I N D E X

SECTION 1 - SERVICE

1 - 1. WARRANTY

SONAR RADIO CORPORATION warrants each instrument manufactured by them to be free from defects in material and workmanship. Our liability under this warranty is limited to servicing or adjusting any instrument which is returned to the factory for that purpose and to replacing any defective parts thereof. This warranty on all parts is effective for one year after delivery to the original purchaser, and for free labor and servicing for ninety days after delivery to the original purchaser, provided that all instructions as to installation, use and operation are followed and the fault has not been caused by misuse, accidents, negligence, alteration, unauthorized repairs or has been damaged by excessive input power, lightning or water-flooding. Warranty of parts shall not include pilot lamps.

1 - 2. SERVICE POLICY

If it is necessary to return a BR-21 to the factory, a letter should first be sent describing the basic trouble. If an authorized service and sales agency is close to the customer, the customer will be so informed; otherwise, the unit will be returned to the factory. Do not return the unit without factory authorization.

1 - 3. PACKING FOR RETURN

The return of any item to Sonar Radio Corporation is the responsibility of the customer; therefore, all items should be carefully packed and insured. All transportation charges are to be prepaid by the purchaser.

1 - 4. CHANGES

Sonar Radio Corporation reserves the right to modify or change any design or equipment, mechanically or electrically, to any degree as is necessary without Sonar Radio Corporation being liable to modify, change or exchange previously delivered equipment.

SECTION 2 - FCC

2 - 1. FCC REGULATIONS

The operation of the BR-21 is governed by the FCC Rules and Regulations set forth in Parts 10, 11 and 16. A copy of these rules is available from the Department of Commerce and should be in possession of the operator.

Only those personnel holding 2nd class Radiotelephone licenses or higher may perform any transmitter maintenance or tune-up on this equipment.

The Driver-Transmitter frequency must be checked at least every six months. (11.108 (a) (3) FCC Reg.)

Operation of this equipment requires an FCC license. Failure to comply is punishable by penalties set forth in the Rules and Regulations of the FCC.

2 - 2. The BR-21 complies with FCC Regulations when shipped from the factory.

2 - 3. The Driver-Transmitter for the BR-21 must be FCC type accepted under Parts 10, 11 and 16 in order that the system be valid.

SECTION 3 - DESCRIPTION

3 - 1. DESCRIPTION

The Sonar BR-21 is a Linear R. F. Power Amplifier designed to be used with any AM or FM transmitter and receiver unit capable of delivering one or more watts of power to a 50 ohm load, such as the Sonar BR-20. The BR-21 operates in two ranges between 25 - 50 mc. A model is available for the 6 meter amateur band only.

The BR-21 is automatically switched from standby (receive) to the transmitting mode by a unique R. F. detection and switching circuit. This circuit eliminates the need of any external relay circuits. The forced-air cooling system allows the BR-21 to operate continuously.

3 - 2. PANEL CONTROLS

A. FRONT

ON/OFF SWITCH: Turns power on and is indicated by the red indicator.

METER SWITCH: Has three positions: P. A. Plate Current, OFF, and R. F. Indicator.

B. REAR

PLATE TUNING and ANTENNA LOADING: Located adjacent to the R. F. output connector near the top of the rear panel.

INPUT CONNECTOR: Located near the bottom.

NOTE: The Antenna Loading screw tightens in a counter-clockwise direction. Excessive tightening should be avoided to prevent breakage.

3 - 3. R. F. DRIVE REQUIREMENTS

The BR-21 requires a minimum drive of 1 watt power input within the frequency range of 25 - 50 mc. The BR-20 will provide 7 - 8 watts input for an output of around 30 watts. See Fig. 3.

3 - 4. OPERATION

A. AM

In order to operate the BR-21 as a Linear Amplifier for AM transceivers, it is necessary to reduce the maximum power output by decreasing the loading capacity of C9 so that the relative power output, as indicated on the panel meter, is reduced by 20% of maximum reading. See Fig. 2.

B. FM

For FM operation do not reduce the maximum power output.

3 - 5. SPECIFICATIONS

Size	4-3/4" high X 8-1/4" wide X 10-1/4" deep
Weight	12 lbs.
Frequency Range	25 - 50 mc.
Mode	AM
Duty	Continuous
Drive requirements	1 to 10 watts
Input impedance	50 ohms
Output impedance	50 ohms
Noise level	Better than 80 db.
Harmonic output	Better than 60 db.**
Power requirements:	
Amplifier on	110 - 120 VAC 60 cycles 180 Watts or 12 VDC @ 21 Amp.
Amplifier standby	110 - 120 VAC 60 cycles 90 Watts or 12 VDC @ 7.5 Amp.

