

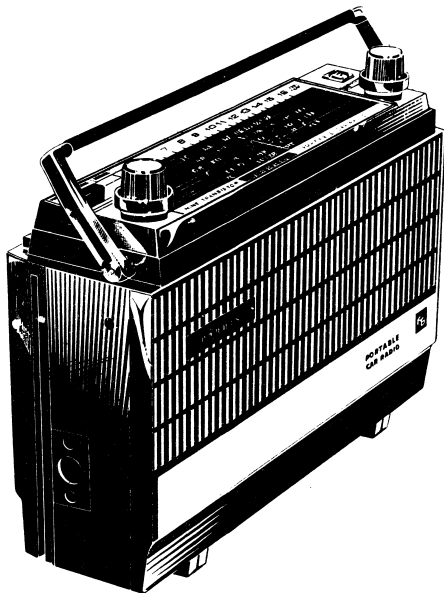
SERVICE MANUAL

FERRIS

MODEL 294

PORTABLE CAR RADIO

9 TRANSISTOR



FERRIS BROS. PTY. LIMITED

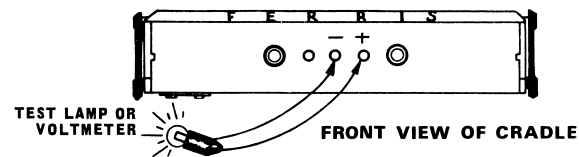
A Hawker Siddeley Company

BRANCHES, MANUFACTURER'S, REPRESENTATIVES & DISTRIBUTORS
THROUGHOUT AUSTRALIA.

TRANSISTORISED POWER CRADLE M294 - 284

FOR USE WITH FERRIS MODELS 294 and 284 - PORTABLE CAR RADIOS

The self-locking cradle is designed to mount under the dash or parcel shelf of a motor vehicle. When the Ferris M294 is inserted into the cradle, automatic connection is made to the external car aerial, car battery and extension speaker. A 15 ohm extension speaker must be used. The cradle has a single class 'A' power output stage which is capable of delivering 3 watts of undistorted audio power, with 14 volts applied from the car battery. This approximates the battery voltage when the car is in motion. The complementary symmetry output stage of the set serves to drive the power stage of the cradle. Filters are incorporated in aerial, speaker and battery circuits of the cradle to ensure effective suppression of electrical interference. Full polarity protection for the cradle is afforded by a discriminator stage built into the M294 receiver. For cradle polarity adjustment, see instruction adjacent to polarity selector panel.

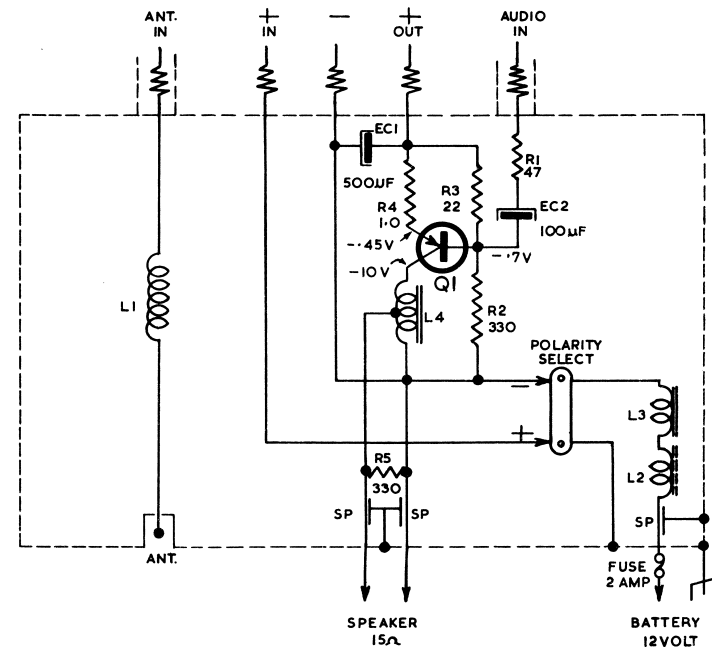


TO TEST CRADLE:

Connect either a voltmeter or 12 volt test lamp to the contacts as shown. No indication by test lamp or volt meter means:-

- blown fuse.
- faulty battery connection.
- faulty cradle.

