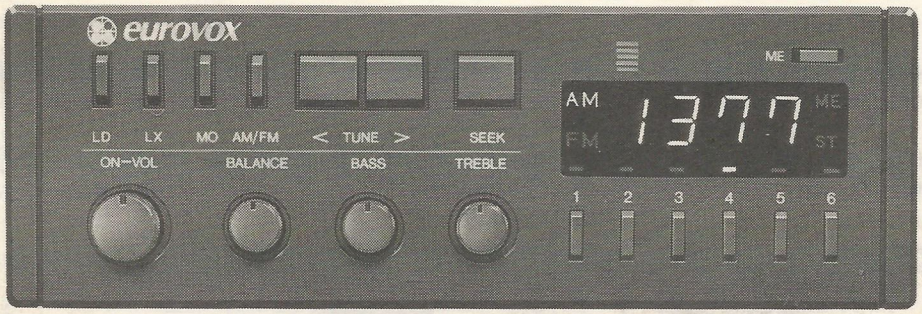
eurovox

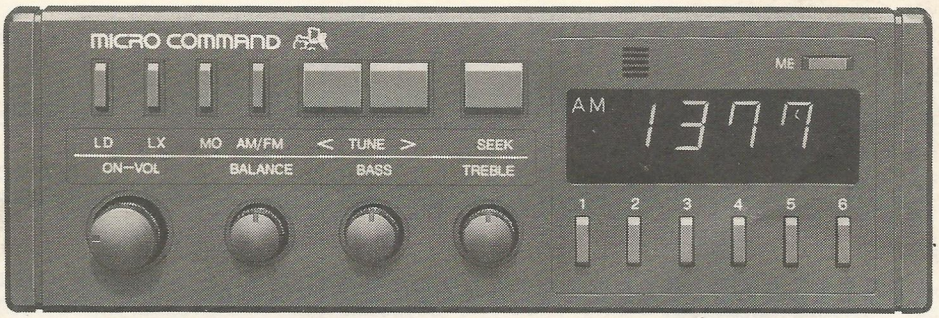
HOLDEN GMH

SERVICE MANUAL

ELECTRONIC SEEK TUNE AM FM STEREO RADIO with 12 programmable Memories & Display, Loudness Contour and separate Bass and Treble Controls



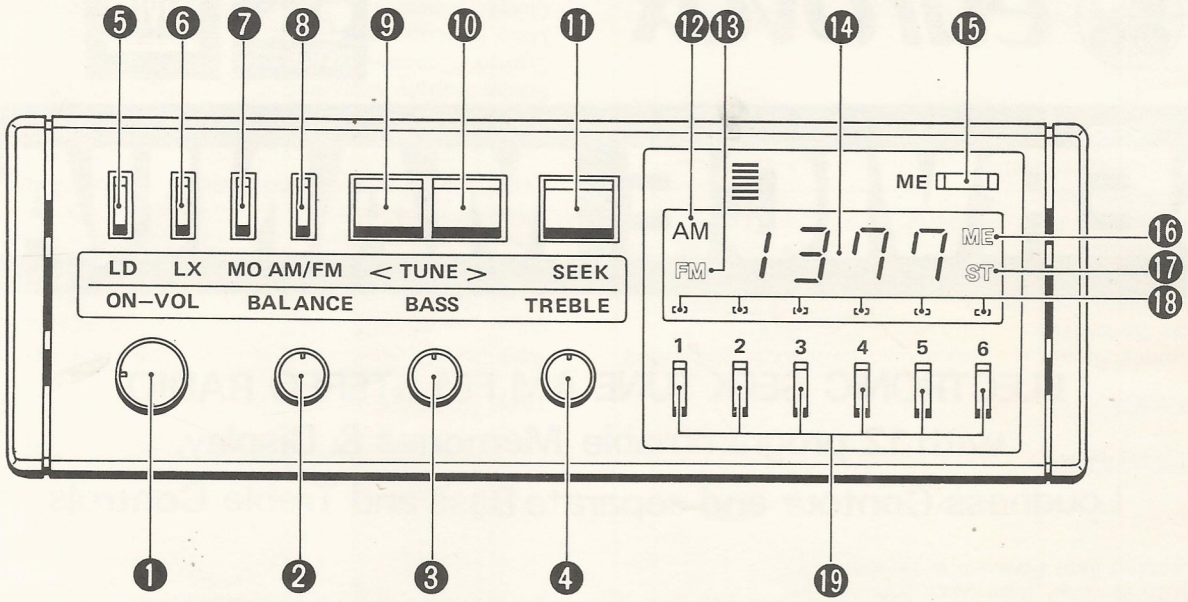
MRE-2100



MRB-6201

Printed in Japan Jul. '84 Modification Reserved

LOCATION OF CONTROLS



1. Power On-Off Switch/Volume Control
2. Balance Control
3. Bass Control
4. Treble Control
5. Loudness Contour Switch
6. Local/Distant Selector
7. FM Stereo/Mono Selector
8. Waveband Selector
9. Manual Tuning Switch
10. Manual Tuning Switch
11. Automatic Seek Tuning Switch
12. AM Indicator
13. FM Indicator
14. Digital Frequency Readout
15. Memory Enable Switch
16. Memory Enable (ME) Indicator
17. FM Stereo (ST) Indicator
18. Memory Address Indicators
19. Memory Address Switches

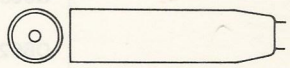
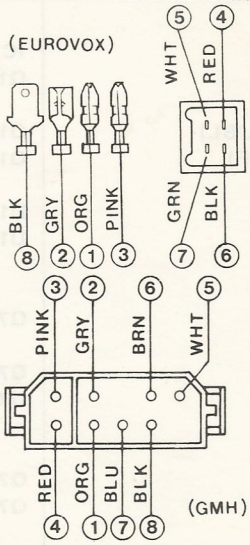
GENERAL INFORMATION

SEMICONDUCTORS: 10 ICs, 3 FETs, 31 Transistors, 40 Diodes

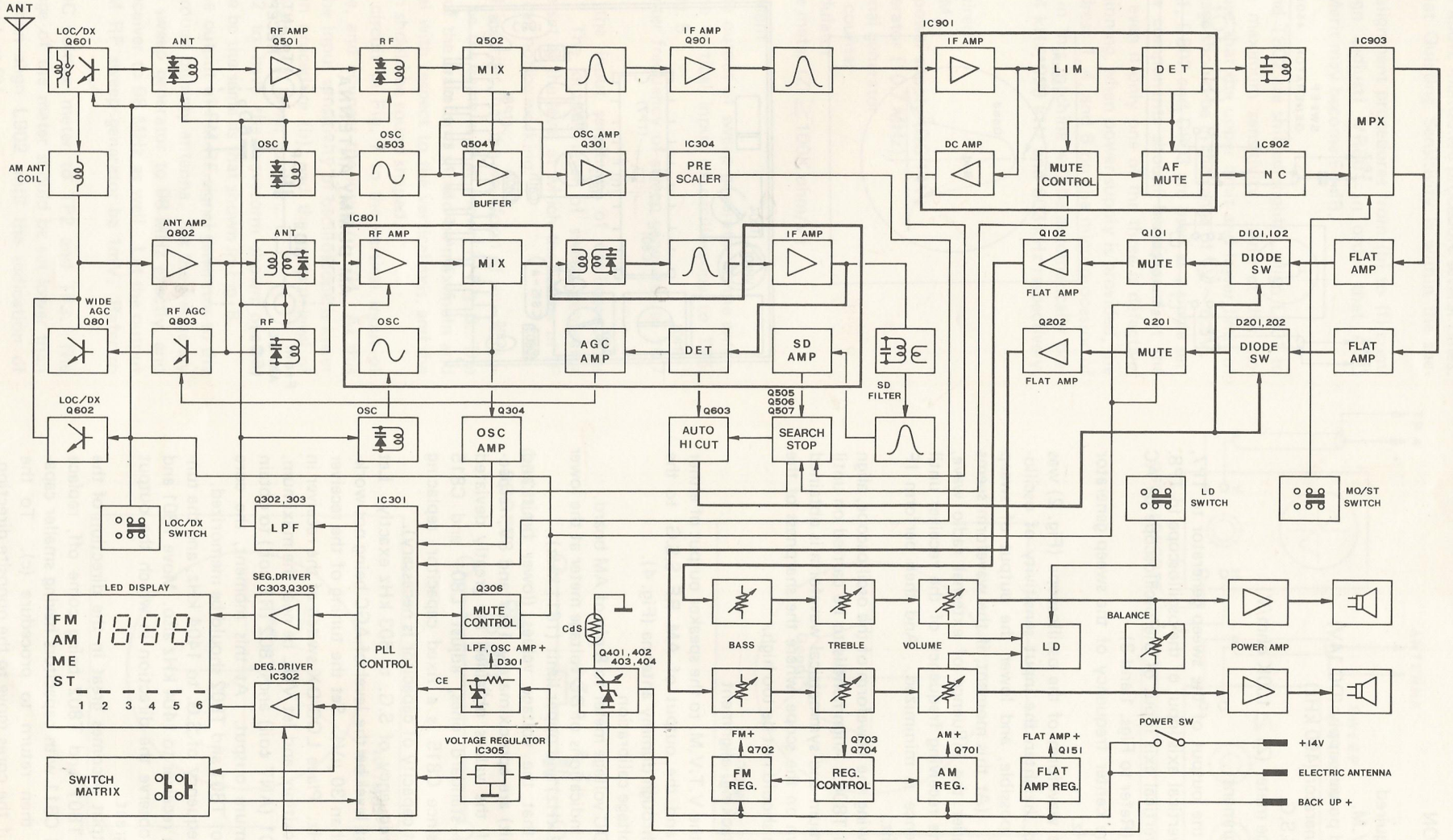
Description	Ref. No.	Q'ty	Equivalent
(AM Radio)			
AM IC HA12428	IC801	1	
Radio frequency amplifier FET 2SK217(E)	Q802	1	
Switching transistor 2SC2814(F3)	Q801, 803, 804	3	2SC814(F4), 2SC2620(B), 2SC2714(O) or (Y)
Oscillator buffer amplifier transistor 2SC2603(F)	Q304	1	2SC2603(E), 2SC2785(F) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Voltage shift diode 1SS110	D804	1	1SS53, 1S1555
Varactor diode SVC321	D801, 802, 803	3	1SV101
Switching diode 1SS133	D102, 202	2	1SS53, 1S1555
(FM Radio)			
IF IC LA1140	IC901	1	
NB IC HA11219 or LA2100	IC902	1	
MPX IC LA3370	IC903	1	
Radio frequency amplifier FET 3SK101(GR)	Q501	1	3SK85
Mixer transistor 2SC2714(R)	Q502	1	2SC2714(O) or (Y), 2SC2620
Oscillator buffer amplifier transistor 2SC2714(R)	Q504	1	2SC2714(O) or (Y), 2SC2620
Oscillator FET 2SK210(Y)	Q503	1	2SK210(GR) or (BL)
IF amplifier transistor 2SC930(D)	Q901	1	2SC2787(K) or (L)
Oscillator buffer amplifier transistor 2SC930(D)	Q301	1	2SC2787(K) or (L)
AM and FM LOC/DX switching transistor 2SC2603(F)	Q602	1	2SC2603(E), 2SC2785(F) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Switching transistor 2SC2603(F)	Q601	1	2SC2603(E), 2SC2785(F) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Switching diode 1SS133	D101, 201, 601	3	1SS53, 1S1555
Voltage shift diode 1SS133	D901, 902	2	1SS53, 1S1555
Varactor diode 1SV103	D501, 502, 503	3	SVC211
(AM Hi cut)			
Switching transistor 2SC2603(F)	Q603	1	2SC2603(E), 2SC2785(F) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Switching diode 1SS133	D602, 603	2	1SS53, 1S1555
(Audio)			
Power amplifier IC HA13001	IC151	1	
Muting transistor 2SC2603(F)	Q101, 201	2	2SC2603(E), 2SC2785(F) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Flat amplifier transistor 2SC2458L(BL)	Q102, 202	2	
Flat amplifier transistor 2SC2603(F)	Q151	1	2SC2603(E), 2SC2785(F) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Switching diode 1SS133	D152	1	1SS53, 1S1555
Zener diode EQA02-09(SA)	D153	1	
(AM FM Regulator)			
Switching transistor 2SC2603(F)	Q701, 703, 704	3	2SC2603(E), 2SC2785(F) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Switching transistor 2SD400(F)	Q702		
Zener diode EQA02-09(SA)	D701, 702	2	
(Search stop)			
Switching transistor 2SA1115(E)	Q705	1	2SA1115(F), 2SA1175(E)
Switching transistor 2SC2603(F)	Q706, 707	2	2SC2603(E), 2SC2785(F) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Zener diode RD5.6E (B2)	D703	1	
Switching diode 1SS133	D704, 705, 706	3	1SS53, 1S1555

Description	Ref. No.	Q'ty	Equivalent
(PLL)			
PLL control IC μPD1710G-016	IC301	1	
Prescaler μPB553AC	IC304	1	
Regulator IC μPC78L05	IC305	1	
Low pass filter transistor 2SC2603(F)	Q302, 303	2	2SC2603(E), 2SC2785(F) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Switching transistor 2SC2603(F)	Q305, 306	2	2SC2603(E), 2SC2785(F) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Zener diode RD5.1E (B2)	D301	1	
Zener diode EQA02-09 (SA)	D302	1	
Switching diode 1SS133	D304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315	12	1SS53, 1S1555
(Display)			
Transistor array M54562P	IC302	1	
Transistor array M54517P	IC303	1	
Power transistor 2SD313(E)	Q401	1	
Dimmer control transistor 2SC2603(F)	Q402, 403, 404	3	2SC2603(E), 2SC2785(E) or (H), 2SC536(F) or (G), 2SC1740S(Q) or (R)
Zener diode RD5.6E (B2)	D401	1	
Protector diode ERB12(02)	D151	1	DS135(D)

INPUT AND OUTPUT

Indication	For connection of:	Sensitivity	Impedance	Type of Socket	Connection
Antenna receptacle	Car radio aerial	1 μV – 3V	75 ohm		Aerial
Power supply, 4P plug or 8P plug	Small light switch	---	---		1. Back light
	Automatic aerial	14V DC (Max. 500mA)	---		2. Automatic aerial
	Power supply +14V (Car battery)	---	---		3. Car battery +14V DC
	Power supply +14V (Ignition switch)	---	---		4. +14V DC
	Output Speaker Left CH and Right CH	5. 7.5W 7. 7.5W	4 ohm 4 ohm		5. Right Speaker 6. Speaker GND 7. Left Speaker
	Chassis of car (Ground)	---	---		8. Ground

CIRCUIT FUNCTION DIAGRAM



SERVICE ALIGNMENT PROCEDURE

RADIO SECTION
AM CIRCUIT
Equipment Required

1. AC V.T.V.M.
2. Stabilized power supply (DC 14V)
3. Sweep generator (450 kHz)
4. AM RF S.S.G.
5. DC voltage meter (Zi $\geqq$100K ohm/V)

(A) AM, IF alignment

(a) Connect the output of the sweep generator to TP7, and the vertical axis input of the oscilloscope to TP8. Let the vertical axis input of the oscilloscope be AC coupling (Refer to Figs. 1 and 3).

(b) Adjust the center frequency of the sweep generator to 450 kHz.

(c) When the waveform of the oscilloscope (Fig. 2) was confirmed, heighten the input sensitivity of oscilloscope as possible, and lower the output of sweep generator. (At this moment, if the waveform seems to be under the influence of external radio wave, change the receiving frequency of the receiver until the influence is minimized. And then perform IF adjustment.

(d) While viewing the waveform of the oscilloscope, align T803 and T804. Alignment is to be carried on until the maximum and symmetrical waveform is obtained and shown on the scope, where the sharpness of the waveform should not be too high.

(B) AM RF (Tracking) alignment

(a) Connect the V.T.V.M. to the speaker output of either channel, and the output of AM RF S.S.G. to the antenna through dummy antenna (Fig. 4).

