicator.
- A flashing band indicator indicates that the unit is in "memory write" (preset) status.
- STATION indicators (memory address).
- FM STEREO reception indicator.

4.2 FM TUNER SECTION

FM Front End

The RF amp uses two newly developed D-MOS FETs with improved high-input characteristics, improving both intermodulation interference elimination and sensitivity. These FETs operate in a negative-phase mode, and are coupled in a push-pull configuration.

The mixer also uses a newly developed circuit with excellent RF mutual modulation characteristic, and a double balanced mixer with an FET constant-current buffer.

The tuning circuit consists of four twin-type varicap diodes, also with superior high-input characteristics. This circuit and component combination gives the F-9 interference elimination performance comparable to that of a variable capacitor type tuner, and attains particularly excellent RF intermodulation characteristics.

FM IF Amplifier

The FM IF circuit may be switched between a WIDE and NARROW band range. In the WIDE mode, better sound quality is attained, and the NARROW mode features better station selectivity. Two ceramic filters with superior group delay frequency characteristics are used in the circuit during WIDE mode operations, and two narrow band ceramic filters are inserted between the WIDE stages during NARROW mode operations. Darlington differential limiter ICs are used between stages, and the final stage uses an IF system IC (PA3007). PA3007 not only features better characteristics than previous IF system ICs, but also has a built-in noise muting (anti-hum) circuit. In the F-9, only the IF limiter amp section of this IC is used in the signal path, with the built-in FM detector being placed in the control circuit.

Detection Circuit

The F-9 uses the digital method of detection. The 10.7MHz IF signal is input into the convertor IC (PA5001). PA5001 includes a push-pull local oscillator circuit and a linear-multiplier mixer serving to beat down the 9.44MHz local signal to 1.26MHz. FM detection is performed on the no.2 IF signal (1.26MHz) by the digital detector IC (PA5002).

Since the FM signal is an inconsistent wave, it can be demodulated after being converted to a DC level. The IF signal is converted to a trigger pulse by the differential circuit, and this pulse is used to trigger the astable multivibrator functioning as the PPM (pulse phase modulation) signal

source. This signal is applied to the integrator circuit where the pulse trains are averaged to obtain the demodulation signal.

Since beating down the IF frequency in the first stage results in an improved S/N, the effects of pulse variations are reduced and a higher degree of modulation (deviation frequency/carrier frequency) is possible, resulting in better detection efficiency.

Multiplex Decoder

This section consists of IC (PA4006-A), and contains the PLL system switching signal generator circuit, chopper type MPX decoder, pilot signal automatic canceller, stereo auto selector, VCO killer circuit, muting amplifier, muting control circuit, and stereo reception indicator circuit.

The chopper type switching circuit either does or does not establish a signal, thereby generating no noise or distortion.

4.3 AM TUNER

The AM tuner section uses three varicap diodes with an AM tuner IC (HA1138). The selectable WIDE IF band for better sound quality and NARROW IF band feature for good selectivity is also included in the AM band. During NARROW band operation, an additional ceramic filter is inserted into the circuit. Also during the NARROW band mode, a high-pass filter functioning to eliminate the low frequency beat and improve audible frequency band balance is inserted into the detection output circuit.

Additionally, an AGC circuit built into the IC suppresses performance degradation in the presence of a strong magnetic field. The bar-antenna also features a cancellation coil; cancellation current to the coil being supplied by a high-powered AGC circuit. The cancellation current is controlled by output applied to FET (Q20) from the RF amp (no. 6 pin).

Muting control and SIGNAL indicator control is by signals from Q24 — Q26, the IF amp and detection circuit used exclusively for control applications.

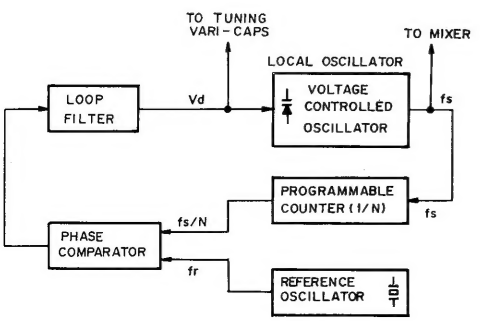


Fig. 4-1 Basic composition of the PLL synthesizer circuit

4.4 SYNTHESIZER CIRCUIT

Basic Principle

As may be noted in Fig. 4-1, the quartz PLL synthesizer consists of a voltage controlled oscillator (VCO), programmable counter, phase comparator, reference oscillator, and loop filter. With VCO frequency represented as fs, reference frequency as fr, and the programmable counter division ratio as N (an integer), loop value is determined by the equation fr = fs/N. In other words, when fr is a set value, VCO frequency (fs) depends on the division ratio (N) of the programmable counter and becomes a multiple of fr.

F-9 Synthesizer Circuit

The synthesizer circuit used in the F-9 consists of the circuit itself, and a control circuit using a one-chip C-MOS IC (TC9137P). Generally, due to limitations in the operating speed of the C-MOS IC, VCO output is divided by a ratio of 8 by a high-speed prescaler such as an ECL (emitter-coupled-logic) IC for FM reception, then input into the synthesizer IC. In this case, the equation becomes fr = fs/8N, and during 100kHz step operations, fr becomes 12.5kHz. Any portion of the 12.5kHz signal not eliminated by the loop filter leaks into the local oscillator (VCO) as signal line residual noise. TC9137P is used with prescaler IC (TD6104P) in a dual programmable counter configuration to provided split ratio prescaling according to the pulse swallow count method to put the reference frequency at 25kHz, outside the audible range. Thus, noise escaping the loop filter is diminished, and a high S/N is obtained.

- **Reference Signal**

The 7.2MHz crystal oscillator signal at pin 2 and 3 of TC9137P is divided by 288 during FM reception (25kHz), and by 720 during AM reception (10kHz), then input into the phase comparator.

- **Programmable Counter**

During FM reception, this signal is output from pin 38 to control prescaler IC (TD6104P) using the swallow count method. During AM reception, the frequency is split directly.

- **Phase Comparator**

The phase comparator compares the phase of the output of the programmable counter with that of the reference signal, and if the phase of programmable counter output signal is found to be lagging, it lowers the level at pins 34 and 33 by an amount equivalent to the period of phase lag.

If found to be advanced, it raises the level at the pins by an equivalent amount. Except for periods of phase lag or advance, pins 34 and 33 are held at high impedance levels.

The output of pins 34 and 33 is integrated (passed through the low-pass filter) and applied to the VCO varicap diode of the quartz PLL synthesizer.

4.5 SYNTHESIZER SYSTEM CONTROL

Figure 4-2 shows a block diagram of the synthesizer IC (TC9137P). The following section will describe the input/output terminals of TC9137P.

Operation Mode Designation

Pins 4 (B1) and 5 (B2) of TC9137P are FM/AM band designation terminals, and pins 6 (E1) and 7 (E2) are connected in accordance with the local power supply requirements (for Japan, Europe, or USA). The input (whether high or low level) to these terminals designates the operation mode of the unit (Table 1).

Manual Tuning

When a low level input is applied to pin 9 (A/M) of TC9137P, the set goes into the manual tuning mode. In this status, when either pin 10 ($\overline{UP}$) or pin 11 ($\overline{DOWN}$) is momentarily dropped to a low level (as in pressing the UP or DOWN key once), the tuning frequency will increment up or down the frequency band in 100kHz steps for FM reception (FMU mode), and in 10kHz steps for AM (AM10 mode).

When low level input is applied to pin 10 or 11 continuously, tuning frequency will move rapidly up or down the frequency band (scan function). When low level input is removed, scan will immediately stop.

Also during the manual tuning modes, when the tuning frequency reaches the edge of the band being tuned, scan will stop.

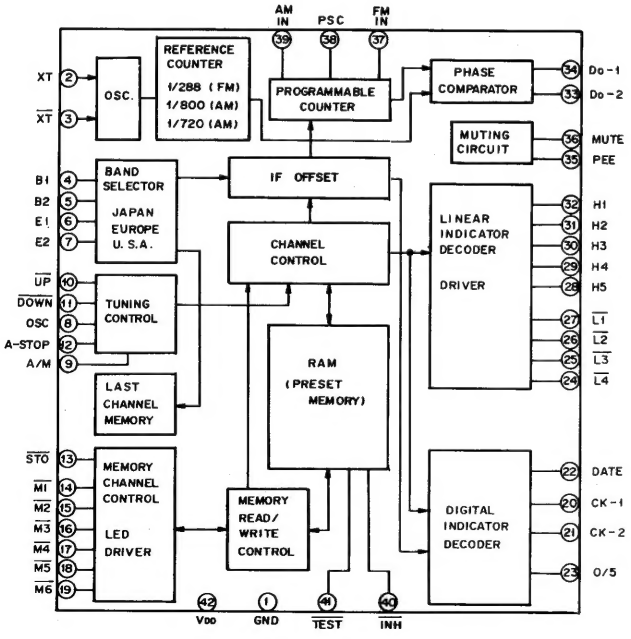


Fig. 4-2 Block diagram of synthesizer IC (TC9137P)

Table 1 Operation designation data

Mode	B1	B2	E1	E2	Remarks
FMJ	H	H	H	L	76.0–90.0MHz, 100kHz steps
FME	H	H	H	H	87.5–108.0MHz, 50kHz steps
FMU	H	H	L	H	87.5–108.0MHz, 100kHz steps
AM9	L	L	H	L(H)	522–1602kHz, 9kHz steps
AM10	L	L	L	H	520–1610kHz, 10kHz steps

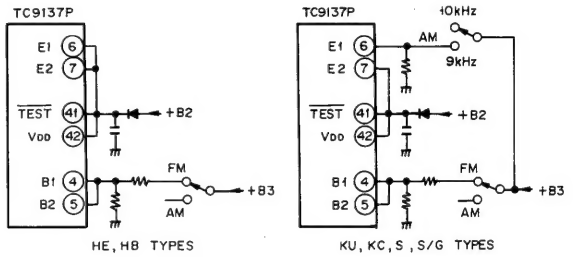


Fig. 4-3 Operation mode designation circuit

Auto Search Tuning

When a high level input is applied to pin 9 (A/M) of TC9137P, the set goes into the auto scan tuning mode. To scan up the frequency band, a low level input is applied to pin 10 ($\overline{UP}$); to scan down the band, low level input is applied to pin 11 ($\overline{DOWN}$). Even though the low level input is removed from pin 10 or 11, scan continues. When it reaches the edge of the band, it reverses itself and moves back up or down the same band. To stop auto search tuning, a stop signal (H level) must be applied to pin 12 (A–STOP).

- **Stop signal generation**

The muting signal (high level signal output for inter-station muting or for muting low-strength broadcast signal) output from pin 13 of the FM IF system IC (PA3007-A) is used as the stop signal in the FM mode (Fig. 4-4).

For AM tuning, the AM IF signal is passed through the IF narrow filter, and that output is rectified and used as the signal source. Accurate detection can not be performed by this circuit alone. However, since the IC is capable of receiving only frequencies that are multiples of 10kHz, accurate tuning is possible.

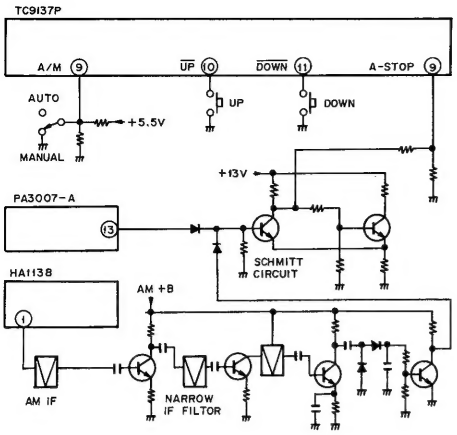


Fig. 4-4 Scan control circuit

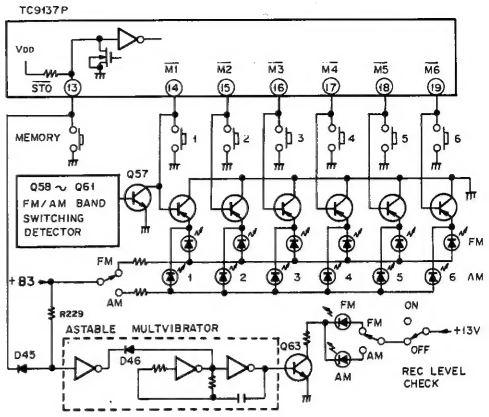


Fig. 4-5 Memory store/call circuit

Preset Memory

Preset memory (in TC9137P) allows 6 FM band and 6 AM band stations to be placed in memory. Pins 13 through 19 of TC9137P are input/output type terminals used by the display driver. When a low level input is applied momentarily to pin 13 ($\overline{STO}$), memory write may be performed for a few seconds. During this period, if one of the pins between 14 and 19 ($\overline{M1}$—$\overline{M6}$) is designated (by L level input) as the memory address, the frequency on the display at that time is stored in memory, and the corresponding memory address indicator (STATION 1-6) is illuminated. When this sequence is completed, the memory write status is released. If a memory address is not designated within this few-second time period, the memory write status will automatically be released. Preset memory is automatically switched between the FM and AM band along with regular band switching.