The above test is important, as any of the suggested faults would prevent the set from operating. If cradle tests out correctly but set fails to operate, check polarity setting. Note that set and dial light, as well as cradle power output stage, will only operate when cradle polarity is matched to that of the vehicle.



M294/284 Cradle 12 Volt

R1	47 OHM	10% RESISTOR
R2	330 OHM	10% RESISTOR
R3	22 OHM	10% RESISTOR
R4	1.0 OHM	10% RESISTOR 1 WATT
R5	330 OHM	10% RESISTOR
EC1	500 µf	16V ELECTROLYTIC
EC2	100 µf	12V ELECTROLYTIC
L1	AERIAL FILTER CHOKE Type 6108	
L2	R.F. CHOKE Type 828	
L3	FILTER CHOKE Type 8131	
L4	OUTPUT CHOKE Type 4336	

D.C. RESISTANCE OF WINDINGS

Winding:	D.C. Resistance in OHMS:
L1	2.5
L2	less than 0.2
L3	2.0
L4	2.5 (total)

TOTAL CURRENT CONSUMPTION WITH SET IN CRADLE 550 MA APPROXIMATELY.

ROUTINE SERVICE ADJUSTMENTS

SPECIFICATIONS

Tuning Range: 525-1620 KHz

Battery:

1 x Eveready Type 2364
Current Consumption (no signal)
approx. 12 ma

Power Output:

Max. Undistorted - 330 MW.
Max. Undistorted in Cradle - 3 watts
with 14 volt supply.

Transistor Complement:

1 x 2N1637 R.F. Amplifier
1 x 2N1639 Converter
1 x 2N1638 1st I.F. Amplifier
1 x 2N1638 2nd I.F. Amplifier
1 x AC172 Audio Amplifier
1 x AC125 Audio Driver
1 x FB4001 Battery Discriminat.
1 x AC187 P.P. Power Output
1 x AC188 (complementary pair)

Loudspeaker:

5½" x 4" perm. magnet.
Voice Coil Impedance - 15 ohms

Tuning Ratio:

13:1 - 6½ turns of knob

Dial Lamp:

12 volt - .15 amp miniature bayonet

Diodes:

1 x OA90 Detector & A.V.C.

Dimensions:

9" x 6½" x 2½"

Weight: 4lbs. 6ozs.

DESCRIPTION

The Ferris 9 Transistor MODEL 294 is designed to operate as a portable or home radio, as well as a car radio. Complete shielding and rugged construction is assured by use of an attractively styled diecast metal case and speaker grille. A large station-marked dial with 4¾" pointer traverse is made possible by the use of a specially designed gang gear drive. A push-button switch cluster provides aerial selection, tone and battery on/off.

A Ferrite rod antenna is housed in a pivoted polycarbonate moulding which permits variable control of signal pick-up when the set is used as a portable.

CONTROLS:

Tuning: A diecast metal knob operates tuning capacitor via moulded worm and gear assembly. Dial pointer operation is via cord and pulley to tuning spindle.

Volume: A matching diecast knob is provided for volume adjustment.

On/Off Switch: Set is switched on by depressing red ON/OFF button.

Tone Control: Press-button marked TONE selects either bass or treble response.

Aerial Switch: When button marked AERIAL is in down position, it selects car aerial by switching into circuit a high gain aerial coil and, at the same time, effectively shorts out the Ferrite rod aerial - thus eliminating interference which would otherwise be led into the set when it is being used as a car radio. UP position of button switches out aerial coil and brings 'FERRITENNA' (Ferrite rod aerial) into circuit. Re-press buttons to return them to the UP position.