**See Section 2 - 3.

SECTION 4 - INSTALLATION

4 - 1. INSPECTION

A. PHYSICAL

Prior to installation, the BR-21 should be opened and the top shield cover removed to take out the filler that is holding down the tubes during shipment. An examination of the entire unit will disclose any possible physical damage. See "Service Policy" for method of reporting any damage.

B. ELECTRICAL

Plug the BR-21 into proper power source. Turn power switch on. Pilot lamp should light and cooling fan should be turning as evidenced by a draft of air out the rear and top of the BR-21.

4 - 2. INSTALLATION

Every installation should provide 3 inches of space around the BR-21 to allow for adequate ventilation and cooling.

A. 110 - 120 VAC (See Fig. 1A)

When the BR-21 operates from 110 - 120 VAC a 3 wire AC plug and cord are provided to permit grounding of the chassis to the electrical ground. A 2 foot coaxial cable and two UHF connectors are provided to connect the BR-21 to the driver-transmitter. Fig. 1A illustrates all the cable connections. An auxiliary AC outlet for the BR-20 is provided on the rear of the BR-21.

B. MOBILE, 12 VDC, NEGATIVE GROUND (See Fig. 1B and 1C)

The BR-21 (12 VDC) has a starting relay (Ry3) to handle the heavy input current. One side of the relay coil is grounded so that + 12 VDC is necessary to energize the relay. This + 12 VDC is applied to the "START" terminal on the rear of the BR-21. When used with a BR-20 the "START" terminal is connected to pin 2 of the BR-20 power cable socket so that the BR-20 power switch will also turn on the BR-21.

Other units similar to the BR-20 can be used, but the start circuit shown in Fig. 1C should be used.