Memory write status is indicated by the AM or FM band indicator going from an illuminated to a flashing status. The cathode for the indicator LEDs uses a common circuit, and switching is performed by Q63. Q63 is driven by an astable multi-vibrator that consists of two inverters. Normally, this multivibrator is cut off by +B3 supplied through R229, and this maintains Q63 in an ON status, lighting either the FM or AM indicator. When the MEMORY switch is placed on, a low level input is applied to pin 13 ($\overline{STO}$). This causes D45 to conduct, inhibiting +B3 and causing the astable multivibrator to operate, turning Q63 on-off and causing the FM (or AM) band indicator to flash. Even though the MEMORY switch is turned off (by releasing the MEMORY key), the low level input at pin 13 ($\overline{STO}$) continues (memory write status held) and the FM (AM) band indicator continues to flash.

Memory recall is by designating one of the memory address pins between 14 and 19 ($\overline{M1}$—$\overline{M6}$). This applies a low level input to the pin causing the broadcast frequency stored in that memory to be tuned to and illuminates the corresponding indicator.

When the band is switched between FM and AM, a signal from the band switch detection circuit causes Q57 to momentarily come on, and tuning automatically goes to the frequency stored in memory 1 (STATION 1).

Memory Hold

The power switch (ON/STANDBY) for the F-9 is located in the second stage of the power transformers (Fig. 4-6). Power continues to be supplied to TC9137P even after the power switch is turned off (in STANDBY position).

TC9137P has a self-contained inhibit function allowing it to set all its functions to a static condition (oscillations stopped, all inputs locked, indicator drives turned off, all outputs set to L level).

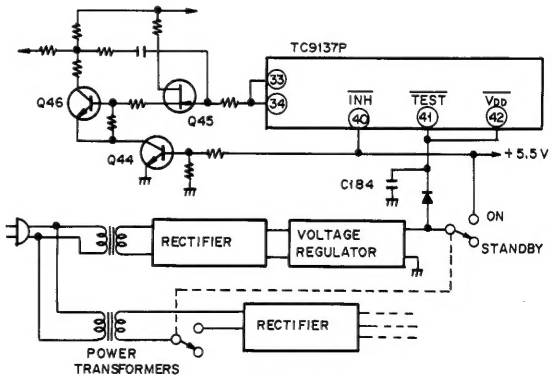


Fig. 4-6 Memory backup circuit

This function is activated by a low level input to pin 40 ($\overline{INH}$), and during this time, power consumption is held to a level of approximately 10μA. When the power switch is cut off (placing set in STANDBY position), pin 40 goes to a low level, TC9137P goes into an inhibit status, holding memory contents using minimum current. Also, when external power supply is cut (AC line cord unplugged), the charge stored in backup capacitor (C184) protects the contents stored in memory for approximately 3 days.

Q44 functions to prevent IC current drain. When pins 34 and 33 go into an inhibit status (H level), the current discharge from these pins can increase power consumption. Q44 is turned off during inhibit to prevent this from occurring.

4.6 FREQUENCY DISPLAY CIRCUIT

The synthesizer IC (TC9137P) uses the reception frequency display static driver IC (TD6301P) to convert the 5 digit LED numeric display to a 4 digit display.

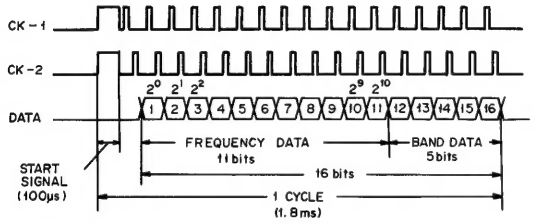


Fig. 4-7 Frequency data signal

During FM reception, the 5th digit displays either a "0" or "5" (10kHz increments). The TC9137P 0/5 terminal (pin 23) is controlled without being passed through TD6301P. The connection between TC9137P and TD6301P consists of two timing signal lines and one data signal line. One cycle of data (Fig. 4-7) is transmitted through the data line when power is turned on, when tuning frequency is moved UP or DOWN, during auto-scan, during memory recall, or when the band is switched between FM/AM. The data signal consists of a 16 bit binary code, with 11 bits of frequency data and 5 bits of reception band data. The 11 bits of frequency data consists of the difference between the present reception frequency and the lowest frequency obtainable in the present reception frequency band, in binary-coded form (the decimal point and 50kHz increments ignored in FM).

Using two strings of pulse signals, the TD6301P converts the binary coded serial data into BCD coded parallel data. This data is decoded by the BCD to 7-segment decoder and output to the display.

When switched to the FM band, TC9137P pin 23 (0/5) controlling the 5th digit (50kHz increment display) is held at high impedance when "0", and drops to a low level at "5". Q35 and Q34 switch on/off to change the 5th digit of the LED numberic display between "0" and "5".

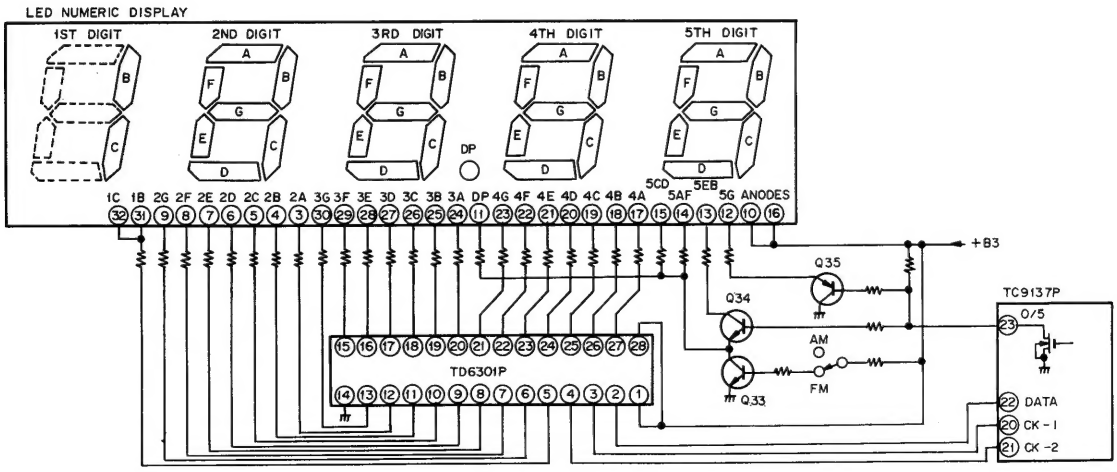
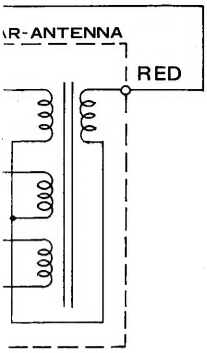
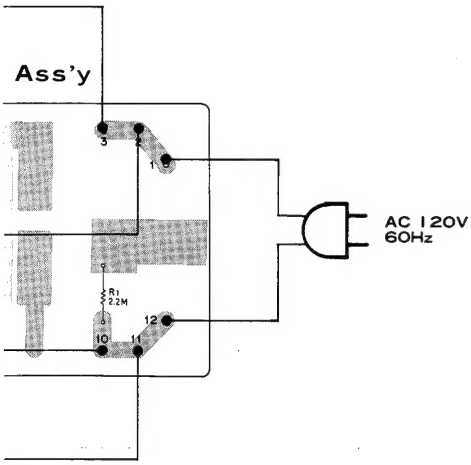
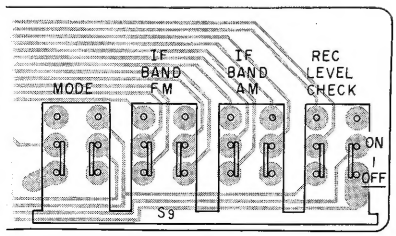


Fig. 4-8 Frequency display circuit



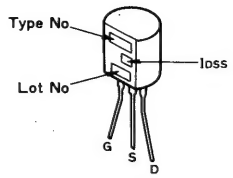


SWITCH Ass'y(GWS-296)