Ferritenna Signal Control: A hinged plastic moulding which folds into the cavity of the rear grille contains the Ferrite rod aerial. When closed flush with metal case, signal pickup and interference is kept to a minimum (FIG. 1A). It should be used in this position in strong signal areas. For maximum signal pick-up, i.e. deep fringe areas, the Ferritenna should be turned until it is at right angles to the set (FIG. 1B.) Any intermediate setting can, of course, be used depending on signal reception.

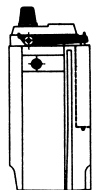


Fig. 1A

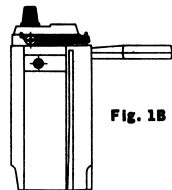


Fig. 1B

EXTERNAL CONNECTIONS:

Aerial Socket: The aerial socket at side of set is for connection of a Ferris car radio or wire aerial.

Tape Pick-Up Socket: Miniature jack is for the connection of a pick-up or tape player. The radio is automatically muted when either of these accessories is connected.

The 5 contacts at the base of the set are for connection to external speaker, car aerial and car battery when the set is used in the M294/284 Transistorised Power Cradle.

A 15 ohm external speaker MUST be used.

A special transistor discriminator stage provides complete polarity protection for both receiver and cradle. It also controls dial lighting which is, in fact, a visual indication of correct polarity function.

BATTERY TEST:

The condition of the battery can be quickly checked by switching the set on and connecting a voltmeter to the test points indicated in FIG. 3. Replace if reading is 5 volts or lower.

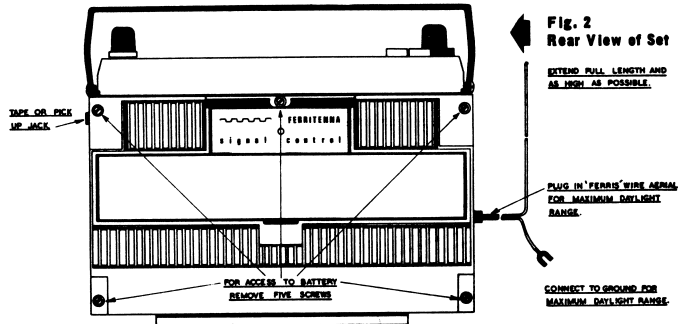


Fig. 2
Rear View of Set

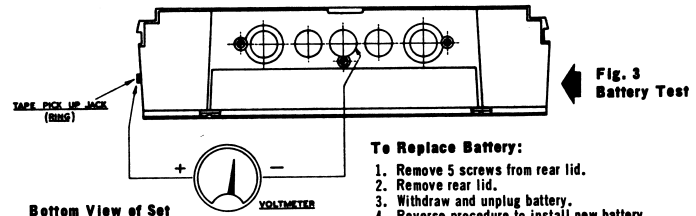


Fig. 3
Battery Test

To Replace Battery:

1. Remove 5 screws from rear lid.
2. Remove rear lid.
3. Withdraw and unplug battery.
4. Reverse procedure to install new battery.

BATTERY REPLACEMENT:

To replace battery, follow instructions as shown in FIGS. 2 & 3. After releasing screws, turn the set over and gently shake them free of rear grille. N.B. When replacing the rear grille, ensure that the screw threads are properly engaged before screwing down firmly.

REMOVAL OF SPEAKER GRILLE:

First remove rear lid as previously described. Remove 2 screws marked 'B' in FIG. 5. Speaker grille can then be pressed outward from case, and the speaker disconnected by unfastening the voice coil leads. Connecting lugs pull off. Printed board is then accessible from both sides and any component can be replaced when the set is dismantled to this point.

