

Mobile
Amplifier Charger

RITRON, INC.

MAINTENANCE AND OPERATING MANUAL MODEL RA-150 VHF - MOBILE AMPLIFIER CHARGER

LIMITED 90 DAY WARRANTY

To the original consumer purchaser only, Ritron, Inc. warrants this product and its components and parts to be free from defects in materials and/or workmanship for a period of 90 days from the date of purchase. If the product malfunctions within 90 days from the date of purchase as a result of any defect in materials and/or workmanship and is sent at the sender's expense and received by Ritron, Inc. ("Attention Warranty Department") at 148 West Carmel Drive, Carmel, Indiana 46032 within 110 days of the date of purchase, then Ritron, Inc. will restore the product to proper operating condition without additional charge to the original consumer purchaser by either repairing or replacing the product, its components or parts. ANY AND ALL TECHNICAL INFORMATION PROVIDED WITH THIS OR ANY OTHER RITRON, INC. PRODUCT IS EXPRESSLY EXCLUDED FROM THIS WARRANTY.

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This warranty is the only express warranty made by Ritron, Inc. relating to this product. No person is authorized to make any other warranty on behalf of Ritron, Inc. with respect to this product and no representation made by any person about this product is included in this warranty.

Duration of Implied Warranty

THE DURATION OF ANY AND ALL IMPLIED WARRANTIES APPLICABLE TO THIS PRODUCT, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, SHALL BE THE SAME 90-DAY PERIOD AS FOR THIS EXPRESS WARRANTY. (Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.)

Limitation of Actions

Any law suit for breach of warranty, whether express or implied, with respect to this product, must be commenced within one year and 90 days after its original purchase by a consumer or be permanently barred.

Not Responsible for Consequential Damages

Ritron, Inc. shall have NO RESPONSIBILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUSINESS LOSS, PROPERTY DAMAGE OR PERSONAL INJURY, FOR BREACH OF THIS WARRANTY OR ANY IMPLIED WARRANTY in connection with any malfunction of this product. The sole remedy for any such breach is that established in the first paragraph of this Limited 90 Day Warranty. (Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.)

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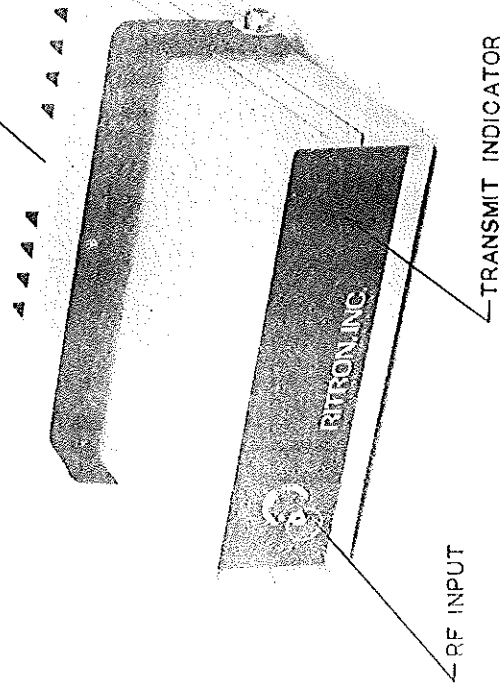
***** RA-150 OPERATING INSTRUCTIONS *****

The RA-150 VHF Power Amplifier is extremely simple to operate. There are no operating controls. Once the unit has been installed, it's operation is completely automatic.

Using a handheld designed or modified for operation with the RA-150, connect the antenna jack of the handheld to the RF input connector on the front panel of the RA-150. Provided that the unit has been properly installed with power and an external antenna connected, the unit is now fully functional.

Signals from the external antenna are sent to the handheld as long as the transmit key of the handheld is not activated. When the handheld is put into the transmit condition, the RA-150 automatically switches into the amplifier mode and boosts the RF output of the handheld to approximately 25 watts.

RF OUTPUT



***** INSTALLATION *****

The RA-150 may be installed in much the manner as any mobile radio. The unit will work best if the heat sink has a clear path for airflow, and the connection to the battery is made with heavy wire to minimize the voltage drop.