(b) Tuning voltage calibration
Connect DC voltage meter to 8 pin of AM board.
Read the indications of DC voltage meter at the lower limit (522 kHz) and upper limit (1611 kHz).
Confirm that the voltage values (lower limit and upper limit) are approximately 1.5V and 8V, respectively. If the values obtained are greatly deviated from the standard ones, adjust L801 and C815 (Note: since C815 is a fixed capacitor, replacing a different capacity of capacitor is necessary).

(c) Set the frequency of S.G. to 603 kHz exactly. Let the output level be the level of AGC being not working (less than 30 μV). Set the tuning of the receiver to 603 kHz. Place LOC/DX switch of the receiver in the DX position, and let VOL be near the maximum.

(d) Align T801 (ANT coil) and T802 (RF coil) to obtain the maximum output. At this moment, the core positions of T801 and T802 should be memorized.

(e) Set the frequency of S.G. to 1404 kHz, and the tuning of the receiver to 1404 kHz also. Move T801 and T802 to observe the direction in which the output becomes great.
If the output becomes great in the direction of the cores of T801 and T802 being come off, replace C808 and C811 with capacitors having smaller capacity, and then return to procedure (c). To the contrary, if the cores move to the opposite direction, replace C808 and C811 with capacitors having greater capacity.

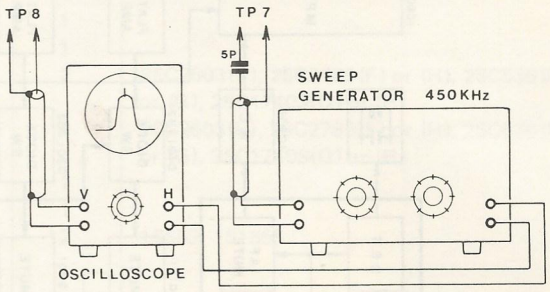


Fig. 1

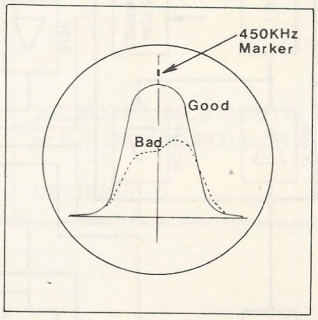


Fig. 2

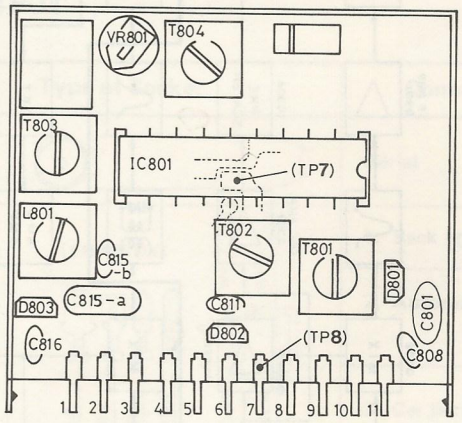


Fig. 3

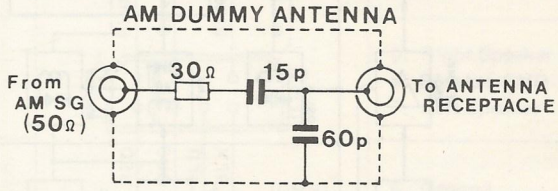


Fig. 4

(f) Repeat the above mentioned procedure several times. (Ensure that Quieting Sensitivity is within the specification).

(g) When the alignment procedures from (b) to (f) completed, align (adjust) VR801 in order that AGC Figure of Merit may become 50 dB.

Note:

1. If T801 and T802 are shifted slightly, align L801 to obtain the maximum sensitivity. And at this moment, ensure that the upper limit and lower limit of tuning voltage should be in the range of 1V ~ 8.5V.
2. Since D801, D802 and D803 are used as a single set, these three components should be replaced at the same time even if only one of the three is defective.
3. At the beginning, when power supply is provided, the pre-set address 1, 4, and 6 on the microprocessor of PLL used in this machine will be automatically pre-set to 1404 kHz, 999 kHz and 603 kHz respectively.

FM Circuit

Equipment Required

1. AC V.T.V.M.
2. Stabilized power supply (DC 14V)
3. Sweep generator (10.7 MHz)
4. FM RF Signal generator
5. Frequency counter
6. Stereo modulator
7. DC Voltage meter (Zi $\geqq$ 100K ohm/V)

(A) FM IF alignment

(a) Connect the output of sweep generator to the antenna, and the vertical input of oscilloscope to TP5. Refer to Fig. 5.

(b) Set the center frequency of sweep generator to 10.7 MHz.

Note: Heighten the input sensitivity of oscilloscope as possible. The output level of sweep generator should be set at the level at which the limiter of IF amplifier can not be working.

(c) Align T501 in order that the waveform of the oscilloscope may be the same as that shown in Fig. 6. The amplitude of the waveform should be maximum and symmetrical with respect to the vertical axis, and the end portion should be round shaped.

(d) Place C.R circuit in Fig. 7 to the vertical input of oscilloscope, and connect the input to TP4. At this moment, the input sensitivity of oscilloscope is lower than that in procedure (b), and the output level of sweep generator will lower further.

(e) Align L902 to have the waveform shown on the oscilloscope be the same as that shown in Fig. 8.

(f) Connect the output of FM RF signal generator to the antenna through dummy antenna. Set the frequency of FM RF sweep generator to 98 MHz exactly, and tune the receiver to 98 MHz as well. Let the output level of FM RF sweep generator be 1mV. Refer to Fig. 9.

(g) Connect DC voltage meter to TP2 and TP3. The voltage range of the meter should be set lower than 0.5V and then align L902 until the indication of voltage meter is at 0V.

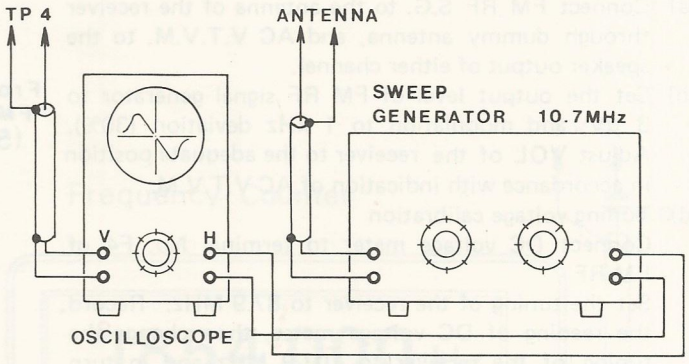


Fig. 5

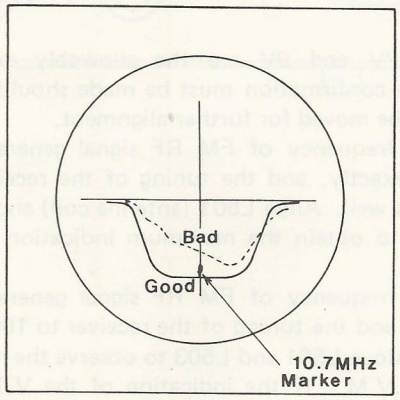


Fig. 6

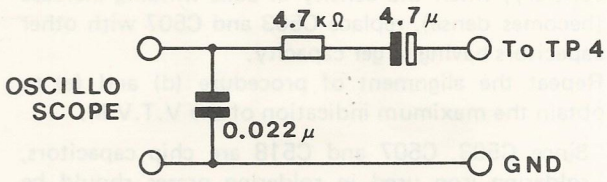


Fig. 7

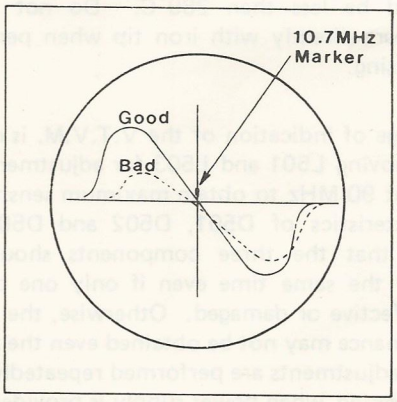


Fig. 8

(B) FM RF board alignment

(a) Connect FM RF S.G. to the antenna of the receiver through dummy antenna, and AC V.T.V.M. to the speaker output of either channel.

(b) Set the output level of FM RF signal generator to 3 μV, and modulation to 1 kHz deviation (30%). Adjust VOL of the receiver to the adequate position in accordance with indication of AC V.T.V.M.

(c) Tuning voltage calibration
Connect DC voltage meter to terminal No. F4 of FM RF
Set the tuning of the receiver to 87.9 MHz. Record the reading of DC voltage meter, then change the tuning of the receiver to 107.9 MHz and in turn record the reading of DC voltage meter. Confirm that the two voltage values are to be approximately 1.5V and 7V, respectively. If the values indicated are greatly deviated from the standard ones, adjust L505 and C518.

Note: Since 1.2V and 9V are the allowably extreme values, re-confirmation must be made should L505 or C518 be moved for further alignment.

(d) Tune the frequency of FM RF signal generator to 90 MHz exactly, and the tuning of the receiver to 90 MHz as well. Align L501 (antenna coil) and L503 (RF coil) to obtain the maximum indication of the V.T.V.M.

(e) Tune the frequency of FM RF signal generator to 106 MHz, and the tuning of the receiver to 106 MHz as well. Move L501 and L503 to observe the reading of the V.T.V.M. If the indication of the V.T.V.M. increases when the density of coils winding decreases (becomes coarse), replace C503 and C507 with other capacitors having smaller capacity, and then perform the alignment of procedure (d). To the contrary, when the density of coils winding increase (becomes dense), replace C503 and C507 with other capacitors having larger capacity.

(f) Repeat the alignment of procedure (d) and (e) to obtain the maximum indication of the V.T.V.M.

Note: Since C503, C507 and C518 are chip capacitors, soldering iron used in soldering prases should be of less than 30W, and the temperature of the iron tip should be less than 280°C. Do not touch ceramic part directly with iron tip when performing processing.

Note:

1. If the change of indication of the V.T.V.M. is only a bit when moving L501 and L503 for adjustment, adjust L505 at 90 MHz to obtain maximum sensitivity.
2. The characteristics of D501, D502 and D503 are similar so that the three components should be replaced at the same time even if only one of the three is defective or damaged. Otherwise, the specified performance may not be obtained even the above mentioned adjustments are performed repeatedly.
3. At the beginning, when power supply is provided, the pre-set address buttons 1, 4 and 6 on the microprocessor of PLL used in this machine will be automatically pre-set to 106 MHz, 98 MHz and 90 MHz respectively.

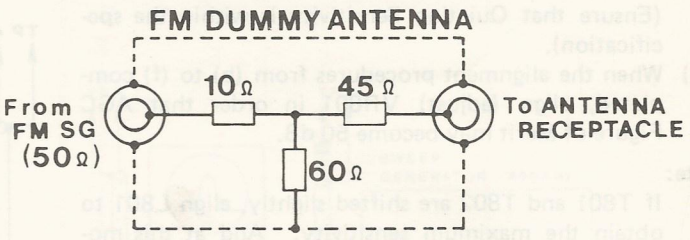


Fig. 9

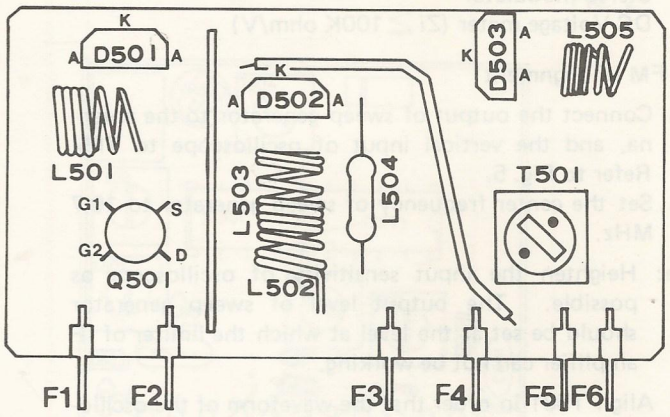


Fig. 10

(g) Gain adjustment
Tune the frequency of FM RF signal generator to 98 MHz and output level to 3.2μV (no modulation). Set the tuning of the receiver to 98 MHz, and set VOL to the maximum. Align trimmer resistor VR 901 to obtain the minimum indication of the V.T. V.M.

Note: Noise may be small even if trimmer resistor is dialed to the extreme position, counterclockwise. But, the optimum position of trimmer resistor is, in general at central part.

(C) FM MPX Circuit alignment

(a) Tune the frequency of FM RF signal generator to 98 MHz and output level to the no modulation value of 1mV. The receiver receives at 98 MHz. Connect a digital frequency counter to TP9. Refer to Fig. 12.

(b) Align trimmer resistor VR903 until the indication of frequency counter indicating 19 kHz.

(c) MPX separation alignment
Set the output level of FM RF signal generator to 1mV, and set the modulator to 75 kHz deviation (10% for pilot signal and 90% for 1 kHz main signal L + R).
Tune the frequency of FM RF signal generator to 98 MHz and receive 98 MHz by the receiver. Adjust balance Volume to have the right and left volumes be equal.

(d) Tune the mode selector of the stereo modulator to only R channel. Align trimmer resistor VR904 to obtain maximum separation. Fig. 12.

(e) Stereo noise control level alignment
Let the stereo modulator be at the same state as that set in procedure (d) and then set the output level of FM RF signal generator to 56.2 μV. Align trimmer resistor VR902 to have separation of 20 dB. Fig. 12.

Note: Regarding relationship between a signal output level and a reading of the signal generator,

(1) Count directly a reading of the attenuator, in case the output of the signal generator is "Load type".

(2) Count 1/2 of a reading of the attenuator, in case the output of the signal generator is "Open type".

PLL Microprocessor Circuit

Equipment Required

1. Stabilized power supply (DC 14V)
2. Frequency counter with more than 7 digits

Adjustment in crystal oscillator frequency

(a) Connect the input of frequency counter to TP10. Place the band changeover switch of the receiver in AM position and set receiving frequency to 1404 kHz. Refer to Fig. 12.

(b) Align trimmer capacitor TC301 to have the indication of frequency counter be of 1854000 Hz. Refer to Fig. 11.

Note: If receiving frequency of the receiver is not 1404 kHz, let the receiving frequency be added by 450 kHz, by performing the alignment of TC301 (trimmer capacitor). Correctly perform the alignment; otherwise radio will be affected.

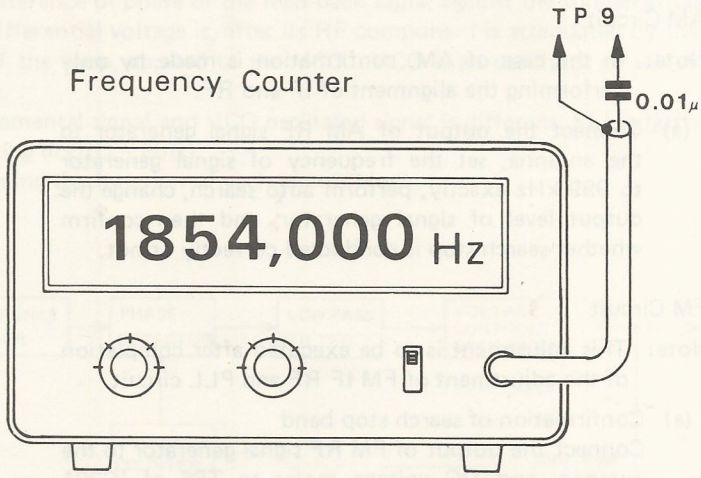


Fig. 11

AM/FM stop signal circuit alignment

Equipment Required

1. AM RF signal generator
2. FM RF signal generator
3. Stabilized power supply (DC 14V)
4. DC voltage meter

AM Circuit

Note: In the case of AM, confirmation is made by only performing the alignment of IF and RF.

(a) Connect the output of AM RF signal generator to the antenna, set the frequency of signal generator to 999 kHz exactly, perform auto search, change the output level of signal generator, and then confirm whether search stop is conducted correctly or not.