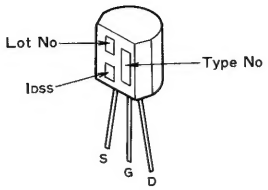


External Appearance of Transistors and ICs

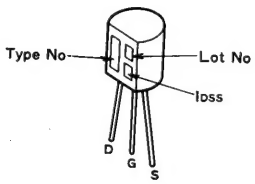
2SK168



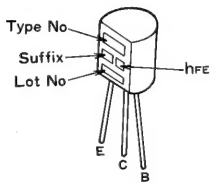
2SK34



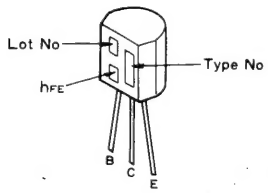
2SK61



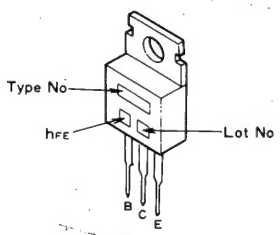
2SA872A



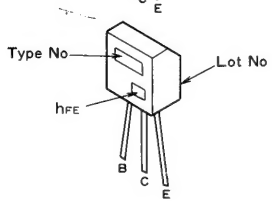
2SA1100
2SC2575



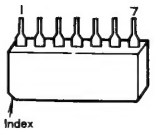
2SB834



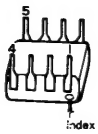
2SC461
2SC535



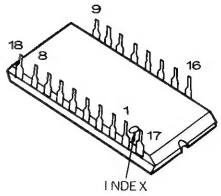
μPC1163H



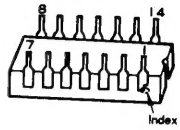
HA1201
PA5001



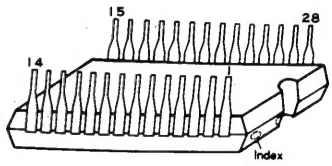
PA3007



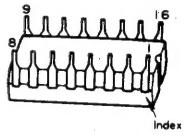
PA5002
μPD4069C



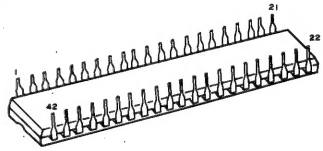
PA4006



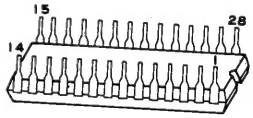
HA1138
IR2E01



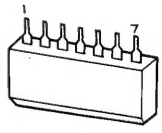
TC9137P



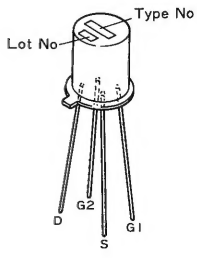
TD6301P



TD6104P

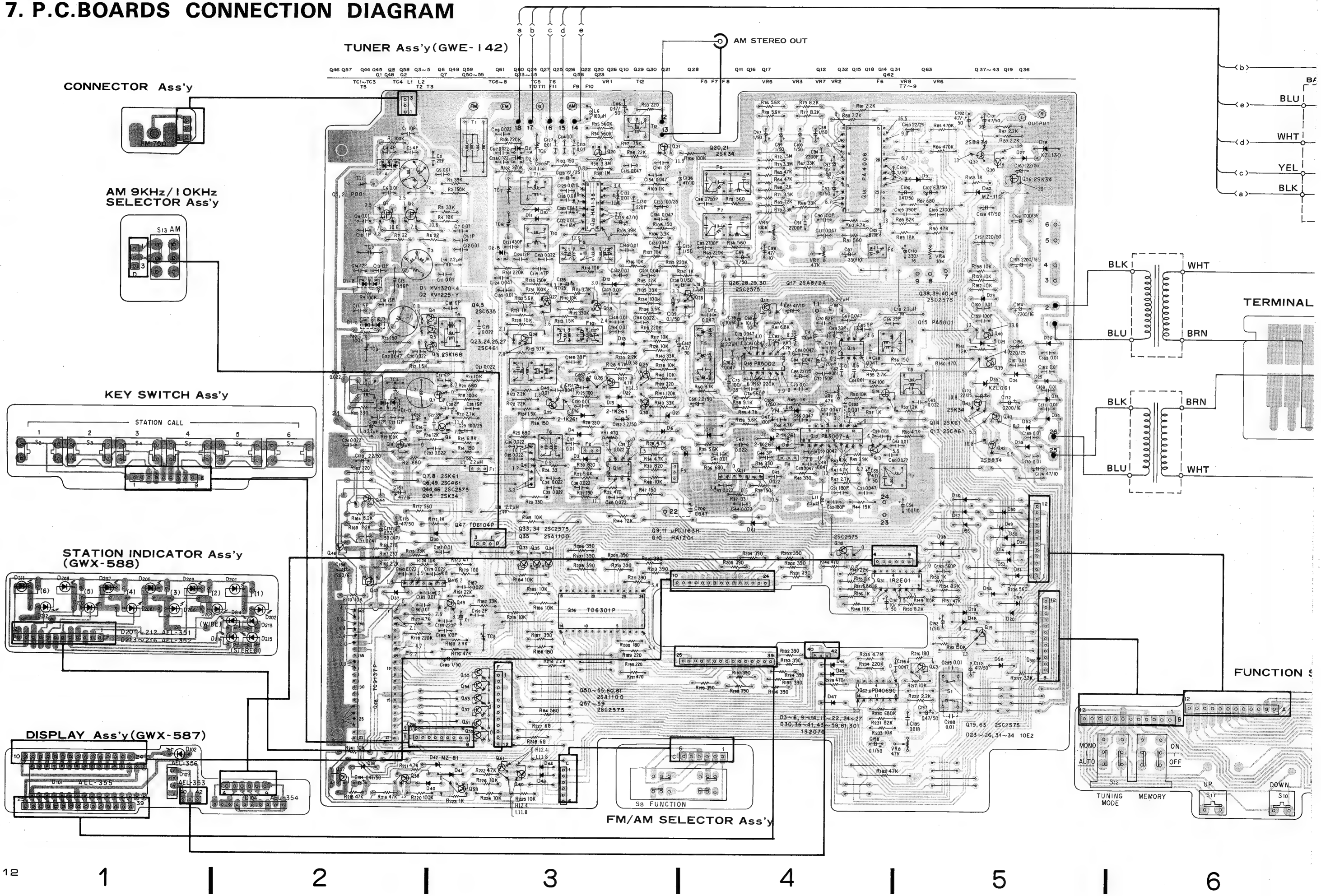


P001

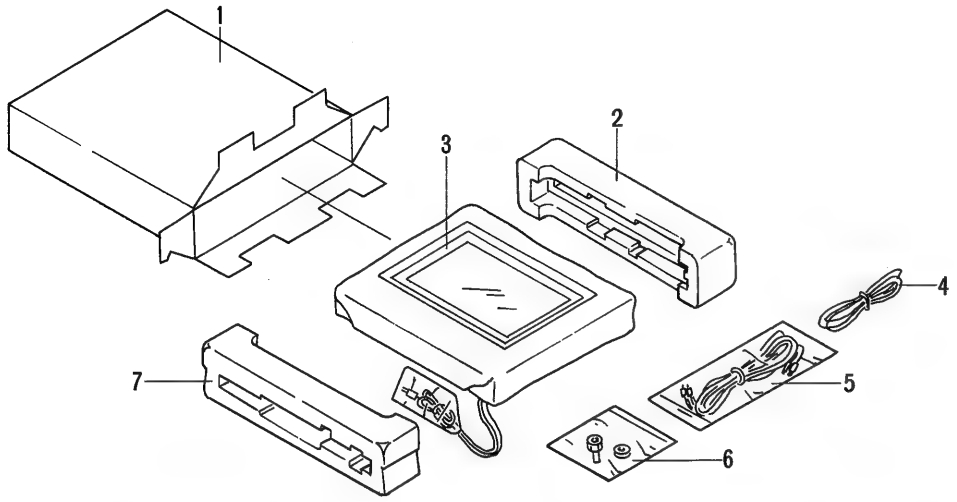


A B C D

7. P.C.BOARDS CONNECTION DIAGRAM



5. PACKING

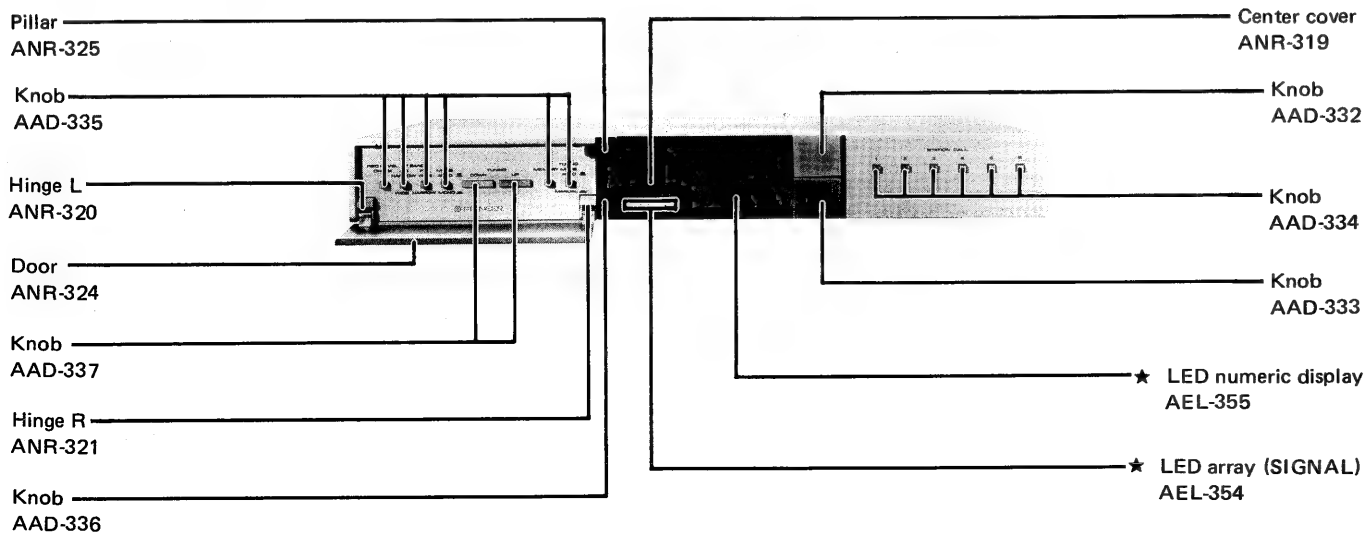


Mark	No.	Part No.	Description	Mark	No.	Part No.	Description
	1.	AHD-872	Packing case		6.	AKX-056	F-type plug
	2.	AHA-275	Front pad		7.	AHA-276	Rear pad
	3.	ARB-393	Operating instructions				
	4.	ADH-004	FM T-type antenna				
	5.	ADE-015	Connection cord				

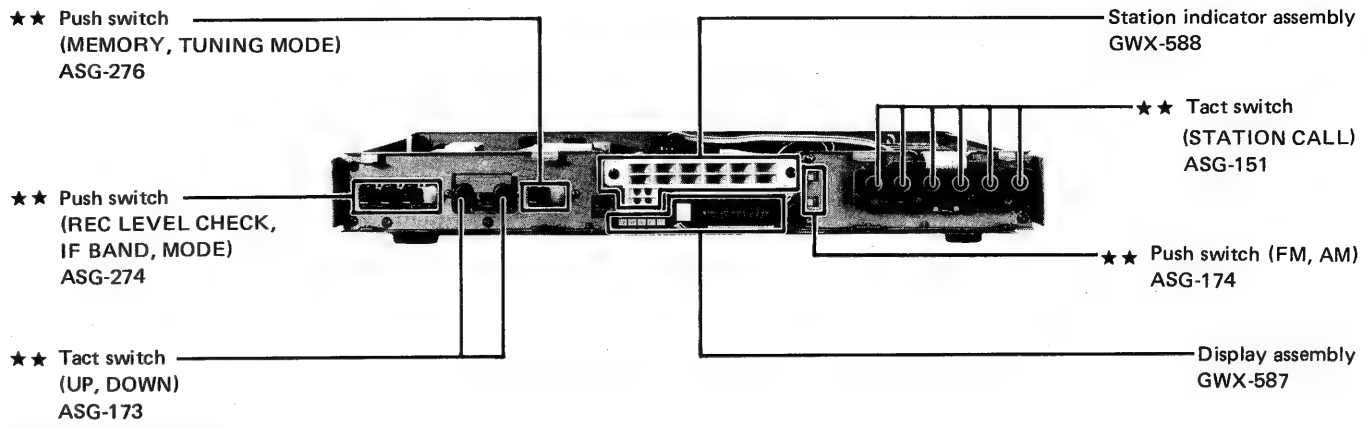
6. PARTS LOCATION

NOTES:
- *Parts without part number cannot be supplied.*
- *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 symbols ★★ and ★ .*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model No., temperature, humidity, etc.

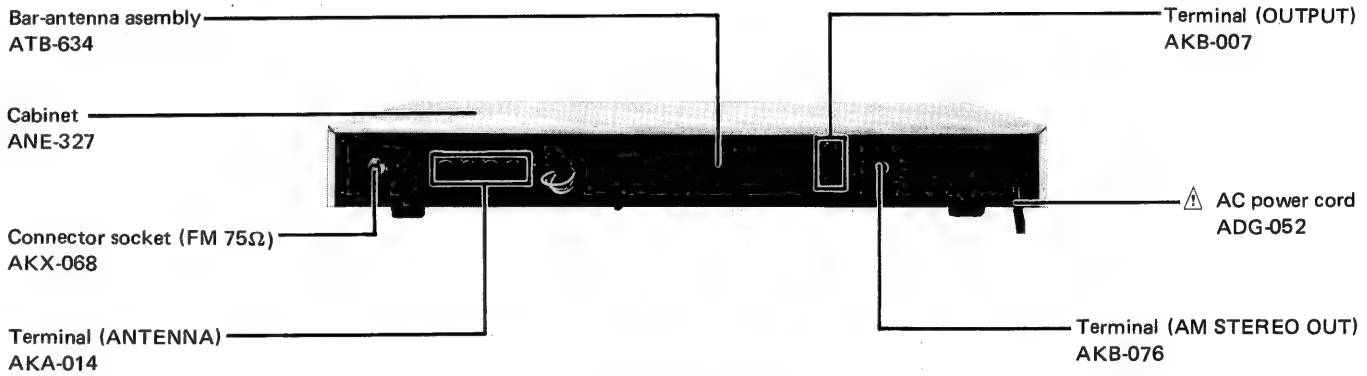
Front Panel View



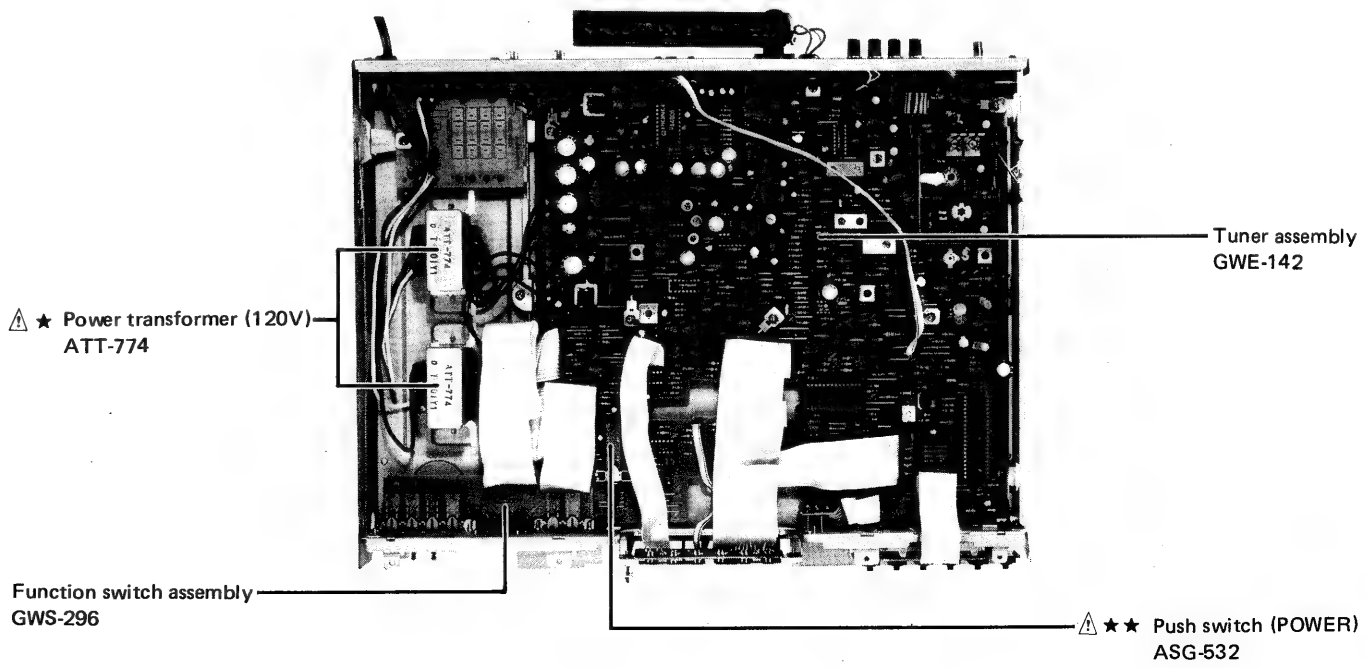
Front View with Panel Removed



Rear Panel View



Top View



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

TUNER Ass'y GWE-142

09~11 FM IF AMP

Q4,5 2SC535

Q9 μPC1163H

Q10 HA1201

Q11 μPC1163H

D3,4 1S2076

D5,6 1S2076

D7,8 2-1K261

D61 1S2076

Q12 PA3007-A FM IF AMP & DET

Q13 2SC461 BUFFER AMP

Q15 PA5001 2ND OSC & MIXER

Q16 PA5002

Q16,17 DIGITAL DET

Q17 2SA872A

Q14 2SK61 BUFFER AMP

Q18 PA4006 FM MPX & MUTING

Q19 2SC2575 BUFFER AMP

Q29,30 2SC2575 SCHMITT

Q26 2SC2575 INVERTER

Q32~34 2SC2575

Q35 2SA1100E LED DRIVE

Q31 IR2E01 LED DRIVE

D15,16 2-1K261

D21,22 1S2076

D17~20 1S2076

Q50~55 2SA1100E LED DRIVE

Q56 TD6301P LED DRIVE

D101 AEL-355

D102 AEL-356

D103 AEL-353

D104 AEL-354

DISPLAY Ass'y GWX-587

Q63 2SC2575 LED DRIVE

Q59 2SC2575

Q60,61 2SA1100E MUTING

Q57,58 2SC2575 SWITCHING

D40,41,43,44 1S2076

D42 MZ-081

Q62 μPD4069C REC CHECK OSC

D45~48,301 1S2076

D49~59 1S2076

Q49 2SC461 CRYSTAL OSC

X1: ASS-015

X1 (7.2MHz)