The RA-150 draws only 75 ma with the handheld connected and charging. It draws less than 5 ma with the handheld disconnected. Therefore, it is not necessary to turn the RA-150 on and off with the ignition as it will not seriously discharge the vehicle's battery.

***** RA-150 PERFORMANCE SPECIFICATIONS *****

Power Requirements:

13.75 VDC, 4 Amps Max
(11 - 16 VDC Operational)

Output Power:

25 Watts Minimum at 150 MHz
with 1 Watt input at 13.75 VDC

RF Input Power Range:

0.5 to 5 Watts

Operating Frequency Range:

136 to 174 MHz

Bandwidth:

4 MHz with no degradation

Generated Spurious Outputs:

-58 dBc Max

Receive Insertion Loss:

Less than 2 dB

Transmit Indicator:

LED, RF Sensing

Charging Current to Handheld:

60 ma nominal in Receive
500 ma nominal in Transmit

Operating Temperature Range:

-30 to +50 degrees C

RF Input and DC Charging Input Connector:

BNC Female

RF Output Connector:

UHF Female

DC Power Connector:

2 pin Male Molex

Size:

1.5"H X 5.1"W X 6.0"L

Weight:

1 Lb.

Mounting:

Aluminum "U" Channel

***** GENERAL DESCRIPTION *****

The RA-150 is a VHF RF Power Amplifier and current controlled Battery Charger intended for use with handheld transceivers. The RF signals and the charging current are carried on the same coaxial cable to simplify the operation of the unit.

The RF Amplifier provides 25 Watts of output and will accept input RF levels of 0.5 to 5 Watts over the frequency range of 136 to 174 MHz. A tunable bandpass filter is used in the input circuit to suppress spurious output from the handheld.

The Battery Charger circuit provides 80 ma of current when no RF power is presented to the input. When the RF input level exceeds 1 watt, the charging circuit increases its output to 500 ma. This system will maintain the charge on the handheld batteries under all conditions of use while the handheld is being operated with the RA-150.

***** RA-150 THEORY OF OPERATION *****

The RA-150 is a radio frequency power amplifier designed specifically for use with VHF-FM handheld transceivers. The unit incorporates circuitry for charging the handheld's battery system, for sensing RF power from the handheld, separate bandpass filters for the signal to be amplified and the receiver signal, an RF power amplifier, a lowpass filter, and a function relay.

The handheld transceiver connects to the RA-150 through a BNC jack mounted on the front panel. A constant current of 75 ma, developed by Q101, is applied to the BNC jack. If the handheld's internal battery is connected to its antenna line through an RF choke and a diode, then this current will charge the handheld's battery.

Radio frequency power from the handheld is detected by CR102 and CR103 and turns on Q102. This transistor is connected to the coil of relay K101, the charging circuit, and the transmit LED. The signal to the charging circuit boosts the charge current to approximately 500 ma while the handheld is transmitting to maintain the handheld battery's charge.

When the RA-150 is in the receive mode, a bandpass filter is connected in series with the antenna line. This filter will help suppress frequencies removed from the desired by more than 5 MHz and improve the perceived intermodulation characteristics of the receiver.

Another bandpass filter is situated in series with the input to the power amplifier. It is tuned to the frequency to be amplified. It will attenuate the spurious outputs of a handheld transceiver that are greater than 5 MHz from the carrier. The power amplifier consists of Q103, and Q104. When driven with 1 watt of power from a handheld, the output power from Q104 will be approximately 25 watts. These stages are matched to be stable with all levels of drive and VSWR.

A combination Butterworth and Elliptic lowpass filters consisting of L115, L116, L117, C139, C140, C141, C142, C144 and C145 attenuate the generated harmonics to a level more than 58 dB below the carrier.

The battery supply voltage for the RA-150 is fused, filtered, and protected for reliability.

The external antenna is connected to the RA-150 by a "UHF" type connector on the back panel.

***** TUNE-UP PROCEDURE *****

Test Equipment Required:

1. RF Wattmeter: 1 to 40 Watts, 136 to 174 MHz
2. DC Power Supply 13.75 VDC 0 - 5 Amperes

3. RF Signal Generator 136 to 174 MHz
4. Voltmeter

First, confirm that the handheld transceiver to be used with the RA-150 is working properly with respect to its receiver sensitivity and power output. The unit must be capable of producing at least 1 watt to drive the RA-150 to full power. If the handheld produces more than 4 watts of output power, the track from the relay to C117 should be cut and a 100 Ohm 1/2 watt carbon film resistor inserted.