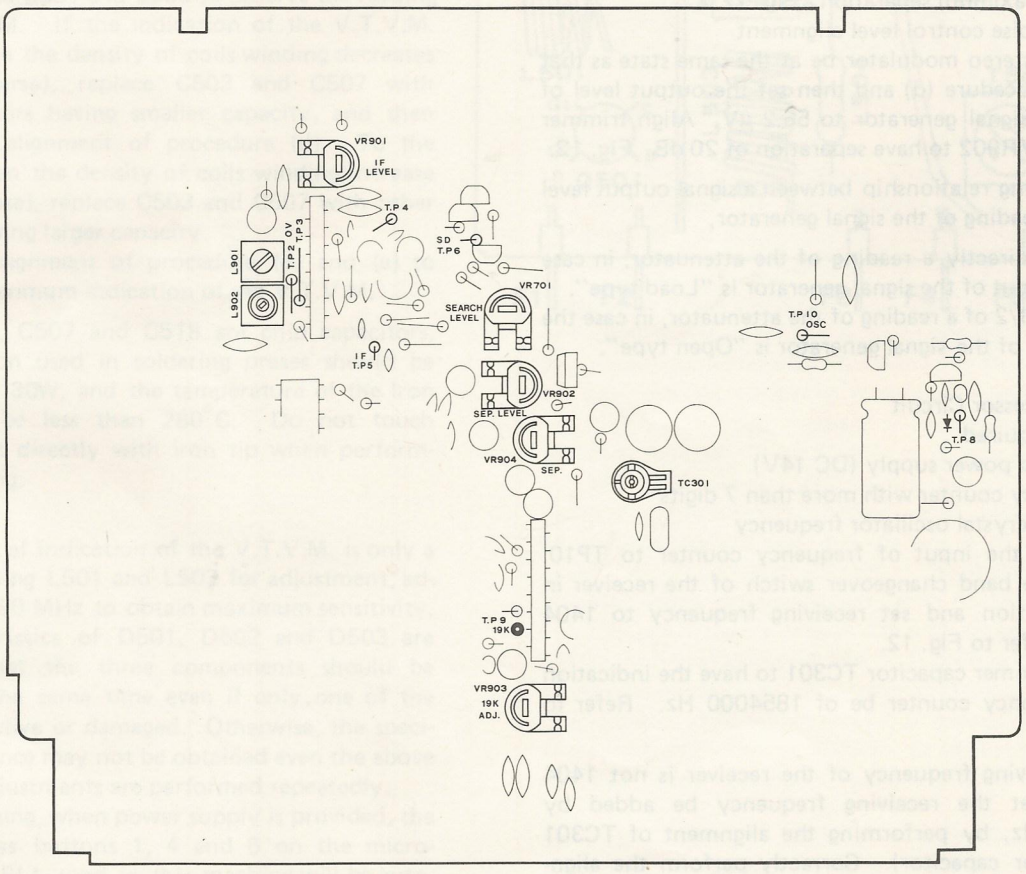
FM Circuit

Note: This adjustment is to be executed after completion of the adjustment of FM IF RF and PLL circuit.

(a) Confirmation of search stop band
Connect the output of FM RF signal generator to the antenna, and DC voltage meter to TP6 of IC301 (The voltage range of DC voltage meter is set at 5V). Let the output level of FM RF signal generator be of 1mV and set the frequency to 98 MHz. Set the tuning of the receiver to 98 MHz to confirm receiving condition. Place LOC/DX switch of the receiver in the DX position.

(b) While observing the DC voltage meter, change the frequency of FM RF signal generator from the set frequency to higher frequency and to lower frequency. Record or memorize the frequencies at which the reading of DC voltage meter starts dropping.
Confirm that the differential of the two frequencies recorded or memorized is to be about 60 ~ 70 kHz. If these two frequencies are unbalanced, execute procedure (f) and (g) of (A) FM IF alignment again.

(c) Adjustment of FM search stop sensitivity
Set the frequency of FM RF signal generator to 98 MHz and set the output to 14 μV. While observing DC voltage meter, align trimmer resistor VR701. The alignment is made until the indication of DC voltage is of 3 ~ 4V.



PRINCIPLE FUNCTION OF PHASE-LOCKED-LOOP

(1) Although there are two major kinds of PLL which are Analogue PLL and Digital PLL, the Frequency Synthesizer Radio MRE-2100 and MRB-6201 uses the Digital PLL.
Basic circuit of PLL is consisted of Phase detector, Low-pass filter and Voltage controlled oscillator as shown in Fig. 1. The phase detector detects either advance or delayed difference of phase of the feed-back signal against the fundamental signal, and converts it to the differential voltage. This differential voltage is, after its RF component is attenuated by the low-pass filter which determines the response speed of the loop, applied to the VCO. VCO is an oscillator of which frequency is determined according to the applied voltage.
When each of the frequency or phase between the fundamental signal and VCO oscillated signal is different, PLL adjusts the radio circuit to the fundamental signal with maintaining $\theta ref(t) = \theta o(t)$.
Fig. 2 shows actual diagram of the PLL circuit for explaining the function of each circuit block.

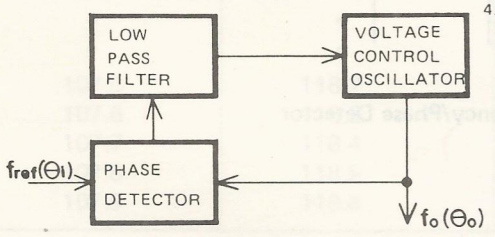


Fig. 1

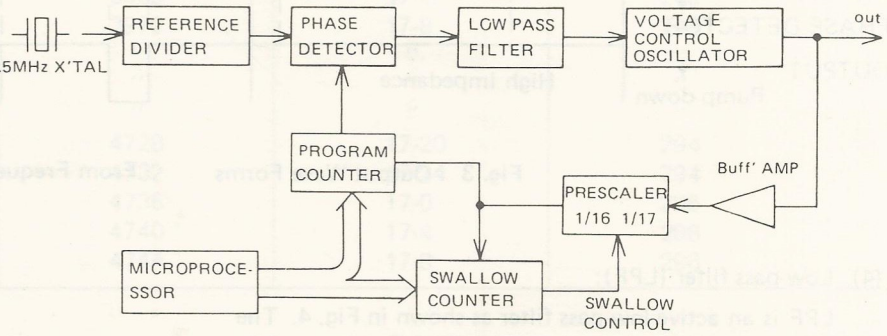


Fig. 2

(2) Reference divider:

Reference divider divides frequency of X'tal oscillator (by dividing ratio "A") to produce a reference frequency (AM = 9 kHz, FM = 25 kHz) for the phase detector.

$$A_{AM} = \frac{4500\ kHz}{\text{AM reference frequency } 9\ kHz} = 500 \qquad A_{FM} = \frac{4500\ kHz}{\text{FM reference frequency } 25\ kHz} = 180$$

(3) Phase detector:

Phase detector produces the output according to the difference between the reference frequency and "N"-divided frequency of the VCO, Fig. 3 shows the detail of the function.
When rise-up of both of the reference frequency and the comparing frequency are equal with both of its frequency and phase, the output of the detector is high impedance, and the PLL locks. If the comparing frequency is lower than the reference frequency, or the phase delays, output of detector becomes low impedance, and the oscillating frequency of VCO after low-pass filter is driven for higher frequency, or Vice Versa.
Digital phase detector operates regardless with the duty cycle of input signal, but operates only by the sequential modes of fall-down of the two input signals. Therefore, the lock-range of PLL with digital phase detector covers all range that VCO can oscillate.

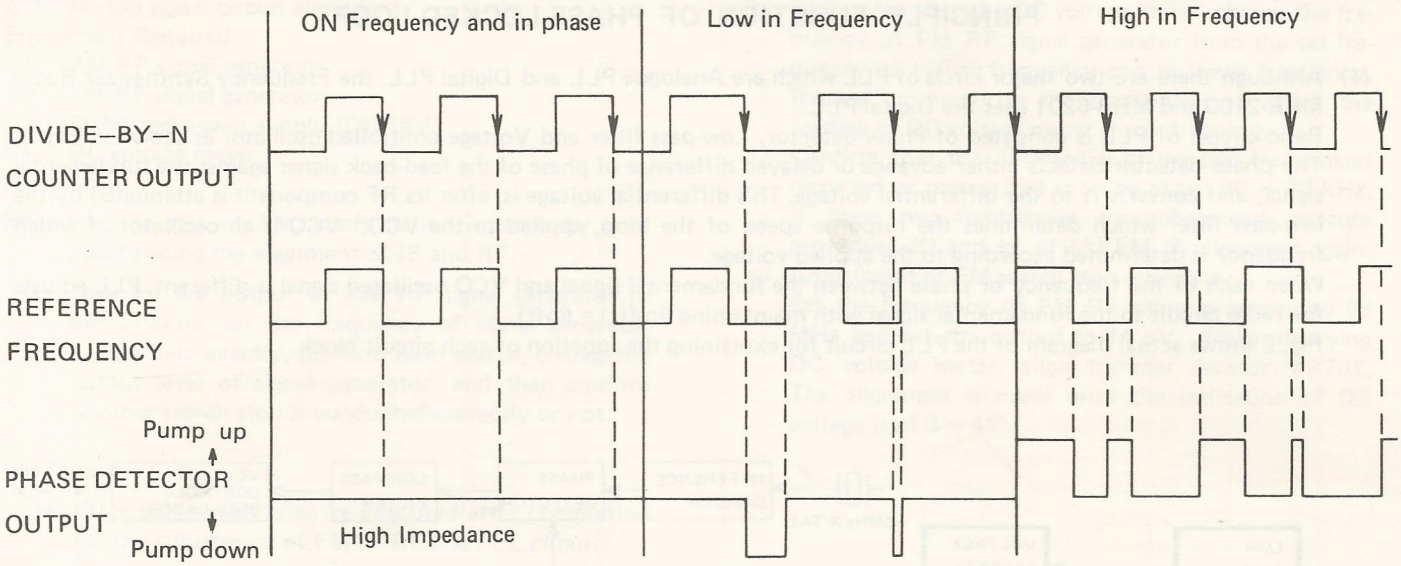


Fig. 3 Output Wave Forms From Frequency/Phase Detector

(4) Low-pass filter (LPF):

LPF is an active low-pass filter as shown in Fig. 4. The voltage which has been charged in "C" discharges while output of the phase detector is kept low, and it increases output voltage of the LPF. And when the PLL comes to lock, output of the phase detector changes to high to hold the voltage of "C" constant.
Vice Versa, "C" is charged up while output of the phase detector is high for resulting decreasing of LPF output voltage.

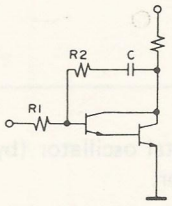


Fig. 4

(5) Voltage controlled oscillator (VCO):

The VCO is consisted basically of a varactor diode and an inductance resonance circuit. Fig. 5 shows its output voltage vs output frequency characteristic.

(**Note:** The actual oscillating frequency of VCO is higher than as shown in Fig. 5 by the IF frequency.)

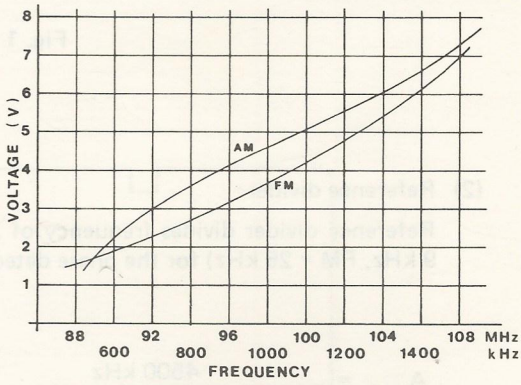


Fig. 5

(6) Prescaler and Program counter:

The dividing ratio of prescaler changes to 16 or 17. It divides input pulse by 17 when one (single) pulse is added from swallow counter, and otherwise it divides by 16.
The total dividing ratio together with the prescaler and program counter is;

FM	Receiving frequency		IF frequency		Reference frequency		
LOW-END	(87.9	+	10.7) MHz	÷	25 kHz	=	3944
HIGH-END	(107.9	+	10.7) MHz	÷	25 kHz	=	4744

Because channel spacing is 100 kHz, the dividing ratio is changed every 4 steps between 3944 and 4744.

AM	Receiving frequency		IF frequency		Reference frequency		
LOW-END	(522	+	450) kHz	÷	9 kHz	=	108
HIGH-END	(1611	+	450) kHz	÷	9 kHz	=	229

Prescaler is not needed for AM.
CHART-1 shows dividing ratios by prescaler and program counter for FM.

CHART-1

Receiving frequency	Local oscillator frequency	Total dividing ratio	Pulse swallowing divide ratio	Program counter divide ratio
87.9 MHz	98.6 MHz	3944	17-8	246
88.0	98.7	3948	17-12	246
88.1	98.8	3952	17-16	246
88.2	98.9	3956	17-20	246
88.3	99.0	3960	17-24	246
88.4	99.1	3964	0	248
88.5	99.2	3968	17-4	248
88.6	99.3	3972	17-8	248
"	"	"	"	"
"	"	"	"	"
"	"	"	"	"
107.5	118.2	4728	17-20	294
107.6	118.3	4732	17-24	294
107.7	118.4	4736	17-0	296
107.8	118.5	4740	17-4	296
107.9	118.6	4744	17-8	296

(7) Principle function of pulse swallow counting:

To give an example, a single output pulse of prescaler is likened to a piece of brick, and a single output pulse of program counter is likened to a wall. For building walls of various length from 3944 to 4744 inches each different by 4 inches however without resizing any of those bricks, the usual way is to use 4 inch bricks. But, if it is allowed to use two different kinds of longer bricks in proper combination, it would be also possible to build those various length of walls without resizing any of those. As an example, Fig. 6 shows how to build a wall of 4008 inches with 16 inch and 17 inch bricks.

As the above example, by properly switching the dividing ratio to 1/P or 1/P+1, it is possible to minimize the dividing ratio of prescaler as well as required number of the programs, and furthermore possible to use a higher reference frequency. This switching of prescaler to either 1/P or 1/P+1 is made by a separate counter (beside of the program counter) and a swallow counter.

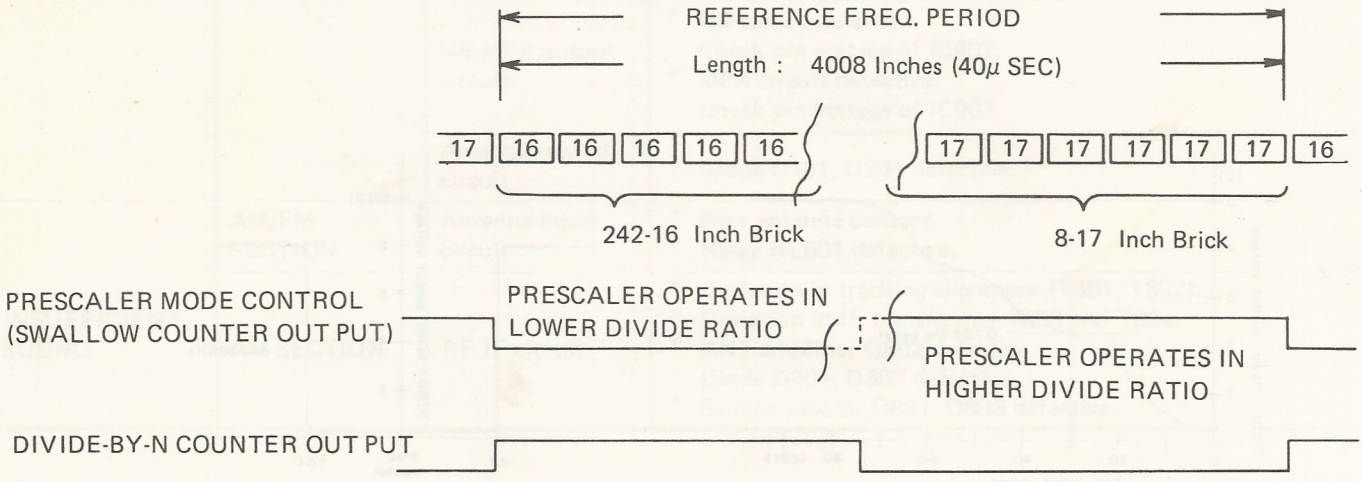


Fig. 6

OPERATING DESCRIPTION FOR SEARCH STOP CIRCUIT

The block diagram and actual circuit of search stop circuit are shown in Figs. 1 and 2. The area surrounded by broken line in the block diagram is the common part for AM and FM. Below the explanation on operation of each part.