TP. SIGNAL LEVEL

TP. NOISE CENTER

TP. 1.25MHz

TP. V-CENTER

TP. VCO

OUTPUT (650mV)

VR1: WIDE SEPARATION ADJ CS2-047

VR2: MUTING LEVEL ADJ CS2-048

VR3: CENTER POINT ADJ CS2-051

VR4: VCO ADJ CS2-049

VR5: REC LEVEL ADJ CS2-048

VR6: AUTO PILOT CANCELER ADJ CS2-048

VR7: NARROW GAIN ADJ. ACP-006

FUNCTION SWITCH Ass'y GWS-296

S12: ASG-276

S9: ASG-274

S8: FUNCTION ASG-174

S10,11: TUNING ASG-173

S2~7: STATION CALL ASG-151

FM/AM SELECTOR Ass'y

KEY SWITCH Ass'y

AM 9kHz/10kHz SELECTOR Ass'y

STATION INDICATOR Ass'y GWX-588

D201~212 AEL-351

D213~216 AEL-352

1. RESISTORS:
Indicated in Ω, ¼W, ±5% tolerance unless otherwise noted k : kΩ, M : MΩ, (F) : ±1%, (G) : ±2%, (K) : ±10%, (M)±20% forerence

2. CAPACITORS:
Indicated in capacity (μF)/voltage (V) unless otherwise noted p : pF
Indication without voltage is 50V except electrolytic capacitor.

3. VOLTAGE
: DC voltage (V) at no input signal

4. OTHERS:
: Adjusting point.
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.

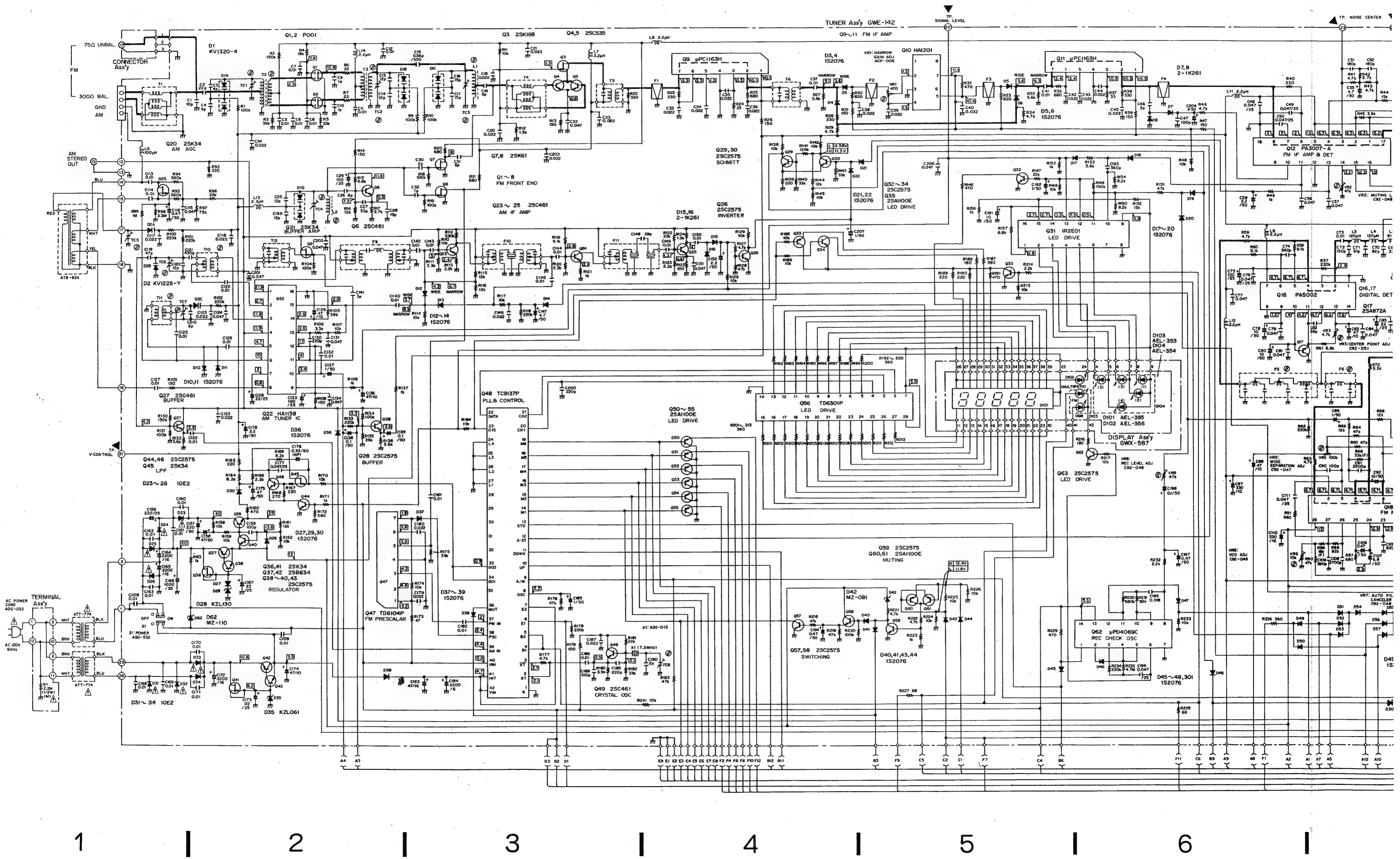
SWITCHES:

S1: POWER	STANDBY – OFF
S2: STATION CALL 1	ON – OFF
S3: STATION CALL 2	ON – OFF
S4: STATION CALL 3	ON – OFF
S5: STATION CALL 4	ON – OFF
S6: STATION CALL 5	ON – OFF
S7: STATION CALL 6	ON – OFF
S8: FUNCTION	AM – FM
S9-1: REC LEVEL CHECK	ON – OFF
S9-2: IF BAND AM	WIDE – NARROW
S9-3: IF BAND FM	WIDE – NARROW
S9-4: MODE	AUTO – MONO
S10: TUNING (DOWN)	ON – OFF
S11: TUNING (UP)	ON – OFF
S12-1: MEMORY	ON – OFF
S12-2: TUNING MODE	AUTO – MANUAL
S13: STEP SELECTOR	10kHz – 9kHz

The underlined indicates the switch position.

This is the basic schematic diagram, but the actual circuit may vary due to improvements in design.

8. SCHEMATIC DIAGRAM



9. ELECTRICAL PARTS LIST

NOTES:

- *When ordering resistors, first convert resistance values into code form as shown in the following examples.*
  Ex. 1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J=5%, and K=10%).

560Ω	*56 × 10¹*	*561 .....*	*RD¼PS 5 6 1 J*
57kΩ	*47 × 10³*	*473 .....*	*RD¼PS 4 7 3 J*
0.5Ω	*0R5 .....*		*RN2H 0 R 5 K*
1Ω	*010 .....*		*RS1P 0 1 0 K*

  Ex. 2 When there are 3 effective digits (such as in high precision metal film resistors).

5.62kΩ	*562 × 10¹*	*5621 ....*	*RN¼SR 5 6 2 1 F*

- *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 symbols ★★ and ★ .*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model No., temperature, humidity, etc.

Miscellaneous Parts

ELECTRICAL PARTS

Mark	Part No.	Symbol& Description
⚠ ★	ATT-774	Power transformer (120V)
	ATB-634	Bar-antenna ssembly
	AKB-076	Terminal (AM STEREO OUT)
⚠	ADG-052	AC power cord

P.C. BOARD ASSEMBLIES

Mark	Part No.	Symbol & Description
	GWE-142	Tuner assembly
	GWS-296	Function switch assembly
	GWX-587	Display assembly
	GWX-588	Station indicator assembly

Tuner Assembly (GWE-142)

CAPACITORS

Mark	Part No.	Symbol & Description
	ACM-008	TC1–TC3,TC5–TC7 Film trimmer
	ACM-006	TC4 Ceramic trimmer
	ACM-010	TC8 Film trimmer
	CCDCH 100D 50	C1
	ACG-018	C109 Ceramic (390p/50V)
	ACH-360	C176 Electrolytic (0.33/50V,NP)
	CGB R56J 500	C15
	CCDCH 010C 50	C9,C10,C32
	CCDCH 020C 50	C30, C190
	CCDCH 030C 50	C46
	CCDTH 040C 50	C3,C4
	CCDCH 050C 50	C65
	CCDCH 060D 50	C18,C31,C210
	CCDCH 080D 50	C26
	CKDYB 102K 50	C205
	CCDUJ 120J 50	C13,C14
	CCDXL 120J 50	C25,C120,C199
	CCDCH 150J 50	C28
	CCDUJ 150J 50	C16,C17
	CCDCH 220J 50	C2
	CCDCH 330J 50	C27,C69
	CCDCH 390J 50	C66
	CCDCH 470J 50	C119
	CCDCH 560J 50	C82
	CCDCH 820J 50	C70
	CCDCH 910J 50	C71
	CCDCH 101J 50	C188
	CCDSL 030C 50	C141
	CCDSL 390J 50	C148
	CCDSL 101K 50	C47,C90,C159
	CCDSL 181K 50	C51,C52
	CCDSL 151K 50	C72
	CCDSL 221K 50	C130,C200
	CKDYB 561K 50	C74,C193
	CKDYB 821K 50	C105
	CKDYX 473M 25	C48–C50, C53, C67, C76, C111, C151, C177, C196
	CKDYF 103Z 50	C5–C8, C11, C12, C37, C41, C59, C61, C62, C64, C73, C113, C114, C122, C125–C127, C132, C140, C142–C145, C149–C150, C155, C160–C163, C168–C171, C181, C182, C186, C208, C209
	CKDYF 223Z 50	C19–C21, C23, C24, C33–C36, C38–C40, C42–C45, C60, C63, C117, C118, C123, C146, C153,C179, C180,C187,C203

Mark	Part No.	Symbol & Description
	CKDYF 473Z 50	C22, C56, C57, C68, C77, C79, C81, C84, C86, C115, C124, C131, C134, C154, C201,C202,C206
	CQMA 272J 50	C95, C96, C108
	CQMA 183J 50	C195
	CQSA 221J 50	C189
	CQSA 431J 50	C121
	CQSA 222G 50	C91,C94
	CEA 0R1M 50L	C138,C139,C198
	CEA R47M 50L	C106,C116,C194,C197
	CEA 010M 50L	C89,C97–C100,C104,C137,C185, C192,C204,C207
	CEA 2R2M 50L	C58,C152
	CEA 4R7M 50L	C55,C101,C102,C112,C147
	CEA 6R8M 50L	C107
	CEA 100M 50L	C78,C80,C92,C93,C191
	CEA 220M 25L	C85,C103,C128,C167,C173
	CEA 470M 10L	C83,C88,C129,C136,C174
	CEA 470M 25L	C135
	CEA 470M 50L	C158,C175
	CEA 101M 10L	C54
	CEA 101M 25L	C29,C75,C133
	CEA 221M 25L	C156
	CEA 221M 50L	C157
	CEA 331M 10L	C87
	CEA 331M 16L	C110
	CEA 102M 35L	C166
	CEA 222M 6L	C184
	CEA 222M 16L	C164,C165,C172
	CEANL 2R2M 50	C178
	CEANL 470M 16	C183