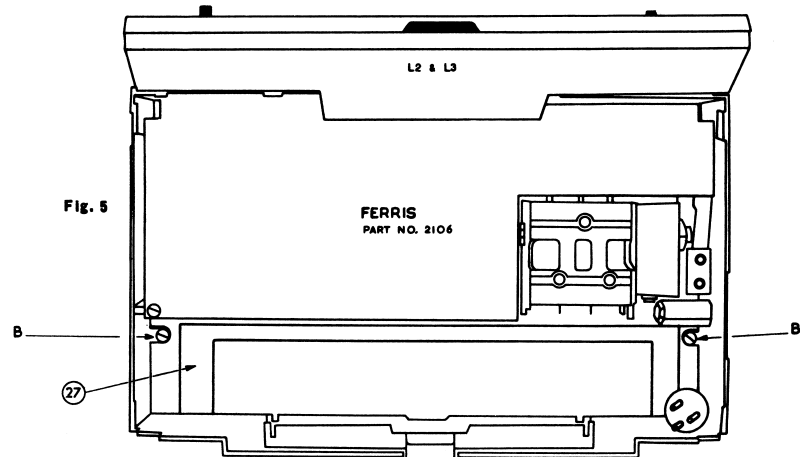


Fig. 5

FERRIS MODEL 294 - SPARE PARTS LIST

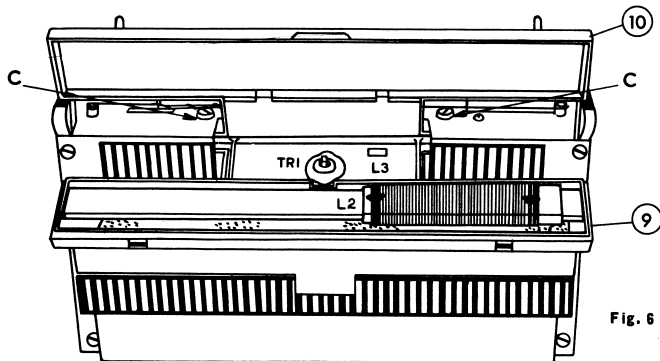


Fig. 6

COMPLETE FERRITENNA ALIGNMENT:

- 1) Replace top half of Ferritenna housing, but do not insert the small screws.
- 2) Tighten screws 'C' just sufficiently to hold plastic halves together.
- 3) Replace rear grille.
- 4) Stand set in normal operating position and open Ferritenna as shown in FIG. 6. A small cardboard box or similar non-metallic object may be required to support the Ferritenna assembly during alignment.
- 5) Connect signal generator to aerial socket at side of set. Adjust volume for maximum output.
- 6) Set aerial button to UP position.
- 7) Tune receiver and signal generator to 600 KHz.
- 8) Slide winding along slab for maximum signal
- 9) Tune receiver and signal generator to 1500 KHz.
- 10) Adjust TR1 for maximum output.
- 11) Repeat Steps 6 to 9 until no further output can be obtained.
- 12) Seal position of winding with electrical adhesive tape and replace estafoam packing strips.
- 13) Close plastic halves and replace small fixing screws. Ensure that none of the terminating leads are strained or severed in so doing.
- 14) Tighten screws 'C' to give adequate friction loading of Ferritenna assembly.
- 15) Finally, check TR1 setting whilst tuned to a distant station near 1500 KHz.
- 16) Replace canopy.

NOTE - when aligning the Ferritenna as described, the output from the signal generator will need to be in the order of 0.3 - 1 mv, as it is only loosely coupled to the set via the capacity of the aerial switch.

SERVICE HINTS:

Extreme care should be taken to avoid accidental shorting of transistor elements to circuit ground - this is especially true of the output transistors.

Since a transistor needs only low voltage applied to its terminals for conduction, testing continuity of a circuit which includes a transistor can result in misleading indications and damage to the transistor. To avoid this, remove the transistor from the circuit board before making continuity tests.

The first thing to check when the receiver is inoperative is the battery. With the receiver switched on, replace if 5 volts or less.

Voltmeters used for test purposes must have a sensitivity of at least 20,000 ohms per volt. The use of low impedance meters will give misleading results as serious shunting effects will occur. When checking for a circuit fault causing excessive battery drain, an over all current measurement and supplementary voltage measurements should be made. A quick way to check battery current is to turn set off, set volume to minimum, then place a suitable milli-ammeter across the on/off switch contacts.