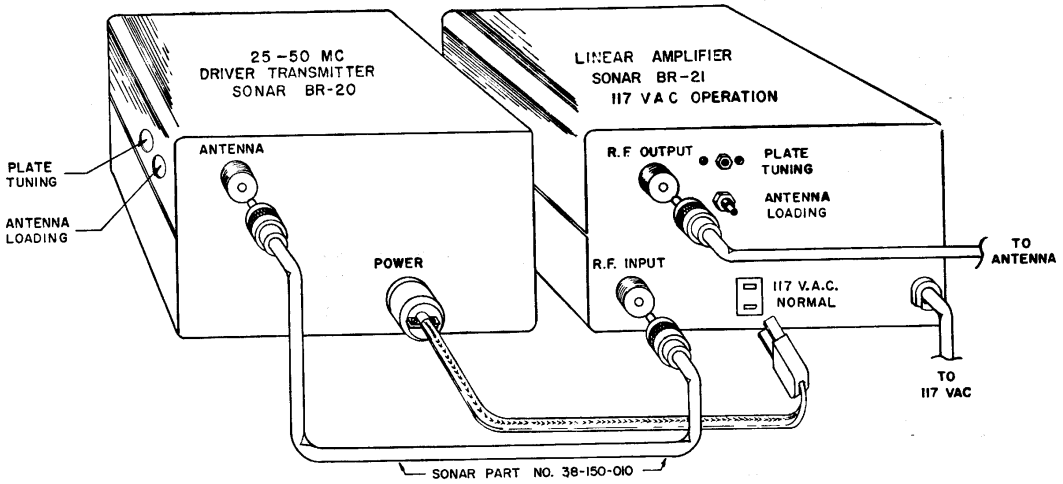


FIG. IA INSTALLATION DIAGRAM
117 VAC OPERATION

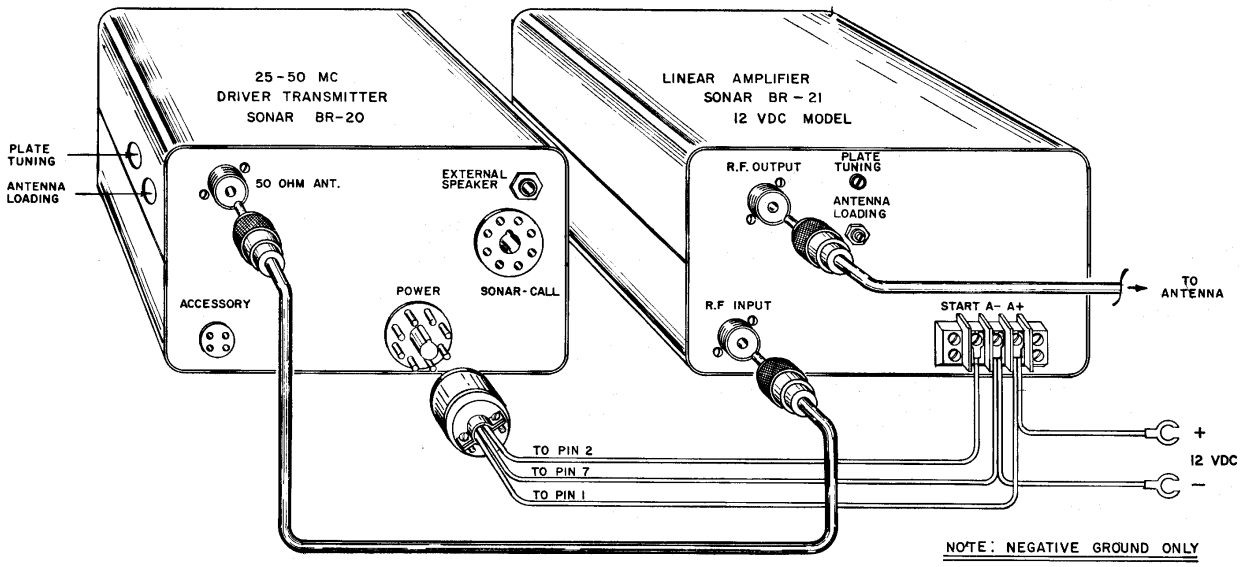


FIG. 1B INSTALLATION DIAGRAM
12 VDC OPERATION

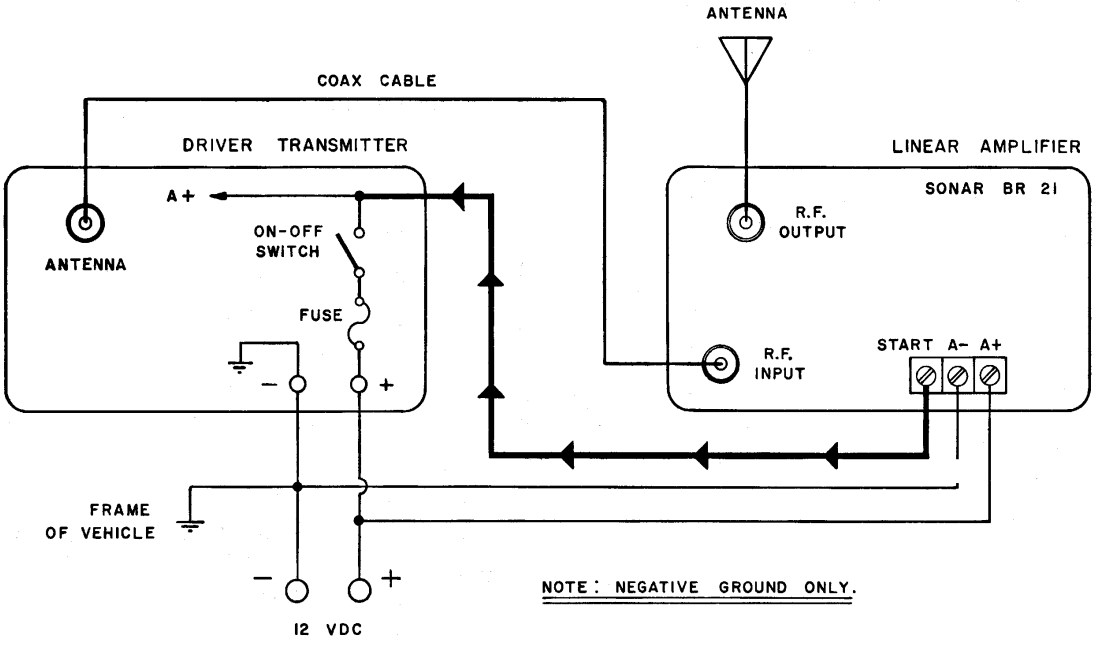


FIG. 1C INSTALLATION DIAGRAM

FOR DRIVER TRANSMITTER OTHER THAN SONAR BR 20

START CONTACT OF BR-21 TO BE CONNECTED TO SWITCHED A+ OF DRIVER TRANSMITTER

SECTION 5 - OPERATION

5 - 1. FREQUENCY RANGE ADJUSTMENT

The BR-21 is shipped from the factory for the 25 - 32 mcs. range. If operation in the second range is required, then certain adjustments must be made. Capacitor C10 is connected with a jumper lead soldered across terminals such that the removal of this jumper lead removes the capacity from the circuit. The following chart indicates the necessary changes:

Range	C4	L6	C10
25 - 32 mc.	Adjust for Maximum Drive*	Jumper Disconnected	Jumper Connected
32 - 50 mc.		Jumper Connected	Jumper Disconnected

*Drive is indicated by maximum P. A. plate current or R. F. Indication.