1. Operating description on AM reception

   In order to prevent mess-stop during search, the signal amplified by IF amplifier in AM IC (IC 801) passes through the narrow band filter (T804 CF802) and enters into SD circuit in AM IC. And then the signal is detected. The detection output is reversed at Q804 and applied to the base of Q706.

2. Operating description of FM reception

   In the case of FM, the output of two terminals of IF IC IC901 is used for generating search stop signal. The DC electrical potential responding to the field strength can be obtained from pin No. 15 of IF IC (see Fig. 3) and passes through D706 and VR701 and then is added to the base of Q706. On the other hand, pin No. 14's output being applied to Q705 is almost the same as GND potential in the range of center frequency ± Δf (approximately 70 kHz) as shown in Fig. 4. Therefore, the emitter potential of Q705 won't be changed unless both transistors Q705 and Q706 are ON. Thus in the case of FM, pin No. 13 of IC301 won't be at Hi level unless field strength is higher than Eo and receiving frequency is within Δf.

Note: Signal is applied to the base of transistor Q307 only for the case of FM. As for the case of AM, Q307 is always at ON state. Diodes D706 and D704 are for eliminating the effect between AM and FM.

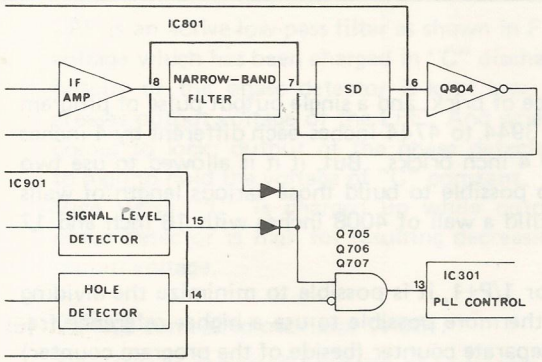


Fig. 1

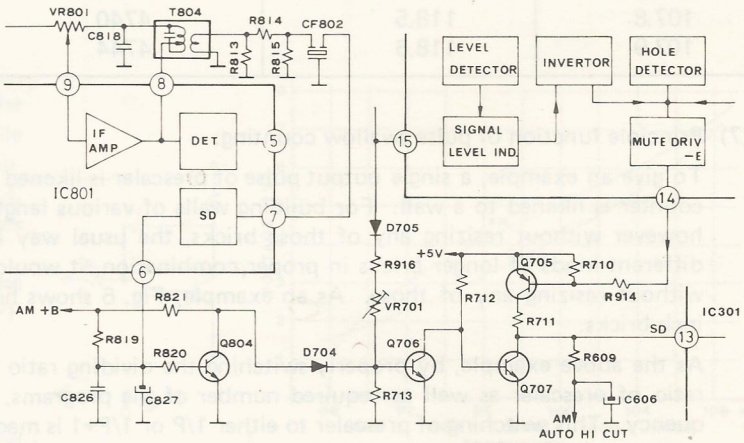


Fig. 2

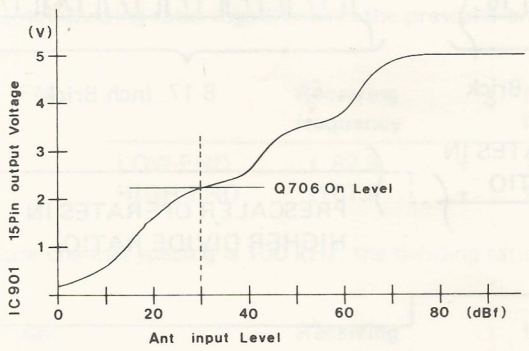


Fig. 3

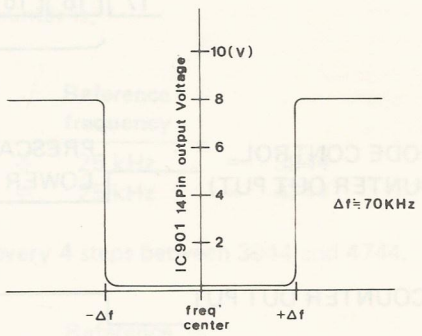


Fig. 4

TROUBLESHOOTING

RADIO SECTION

SYMPTOM	DEFECTIVE CIRCUIT		DEFECTIVE POINT AND CAUSE
NO SOUND	AM/FM SECTION	Antenna input circuit	* Antenna input circuit defective. Check wiring. * Poor antenna contact. Due to lower sensitivity, it does search scanning but not search stop.
		Power supply circuit	* Power supply circuit defective. * Q306 defective. * Analogue switch circuit defective. Check pin voltage of D101, D102, D201, D202.
	AM SECTION	Antenna input circuit	* Antenna input circuit defective. Noise choke coil L601 defective.
		Power supply circuit	* Power supply circuit defective.
		RF OSC IF circuit	* AM IC IC801 defective. Check pin voltage of IC801. * Semiconductor defective. Check for voltage of semiconductor. * T801, T802, T803 or L801 open. * Q701 defective.
		Connection of AM board	* Insufficient soldering at the terminal of AM board. * Cracked pattern at the terminal of AM board.
	FM SECTION	Power supply circuit	* Power supply circuit defective.
		RF OSC circuit	* Semiconductor defective. Check for voltage of semiconductor. * D501, D502, D503 defective. * L501, L502, L503, L504, L505 and T501 open or insufficient soldering.
		IF circuit	* Semiconductor defective. Check pin voltage of Q901 and IF IC IC901. * CF901, CF902, L601 and L602 defective. * Trimmer resistor VR901 defective.
		NB MPX output circuit	* NB circuit defective. Check pin voltage of IC902. * MPX circuit defective. Check pin voltage of IC903.
		Analogue switch circuit	* Diode D101, D201 defective.
INSUFFICIENT SOUND	AM/FM SECTION	Antenna input circuit	* Poor antenna contact. * Relay RL601 defective.
	AM SECTION	RF IF circuit	* Deviation in tracking alignment (T801, T802). * Deviation in IF transformer T803 and T804. * ANT amplifier Q802 defective. * Diode D801, D802 defective. * Semiconductor Q801, Q803 defective.

TROUBLESHOOTING

SYMPTOM	DEFECTIVE CIRCUIT		DEFECTIVE POINT AND CAUSE
INSUFFICIENT SOUND	FM SECTION	RF IF circuit	* Deviation in tracking alignment (L501, L503). * RF amplifier Q501 defective. * Diode D501 and D502 defective. * IF transformer T501 defective. * IF amplifier Q901 and IC IC901 defective. Check for voltage of Q901 and IC901. * L902 misalignment. * L901 defective.
		NB circuit	* NB circuit defective. Check pin voltage of IC902.
		MPX circuit	* MPX circuit defective. Check pin voltage of IC903.
DISTORTED SOUND	AM SECTION	IF circuit	* Diode D804 defective. * AM IC IC801 defective. * Semiconductor Q801, Q803 defective.
	FM SECTION	IF circuit	* Misalignment or defective of L902.
OSCILLATION	AM/FM SECTION	Power supply circuit	* Capacitor C702, C703 defective.
	AM SECTION	RF IF circuit	* Capacitor C804, C819, C820 and C818 defective.
	FM SECTION	RF IF circuit	* RF circuit defective. C513, C515 and C517 defective. * IF circuit defective. C901, C903, C905, C907, C908 and C938 defective.
POOR NB		NB circuit	* NB IC defective. Check pin voltage of IC902. * Capacitor C664, C915, C916 and C917 defective. * Capacitor C920 defective.
POOR MUTE IN SEARCH SCANNING AND AM/FM SWITCH POP NOISE	MUTE SECTION		* Semiconductor defective. * Diode D315 or transistor Q151 defective. * Q101, Q201 defective.
POOR STEREO EFFECT		MPX circuit	* VR903 and VR904 misalignment. * Capacitor C937 defective. * MPX IC defective. Check pin voltage of IC903.
INDICATOR DOES NOT LIGHT		AM or FM indicator	* Check the wiring of indicator circuit. * Driver IC IC302, IC303 defective. * PLL control IC IC301 defective. * LED defective.
		Stereo indicator	* Check the wiring of stereo indicator circuit. * MPX IC IC903 defective. * LED defective.

TROUBLESHOOTING

SYMPTOM	DEFECTIVE CIRCUIT	DEFECTIVE POINT AND CAUSE
ENGINE NOISE IS EXTREME	MOTOR COMPARTMENT	* Missing or poor connection of resistor wire on high tension coil of car. Insert noise preventing resistor between ignition coil and distributor of car. * Missing or poor connection of noise silencer by alternator of car. Install specified noise silencer on the alternator. * Missing or poor connection of grounding wire between engine chassis and engine, transmission and engine chassis of car.
	ANTENNA GROUND CIRCUIT	* Missing or poor connection of grounding wire for antenna to grounding point of the car chassis.
LESS SENSITIVITY DRIFT OCCURS WITH AIR CONDITIONER IS ON		* If the set was installed near the blower of the air conditioner, the sensitivity drift will be created by the temperature (Hot or Cold). Avoid installing the set near air conditioner or installing the set near air conditioner is unavoidable, isolate the set by isolating material from the air conditioner.

AUDIO SECTION

SYMPTOM	DEFECTIVE CIRCUIT	DEFECTIVE POINT AND CAUSE
NO SOUND	Power supply circuit	* Fuse open. * Power switch S151 defective. * Faulty connection to the battery. * Lead wire cold soldered.
	Amplifier circuit	* Ripple filter defective. Transistor Q151 open. Diode D152 open. * Buffer amplifier defective. Check each pin voltage of Flat amplifier Q101, Q201. Power amplifier IC IC151 defective.
DISTORTED SOUND OR INSUFFICIENT SOUND	Tone control circuit	* Variable resistor VR102, VR103, VR202, VR203 defective. * Lead wire open.
	Buffer amplifier circuit	* Buffer amplifier circuit defective. Check each pin voltage of amplifier Q101, Q201. * Power amplifier IC IC151 defective.
OSCILLATION	Power supply circuit	* C155, C156 capacity insufficient or open.
	Buffer amplifier circuit	* Ripple filter defective. Transistor Q151 defective. C157 capacity insufficient or open.
ENGINE NOISE IS EXTREME	Grounding wire circuit	Missing or poor connection of grounding wire between main unit and power amplifier.
	Amplifier circuit	* Ripple filter defective. Transistor Q151 short. C158 capacity insufficient or open. * Capacitor C159 insufficient or open. * Capacitor C155, C156 open.
DIMMER DOES NOT FUNCTION	DIMMER CIRCUIT	* Check emitter voltage of Q401 (The LED display will be incapable but other controls remain their functions, in this case). * CDS or Q403, Q404 defective.

TROUBLESHOOTING

SYMPTOM	DEFECTIVE CIRCUIT		DEFECTIVE POINT AND CAUSE
A DIGIT OR SEGMENT DOES NOT DISPLAY OR FAIL	POWER SUPPLY CIRCUIT OR BATTERY BACK-UP CIRCUIT		* Diode D301, D305 defective. IC305 defective.
	DIGIT/SEGMENT DRIVE CIRCUIT		* IC IC302, IC303 defective. * LED defective.
MANUAL TUNING INOPERATIVE			* Check wiring. * UP, DOWN switch defective. * Diode D310, D311 defective.
PRESETTING OR SELECTION OF PRESET STATIONS INOPERATIVE			* D309, D312 ~ D314 defective. * Switch M1 ~ M6, ME defective.
NO SEARCH SCANNING (See paragraphs of "Principle Function of Phase-Locked-Loop" and "Operating Description for Search-Stop circuit" in this manual for further informations)	AM/FM SECTION	Stop circuit	* Seek switch defective. * Search stop circuit defective.
	AM SECTION	PLL circuit	* Q304 defective.
	FM SECTION	PLL circuit	* IC IC301 defective. * Q301 defective.
THE UNIT SEARCH SCANS BUT DOES NOT STOP (See paragraph of "Operating Description for Search-Stop-Circuit" in this manual for further information)	AM/FM SECTION	Stop circuit	* Transistor Q705, Q706 or Q707 defective.
	AM SECTION		* Diode D704 or Transistor Q804 defective. * AM IC IC801 defective. * Ceramic filter CF802 defective.
	FM SECTION		* Diode D706 or Trimmer resistor VR701 defective. * IF IC IC301 defective.
IN THE CASE OF FM, THE RECEIVING FREQUENCY CAN ONLY BE MATCHED EVERY 8 STEPS (800 kHz) REFER TO CHART 1 FOR PLL			* IC301 or IC304 defective.

CONTROL CIRCUIT

If something amiss with Phase Lock and the loop became unlock condition, the following phenomena will be observed.

(1) The output of phase detector will be fixed at High or Low level, the tuning voltage will be changed either 0V or about 9V.

(2) In above case, if there is an auto search input present, the IC301 actuates to step 9 kHz up in AM and 100 kHz in FM. Then, the manual tuning function and all switches will be incapable with the exception of the power and AM/FM switches. During the repairing this control circuit, if there is a possibility that the loop going to be unlock condition, operation of station selection will be done by MU (manual up) or MD (manual down). For all inputs of PLL micro processor, the segment output and the dynamic signal is used. Therefore, if something amiss with that output, it will interfere all the functions as well as LED display.
The wave forms of all parts of the IC301 are shown in Fig. 1.
Fig. 2 shows pin connection for IC301.

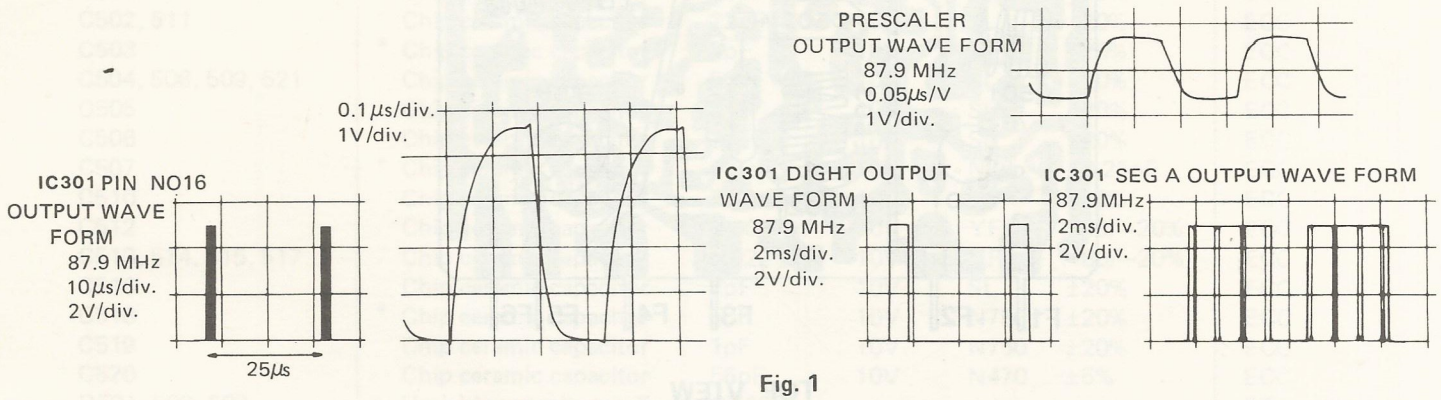

IC301 PIN NO16
OUTPUT WAVE
FORM
87.9 MHz
10μs/div.
2V/div.
25μs
0.1μs/div.
1V/div.
PRESCALER
OUTPUT WAVE FORM
87.9 MHz
0.05μs/V
1V/div.
IC301 DIGHT OUTPUT
WAVE FORM
87.9 MHz
2ms/div.
2V/div.
IC301 SEG A OUTPUT WAVE FORM
87.9MHz
2ms/div.
2V/div.