When using a signal generator or signal tracer for fault finding, a .1uf capacitor must be inserted with the active lead of the test instrument, to avoid shorting out bias voltages.

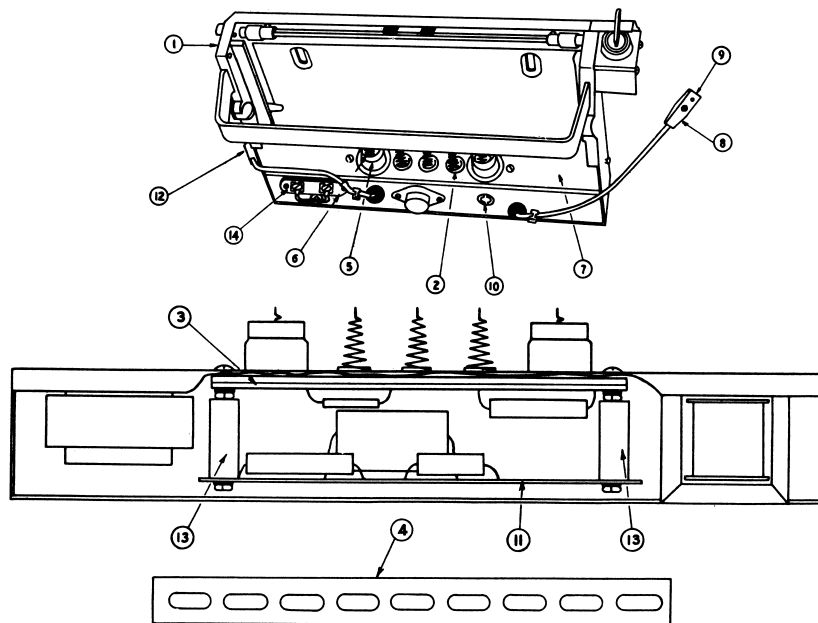
The output of this receiver is of the Class 'B' type. It should be noted that in Class 'B' output, the battery current increases with increase in power output.

Transistors and printed circuit board can be damaged by excessive heat. Whenever soldering is necessary on the printed circuit board, use a soldering iron which is both HOT and CLEAN. Do not hold the soldering iron on a soldering point any longer than is absolutely necessary. This minimises the amount of heat which will be radiated from the point of soldering. When soldering or unsoldering a transistor, grasp the transistor lead with a pair of long-nose pliers to provide a heat sink. Excessive heat can damage a transistor.