RESISTORS

NOTE: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

Mark	Part No.	Symbol & Description
★	ACP-006	VR1 Semi-fixed (470)
★	C92-047	VR5 Semi-fixed (100k)
★	C92-048	VR2,VR7,VR8 Semi-fixed (47k)
★	C92-049	VR6 Semi-fixed (10k)
★	C92-051	VR3 Semi-fixed (4.7k)
	RF¼PS220J	R6,R7
	RN¼PQ□□□□F	R66,R67,R89
	RD¼PM□□□J	R1–R5, R9–R65, R68–R88, R90–R126,R128–R237,R241

SEMICONDUCTORS

Mark	Part No.	Symbol & Description
★★	P001	Q1,Q2
★★	2SK168-F	Q3
★★	2SK34-C	Q20,Q36,Q41
★★	μPC1163H	Q9,Q11
★★	HA1201	Q10
★★	2SK34-D	Q45
★★	PA3007-A	Q12
★★	PA5001	Q15
★★	PA5002	Q16
★★	PA4006	Q18
★★	HA1138	Q22
★★	2SK34	Q21
★★	2SK61-Y	Q7,Q8,
★★	μPD4069C	Q62
★★	IR2E01	Q31
★★	TC9137P	Q48
★★	TD6301P	Q56
★★	2SK61-GR	Q14
★★	TD6104P	Q47
★★	2SA872A	Q17
★★	2SA1100 (2SA733A)	Q35,Q50–Q55,Q60,Q61
★★	2SB834	Q37,Q42
★★	2SC535-A	Q4,Q5
★★	2SC461-B	Q6,Q13,Q23–Q25,Q27,Q49
★★	2SC2575 (2SC 945A)	Q19, Q26, Q28–Q30, Q32–Q34, Q38–Q40, Q43, Q44, Q46, Q57–Q59,Q63
★	KV1320-4	* D1 (D1A–D1D)
★	KV1225-Y	** D2 (D2A–D2C)
★	MZ-081	D42
★	KZL130	D28
★	KZL061	D35
★	MZ-110	D62
⚠ ★	10E2 (SIB01–02)	D23–D26,D31–34
★	2–1K261	D7,D8,D15,D16
★	1S2076 (1S1555) (1S2473)	D3–D6, D9–D14, D17–D22, D27, D29, D30, D36–D41, D43–D61

** D1 (KV1320-4) consists of four vari-cap diodes with the identical characteristics. When replacing either of them, first split the new D1 into four pieces (D1A–D1D), and replace both of them by new D1D (for FM antenna tuning circuit), D1B and D1C (for FM RF tuning circuit) and D1D (for FM local oscillator circuit) at the same time in order to match their characteristics.*

*** D2 (KV1225-Y) consists of three vari-cap diodes with the identical characteristics. When replacing either of them, first split the new D2 into three pieces (D2A-D2C), and replace both them by new D2A (for AM antenna tuning circuit), D2B (AM RF tuning circuit) and D2C (for AM local oscillator circuit) at the same time in order to match their characteristics.*

TRANSFORM

Mark	Part N
	ATX-0
	ATX-0
	ATC-1
	ATC-1
	ATE-0
	ATE-0
	ATE-0
	ATE-0
	ATB-0
	ATB-0
	ATB-0
	ATC-1
	ATC-0
	T24-0
	ATH-0
	ATF-1
	ATF-0
	ATF-0
	ATF-0
	ATF-0
	ATF-0
	ATF-1
	ATF-1

OTHERS

Mark	Part N
	AKA-0
	AKB-0
	VBZ3
	(ABA-
★★	ASG-5
★	ASS-0

Key Switch

Mark	Part N
★★	ASG-1

FM/AM Selec

Mark	Part N
★★	ASG-1

Mark	Part No.	Symbol & Description
	CKDYF 473Z 50	C22, C56, C57, C68, C77, C79, C81, C84, C86, C115, C124, C131, C134, C154, C201, C202, C206
	CQMA 272J 50	C95, C96, C108
	CQMA 183J 50	C195
	CQSA 221J 50	C189
	CQSA 431J 50	C121
	CQSA 222G 50	C91, C94
	CEA 0R1M 50L	C138, C139, C198
	CEA R47M 50L	C106, C116, C194, C197
	CEA 010M 50L	C89, C97–C100, C104, C137, C185, C192, C204, C207
	CEA 2R2M 50L	C58, C152
	CEA 4R7M 50L	C55, C101, C102, C112, C147
	CEA 6R8M 50L	C107
	CEA 100M 50L	C78, C80, C92, C93, C191
	CEA 220M 25L	C85, C103, C128, C167, C173
	CEA 470M 10L	C83, C88, C129, C136, C174
	CEA 470M 25L	C135
	CEA 470M 50L	C158, C175
	CEA 101M 10L	C54
	CEA 101M 25L	C29, C75, C133
	CEA 221M 25L	C156
	CEA 221M 50L	C157
	CEA 331M 10L	C87
	CEA 331M 16L	C110
	CEA 102M 35L	C166
	CEA 222M 6L	C184
	CEA 222M 16L	C164, C165, C172
	CEANL 2R2M 50	C178
	CEANL 470M 16	C183

RESISTORS

NOTE: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

Mark	Part No.	Symbol & Description	
★	ACP-006	VR1	Semi-fixed (470)
★	C92-047	VR5	Semi-fixed (100k)
★	C92-048	VR2, VR7, VR8	Semi-fixed (47k)
★	C92-049	VR6	Semi-fixed (10k)
★	C92-051	VR3	Semi-fixed (4.7k)
	RF¼PS220J	R6, R7	
	RN¼PQ□□□□F	R66, R67, R89	
	RD¼PM□□□J	R1–R5, R9–R65, R68–R88, R90–R126, R128–R237, R241	

SEMICONDUCTORS

Mark	Part No.	Symbol & Description
★★	P001	Q1, Q2
★★	2SK168-F	Q3
★★	2SK34-C	Q20, Q36, Q41
★★	μPC1163H	Q9, Q11
★★	HA1201	Q10
★★	2SK34-D	Q45
★★	PA3007-A	Q12
★★	PA5001	Q15
★★	PA5002	Q16
★★	PA4006	Q18
★★	HA1138	Q22
★★	2SK34	Q21
★★	2SK61-Y	Q7, Q8,
★★	μPD4069C	Q62
★★	IR2E01	Q31
★★	TC9137P	Q48
★★	TD6301P	Q56
★★	2SK61-GR	Q14
★★	TD6104P	Q47
★★	2SA872A	Q17
★★	2SA1100 (2SA733A)	Q35, Q50–Q55, Q60, Q61
★★	2SB834	Q37, Q42
★★	2SC535-A	Q4, Q5
★★	2SC461-B	Q6, Q13, Q23–Q25, Q27, Q49
★★	2SC2575 (2SC 945A)	Q19, Q26, Q28–Q30, Q32–Q34, Q38–Q40, Q43, Q44, Q46, Q57–Q59, Q63
★	KV1320-4	* D1 (D1A–D1D)
★	KV1225-Y	** D2 (D2A–D2C)
★	MZ-081	D42
★	KZL130	D28
★	KZL061	D35
★	MZ-110	D62
⚠ ★	10E2 (SIB01–02)	D23–D26, D31–34
★	2–1K261	D7, D8, D15, D16
★	1S2076 (1S1555) (1S2473)	D3–D6, D9–D14, D17–D22, D27, D29, D30, D36–D41, D43–D61

** D1 (KV1320-4) consists of four vari-cap diodes with the identical characteristics. When replacing either of them, first split the new D1 into four pieces (D1A–D1D), and replace both of them by new D1D (for FM antenna tuning circuit), D1B and D1C (for FM RF tuning circuit) and D1D (for FM local oscillator circuit) at the same time in order to match their characteristics.*

*** D2 (KV1225-Y) consists of three vari-cap diodes with the identical characteristics. When replacing either of them, first split the new D2 into three pieces (D2A-D2C), and replace both them by new D2A (for AM antenna tuning circuit), D2B (AM RF tuning circuit) and D2C (for AM local oscillator circuit) at the same time in order to match their characteristics.*

TRANSFORMERS, COILS, AND FILTERS

Mark	Part No.	Symbol & Description	
	ATX-013	T1	Balun
	ATX-018	T4	Balun
	ATC-132	T2	FM ANT, coil
	ATC-133	T3	FM RF coil
	ATE-008	T5	FM IFT
	ATE-046	T7	FM DET. transformer
	ATE-023	T6, T8	FM IFT
	ATE-047	T9	OSC coil
	ATB-020	T11	AM RF coil
	ATB-067	T10	AM OSC coil
	ATB-069	T12	AM IFT
	ATC-134	L1	FM RF coil
	ATC-077	L2	FM OSC coil
	T24-028	L7, L9, L11–L14	RF choke coil
	ATH-046	L8, L10	RF choke coil
	ATF-118	F1, F4	FM ceramic filter
	ATF-092	F5	Trap coil (A)
	ATF-093	F6	Trap coil (B)
	ATF-096	F9	AM filter
	ATF-095	F10	AM ceramic filter
	ATF-094	F7, F8	Low pass filter
	ATF-105	F11	AM ceramic filter
	ATF-119	F2, F3	FM ceramic filter

OTHERS

Mark	Part No.	Symbol & Description	
	AKA-014	Terminal (ANTENNA)	
	AKB-077	Terminal (OUTPUT)	
	VBZ30P060FMC (ABA-065)	Screw	
★★	ASG-532	S1	Push switch (POWER)
★	ASS-015	X1	Crystal resonator

Key Switch Assembly

Mark	Part No.	Symbol & Description	
★★	ASG-151	S2–S7	Tact switch (STATION CALL)

FM/AM Selector Assembly

Mark	Part No.	Symbol & Description	
★★	ASG-174	S8	Push switch (FM, AM)

Function Switch Assembly (GWS-296)

Mark	Part No.	Symbol & Description	
★★	ASG-274	S9	Push switch (REC LEVEL CHECK, IF BAND, MODE)
★★	ASG-276	S12	Push switch (MEMORY, TUNING MODE)
★★	ASG-173	S10, S11	Tact switch (UP, DOWN)

Step Selector Assembly

Mark	Part No.	Symbol & Description	
★★	ASH-015	S13	Slide switch (AM CHANNEL STEP)

Connector Assembly

Mark	Part No.	Symbol & Description
	AKX-068	Connector socket (FM 75Ω)

Display Assembly (GWX-587)

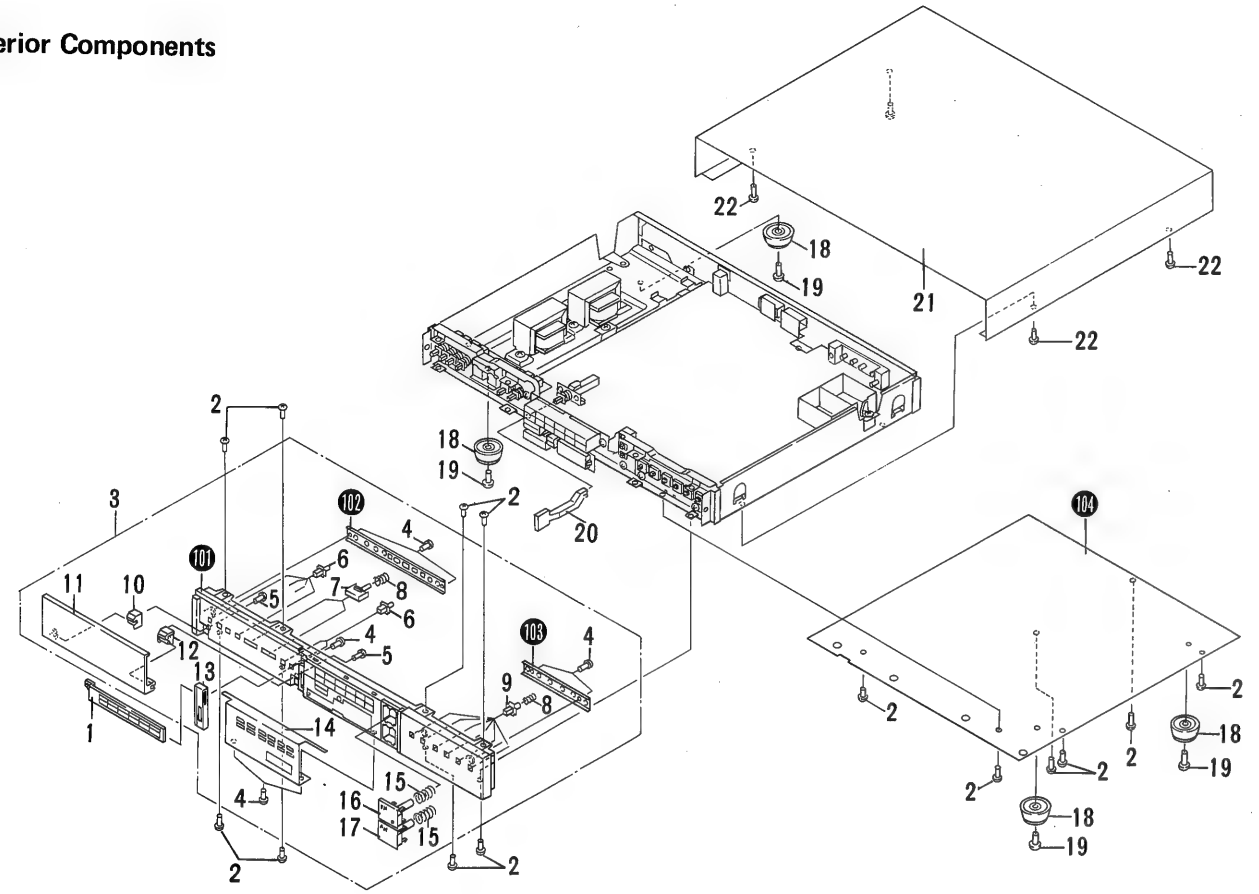
Mark	Part No.	Symbol & Description	
★	AEL-355	D101	LED numberic display
★	AEL-353	D103	LED array (FM, AM)
★	AEL-354	D104	LED array (SIGNAL)
★	AEL-356	D102	LED (red, MULTIPLATH)