5 - 2. TUNING ADJUSTMENTS

A. AM

(1) It is assumed that the Driver-Transmitter has been tuned previously into a 50 OHM antenna or dummy load.

(2) Place the meter switch in the P. A. Plate current position. The meter should read a standby resting current of 50 - 70 ma.

(3) Depress the microphone button. The BR-21 relays should close and the P. A. Plate current rise upscale to 100 - 300 ma. This reading indicates drive.

(4) Readjust the Driver-Transmitter (BR-20) Tuning and Loading controls for maximum drive of the BR-21. Repeat until no further increase is noted.

(5) C4 may now be adjusted for maximum drive indication. Repeat step (4).

(6) Switch Meter to R. F. Indicator and adjust the BR-21 Plate Tuning and Antenna Loading controls until a maximum R. F. indication is noted. Adjust R14 (R. F. Indicator Set) for 500 or full scale.

(7) Rotate the Antenna Loading control clockwise until the R. F. indicator reads 80% of the R. F. indication as noted in step (6). The 0-500 scale may be used for a reference. Readjust Plate Tuning control for maximum R. F. indication. Continue adjustment until the 80% reading or 400 on the meter is obtained. SEE Fig. 2.

B. FM

Follow steps (1) to (6) inclusive.

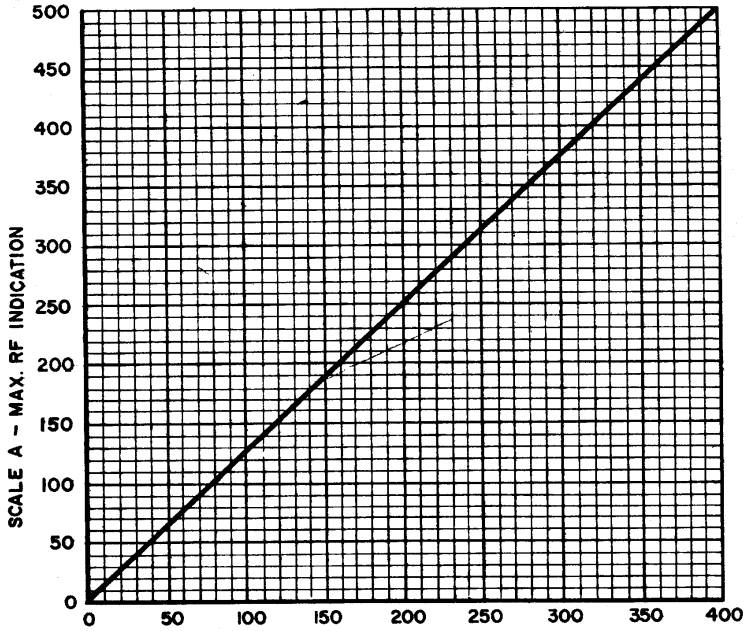


FIG. 2 – AM TUNING INDICATION

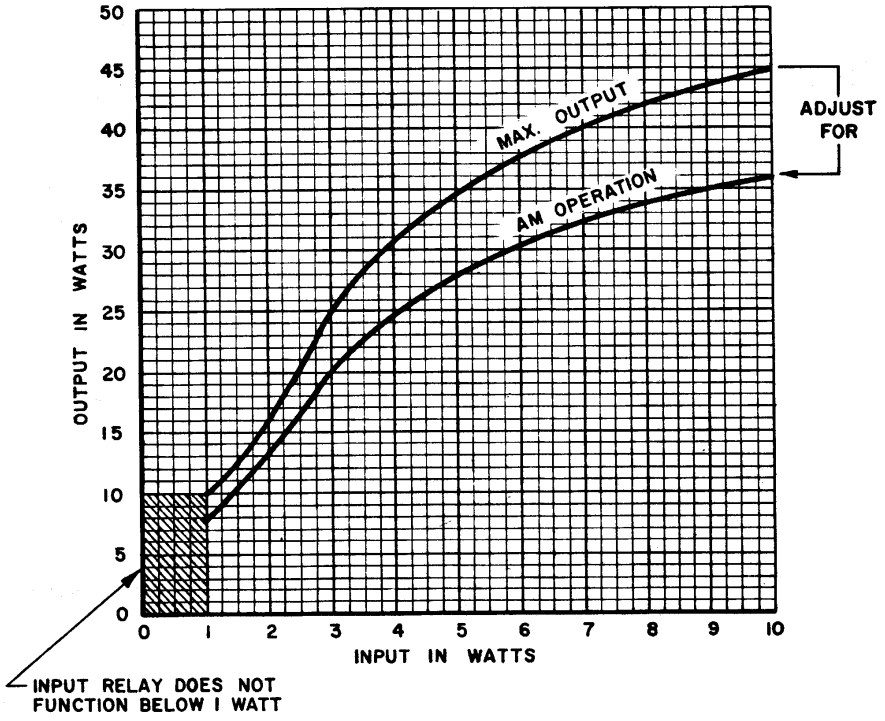


FIG. 3 - TYPICAL BR-21 OPERATION
INPUT VERSUS OUTPUT

5 - 3. USE OF DRIVER-TRANSMITTER ONLY

If the higher power of the BR-21 is not required, the BR-21 may be turned off. The Driver-Transmitter will now operate as normal as though the BR-21 was not in the system. The R. F. Indicator of the BR-21 will indicate the BR-20 relative power output.

SECTION 6 - CIRCUITRY

6 - 1. AUTOMATIC TRANSMIT FEATURE

The BR-21 will automatically switch to the transmit mode when the input is energized by 1 watt or more of RF energy. The diode D1 rectifies this R. F. and applies the negative resultant voltage to the grid (pin 7) of V1A (12AT7). The plate voltage of V1A rises to maximum. V1A is DC coupled to V1B. When the voltage on the grid (pin 2) of V1B rises positively the tube conducts heavily, thereby energizing RY-1. RY-1 energizes RY-2, placing the BR-21 in the transmit mode.

6 - 2. POWER SUPPLY

A. 110 - 120 VAC