If the handheld's battery pack has a fully charged voltage of less than 11 volts, it is possible to charge it from the RA-150. Any unit not equipped for this function must be modified. If this function is not desired, L102 should be cut or removed or damage may result to the handheld because of the charging current applied to the antenna jack.

The modification of a handheld to charge its batteries from the RA-150 involves DC blocking the handheld's antenna line from its circuitry with a capacitor, RF blocking the battery from the antenna with an inductor, and protecting the handheld battery from the discharge through the antenna jack with a diode.

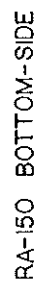
To DC block the antenna line on the handheld, a capacitor with a low RF impedance at the operating frequency must be inserted in series with the antenna line. A high quality ceramic or mica capacitor (150 to 470 pF) is recommended with the leads kept as short as possible (less than .25").

To RF block the battery from the antenna line and protect the battery pack from discharge an inductor with a high impedance at the operating frequency (approximately 1 uHy) and a 1 ampere, 50 V diode should be connected in series with the antenna line to the battery. The diode's cathode should be connected to the battery. An additional by-pass capacitor may be required across the battery.

After completing the charger modifications, connect the handheld to the RA-150 input jack, connect the 13.75 volt supply to the power connector, and connect the Wattmeter to the output jack. Key the transmitter and observe the transmit light for an indication. If the light does not turn on, a fault in the handheld is most probable.

The RA-150 power amplifier stages are factory tuned for operation from 150 to 160 MHz. If the unit is to operate in this range, only the input filter (L105 & L106) will need to be tuned for maximum output power. If operation in some other part of the 136 to 174 MHz band is required, C123, C133, C137 and C138 must be retuned for a maximum reading on the Wattmeter.

The receiver bandpass filter may be peak tuned by adjusting L103 and L104 for best sensitivity. This filter may be removed from the signal path by cutting the printed circuit board tracks in and out of the filter and placing a jumper across it.