Fig. 1

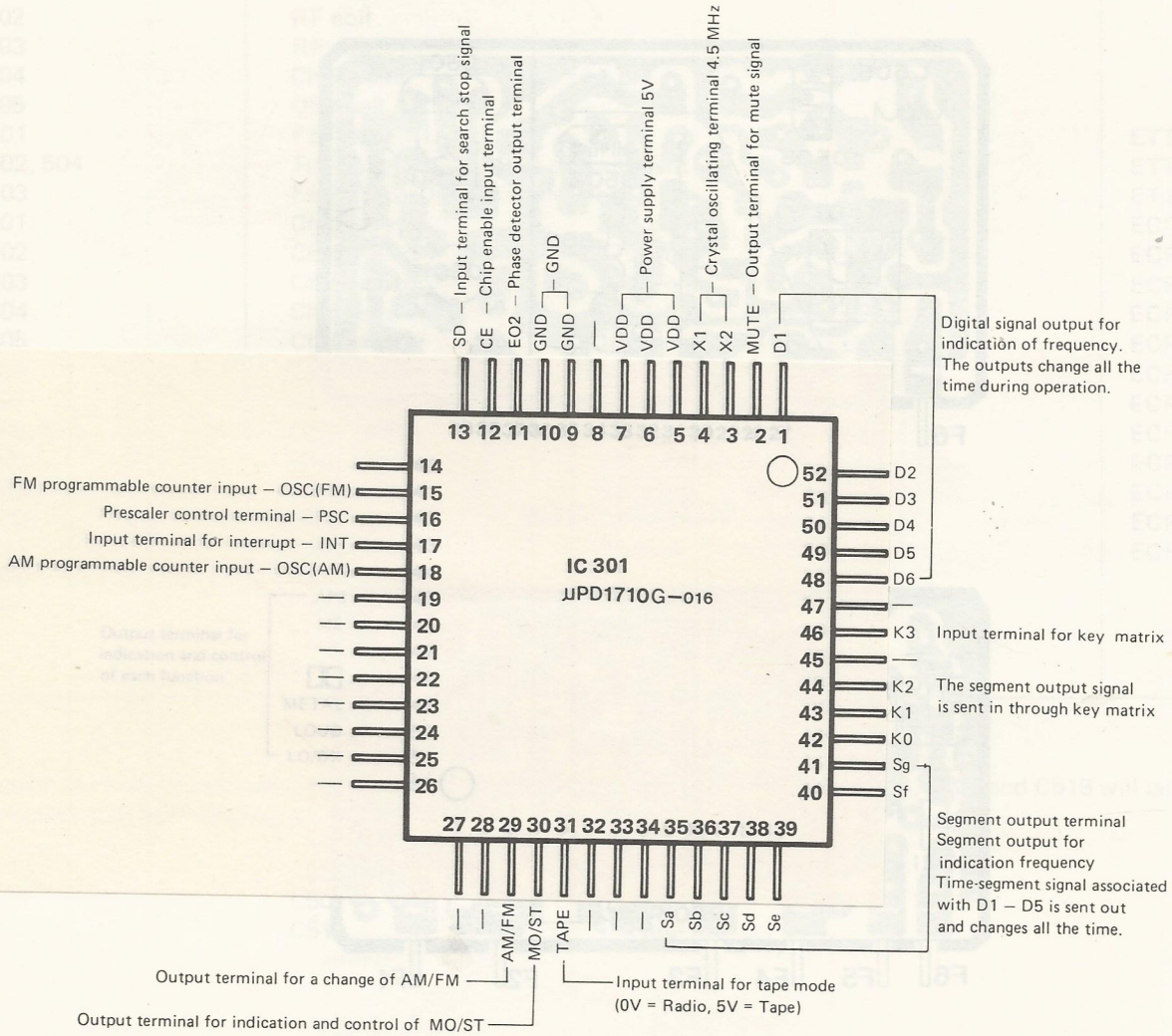
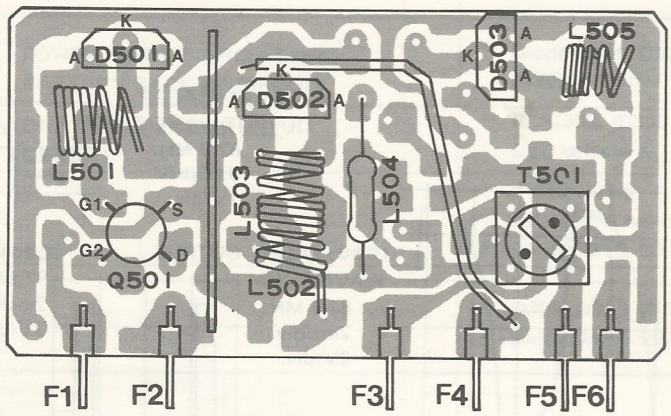
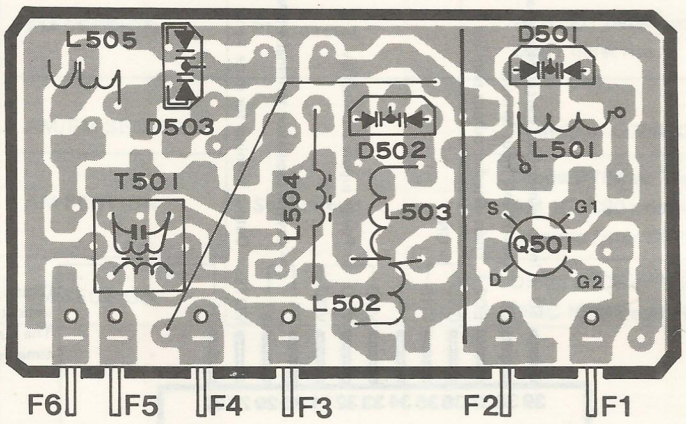

SD — Input terminal for search stop signal
CE — Chip enable input terminal
EO2 — Phase detector output terminal
GND
GND
GND
VDD
VDD
VDD — Power supply terminal 5V
X1
X2 — Crystal oscillating terminal 4.5 MHz
MUTE — Output terminal for mute signal
D1
Digital signal output for indication of frequency. The outputs change all the time during operation.
13 12 11 10 9 8 7 6 5 4 3 2 1
14
15
16
17
18
19
20
21
22
23
24
25
26
FM programmable counter input — OSC(FM)
Prescaler control terminal — PSC
Input terminal for interrupt — INT
AM programmable counter input — OSC(AM)
IC 301
μPD1710G—016
52 D2
51 D3
50 D4
49 D5
48 D6
47
46 K3
45
44 K2
43 K1
42 K0
41 Sg
40 Sf
Input terminal for key matrix
The segment output signal is sent in through key matrix
27 28 29 30 31 32 33 34 35 36 37 38 39
AM/FM
MO/ST
TAPE
Sa
Sb
Sc
Sd
Se
Segment output terminal
Segment output for indication frequency
Time-segment signal associated with D1 — D5 is sent out and changes all the time.
Output terminal for a change of AM/FM
Output terminal for indication and control of MO/ST
Input terminal for tape mode
(0V = Radio, 5V = Tape)

Fig. 2

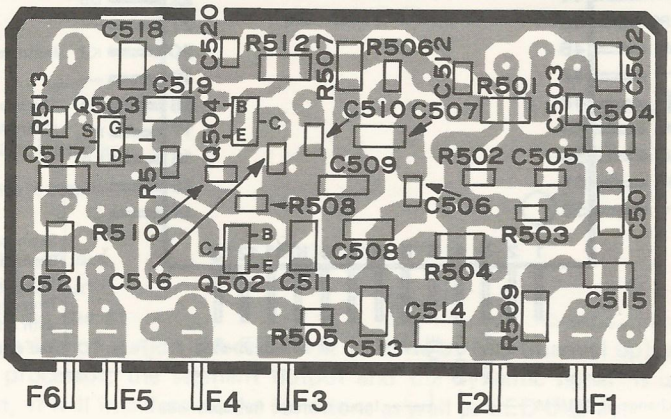
FM RF CIRCUIT BOARD COMPONENT LOCATION GUIDE



TOP VIEW



BOTTOM VIEW



BOTTOM VIEW

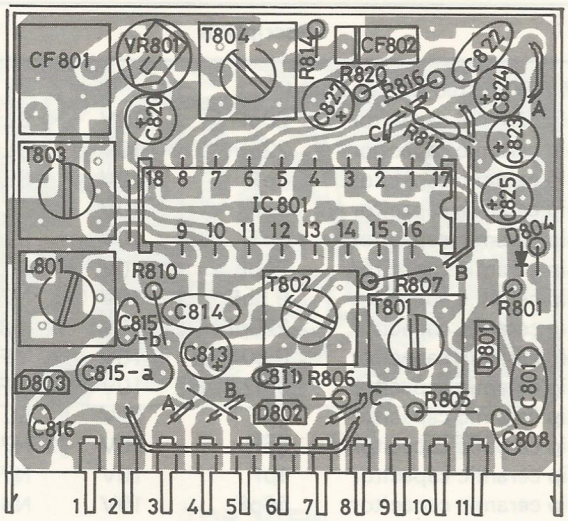
Ref. No. 34 AR-68 FM RF CIRCUIT BOARD ASSEMBLY PARTS LIST

Ref. No.		Description					Part No.
—		FM RF printed circuit board					
C501		Chip ceramic capacitor	20pF	10V	SL	±20%	ECC
C502, 511		Chip ceramic capacitor	22pF	10V	SL	±20%	ECC
C503	*	Chip ceramic capacitor	2pF	10V	SL	±20%	ECC
C504, 508, 509, 521		Chip ceramic capacitor	5pF	10V	SL	±20%	ECC
C505		Chip ceramic capacitor	8pF	10V	SL	±20%	ECC
C506		Chip ceramic capacitor	24pF	10V	SL	±20%	ECC
C507	*	Chip ceramic capacitor	0.5pF	10V	NP0	±0.25pF	ECC
C510		Chip ceramic capacitor	220pF	10V	YB	±10%	ECC
C512		Chip ceramic capacitor	0.0047μF	10V	YF	+80/−20%	ECC
C513, 514, 515, 517		Chip ceramic capacitor	0.022 μF	10V	YF	+80/−20%	ECC
C516		Chip ceramic capacitor	2pF	10V	SL	±20%	ECC
C518	*	Chip ceramic capacitor	5pF	10V	N750	±20%	ECC
C519		Chip ceramic capacitor	1pF	10V	N750	±20%	ECC
C520		Chip ceramic capacitor	56pF	10V	N470	±5%	ECC
D501, 502, 503		Variable capacitance diode 1SV103					ETD
L501		ANT coil					
L502		RF coil					
L503		RF coil					
L504		Choke coil	1 μH				
L505		OSC coil					
Q501		FET 3SK101(GR)					ETTF
Q502, 504		Transistor 2SC2714(R) or equivalent					ETTC
Q503		FET 2SK210(Y) or equivalent					ETTF
R501		Chip resistor	33K ohm	1/8W	±5%		ECR
R502		Chip resistor	470K ohm	1/10W	±5%		ECR
R503		Chip resistor	100K ohm	1/10W	±5%		ECR
R504		Chip resistor	47K ohm	1/8W	±5%		ECR
R505		Chip resistor	100K ohm	1/10W	±5%		ECR
R506		Chip resistor	33K ohm	1/10W	±5%		ECR
R507		Chip resistor	470K ohm	1/8W	±5%		ECR
R508, 511		Chip resistor	680K ohm	1/10W	±5%		ECR
R509		Chip resistor	10K ohm	1/8W	±5%		ECR
R510		Chip resistor	820 ohm	1/10W	±5%		ECR
R512		Chip resistor	2.7K ohm	1/8W	±5%		ECR
R513		Chip resistor	22 ohm	1/10W	±5%		ECR
T501		FM IFT					
—		Shield case					
—		Shield cover					
—		Shield plate					

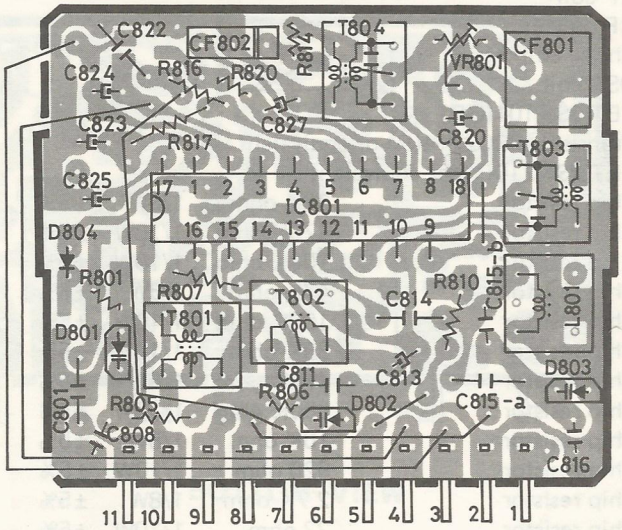
In order to obtain maximum tuner performance, values of * marked capacitors of C503, C507 and C518 will be fluctuated with following values.

C503	0.5 – 8pF
C507	0 – 8pF
C518	1 – 8pF

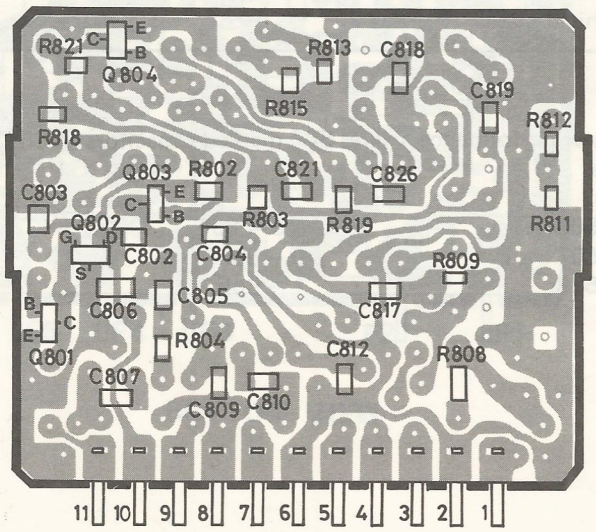
AM CIRCUIT BOARD COMPONENT LOCATION GUIDE



TOP VIEW



BOTTOM VIEW



BOTTOM VIEW

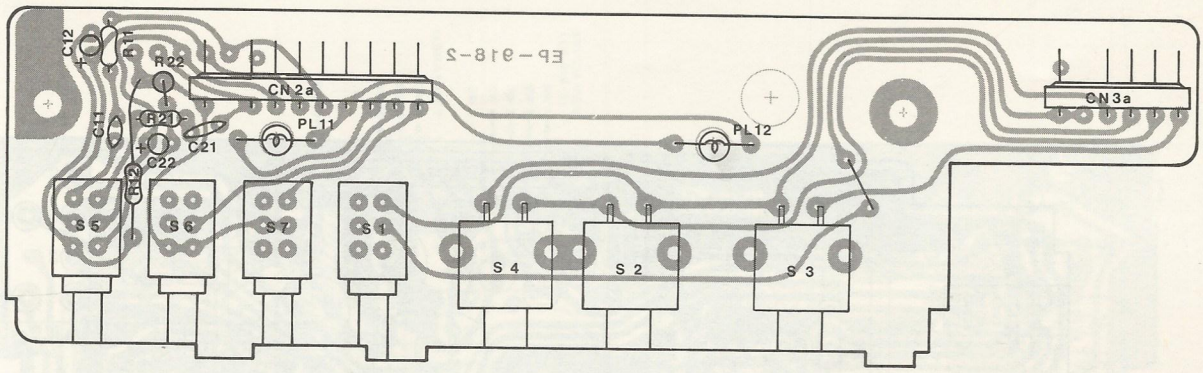
Ref. No. 33 AR-67 AM CIRCUIT BOARD ASSEMBLY PARTS LIST