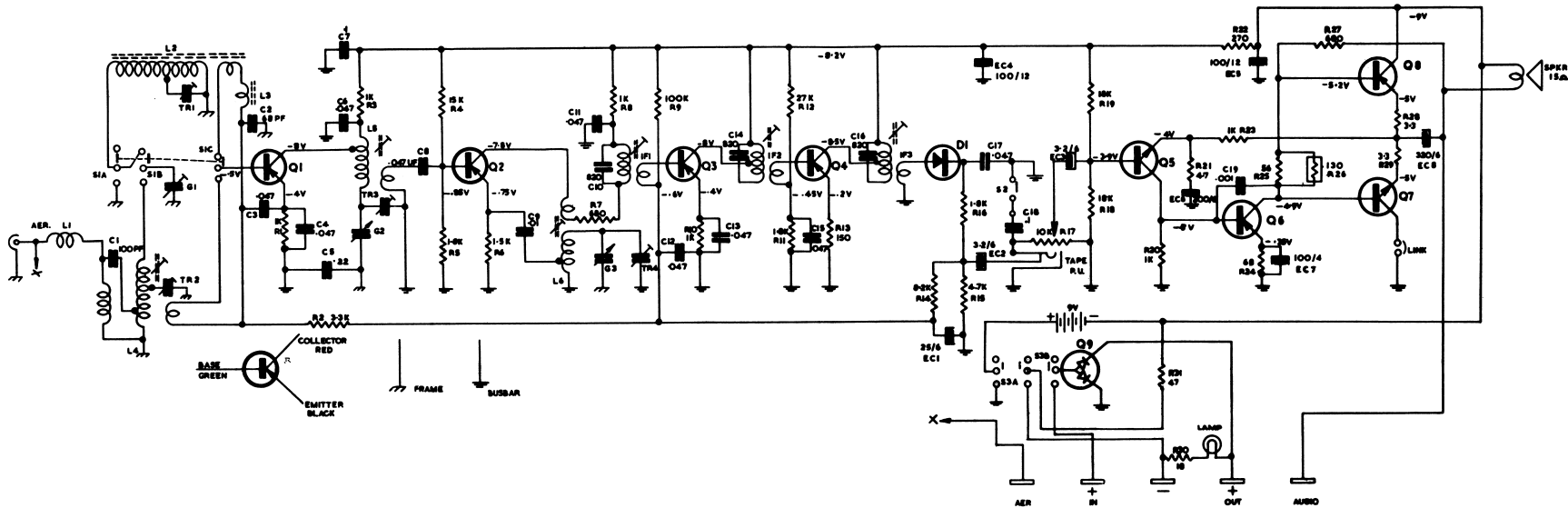
ITEM	DESCRIPTION	PART NO.
1	Case Assembly c/w Contact Strip Assembly and Contact Strip Moulding	R2056A
2	Front Grille	R2057
3	Rear Grille	R2058
4	Handle	R2094
5	Bracket - Gang Mounting	R2664A
6	Spacer - Gang Mounting	R2065
7	Tuning Spindle	R2066-1
8	Gang Gear Drive	R2066-2
9	Aerial Housing	R2055
10	Cover - Aerial Housing	R2060
11	Tuning Knob	R2399
12	Insert (Knob)	R2660
13	Volume Knob	R2398
14	Canopy	R2061
15	Dial Scale	R2665
16	Pointer	R2098
17	Bezel	R2071
18	Spigot Washer	R2115/1/2
19	3 Section Tuning Capacitor	21371
20	Volume Control	R2118
21	Printed Circuit Board	R2106
22	Lampholder (miniature bayonet)	7222-065-01
23	Battery Plug	691-6-4
24	Push-button Switch (miniature short stem)	SK102
25	Metcal - Aerial Housing	R2070
26	Miniature Jack Connector	3, 5 MM
27	Battery Packing Piece	R2669
28	Metcal (Portable Car Radio)	R2663
29	'Ferris' Metcal	R2662

FERRIS MODEL 294/284 TRANSISTORISED POWER CRADLE - SPARE PARTS LIST

1	Cradle including Tie Bar	R1699
2	Contact Assembly	R1689A
3	Contact Cover Plate.	R1690
4	Rear Mount Strap	R2036
5	Contact Shield 3/8" dia., Cad. Plated	R1368
6	Contact Shield 5/8" dia., Cad. Plated.	R1369
7	Contact Box	R2122
8	Connector Socket Halves (speaker connector.)	R1870-1-2
9	Connector Socket Contacts (speaker connector.)	R1871
10	Connector Aerial	H160
11	Printed Circuit Board	R2108
12	Fuse Holder (plastic)	36546
13	Spacer 5/8" x 1 1/4" O.D. x 5/32" I.D.	R2191
14	Terminal Panel	679-2-5



FERRIS - TRANSISTOR CAR RADIO - MODEL 294 (12 V)