The power supply primary source is 110 - 120 VAC 60 cycles. The network L8, L9, C13 to C16 is the powerline R. F. Filter. D3 - D6 is a full wave bridge. The DC output of D3 - D6 is 450 VDC. The transformer T1 center tap provides 225 VDC for V1 and the relays. C17, C18, C19, C26, R15 and R16 form the DC filter network. R17 and R19 bleed the DC charge from C17, C18, and C19 when the BR-21 is turned off.

B. 12 VDC

This power supply consists of a transistor power oscillator generating square waves. R22, R23 and C32 is a starting circuit. R25 regulates bias for Q1 and Q2. R24 controls feedback. C27, C28, C29, C30, C31, CH1 and CH2 is a filter network which prevents motor brush noise from feeding into the receiver. RY-3 is a starting relay that switches heavy primary current. The start terminal on the voltage input strip must be wired to Pin 2 of power cable socket of BR-20. If driver-transmitter is other than a BR-20 then start terminal should receive + 12 VDC to turn BR-21 "ON". This feature allows the BR-21 to be operated from a remote position. Example: BR-20 is mounted under the dashboard of a vehicle while the BR-21 is mounted in the trunk.

6 - 3. R. F. POWER AMPLIFIER

Four (4) 6JB6's are connected such that the control, screen and suppressor grids are tied together to form a common grounded grid. The cathodes are

driven from the C4 and L1 matching network at the input of the BR-21. RFC1 isolates the cathodes from RF ground and provides a DC return. R11 is the Plate Current meter shunt. The output network L6, C8, C9 and C10 matches the P. A. plate impedance to the 50 OHM antenna load. L6 has a shorting bar permanently attached at only one end. For higher frequency operation, this shorting bar is connected at the coil terminal to short out two turns. C4 is adjusted for minimum SWR between the BR-20 and BR-21.

SECTION 7 - MAINTENANCE

7 - 1. CONDITION OF THE 6JB6's may be observed by noting the P. A. Plate current when the BR-21 was initially tuned. More than 10% deterioration of plate current requires that the 6JB6's be changed to insure reliability of the BR-21.

7 - 2. RELAYS THAT FAIL TO CLOSE might indicate that D1 or V1 should be changed.

7 - 3. RELAYS THAT ACT INTERMITTANT might indicate poor condition of D1 or V1 or any of the components in the Circuit. Refer to Sec. 7 - 4.

7 - 4. TEST VOLTAGES (VDC)

12AT7 PIN	STANDBY	TRANSMIT
1	+ 225	+ 150
2	+ 2.7	+ 16
3	+ 6.0	+ 17
4	0	0
5	12**	12**
6	+ 15	+ 100
7	- 1.1	- 6
8	0	0
9	—	—
6JB6's		
Bottom of RFC2	+ 480	+ 430*

* Varies slightly with loading and primary source.
** VDC or VAC depending on version.