Ref. No.		Description				Part No.
—		AM printed circuit board				
C801, 822		Ceramic capacitor	0.022 μF	10V	SR ±20%	ECC
C802, 809, 810, 819, 821		Chip ceramic capacitor	0.022 μF	10V	YF +80/—20%	ECC
C803		Chip ceramic capacitor	0.047 μF	10V	YF +80/—20%	ECC
C804, 812		Chip ceramic capacitor	0.047 μF	10V	YF +80/—20%	ECC
C805		Chip ceramic capacitor	0.022 μF	10V	YB ±10%	ECC
C806		Chip ceramic capacitor	47pF	10V	SL ±20%	ECC
C807, 817, 826		Chip ceramic capacitor	0.022 μF	10V	YF +80/—20%	ECC
C808	*	Ceramic capacitor	7pF	10V	N220	ECC
C811, 816	*	Ceramic capacitor	12pF	10V	N220	ECC
C813, 820		Electrolytic capacitor	22 μF	10V		ECC
C814		Ceramic capacitor	0.01 μF	10V	YF +80/—20%	ECC
C815-a	*	Polypropylene film capacitor	390pF	10V	±5%	ECC
C815-b	*	Ceramic capacitor	12pF	10V	N750	ECC
C818		Chip ceramic capacitor	0.1 μF	10V	YF +80/—20%	ECC
C823, 824, 827		Electrolytic capacitor	1 μF	10V		ECC
C825		Electrolytic capacitor	10 μF	10V		ECC
CF801		Ceramic filter	450 KHz			
CF802		Ceramic filter	450 KHz			
D801, 802, 803		Variable capacitance diode SVC321 or equivalent				ETD
D804		Diode 1SS53 or equivalent				ETD
IC801		AM IC HA12428				
L801		OSC coil				
Q801, 803, 804		Transistor 2SC2814 (F3) or equivalent				ETTC
Q802		FET 2SK217(E)				ETTF
R801, 806		Carbon film resistor	220K ohm	1/8W	±5%	ECR
R802		Chip resistor	330 ohm	1/10W	±5%	ECR
R803		Chip resistor	68 ohm	1/10W	±5%	ECR
R804		Chip resistor	2.7K ohm	1/10W	±5%	ECR
R805		Carbon film resistor	150K ohm	1/8W	±5%	ECR
R807		Carbon film resistor	820K ohm	1/8W	±5%	ECR
R808		Chip resistor	100K ohm	1/8W	±5%	ECR
R809, 819, 821		Chip resistor	22K ohm	1/10W	±5%	ECR
R810, 820		Carbon film resistor	10K ohm	1/8W	±5%	ECR
R811		Chip resistor	5.6K ohm	1/10W	±5%	ECR
R812	*	Chip resistor	470 ohm	1/10W	±5%	ECR
R813		Chip resistor	3.3K ohm	1/10W	±5%	ECR
R814	*	Carbon film resistor	5.6K ohm	1/8W	±5%	ECR
R815		Chip resistor	2.2K ohm	1/10W	±5%	ECR
R816		Carbon film resistor	8.2K ohm	1/8W	±5%	ECR
R817		Carbon film resistor	22K ohm	1/8W	±5%	ECR
R818		Chip resistor	6.8K ohm	1/10W	±5%	ECR
T801		ANT coil				
T802		RF coil				
T803		AM IFT				
T804		AM IFT				
VR801		Trimmer resistor	2K ohm B			
—		Shield cover				

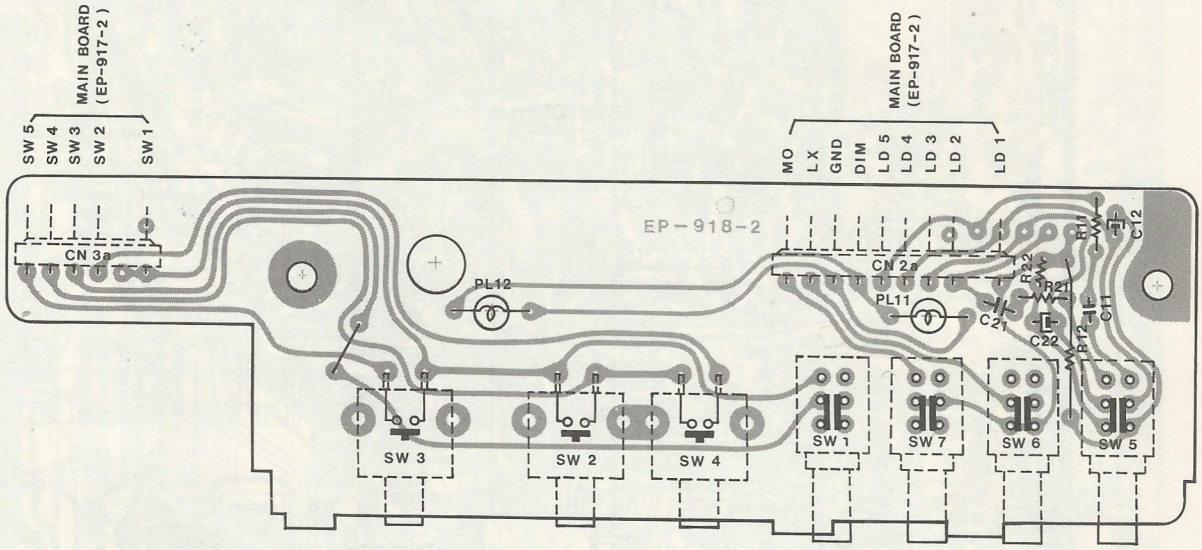
In order to obtain maximum tuner performance, values of * marked capacitors and resistors of C808, C811, C816, C815-a, C815-b, R812, and R814 will be fluctuated with following values.

C808, 811, 816	0 — 20pF
C815-a	330 or 360pF
C815-b	0 — 80pF
R812	0 — 1K ohm
R814	1 — 15K ohm

SWITCH CIRCUIT BOARD COMPONENT LOCATION GUIDE



TOP VIEW

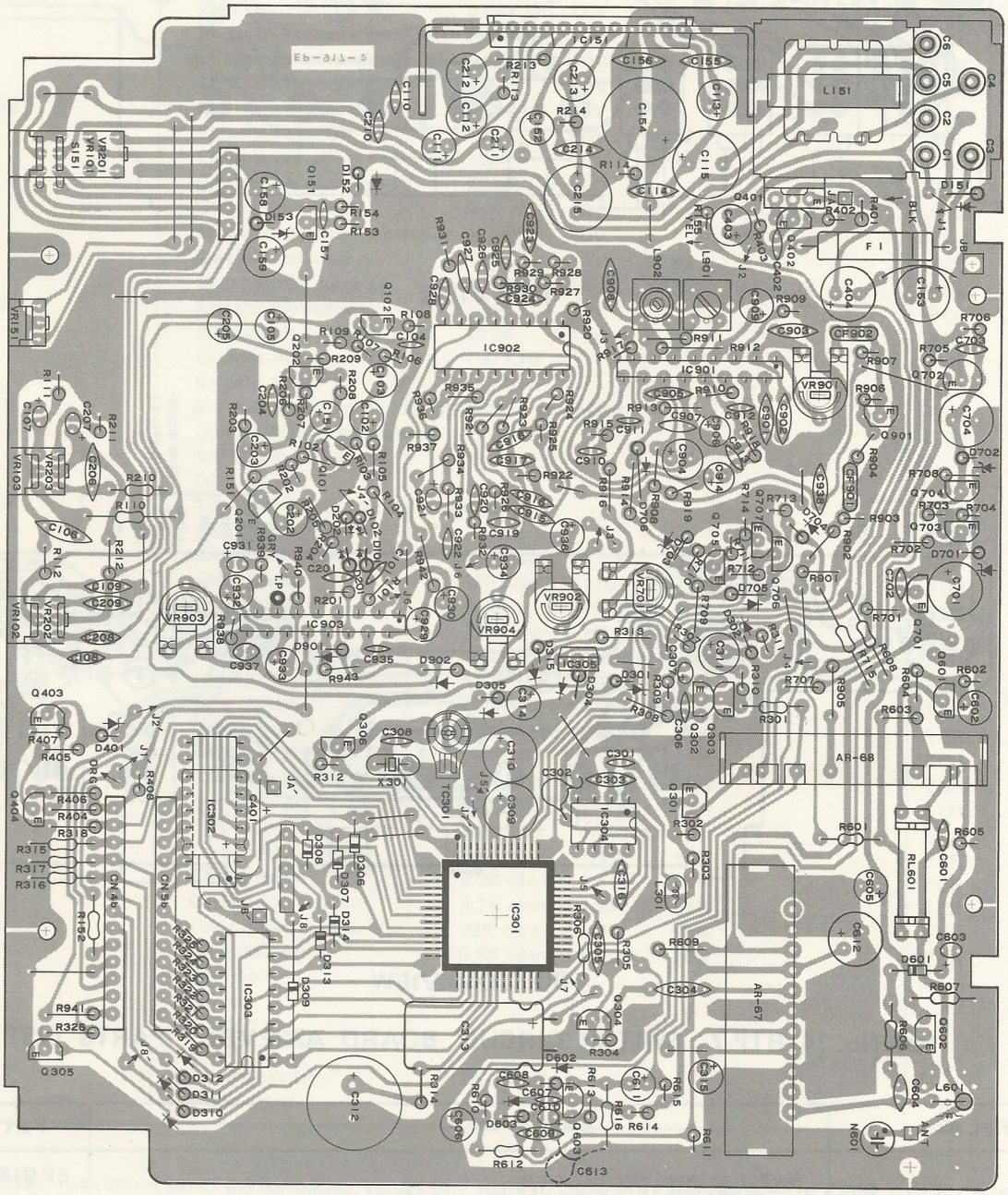


BOTTOM VIEW

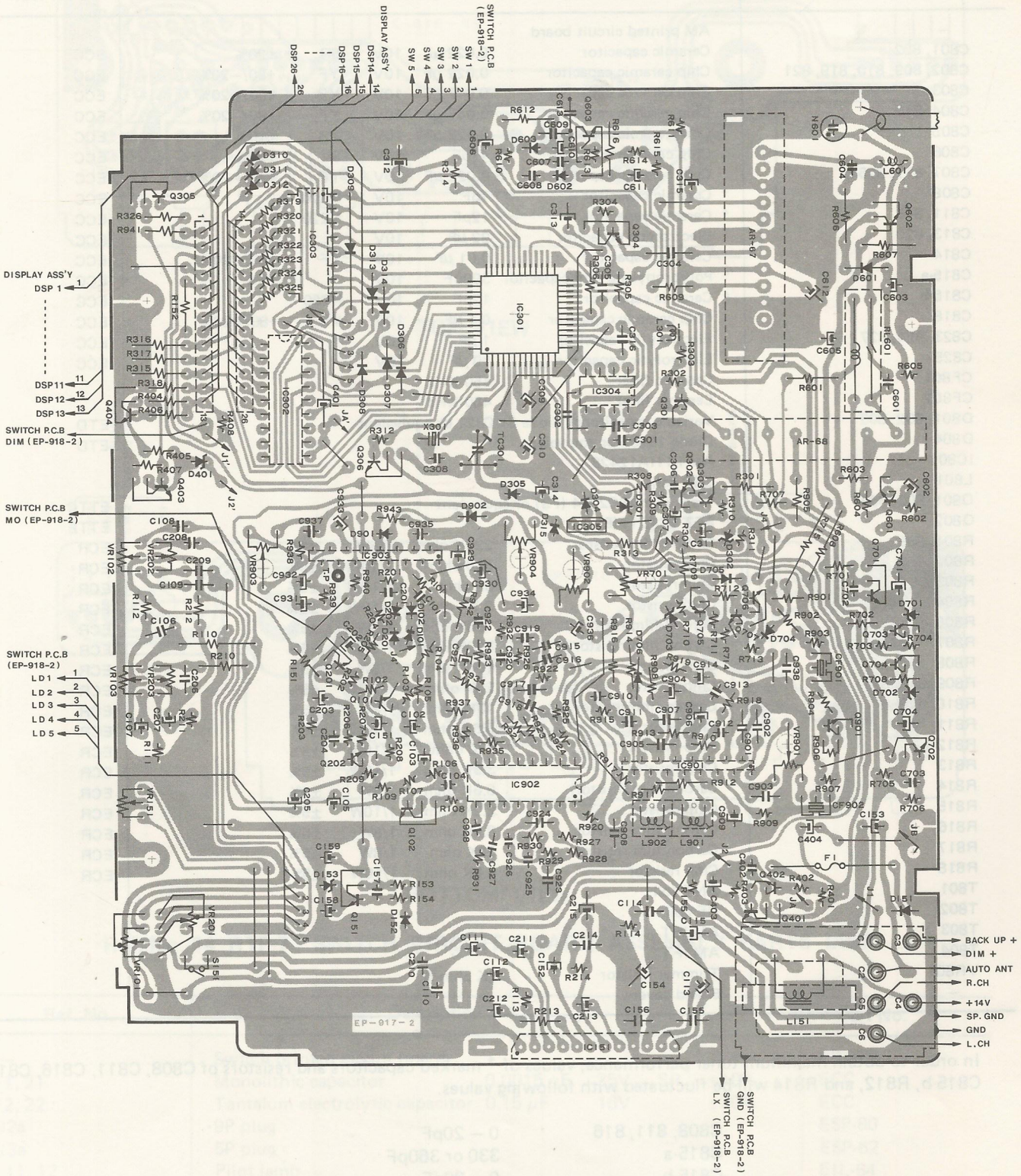
Ref. No. 14 RTP-7 SWITCH CIRCUIT BOARD ASSEMBLY PARTS LIST

Ref. No.	Description					Part No.
—	Switch printed circuit board					EP-918-2
C11, 21	Monolithic capacitor	0.0015 μF	25V	SR	±10%	ECC
C12, 22	Tantalum electrolytic capacitor	0.15 μF	16V		±20%	ECC
CN2a	9P plug					ESP-80
CN3a	5P plug					ESP-62
PL11, 12	Pilot lamp					EIL-64
R11, 21	Carbon film resistor	22K ohm	1/4W		±5%	ECR
R12, 22	Carbon film resistor	1.5K ohm	1/4W		±5%	ECR
S1	Non lock switch					ESS-238
S2, 3, 4	Tact switch					ESS-236
S5, 6, 7	Push lock switch					ESS-226

MAIN CIRCUIT BOARD COMPONENT LOCATION GUIDE



TOP VIEW


DISPLAY ASS'Y
DSP 1
DSP11
DSP12
DSP13
SWITCH P.C.B
DIM (EP-918-2)
SWITCH P.C.B
MO (EP-918-2)
SWITCH P.C.B
(EP-918-2)
LD1
LD2
LD3
LD4
LD5
DISPLAY ASS'Y
SWITCH P.C.B
(EP-918-2)
SW 1
SW 2
SW 3
SW 4
SW 5
DSP 26
DSP 16
DSP 15
DSP 14
BACK UP +
DIM +
AUTO ANT
R.CH
+14V
SP. GND
GND
L.CH
SWITCH P.C.B
GND (EP-918-2)
SWITCH P.C.B
LX (EP-918-2)
EP-917-2

BOTTOM VIEW

Ref. No. 15 RRP-10 MAIN CIRCUIT BOARD ASSEMBLY PARTS LIST
RRP-11 MAIN CIRCUIT BOARD ASSEMBLY PARTS LIST

(ITEMS marked with * are for RRP-11.)