R1	1K	10% Resistor	C1	100pF	125v	Styrosael
R2	3.3K	"	C2	68pF	500v	Ceramic
R3	1K	"	C3	.047uF	25v	Capacitor
R4	15K	"	C4	.047uF	25v	"
R5	1.8K	"	C5	.22uF	50v	"
R6	1.5K	"	C6	.047uF	25v	"
R7	680	"	C7	.1uF	25v	"
R8	1K	"	C8	.047uF	25v	"
R9	150K	Variable	C9	.01uF	25v	"
R10	1K	10% Resistor	C10	820pF	125v	Styrosael
R11	1.8K	"	C11	.047uF	25v	Capacitor
R12	27K	"	C12	.047uF	25v	"
R13	150	"	C13	.047uF	25v	"
R14	8.2K	"	C14	820pF	125v	Styrosael
R15	4.7K	"	C15	.047uF	25v	Capacitor
R16	1.8K	"	C16	820pF	125v	Styrosael
R17	10K	Potentiometer	C17	.047uF	25v	Capacitor
R18	18K	10% Resistor	C18	.1uF	25v	"
R19	18K	"	C19	.001uF	500v	Ceramic
R20	1K	"	EC1	25uF	6v	Electro
R21	4.7	"	EC2	3uF	6v	"
R22	270	"	EC3	3uF	6v	"
R23	1K	"	EC4	100uF	12v	"
R24	68	"	EC5	100uF	12v	"
R25	56	"	EC6	200uF	6v	"
R26	130	Thermistor	EC7	100uF	4v	"
R27	680	10% Resistor	EC8	320uF	6v	"
R28	3.3	"				
R29	3.3	"				
R30	18	"				
R31	47	"				

G1	3 Gang Tuning Capacitor
G2	200 x 200pF Aerial & RF Sections
G3	98pF Osc. Section
TR1	5.55pF Trimmer Type 31954
TR2	5.55pF Trimmer Type 31954
TR3	2.20pF
TR4	Dual Rotary Trimmer Type AT2-12
S2	1 Pole - 2 Position Switch
S1A	"
S1B	"
S1C	"
S3A	2 Pole - 2 Position Switch
S3B	"
L1	Aerial Choke Type 6108
L2	Rod Aerial Coil Type 7127
L3	Ferrite Bead Choke Type 6109
L4	Aerial Coil Type 7128
L5	RF Coil Type 7206
L6	Osc. Coil Type 7332
IF1	455 KHz Transformer Type 9141
IF2	455 KHz Transformer Type 9141
IF3	455 KHz Transformer Type 9142

TRANSISTORS

Q1	2N1637 - AF116
Q2	2N1639 - AF116
Q3	2N1638 - AF117
Q4	2N1638 - AF117
Q5	2N 649 - AC172
Q6	2N 406 - AC125
Q7	AC 187 - AC127
Q8	AC 188 - AC128
Q9	FB4001

DIODES

D1	OA90
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BAND COVERAGE 525-1620 KHz
IF FREQUENCY 455 KHz

ZERO SIGNAL BATTERY CURRENT 13 MA FOR 9V SUPPLY
ZERO SIGNAL COLLECTOR CURRENT OF P STAGE 2.5 - 4 MA.

ALL RESISTORS 1/2 WATT RATING UNLESS OTHERWISE STATED
ALL RESISTANCE VALUES IN OHMS UNLESS OTHERWISE STATED.

VOLTAGE CHECKED WITH 20,000 O.P.V. METER AT ZERO SIGNAL INPUT

D.C. RESISTANCE OF WINDINGS

WINDING	D.C. RESISTANCE IN OHMS:
Aerial Choke (L1)	2.5
Rod Aerial (L2)	2.0
Aerial Coil Primary	21.0
Aerial Coil Secondary (total) (L4)	2.5
RF Coil Primary	5.4
RF Coil Secondary (total) (L5)	0.3
Osc. Coil Primary	0.4
Osc. Coil Secondary (total) (L6)	3.8
IF1 Primary (total)	2.1
IF1 Secondary	0.3
IF2 Primary (total)	2.1
IF2 Secondary	0.3
IF3 Primary (total)	2.1
IF3 Secondary	1.0

Battery Type 2364
 Pilot Lamp 12volt 2 watt.

DO NOT OPERATE SET WITHOUT SPEAKER CONNECTED.