7 - 5. FAN MOTOR

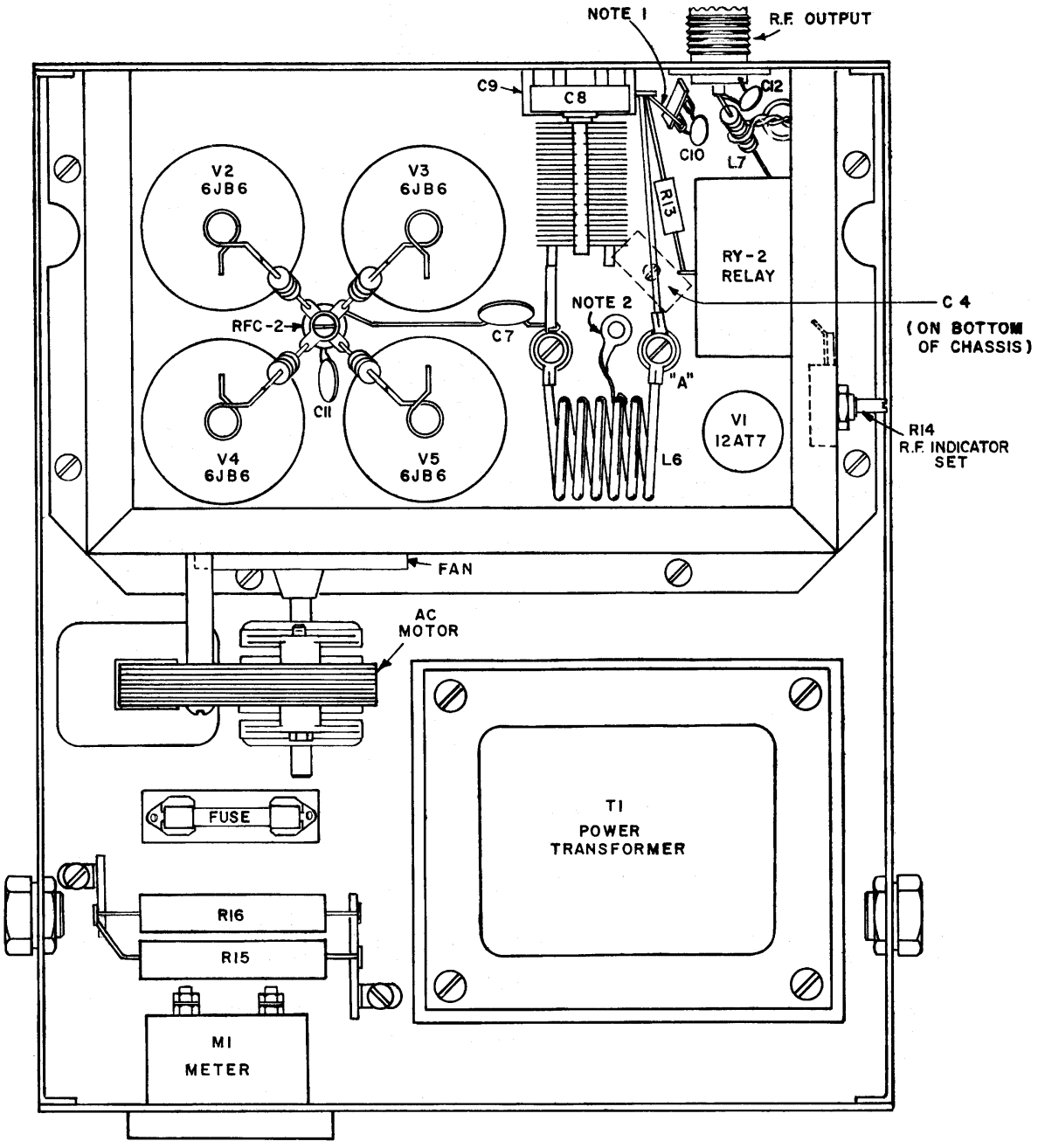
The fan motor requires no lubrication. Should the bearings ever wear and become very noisy, they can be replaced. Do not oil the motor bearing as this will only splatter oil throughout the equipment.

7 - 6. RELAY CONTACTS

The relay contacts should be cleaned using only a piece of paper saturated with contact cleaner. Provide adequate ventilation when using volatile fluids.