Station Indicator Assembly (GWX-588)

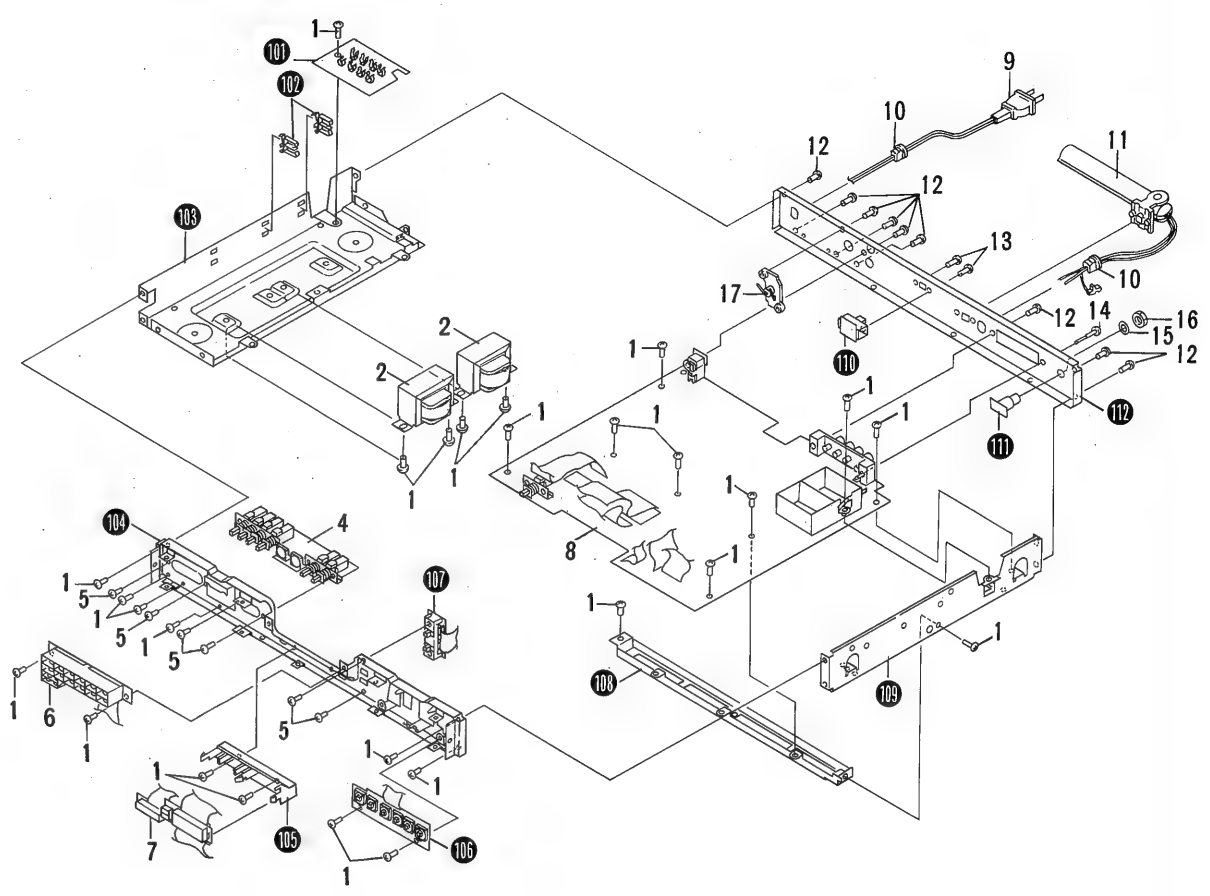
Mark	Part No.	Symbol & Description	
★	AEL-351	D201-D212	LED (Green)
★	AEL-352	D213-D216	LED (Orange)
	VBZ30P080FMC (ABA-066)	Screw	

10. EXPLODED VIEW

Exterior Components



Interior Components



NOTES:

- *Parts without part number cannot be supplied.*
- *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 symbols ★★ and ★ .*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model No., temperature, humidity, etc.

Mark	No.	Part No.	Description
	1	ANR-316	Slider assembly
	2.	VBZ30P060FMC	Screw
	3.	ANB-969	Front panel assembly
	4.	BTZ23P050FZK	Screw
	5.	VBZ30P060FMC	Screw
	6.	AAD-335	Knob (REC LEVEL CHECK, IF BAND, MODE, MEMORY, TUNING MODE)
	7.	AAD-337	Knob (UP, DOWN)
	8.	ABH-070	Coiled spring
	9.	AAD-334	Knob (STATION CALL)
	10.	ANR-320	Hinge L
	11.	ANR-324	Door
	12.	ANR-321	Hinge R
	13.	ANR-325	Pillar
	14.	ANR-319	Center cover
	15.	ABH-069	Coiled spring
	16.	AAD-332	Knob (FM)
	17.	AAD-333	Knob (AM)
	18.	AEC-613	Cabinet bumper
	19.	VTZ40P080FMC	Screw
	20.	AAD-336	Knob (POWER)
	21.	ANE-327	Cabinet
	22.	BBT30P080FZK	Screw
	101.		Front panel
	102.		Guide plate B
	103.		Guide plate A
	104.		Bottom plate

Mark	No.	Part No.	Description
	1.	VBZ30P060FMC	Screw
⚠ ★	2.	ATT-774	Power transformer (120V)
	3.	. . . . .	
	4.	GWS-296	Function switch assembly
	5.	PMZ30P060 FMC	Screw
	6.	GWX-588	Station indicator assembly
	7.	GWX-587	Display assembly
	8.	GWE-142	Tuner assembly
⚠	9.	ADG-052	AC power cord
	10.	AEC-327	Strain relief
	11.	ATB-634	Bar-antenna assembly
	12.	BBT30P080FZK	Screw
	13.	PMT30P060FZB	Screw
	14.	ABA-176	Screw
	15.	ABE-063	Washer
	16.	ABN-059	Nut
	17.	AKB-076	Terminal (AM STEREO OUT)
	101.		Terminal assembly
	102.		Wire saddle
	103.		Frame
	104.		Front frame
	105.		Holder
	106.		Key switch assembly
	107.		FM/AM selector assembly
	108.		Center frame
	109.		Side frame
	110.		Step selector assembly
	111.		Connector assembly
	112.		Rear panel

11. ADJUSTMENTS

FM Tuner

- Set each switch on F-9 as follows:
  REC LEVEL CHECK switch to "OFF"
  FM IF BAND switch to "WIDE"
  MODE switch to "MONO"
  TUNING MODE switch to "MANUAL"
  FM switch to "ON"
- Connect the FM SG (FM signal generator) to the FM ANTENNA 300Ω terminal via a 300Ω dummy antenna.
- Use a frequency counter to accurately set the FM SG output frequency.

Step	FM SG (400Hz, ±75kHz DEV.) Frequency	Level	Frequency on the display	Adjustment point	Method
1	No signal		87.50MHz	L2	Adjust so that voltage between terminal 21 and ground terminal is DC 7.0V.
2			108.00MHz	TC4	Adjust so that voltage between terminal 21 and ground terminal is DC 25V.
3	Repeat steps 1 and 2 until both requirements have been met.				
4	90MHz	20dB	90.00MHz	T2	Adjust so that voltage between terminal 22 and ground terminal is at its maximum.
5				T3	
6				L1	
7	106MHz	20dB	106.00MHz	TC1	
8				TC2	
9				TC3	
10				T5	
11	Repeat steps 4 through 10 until voltage between terminal 22 and ground terminal has reached its maximum.				
12	Set the FM IF BAND to "NARROW" position and turn VR1 fully around in the counter-clockwise direction.				
13	No signal		98.00MHz	T7	Adjust so that voltage across terminals 23-24 is DC 0V ±100mV.
14	98MHz No modulation	60dB	98.00MHz	TC8	Adjust so that voltage across terminals 23-24 is DC 0V ±100mV.
15			98.00MHz	T9	Adjust so that frequency at terminal 11 is 1.26MHz.
16			98.00MHz	VR3	Adjust so that voltage across terminals 8-9 is DC 0V ±100mV.
17	Set the TUNING MODE switch to "AUTO" position, and FM IF BAND switch to WIDE position.				
18	98MHz	26dB	98.00MHz	VR2	Adjust just before muting is effected.
19	98MHz No modulation	40dB or so	98.00MHz	FM SG output level.	Adjust FM SG output level so that No. 3 comes on in the SIGNAL indicator.
20			Set the FM IF BAND switch to the NARROW position.		
21			98.00MHz	VR1	Adjust so that No. 3 comes on in the SIGNAL indicator.
22			Set the FM IF BAND switch to WIDE position.		

FM Multiplex Decorder

- Set the MODE switch on F-9 to the AUTO position.
- Switch the FM SG to external modulation and connect the MPX SG (FM Multiplex signal generator) to the external modulation input terminal.
- Adjust FM SG output to 98.000MHz (Frequency must be accurate), 80dB, and then tune F-9 to the FM SG output (98MHz).

Step	MPX SG OUTPUT MODE	Frequency on the display	Adjustment point	Method
1	No signal (no modulation)	98.00MHz	VR6	Adjust so that frequency at terminal 7 is 76000Hz (±150Hz).
2	Pilot (19kHz) only (±7.5kHz deviation)	98.00MHz	VR7	Adjust so that a leakage of 19kHz at OUTPUT terminal is balanced between R and L channels and minimized at the same time.
3	Main = 1kHz, L or R (±67.5kHz deviation) Pilot (±7.5kHz deviation)	98.00MHz	T5 (with in±90)	Adjust so that distortion factor at OUTPUT terminal is minimized.
4			VR5	Adjust so that separation at OUTPUT terminal is balanced between R and L channels and maximized at the same time.

AM Tuner

- Set each switch on F-9 as follows:
  REC LEVEL CHECK switch to "OFF"
  AM IF BAND switch to "NARROW"
  TURNING MODE switch to "MANUAL"
  AM switch to "ON"
  AM CHANNEL STEP switch to 9kHz
- Connect the AM SG (AM signal generator) to the AM ANTENNA terminal on F-9 via a 1kΩ resistor
- Use a frequency counter to accurately set the AM SG output frequency.

Step	AM SG (400Hz, ±30% MOD.) Frequency	Level	Frequency on the display	Adjustment point	Method
1	No signal		522kHz	T10	Adjust so that DC 2V is obtained between terminal 21 and ground terminal.
2			1602kHz	TC6	Adjust so that DC 25V is obtained between terminal 21 and ground terminal.
3	Repeat steps 1 and 2 until both requirements have been met.				
4	603kHz	40dB	603kHz	Bar antenna	Adjust so that voltage between terminal 22 and ground terminal reaches its maximum level.
5				T11	
6	1404kHz	40dB	1404kHz	TC5	
7				TC7	
8	Repeat steps 4 through 7 until voltage between terminal 22 and ground terminal has reached its maximum level.				

REC Level Check Signal Generator

- Set the FM IF BAND switch to the WIDE position, FM switch to the ON.