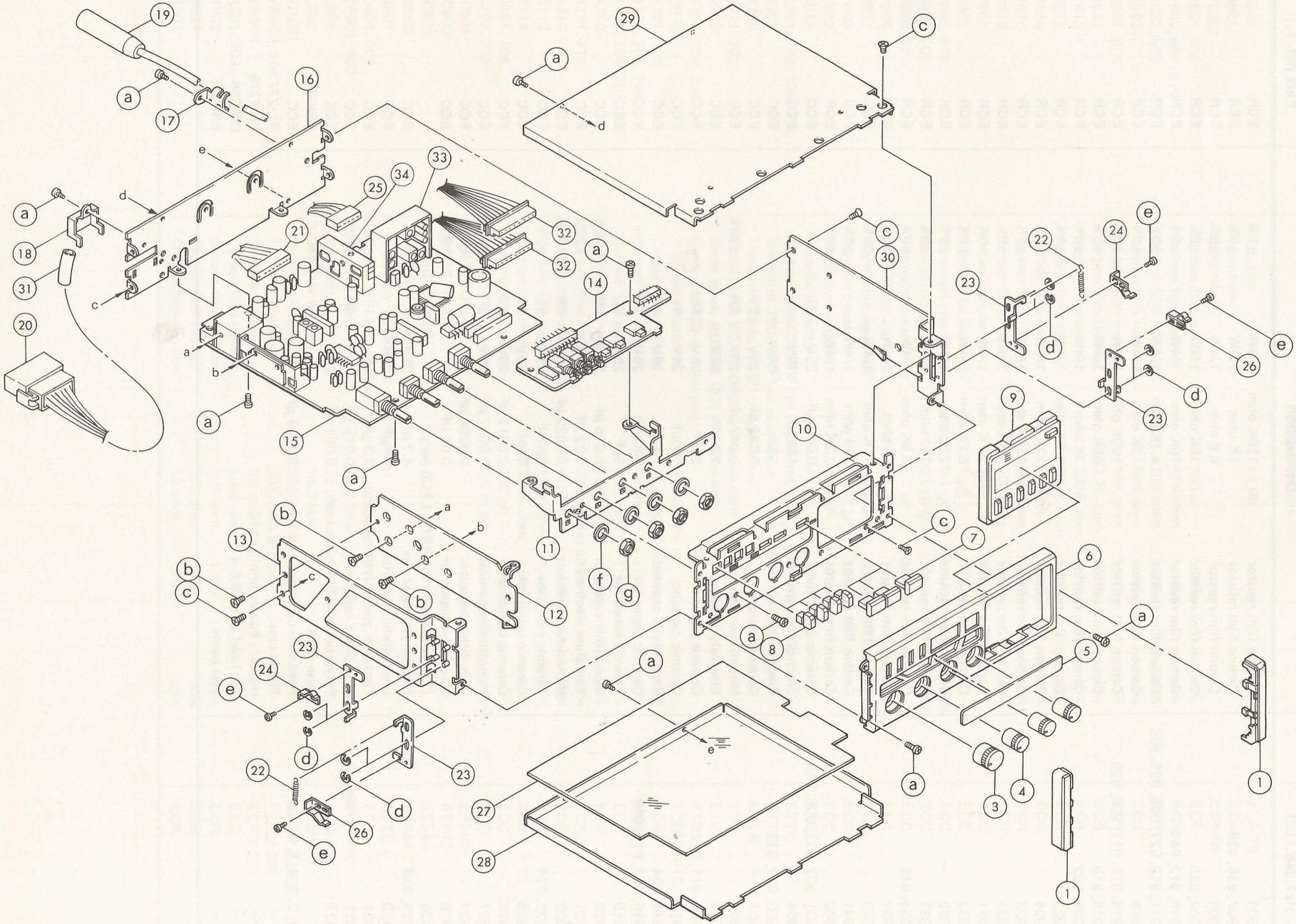
Ref. No.	Description					Part No.
–	Main printed circuit board					EP-917-2
Q101, 201	Transistor 2SC2603(F) or equivalent					ETTC
Q102, 202	Transistor 2SC2458L(BL) or equivalent					ETTC
D101, 102, 201, 202	Diode 1SS133 or equivalent					ETD
VR101, 201, S151	Volume control	50K ohm A				ECRV-347
VR102, 202	Treble control	20K ohm A				ECRV-348
VR103, 203	Bass control	20K ohm A				ECRV-348
R101, 106, 110, 201, 206, 210	Carbon film resistor	3.3K ohm	1/4W		±5%	ECR
R102, 202	Carbon film resistor	2.2K ohm	1/4W		±5%	ECR
R103, 203	Carbon film resistor	100K ohm	1/4W		±5%	ECR
R104, 204	Carbon film resistor	47K ohm	1/4W		±5%	ECR
R105, 205	Carbon film resistor	470 ohm	1/4W		±5%	ECR
R107, 207	Carbon film resistor	470K ohm	1/4W		±5%	ECR
R108, 208	Carbon film resistor	120 ohm	1/4W		±5%	ECR
R109, 209	Carbon film resistor	1.2K ohm	1/4W		±5%	ECR
R111, 211	Carbon film resistor	680 ohm	1/4W		±5%	ECR
R112, 212	Carbon film resistor	1K ohm	1/4W		±5%	ECR
R113, 213	Carbon film resistor	68 ohm	1/4W		±5%	ECR
R114, 214	Carbon film resistor	1 ohm	1/4W		±5%	ECR
C101, 201	Monolithic capacitor	0.015 μF	25V	SR	±10%	ECC
C102, 111, 202, 211	Electrolytic capacitor	1 μF	50V			ECC
C103, 105, 203, 205	Electrolytic capacitor	4.7 μF	25V			ECC
C104, 204	Monolithic capacitor	0.0022 μF	25V	SR	±10%	ECC
C106, 206	Monolithic capacitor	0.068 μF	25V	SR	±10%	ECC
C107, 207	Tantalum electrolytic capacitor	0.33 μF	10V		±20%	ECC
C108, 208	Monolithic capacitor	0.01 μF	25V	SR	±10%	ECC
C109, 209	Monolithic capacitor	0.047 μF	25V	SR	±10%	ECC
C110, 210	Monolithic capacitor	0.001 μF	25V	SR	±10%	ECC
C112, 113, 212, 213	Electrolytic capacitor	100 μF	10V			ECC
C114, 214	Monolithic capacitor	0.1 μF	25V	SR	±20%	ECC
C115, 215	Electrolytic capacitor	1000 μF	10V			ECC
IC151	Power amplifier IC HA13001					ETI-106
Q151	Transistor 2SC2603(F) or equivalent					ETTC
D151	Diode ERB12(02) or equivalent					ETD
D152	Diode 1SS133 or equivalent					ETD
D153	Zener diode EQA02-09(SA) or equivalent					ETD
VR151	Balance control	30K ohm B				ECRV-349
L151	Choke transformer					ELS-99
R151	Carbon film resistor	1.5K ohm	1/4W		±5%	ECR
R152	Carbon film resistor	470 ohm	1/4W		±5%	ECR
R153	Carbon film resistor	10 ohm	1/4W		±5%	ECR
R154	Carbon film resistor	15K ohm	1/4W		±5%	ECR
R155	Carbon film resistor	10K ohm	1/4W		±5%	ECR
C151	Electrolytic capacitor	1 μF	50V			ECC
C152	Electrolytic capacitor	22 μF	16V			ECC
C153	Electrolytic capacitor	100 μF	16V			ECC
C154	Electrolytic capacitor	1000 μF	16V			ECC
C155	Monolithic capacitor	0.1 μF	25V	SR	±20%	ECC
C156	Ceramic capacitor	0.047 μF	25V	ZF		ECC
C157	Monolithic capacitor	0.015 μF	25V	SR	±20%	ECC

RRP-11 Main PCB ass'y is used for the unit with Serial Number from 30311791 to 30330550.

Ref. No.	Description				Part No.
C158, 159	Electrolytic capacitor	100 μF	10V		ECC
IC301	PLL control IC μPD1710G-016				ETI-115
IC302	Transistor array M54562P				ETI-111
IC303	Transistor array M54517P				ETI-57
IC304	Prescaler IC μPB553AC				ETI-89
IC305	Voltage regulator IC μPC78L05				ETI-58
D301	Zener diode RD5.1E(B2) or equivalent				ETD
D302	Zener diode EQA02-09(SA) or equivalent				ETD
D304, 305, 306, 307, 308, 309 310, 311, 312, 313, 314, 315	Diode 1SS133 or equivalent				ETD
Q301	Transistor 2SC930(D) or equivalent				ETTC
Q302, 303, 304, 305, 306	Transistor 2SC2603(F) or equivalent				ETTC
L301	Inductor	22 μH			ELD-164
X301	Crystal	4.5 MHz			EOC-5
TC301	Trimmer capacitor	50pF			ECCV-24
R301	Carbon film resistor	220 ohm	1/4W	±5%	ECR
R302	Carbon film resistor	100K ohm	1/4W	±5%	ECR
R303, 314	Carbon film resistor	470 ohm	1/4W	±5%	ECR
R304	Carbon film resistor	150K ohm	1/4W	±5%	ECR
R305, 313	Carbon film resistor	1K ohm	1/4W	±5%	ECR
R306, 312	Carbon film resistor	10K ohm	1/4W	±5%	ECR
R307	Carbon film resistor	180 ohm	1/2W	±5%	ECR
R308, 310	Carbon film resistor	4.7K ohm	1/4W	±5%	ECR
R309	Carbon film resistor	1.8K ohm	1/4W	±5%	ECR
R311	Carbon film resistor	680 ohm	1/4W	±5%	ECR
R315, 316, 317, 318	Carbon film resistor	22K ohm	1/4W	±5%	ECR
R319, 320, 321, 322, 323, 324, 325	Carbon film resistor	39 ohm	1/4W	±5%	ECR
R326	Carbon film resistor	330 ohm	1/4W	±5%	ECR
C301	Ceramic capacitor	5pF	25V	SL	ECC
C302	Ceramic capacitor	47pF	25V	NP0	ECC
C303, 304, 305, 316	Ceramic capacitor	0.01 μF	25V	ZF	ECC
C306	Monolithic capacitor	0.01 μF	25V	SR ±20%	ECC
C307	Tantalum electrolytic capacitor	3.3 μF	10V		ECC
C308	Ceramic capacitor	22pF	25V	NP0	ECC
C309, 310	Electrolytic capacitor	220 μF	10V		ECC
C311	Electrolytic capacitor	100 μF	10V		ECC
C312	Super capacitor	0.047F	5V		ECC
C313	Electrolytic capacitor	1000 μF	10V		ECC
C314	Electrolytic capacitor	10 μF	16V		ECC
C315	Electrolytic capacitor	2.2 μF	10V		ECC
Q401	Transistor 2SD313(E) or equivalent				ETTD
Q402, 403, 404	Transistor 2SC2603(F) or equivalent				ETTC
D401	Zener diode RD5.6E(B2) or equivalent				ETD
R401	Carbon film resistor	2.2 ohm	1/2W	±5%	ECR
R402	Carbon film resistor	1K ohm	1/4W	±5%	ECR
R403	Carbon film resistor	3.9K ohm	1/4W	±5%	ECR
R404	Carbon film resistor	5.6K ohm	1/4W	±5%	ECR
R405	Carbon film resistor	2.2K ohm	1/4W	±5%	ECR
R406	Carbon film resistor	39K ohm	1/4W	±5%	ECR
R407	Carbon film resistor	1.5K ohm	1/4W	±5%	ECR
R408	Carbon film resistor	2.7K ohm	1/4W	±5%	ECR
C401	Electrolytic capacitor	470 μF	10V		ECC
C402	Monolithic capacitor	0.015 μF	25V	SR ±20%	ECC
C403	Electrolytic capacitor	100 μF	10V		ECC
C404	Electrolytic capacitor	470 μF	16V		ECC
Q601, 602, 603	Transistor 2SC2603(F) or equivalent				ETTC
D601, 602, 603	Diode 1SS133 or equivalent				ETD

Ref. No.	Description					Part No.
L601	Inductor	15 μH				ELA-35
N601	Neon tube					EIN-4
RL601	Reed relay					ESR-68
R601, 606	Carbon film resistor	100 ohm	1/4W		±5%	ECR
R602, 604, 610	Carbon film resistor	47K ohm	1/4W		±5%	ECR
R603, 609	Carbon film resistor	10K ohm	1/4W		±5%	ECR
R605	Carbon film resistor	56K ohm	1/4W		±5%	ECR
R607, 608	Carbon film resistor	15K ohm	1/4W		±5%	ECR
R611	Carbon film resistor	2.7K ohm	1/4W		±5%	ECR
R612	Carbon film resistor	220K ohm	1/4W		±5%	ECR
R613	Carbon film resistor	100K ohm	1/4W		±5%	ECR
R614	Carbon film resistor	1K ohm	1/4W		±5%	ECR
R615	Carbon film resistor	22K ohm	1/4W		±5%	ECR
R616	Carbon film resistor	220 ohm	1/4W		±5%	ECR
C601	Ceramic capacitor	2pF	25V	NP0		ECC
C602	Electrolytic capacitor	1 μF	50V			ECC
C603, 610	Tantalum electrolytic capacitor	0.1 μF	10V		±20%	ECC
C604, 608	Monolithic capacitor	0.015 μF	25V	SR	±20%	ECC
C605, 611	Electrolytic capacitor	4.7 μF	25V			ECC
C606	Electrolytic capacitor	10 μF	16V			ECC
C607	Monolithic capacitor	0.0022 μF	25V	SR	±10%	ECC
C609	Ceramic capacitor	0.047 μF	25V	ZF		ECC
C612	Electrolytic capacitor	220 μF	10V			ECC
C613	Ceramic capacitor	47pF	25V	SL		ECC
Q701, 703, 704, 706, 707	Transistor 2SC2603(F) or equivalent					ETTC
Q702	Transistor 2SD400(F) or equivalent					ETTD
Q705	Transistor 2SA1115(E) or equivalent					ETTA
D701, 702	Zener diode EQA02-09(SA) or equivalent					ETD
D703	Zener diode RD5.6E (B2) or equivalent					ETD
D704, 705, 706	Diode 1SS133 or equivalent					ETD
VR701	Trimmer resistor	200K ohm				ECRV-291D
R701, 705	Carbon film resistor	10 ohm	1/4W		±5%	ECR
R702, 706, 709	Carbon film resistor	1K ohm	1/4W		±5%	ECR
R703, 704, 707, 708	Carbon film resistor	10K ohm	1/4W		±5%	ECR
R710	Carbon film resistor	47K ohm	1/4W		±5%	ECR
R711, 715	Carbon film resistor	22K ohm	1/4W		±5%	ECR
R712	Carbon film resistor	470K ohm	1/4W		±5%	ECR
R713	Carbon film resistor	100K ohm	1/4W		±5%	ECR
R714	Carbon film resistor	220K ohm	1/4W		±5%	ECR
C701, 704	Electrolytic capacitor	220 μF	10V			ECC
C702, 703	Monolithic capacitor	0.015 μF	25V	SR	±20%	ECC
IC901	FM IF IC LA1140					ETI-83
IC902	NB IC HA11219					ETI-73
*IC902	NB IC LA2100					ETI-44
IC903	MPX IC LA3370					ETI-84
Q901	Transistor 2SC930(D) or equivalent					ETTC
D901, 902	Diode 1SS133 or equivalent					ETD
CF901, 902	Ceramic filter	10.7 MHz				EOP-10B
L901	Inductor	22 μH				ELD-178
L902	Detector tank coil	10.7 MHz				ELD-179
VR901	Trimmer resistor	300 ohm B				ECRV-135D
VR902, 904	Trimmer resistor	20K ohm B				ECRV-290
VR903	Trimmer resistor	5K ohm B				ECRV-236
R901, 903	Carbon film resistor	1.8K ohm	1/4W		±5%	ECR
R902	Carbon film resistor	100 ohm	1/4W		±5%	ECR
R904	Carbon film resistor	220 ohm	1/4W		±5%	ECR
R905	Carbon film resistor	12 ohm	1/4W		±5%	ECR