SECTION 8 - PARTS IDENTIFICATION

8 - 1. MODEL BR-21 (117 VAC)



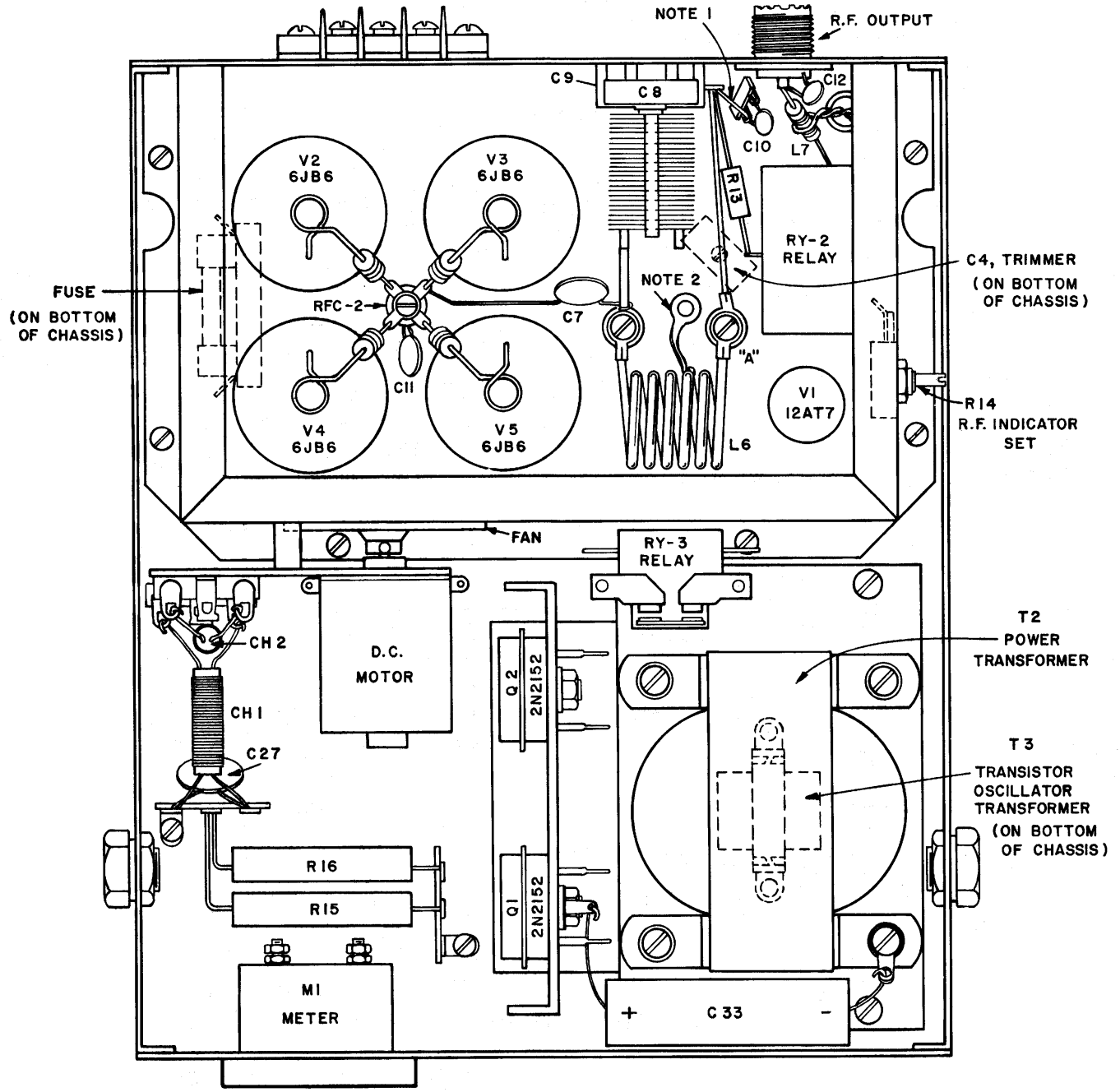
NOTES

1. DISCONNECT JUMPER LEAD FOR 32-50 MC RANGE
2. CONNECT LUG TO POINT "A" FOR 32-50 MC RANGE

FIG. 4 MODEL BR-21 (117 VAC), PARTS IDENTIFICATION

TOP VIEW

8 - 2. MODEL BR-21 (12 VDC)