Step	FM SG (400Hz, ±75kHz DEV.)		Frequency on the display	Adjustment point	Method
	Frequency	Level			
1	98MHz	60dB	98.00MHz	. . . . .	Verify output leve of OUTPUT terminal.
2	. . . . .	. . . . .	Set the REC LEVEL CHECK switch to the ON position.		
3	. . . . .	. . . . .	. . . . .	VR8	Adjust so that output level of OUTPUT terminal is 6dB lower than that in step 1.

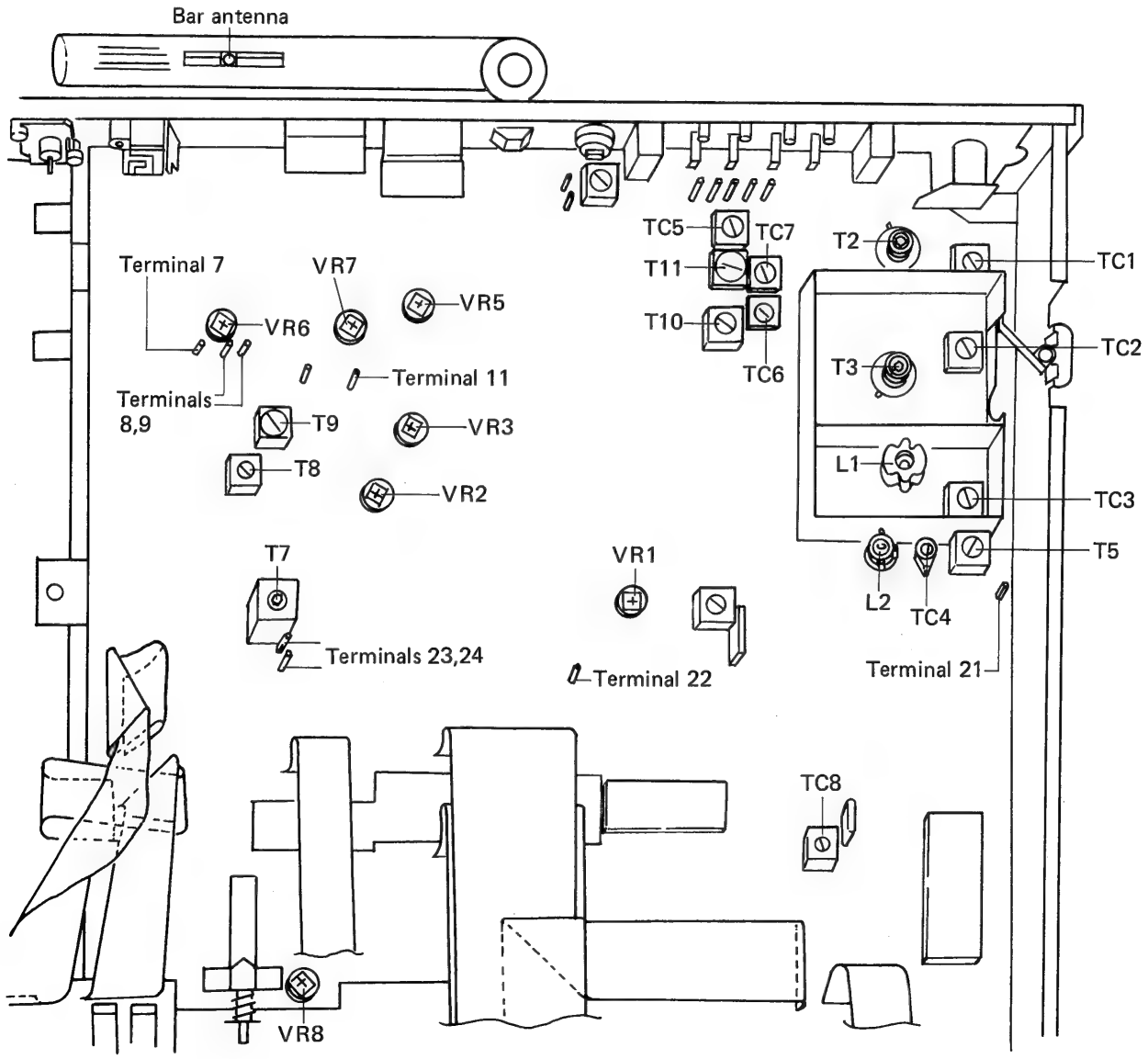


Fig. 12-1 Adjustment points and measuring points

11. RÉGLAGE

Tuner FM

- Positionner chaque commutateurs de F-9 de la manière suivante:
  Contacteur REC LEVEL CHECK sur OFF.
  Commutateur FM IF BAND sur WIDE.
  Sélecteur de MODE sur MONO.
  Sélecteur TUNING MODE sur MANUAL.
  Commutateur FM sur ON.
- Connecter le FM SG (générateur de signaux FM) à la borne FM ANTENNA 300 ohms en intercalant une antenne fictive de 300 ohms.
- Utiliser un compteur de fréquence pour régler exactement la fréquence de sortie FM SG.

Étape	FM SG (400Hz, ±75 KHz dérive)		Affichage de fréquence	Point de réglage	Méthode
	Fréquence	Niveau			
1	Absence de signal		87,50 MHz	L2	Régler de manière à ce que la tension entre la borne 21 et la borne de masse soit de 7 V CC.
2			108,00 MHz	TC4	Régler de manière à ce que la tension entre la borne 21 et la borne de masse soit de 25 V CC.
3	Recommencer 1 et 2 jusqu'à ce que les réglages soient convenables.				
4	90 MHz	20 dB	90,00 MHz	T2	Régler de manière à ce que la tension entre la borne 22 et la borne de masse soit maximale.
5				T3	
6				L1	
7	106 MHz	20 dB	106,00 MHz	TC1	
8				TC2	
9				TC3	
10				T5	
11	Recommencer les travaux de 4 à 10 jusqu'à ce que la tension entre la borne 22 et la borne de masse soit maximale.				
12	Amener le contacteur FM IF BAND sur "NARROW" et tourner VR1 complitement dans le sense inverse des aiguilles d'une montre.				
13	Absence de signal		98,00 MHz	T7	Régler de manière à ce que la tension entre les bornes 23 et 24 soit de 0 V CC ±100 mV.
14	98 MHz Absence de modulation	60 dB	98,00 MHz	TC8	Régler de manière à ce que la tension entre les bornes 23 et 24 soit de 0 V CC ±100 mV.
15			98,00 MHz	T9	Régler de manière à ce que la fréquence au niveau de la borne 11 soit de 1,26 MHz.
16			98,00 MHz	VR3	Régler de manière à que la tension entre les bornes 8 et 9 soit de 0 V CC ±100 mV.
17	Amener le selecteur TUNING MODE en position AUTO et le sélecteur de bande FM IM sur WIDE.				
18	98 MHz	26 dB	98,00 MHz	VR2	Régler juste avant que l'assourdissement ne survienne.
19	98 MHz Absence de modulation	Environ 40 dB	98,00 MHz	Niveau de sortie du FM SG	Régler le niveau de sortie du FM SG de manière à ce que le nº 3 apparaisse sur le témoin de SIGNAL.
20			Amener le commutateur FM IF BAND sur la position NARROW.		
21			98,00 MHz	VR1	Régler de manière à ce que le nº 3 apparaisse sur le témoin de SIGNAL.
22	Positionner le commutateur FM IF BAND sur WIDE.				

Décodeur multiplex de FM

- Amener le sélecteur de MODE de F-9 sur la position AUTO.
- Commuter le FM SG sur la modulation externe et connecter le MPX SG (générateur de signaux multiplex FM) à la borne d'entrée de modulation externe.
- Régler la sortie du FM SG à 98,000 MHz (la fréquence doit être précise), 80 dB puis accorder F-9 sur la sortie du FM-SG (98 MHz).

Étape	MPX SG MODE DE SORTIE	Affichage de fréquence	Point de réglage	Méthode
1	Absence de signal (pas de modulation)	98,00 MHz	VR6	Régler de manière à ce que la fréquence soit de 76000 Hz (±150 Hz) à la borne 7.
2	Fréquence pilote (19 KHz) seulement (dérive de ±7,5 KHz)	98,00 MHz	VR7	Régler de manière à ce qu'une perte de 19 KHz au niveau de la borne OUTPUT soit équilibrée entre les canaux droit et gauche et minimisée simultanément.
3	Principale=1 KHz, droit ou gauche (dérive de ±67,5 KHz) Fréquence pilote (dérive de ±7,5 KHz)	98,00 MHz	T5 (de l'ordre de ±90°)	Régler de manière à minimiser le taux de distortion à la borne OUTPUT.
4			VR5	Régler de manière à ce que la séparation au niveau de la borne OUTPUT soit équilibrée entre les canaux droit et gauche et maximalisée simultanément.

Tuner AM

- Positionner chaque commutateur de F-9 de la manière suivante:
  Contacteur REC LEVEL CHECK sur OFF.
  Commutateur AM IF BAND sur NARROW.
  Sélecteur TUNING MODE sur MANUAL.
  Commutateur AM sur ON.
  Commutateur AM CHANNEL STEP sur 9 KHz.
- Connecter le AM SG (générateur de signaux AM) à la borne AM ANTENNA du F-9 en intercalant une résistance de 1 K-ohm.
- Utiliser un compteur de fréquence pour régler exactement la fréquence de sortie AM SG.

Étape	AM SG (400Hz, ±30% de modulation) Fréquence	Niveau	Affichage de fréquence	Point de réglage	Méthode
1	Absence de signal		522 KHz	T10	Régler de manière à ce qu'un courant de 2 V CC passe entre la borne 21 et la borne de masse.
2			1602 KHz	TC6	Régler le manière à ce qu'un courant de 25 V CC passe entre la borne 21 et la borne de masse.
3	Recommencer 1 et 2 jusqu'à ce que les réglages soient convenables.				
4	603 KHz	40 dB	603 KHz	Antenne-tige	Régler de manière à ce que la tension entre la borne 22 et celle de masse atteigne son niveau maximal.
5				T11	
6	1404 KHz	40 dB	1404 KHz	TC5	
7				TC7	
8	Recommencer les travaux de 4 à 7 jusqu'à ce que la tension entre la borne 22 et la borne de masse soit à son niveau maximal.				

Générateur de signaux REC LEVEL CHECK

- Amener le sélecteur FM IF BAND sur WIDE et le sélecteur FM sur ON.

Étape	FM SG (400 Hz, ±75 KHz dérive) Fréquence	Niveau	Affichage de fréquence	Point de réglage	Méthode
1	98 MHz	60 dB	98,00 MHz		Vérifier le niveau de sortie de la borne OUTPUT.
2			Amener le commutateur REC LEVEL CHECK sur la position ON.		
3				VR8	Régler de manière à ce que le niveau de sortie de la borne OUTPUT soit de 6 dB inférieur au niveau obtenu en 1.