REF #	DESCRIPTION	RITRON#	REF #	DESCRIPTION	RITRON#
C 101	.001 MF VSP CAP	1501039	J 101	BNC JACK UG-1094/U	2100011
C 102	.1 MF CERAMIC .200	1501059	J 102	UHF FEMALE CHASSIS	2100016
C 103	.01MF CERAMIC	1501049	J 103	MOLEX 2 PIN SOCKET	2100005
C 104	.001 MF VSP CAP	1501039	K 101	DPDT RELAY GUARD 1365	4500002
C 105	1000 MF 35 V RADIAL	1503030	L 101	85 UH; 8A CHOKE	1800014
C 106	1000 MF 35 V RADIAL	1503030	L 102	1 UH WILCO ML10G	1800107
C 107	.001 MF VSP CAP	1501039	L 103	4.5T UNICOIL 115	1850004
C 108	.001 MF VSP CAP	1501039	L 104	4.5T UNICOIL 115	1850004
C 109	.68 PF P100 .1" C	1501001	L 105	4.5T UNICOIL 115	1850004
C 110	.001 MF VSP CAP	1501009	L 106	4.5T UNICOIL 115	1850004
C 111	3.3 PF NPO .1" C	1501009	L 107	2.5T; CW; .2" ID; #20 AWG	1801015
C 112	.68 PF P100 .1" C	1501001	L 108	.15 UH WILCO	1800101
C 113	.1 MF CERAMIC .200	1501059	L 109	.15 UH WILCO	1800101
C 114	3.3 PF NPO .1" C	1501013	L 110	.15 UH WILCO	1850003
C 115	.6.8 PF NPO .1" C	1501013	L 111	3.5T UNICOIL 115	1850003
C 116	.6.8 PF NPO .1" C	1501013	L 112	3.5T UNICOIL 115	1850003
C 117	3.3 PF NPO .1" C	1501009	L 113	2.5T; CW; .2" ID; #20 AWG	1801015
C 118	1.5 PF NPO .1" C	1501005	L 114	.15 UH WILCO	1800101
C 119	.62 PF N100 .1" C	1501002	L 115	2.5T; CW; .2" ID; #20 AWG	1801015
C 120	3.3 PF NPO .1" C	1501013	L 116	3.5T; CW; .2" ID; #20 AWG	1801016
C 121	.6.8 PF NPO .1" C	1501013	L 117	3.5T; CW; .2" ID; #20 AWG	1801016
C 122	6.8 PF NPO .1" C	1501013	Q 101	TIP-30 PNP POWER	4800015
C 123	2-27 PF VARIABLE CAP	1500002	Q 102	2N6724; NPN DARL MED PUR	4800012
C 124	22 PF NPO .1" C	1501019	Q 103	MRF-660, 7.5W UHF PUR	4801004
C 125	68 PF NPO .1" C	1501025	Q 104	MRF-264, 30W UHF PLASTIC	4801003
C 126	.001 MF VSP CAP	1501039	R 101	5 OHM; SW; 10%	4720002
C 127	.01MF CERAMIC	1501049	R 102	100 OHM 1/2W CC	4710020
C 128	.1 MF CERAMIC .200	1501059	R 103	1.5K 1/4W 5% CF	4700135
C 129	.01MF CERAMIC	1501049	R 104	270 OHM 1/4W 5% CF	4700126
C 130	.001 MF VSP CAP	1501039	R 105	150 OHM 1/2W 5% CF	4710022
C 131	22 PF NPO .1" C	1501019	R 106	10K 1/4W 5% CF	4700145
C 132	27 PF NPO .1" C	1501020	Z 101	FERRITE BEAD	1801003
C 133	2-27 PF VARIABLE CAP	1500003	Z 102	FERRITE BEAD	1801003
C 134	33 PF NPO .1" C	1501021	Z 103	FERRITE BEAD	1801003
C 135	100PF CHIP CAP	1504025	Z 104	FERRITE BEAD	1801003
C 136	100PF CHIP CAP	1504025	Z 105	FERRITE BEAD	1801003
C 137	2-27 PF VARIABLE CAP	1500003	Z 106	FERRITE BEAD	1801003
C 138	2-27 PF VARIABLE CAP	1500003	Z 107	FERRITE BEAD	1801003
C 139	3.3 PF NPO .1" C	1501009	Z 108	FERRITE BEAD	1801003
C 140	33 PF NPO .1" C	1501021	Z 109	FERRITE BEAD	1801003
C 141	15 PF NPO .1C	1501017	H 1	18 MM SHIELD CANS	2500003
C 142	15 PF NPO .1C	1501017	H 1	MOUNTING BRACKET	2500012
C 143	68 PF NPO .1" C	1501025	H 1	HEATSINK EXTRUDED	2600002
C 144	22 PF NPO .1" C	1501019	H 1	RUBBER GROMMET HHS 2185	2800006
C 145	15 PF NPO .1C	1501017	H 1	SOLDER LUG, .375", #334	2800007
C 146	CAPACITOR; FACTORY SELECT	1501000	H 1	BRACKET; KEYSTONE #619	2800009
C 147	1 MFD; 50 VDC; ELECT. CAP	1503002	H 1	SLDR LUG; KEYSTONE #909	2800010
C 148	.001 MF VSP CAP	1501039	H 1	LED MOUNTING CLIP	2800011
CR101	1N4001 DIODE	4810003	H 1	4-40 1/4" SLOTTED PAN HD	2801001
CR102	MBO-101	4810010	H 1	#4 X 1/4"; TYPE 25; PHLPS	2801009
CR103	MBO-101	4810010	H 1	SCREW; 10-32 X 1/2"; HEX	2801011
CR104	1N5355A, 18V ZENER	4820119	H 1	SCREW; 4-40 X 3/8" PBHMS	2801012
CR105	1N4001 DIODE	4810003	H 1	4-40 NUT	2802003
DS101	LED RED T-1 3/4	2450001	H 1	NUT; 10-32; SQUARE	2802011
F 1	WIRE; FUSE; #36 AWG	6000036	H 1	#4 INTERNAL WASHER	2803004
			H 1	5' CORX W RT ANGLE PLUG	6001009