Ref. No.	Description					Part No.
R906	Carbon film resistor	150K ohm	1/4W		±5%	ECR
R907, 936, 939	Carbon film resistor	1K ohm	1/4W		±5%	ECR
R908	Carbon film resistor	6.8 ohm	1/4W		±5%	ECR
R909, 935	Carbon film resistor	15K ohm	1/4W		±5%	ECR
R910, 912, 940	Carbon film resistor	10K ohm	1/4W		±5%	ECR
R911, 918, 927, 928, 929, 930	Carbon film resistor	4.7K ohm	1/4W		±5%	ECR
R913	Carbon film resistor	12K ohm	1/4W		±5%	ECR
R914, 916, 917, 920, 925	Carbon film resistor	100K ohm	1/4W		±5%	ECR
R915, 919	Carbon film resistor	68K ohm	1/4W		±5%	ECR
R921, 922	Carbon film resistor	2K ohm	1/4W		±5%	ECR
R923	Carbon film resistor	2.7K ohm	1/4W		±5%	ECR
R924	Carbon film resistor	22K ohm	1/4W		±5%	ECR
R926	Carbon film resistor	430K ohm	1/4W		±5%	ECR
R931	Carbon film resistor	5.6K ohm	1/4W		±5%	ECR
*R931	Carbon film resistor	2.7K ohm	1/4W		±5%	ECR
R932	Carbon film resistor	8.2K ohm	1/4W		±5%	ECR
*R932	Carbon film resistor	22K ohm	1/4W		±5%	ECR
R933	Carbon film resistor	390 ohm	1/4W		±5%	ECR
R934, 943	Carbon film resistor	6.8K ohm	1/4W		±5%	ECR
R937	Carbon film resistor	10 ohm	1/4W		±5%	ECR
R938	Carbon film resistor	16K ohm	1/4W		±5%	ECR
R941	Carbon film resistor	330 ohm	1/4W		±5%	ECR
R942	Carbon film resistor	2.2K ohm	1/4W		±5%	ECR
C901, 902, 903, 905, 938	Ceramic capacitor	0.047 μF	25V	ZF		ECC
C904	Electrolytic capacitor	100 μF	10V			ECC
C906, 932, 933	Electrolytic capacitor	1 μF	50V			ECC
C907	Ceramic capacitor	0.022 μF	25V	ZF		ECC
C908	Monolithic capacitor	0.047 μF	25V	SR	±20%	ECC
C909	Electrolytic capacitor	2.2 μF	50V			ECC
C910, 911, 912	Ceramic capacitor	33pF	25V	SL		ECC
C913	Ceramic capacitor	100pF	25V	SL		ECC
C914, 934	Electrolytic capacitor	10 μF	16V			ECC
C915, 916, 917, 918	Ceramic capacitor	330pF	25V	SL	±5%	ECC
C919	Ceramic capacitor	5pF	25V	SL		ECC
C920	Monolithic capacitor	0.015 μF	25V	SR	±20%	ECC
C921	Tantalum electrolytic capacitor	0.22 μF	16V		±20%	ECC
C922	Monolithic capacitor	0.0022 μF	25V	SR	±20%	ECC
C923, 924	Ceramic capacitor	680pF	25V	SL	±5%	ECC
C925	Ceramic capacitor	68pF	25V	SL		ECC
C926	Ceramic capacitor	0.0012 μF	25V	YB		ECC
C927	Monolithic capacitor	0.0047 μF	25V	SR	±20%	ECC
*C927	Monolithic capacitor	0.0068 μF	25V	SR	±20%	ECC
C928	Monolithic capacitor	0.01 μF	25V	SR	±20%	ECC
*C928	(This is not used for RRP-11 PCB ass'y.)					
C929, 936	Electrolytic capacitor	4.7 μF	25V			ECC
C930	Electrolytic capacitor	47 μF	10V			ECC
C931	Tantalum electrolytic capacitor	3.3 μF	10V		±20%	ECC
C935	Monolithic capacitor	0.015 μF	25V	SR	±10%	ECC
C937	Polypropylene film capacitor	0.001 μF	25V			ECC
F1	Fuse 0.5A					ESX-74
C1, 2, 3, 4, 5, 6	Feed-thru capacitor	0.0033 μF				ECC
—	Shield case					PL-2777
—	Holder - Power amplifier IC					PL-2778
—	Pan head screw 2.6 x 6					006266
—	Test point					ESX-82



EXPLODED VIEW

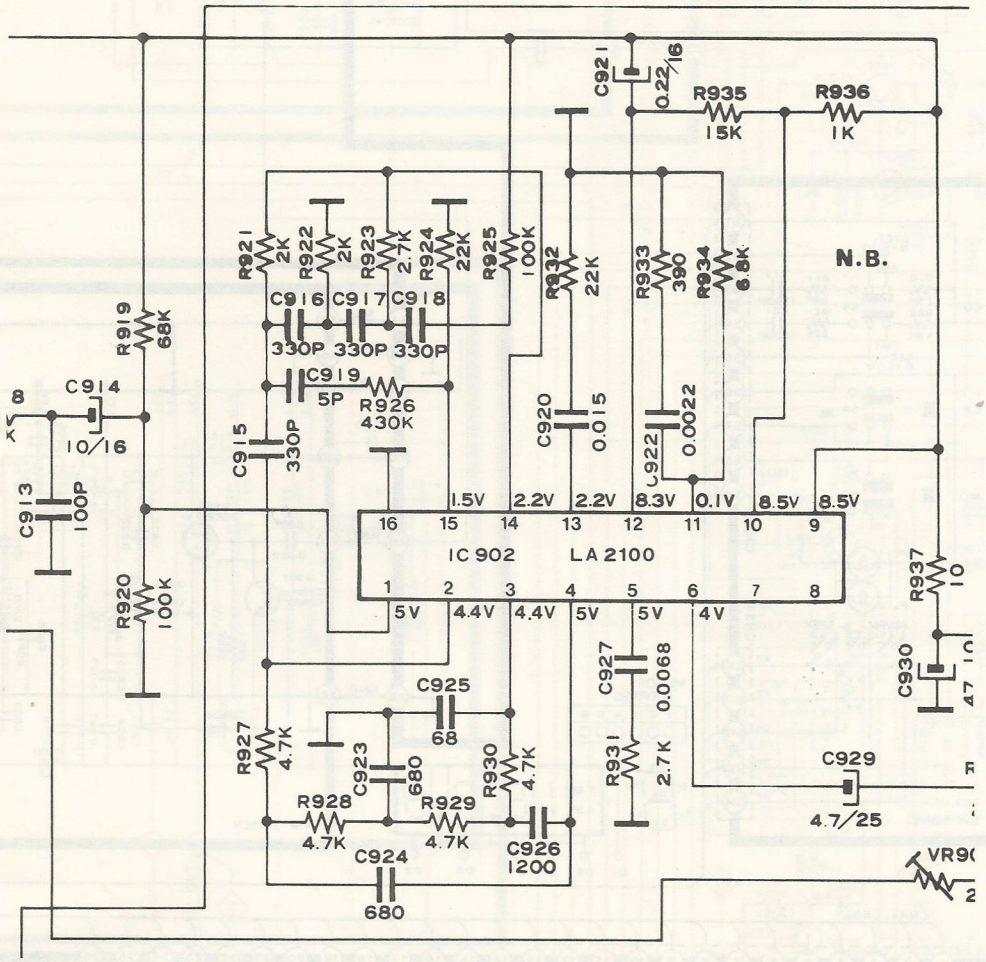
MECHANICAL PARTS LIST

Ref. No.	Description	Part No.
1	Side cover (180) (Black)	MP-1823
1	Side cover (180) (Gunmetal grey)	MP-1823X2
1	Side cover (190) (Black)	MP-1824
1	Side cover (190) (Gunmetal grey)	MP-1824X2
1	Side cover (200) (Black)	MP-1825
1	Side cover (200) (Gunmetal grey)	MP-1825X2
3	Knob – Volume (Black)	MP-1827
3	Knob – Volume (Gunmetal grey)	MP-1827X2
4	Knob – Balance/Bass/Treble (Black)	MP-1828
4	Knob – Balance/Bass/Treble (Gunmetal grey)	MP-1828X2
5	Indicator plate (Black)	PN-646
5	Indicator plate (Gunmetal grey)	PN-646X2
6	Escutcheon (Black)	MP-1842
6	Escutcheon (Gunmetal grey)	MP-1842X2
7	Push button (Black)	MP-1845
7	Push button (Gunmetal grey)	MP-1845X2
8	Push button (Black)	MP-1844
8	Push button (Gunmetal grey)	MP-1844X2
9	LED display	EX-4
10	Front chassis	PL-2798
11	Sub front chassis	PL-2799
12	Heatsink plate	PL-2773
13	Side panel ass'y (L)	CMK-131
14	Switch PC board ass'y	RTP-7
15	Main PC board ass'y	RRP-10
16	Rear panel ass'y	CMK-147
17	Holder – Aerial socket	PL-2109
18	Holder – 8P wires	PL-2784
19	Aerial socket with cable	AH-294
20	8P plug with wires (GMH version)	AH-502
21	9P socket with wires	AH-494
22	Spring – Snap-in	SC-353
23	Holder – Snap-in spring	PL-2779
24	Spring – Slide-in (L)	PL-2780
25	5P socket with wires	AH-493
26	Spring – Slide-in (R)	PL-2781
27	Insulation sheet	PN-675
28	Bottom lid	PL-2772
29	Top lid	PL-2771
30	Side panel ass'y (R)	CMK-132
31	Tube	WTB-12-40
32	13P socket with wires	AH-480
33	AM tuner	AR-67
34	FM tuner	AR-68
	4P plug with wires (EUROVOX version)	AH-158
	Back up power supply wire (EUROVOX version)	AH-463
	Automatic aerial power supply wire (EUROVOX version)	AH-464
	Dimmer wire (EUROVOX version)	AH-465
	Grounding wire (EUROVOX version)	AH-475
a	Pan head screw 2.6 x 5 (Self tight)	006265ST
b	Flush head screw 2.6 x 6	002266
c	Flush head screw 2.6 x 4 (Self tight)	002264ST
d	E-ring D2.3 x 0.4	030234
e	Pan head screw 2 x 2	006202
f	Plain washer D6	010605
g	Hexagon nut M6	020610

NOTICE OF CHANGE

Noise blanker IC for FM circuit board ass'y has been changed from HA11219 to LA2100, RRP-11 is the ass'y No. which has LA2100.
Where the changes are;

IC902	HA11219	⟶	LA2100
C927	0.0047 μF	⟶	0.0068 μF
C928	0.01 μF	⟶	delete
R931	5.6K ohm	⟶	2.7K ohm
R932	8.2K ohm	⟶	22K ohm

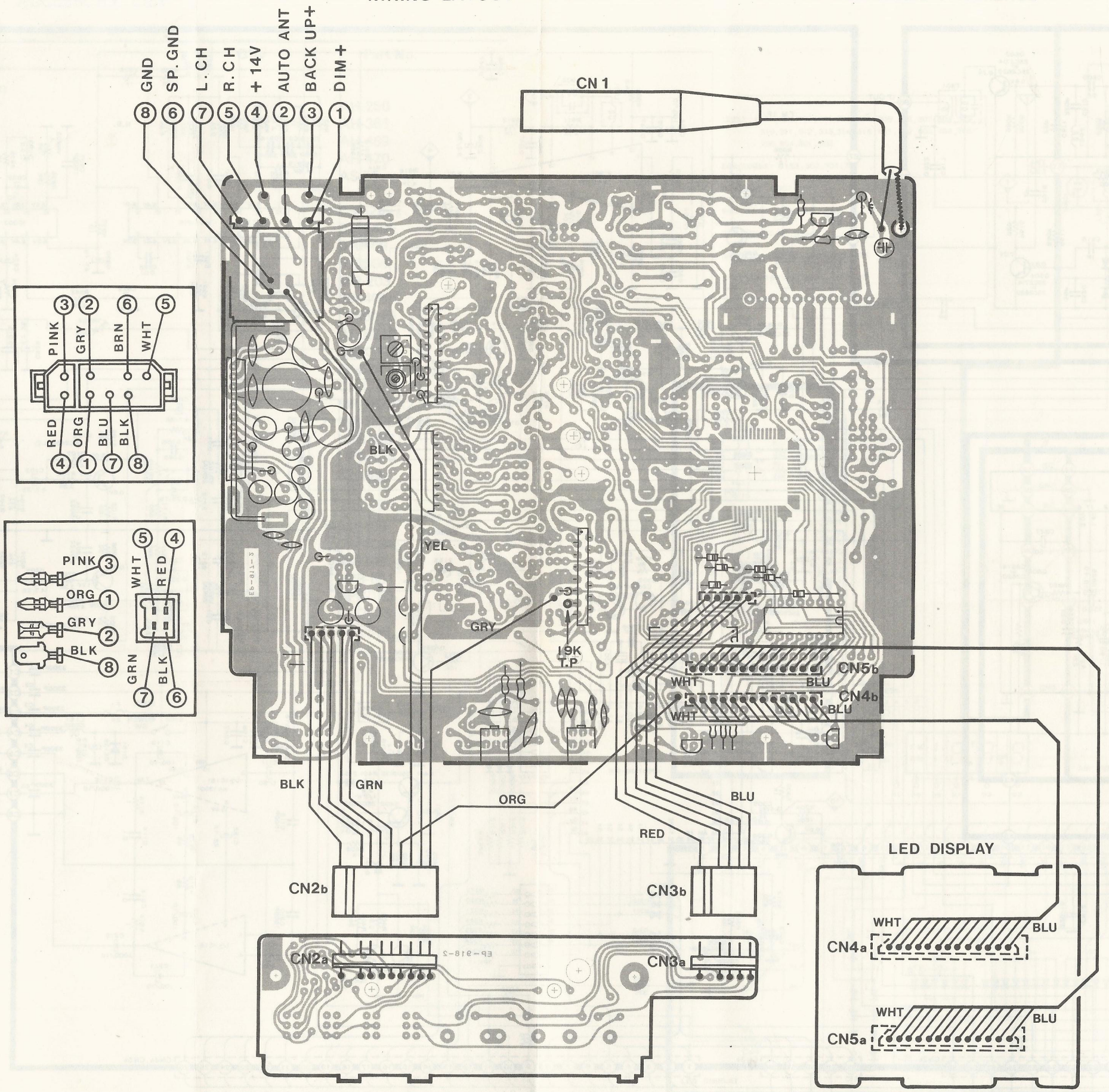


This part is used for the unit with Serial Number from 30311791 to 30330550.

ACCESSORY LIST

Description	Q'ty	Part No.
EUROVOX version		
Grounding wire	1	AH-250
4P socket with wires	1	AH-361
Back up power supply wire	1	AH-469
Dimmer wire	1	AH-470
Screw kit	1	AS-79
Contains;		
Bolt	1	CS-525
Hexagon nut D5	1	020540
Plain washer D4	1	010408
Plain washer D5	1	010508
Rear suspension plug	1	MR-203
SEMS hexagon screw 4 x 8	1	094408
SEMS hexagon screw 5 x 16	1	0945016
Spring washer D5	1	0115210
Removal lever ass'y	1	CMK-113
Removal lever	2	PP-524
Side cover set	1	CMT-145
Side cover (180) (Gunmetal grey)	2	MP-1823X2
Side cover (200) (Gunmetal grey)	2	MP-1825X2
Hand book	1	HPB-667
Warranty card	1	HPC-193
Supporting strap	1	PP-159
GMH version		
Plain washer D4	1	010468
SEMS hexagon screw 4 x 8	1	094408
Hat head screw 3 x 6	2	096306
Handbook	1	HPB-651
Warranty card	1	HPC-163
Bracket - Radio Mtg. (92021248)	1	PL-2806
Bracket - Radio rear Mtg. (92023262)	1	PL-2889

WIRING LAYOUT



SCHEMATIC DIAGRAM

1SS53 : D101, 102, 152, 201, 202, 304, 305, 306, 307, 308, 309
310, 311, 312, 313, 314, 315, 601, 602, 603, 704, 705
706, 804, 901, 902

EQA0209SA : D153, 302, 701, 702

RD5.1EB2 : D301

RD5.6EB2 : D401, 703

ERB1202 : D151, D154

SVC3210 or 1SV101 : D801, 802, 803

SVC211 or 1SV103 : D501, 502, 503

FM TUNER

AM TUNER

FM IF

SW. BOARD

LED DISPLAY

DIMMER

SCHEMATIC DIAGRAM