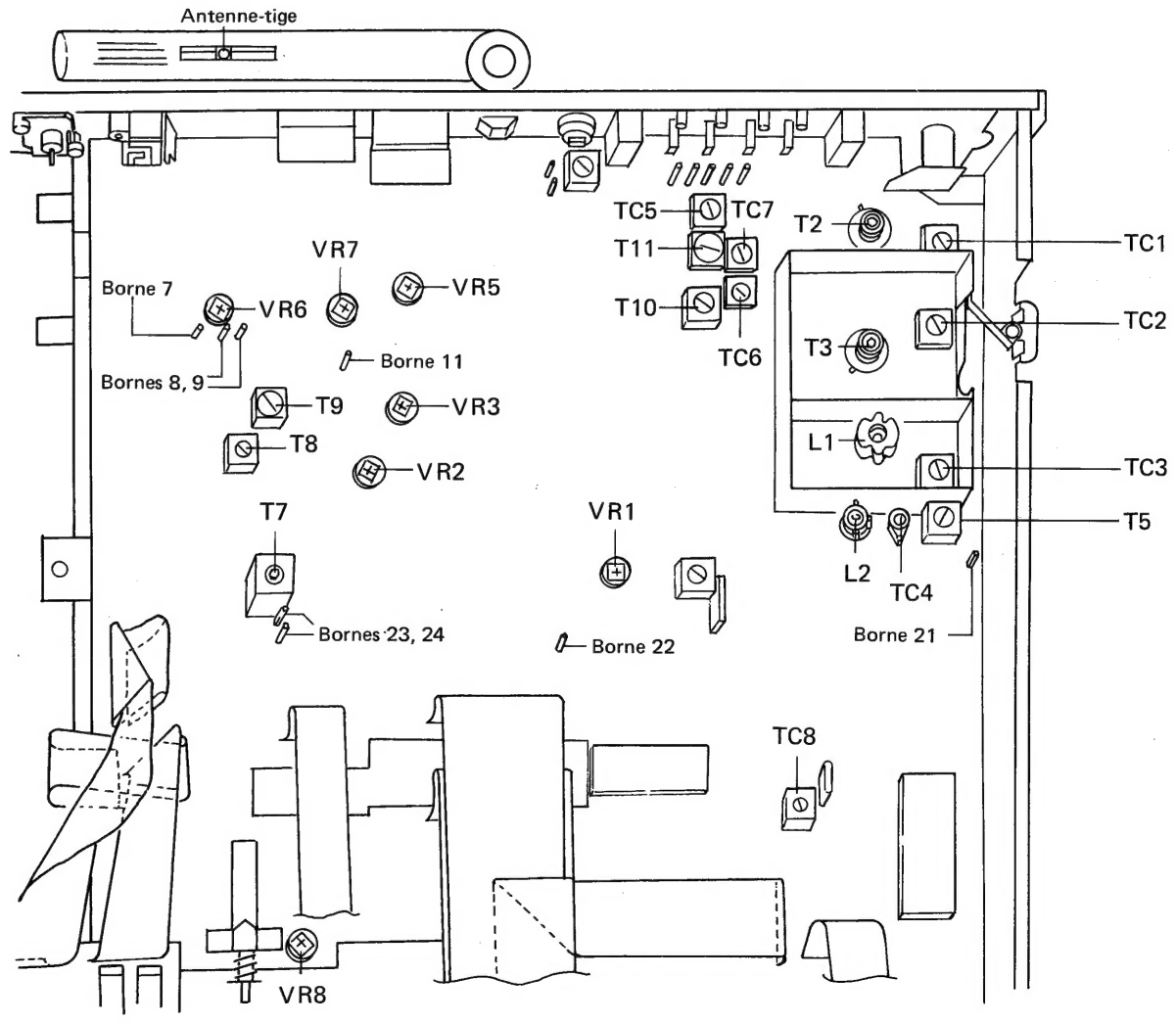


Fig. 11-1 Points de réglage et de mesure

11. AJUSTE

Sintonizador de FM

- Poner cada interruptor del F-9 como se indica a continuación:
  Conmutador de comprobación del nivel de grabación (REC LEVEL CHECK) en la posición "OFF".
  Conmutador de la banda de FI de FM (FM IF BAND) en la posición "WIDE".
  Conmutador de modo (MODE) en la posición "MONO".
  Conmutador del modo de sintonización (TUNING MODE) en la posición "MANUAL".
  Conmutador de FM en la posición "ON".
- Conectar el FM SG (generador de señales de FM) al terminal FM ANTENNA de 300 ohmios a través de una antena artificial de 300 ohmios.
- Utilizar un frecuencímetro para ajustar con precisión la frecuencia de salida del generador de señales de FM (FM SG).

Paso	Generador de señales de FM (400 Hz, ±75 KHz de desviación)		Indicador de frecuencias	Punto de ajuste	Método
	Frecuencia	Nivel			
1	No hay señal		87,50 MHz	L2	Ajustar de modo que la tensión entre el terminal 21 y el terminal de toma de tierra sea de 7,0V CC.
2			108,00 MHz	TC4	Ajustar de modo que la tensión entre el terminal 21 y el terminal de toma de tierra sea de 25V CC.
3	Repetir los pasos 1 y 2 hasta que se satisfagan ambos requisitos.				
4	90 MHz	20 dB	90,00 MHz	T2	Ajustar de modo que la tensión entre el terminal 22 y el terminal de toma de tierra alcance su máximo nivel.
5				T3	
6				L1	
7	106 MHz	20 dB	106,00 MHz	TC1	
8				TC2	
9				TC3	
10				T5	
11	Repetir los pasos 4 al 10 phasta que la tensión entre el terminal 22 y el terminal de toma de tierra alance su máximo nivel.				
12	Poner FM IF BAND en la posición "NARROW" y girar completamente VR1 en el sentido hacia la izquierda.				
13	No hay señal		98,00 MHz	T7	Ajustar de modo que la tensión por los terminales 23-24 sea de 0 V CC ±100 mV.
14	98 MHz / Sin modulación	60 dB	98,00 MHz	TC8	Ajustar de modo que la tensión por los terminales 23-24 sea de 0 V CC ±100 mV.
15			98,00 MHz	T9	Ajustar de modo que la frecuencia en el terminal 11 sea de 1,26 MHz.
16			98,00 MHz	VR3	Ajustar de modo que la tensión por los terminales 8-9 sea de 0 V CC ±100 mV.
17	Poner el selector de modo de sintonización (TUNING MODE) en la posición "AUTO" y el selector de banda FM IF en la posición "WIDE".				
18	98 MHz	26 dB	98,00 MHz	VR2	Ajustar antes de que se produzca el silenciamineto.
19	98 MHz / Sin modulación	Unos 40 dB	98,00 MHz	Nivel de salida del FM SG	Ajustar el nivel de salida del FM SG de modo que aparezca el no. 3 en el indicador de sañal (SIGNAL).
20			Poner el conmutador de la banda de FI de FM (FM IF BAND) en la posición "NARROW".		
21			98,00 MHz	VR1	Ajustar de modo que aparezca el no. 3 en el indicador de señal (SIGNAL).
22	Poner el conmutador de la banda de FI de FM (FM IF BAND) en la posición "WIDE".				

Decodificador de multiplex de FM

- Poner el conmutador de modo (MODE) del F-9 en la posición "AUTO".
- Conmutar el FM SG a modulación exterior y conectar el MPX SG (generador de señales multiplex de FM) al terminal de entrada para modulación exterior.
- Ajustar la salida del FM SG a 98,000 MHz (la frecuencia tiene que ser precisa), 80 dB, y luego sintonizar el F-9 a la salida del FM SG (98 MHz).

Paso	Generador de señales de multiplex de MODO DE SALIDA	Indicador de frecuencias	Punto de ajuste	Método
1	No hay señal (sin modulación)	98,00 MHz	VR6	Ajustar de modo que la frecuencia en el terminal 7 sea de 76000 Hz (±150 Hz).
2	Piloto (19 KHz) sólo (desviación de ±7,5 KHz)	98,00 MHz	VR7	Ajustar de modo que la fuga de 19 KHz en el terminal de salida (OUTPUT) esté equilibrada entre los canales derecho (R) e izquierdo (L) y quede, al mismo tiempo, minimizada.
3	Principal=1 KHz, izq. o der. (desviación de ±67,5 KHz) Piloto (desviación de ±7,5 KHz)	98,00 MHz	T5 (dentro de ±90°)	Ajustar de modo que el factor de distorsión el terminal de salida (OUTPUT) quede minimizado.
4			VR5	Ajustar de modo que la separación en el terminal de salida (OUTPUT) esté equilibrada entre los canales derecho (R) e izquierdo (L) y quede, al mismo tiempo, maximizada.

Sintonizador de AM

- Poner cada interruptor del F-9 como se indica a continuación:
  Conmutador de comprobación del nivel de grabación (REC LEVEL CHECK) en la posición "OFF".
  Conmutador de la banda de FI de AM (AM IF BAND) en la posición "NARROW".
  Comutador del modo de sintonización (TUNING MODE) en la posición "MANUAL".
  Conmutador de AM en la posición "ON".
  Conmutador de pasos del canal de AM (AM CHANNEL STEP) en la posición de 9 KHz.
- Conectar el AM SG (generador de señales de AM) al terminal AM ANTENNA del F-9 a través de una resistencia de 1K ohmio.
- Utilizar un frecuencímetro para ajustar con precisión la frecuencia de salida del generador de señales de AM (AM SG).

Paso	Generador de señales de AM (400 Hz, ±30% de modulación)		Indicador de frecuencias	Punto de ajuste	Método
	Frecuencia	Nivel			
1	No hay señal		522 KHz	T10	Ajustar de modo que se obtengan 2V CC entre el terminal 21 y el terminal de toma de tierra.
2			1602 KHz	TC6	Ajustar de modo que se obtengan 25V CC entre el terminal 21 y el terminal de toma de tierra.
3	Repetir los pasos 1 y 2 hasta que se satisfagan ambos requisitos.				
4	603 KHz	40 dB	603 KHz	Antena de barra	Ajustar de modo que la tensión entre el terminal 22 y el terminal de toma de tierra alcance su máximo nivel. .
5				T11	
6	1404 KHz	40 dB	1404 KHz	TC5	
7				TC7	
8	Repetir los pasos 4 al 7 hasta que la tensión entre el terminal 22 y el terminal de toma de tierra alcance su máximo nivel.				

Generador de señales de comprobación del nivel de grabación (REC LEVEL CHECK)

- Poner el conmutador FM IF BAND en la posición "WIDE" y el interruptor de FM en la posición ON.

Paso	Generador de señales de FM (400 Hz, ±75 KHz de deviación)		Indicador de frecuencias	Punto de ajuste	Método
	Frecuencia	Nivel			
1	98 MHz	60 dB	98,00 MHz		Verificar el nivel de salida del terminal de salida (OUTPUT).
2			Poner el conmutador de comprobación del nivel de grabación (REC LEVEL CHECK) en la posición "ON".		
3				VR8	Ajustar de modo que el nivel de salida del terminal de salida (OUTPUT) sea de 6 dB o inferior que el del paso 1.

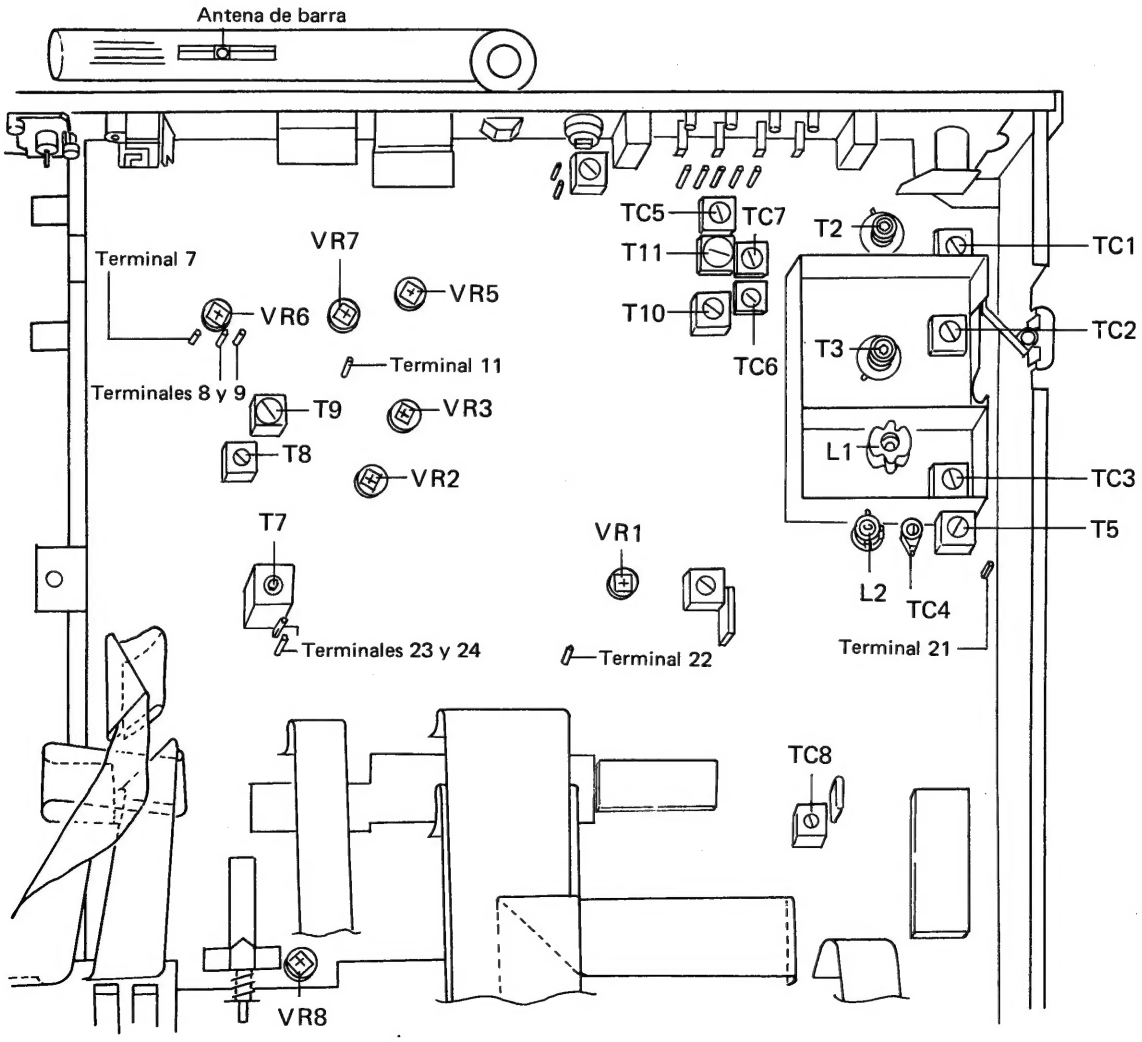


Fig. 11-1 Puntos de ajuste y de medición