NOTES

1. DISCONNECT JUMPER LEAD FOR 32-50 MC RANGE.
2. CONNECT LUG TO POINT "A" FOR 32-50 MC RANGE.

FIG. 5 MODEL BR-21 (12 VDC), PARTS IDENTIFICATION

TOP VIEW

SECTION 9 - MODEL BR-21 PARTS LIST

DIAGRAM NO.	DESCRIPTION	SONAR PART NO.
V1	Electron Tube, 12AT7	19-010-005
V2, 3, 4, 5	Electron Tube, 6JB6	19-010-051
D1, 2	Diode, Germanium, IN295	19-050-001
D3, 4, 5, 6	Diode, Silicon, 600 PIV	19-040-002
B1	Bulb, Pilot, #1892	19-060-002
M1	Meter	32-010-009
RY-1	Relay, 3 PDT, 110 VDC	16-010-002
RY-2	Relay, SPDT, 110 VDC	16-030-002
L1	Coil, Input	22-150-001
L6	Coil, Output	22-070-005
L7	Coil, Low Pass Filter	22-090-003
RFC-1	Choke, Radio Freq., 10 UH	22-060-020
RFC-2	Choke, P.A. Plate	22-060-019
SW-1	Switch, Meter Selector	10-030-013
SW-2	Switch, Power On-Off	10-010-002
R1	Resistor, Fixed, Composition 10 M Ohm, ± 10%, 1/2 W	01-106-531
R2	Resistor, Fixed, Composition 470 K Ohm, ± 10%, 1/2 W	01-474-531
R3, 4	Resistor, Fixed, Composition 4.7 M Ohm, ± 10%, 1/2 W	01-475-531
R5	Resistor, Fixed, Composition 1 M Ohm, ± 10%, 1/2 W	01-105-531
R6	Resistor, Fixed, Composition 2.2 K Ohm, ± 10%, 1/2 W	01-222-531
R7, 8, 9, 10	Resistor, Fixed, Composition 47 Ohm, ± 10%, 1 W	01-470-631
R11	Resistor, Fixed, Composition 0.36 Ohm, ± 5%, 1/2 W (two connected in parallel)	01-368-521
R12	Resistor, Fixed, Composition 470 Ohm, ± 10%, 1/2 W	01-471-531
R13	Resistor, Fixed, Composition 3.9 K Ohm, ± 10%, 1 W	01-392-631
R14	Resistor, Variable, Composition 1 K Ohm, RF Indicator Set	03-102-035
R15	Resistor, Fixed, Wirewound 12 Ohm, ± 10%, 10 W	02-120-522
R16	Resistor, Fixed, Wirewound 62 Ohm, ± 10%, 15 W	02-620-822
R17, 19	Resistor, Fixed, Composition 150 K Ohm, ± 10%, 2 W	01-154-731
R18	Resistor, Fixed, Composition 62 Ohm, ± 10%, 1/2 W	01-620-531

MODEL BR-21 PARTS LIST (continued)

DIAGRAM NO.	DESCRIPTION	SONAR PART NO.
R20, 21	Resistor, Fixed, Wirewound 2.5 Ohm, ± 10%, 3 W	02-257-322
C1	Capacitor, Fixed, Ceramic 2.7 MMFD, 1 KVDC	04-276-001
C2, 3, 5, 6	Capacitor, Fixed, Ceramic .001 MFD, 500 VDC	04-103-004
C4	Capacitor, Variable, Compression 15 - 200 MMFD	09-210-021
C7	Capacitor, Fixed, Ceramic 100 MMFD, 2 KVDC	04-104-020
C8	Capacitor, Variable, Air, Plate Tuning	08-150-015
C9	Capacitor, Variable, Compression 100 - 500 MMFD Antenna Loading	09-210-001
C10	Capacitor, Fixed, Dur-Mica 150 MMFD, 500 VDC	07-154-002
C11	Capacitor, Fixed, Ceramic .001 MFD, 1400 VDC	04-103-015
C12	Capacitor, Fixed, Ceramic 25 MMFD, 1 KVDC	04-255-001
C17, 18, 19, 26	Capacitor, Fixed, Electrolytic 40 MFD., 450 VDC,	06-130-027
C20, 21, 22, 23, 24, 25	Capacitor, Fixed, Ceramic .01 MFD, 100 VDC	04-102-003
	Fan, 2" Dia.	27-050-001
J1, 2	Connector, RF Input & Output SO-239	15-120-001
	Socket, Novar	13-020-005
	Socket, 9 Pin	13-020-002
	Fuse Holder	42-020-003
	Knob	33-010-008
	Interconnection Cable with (2) Two UHF Connectors	38-150-010
	Instruction Manual	44-010-018A

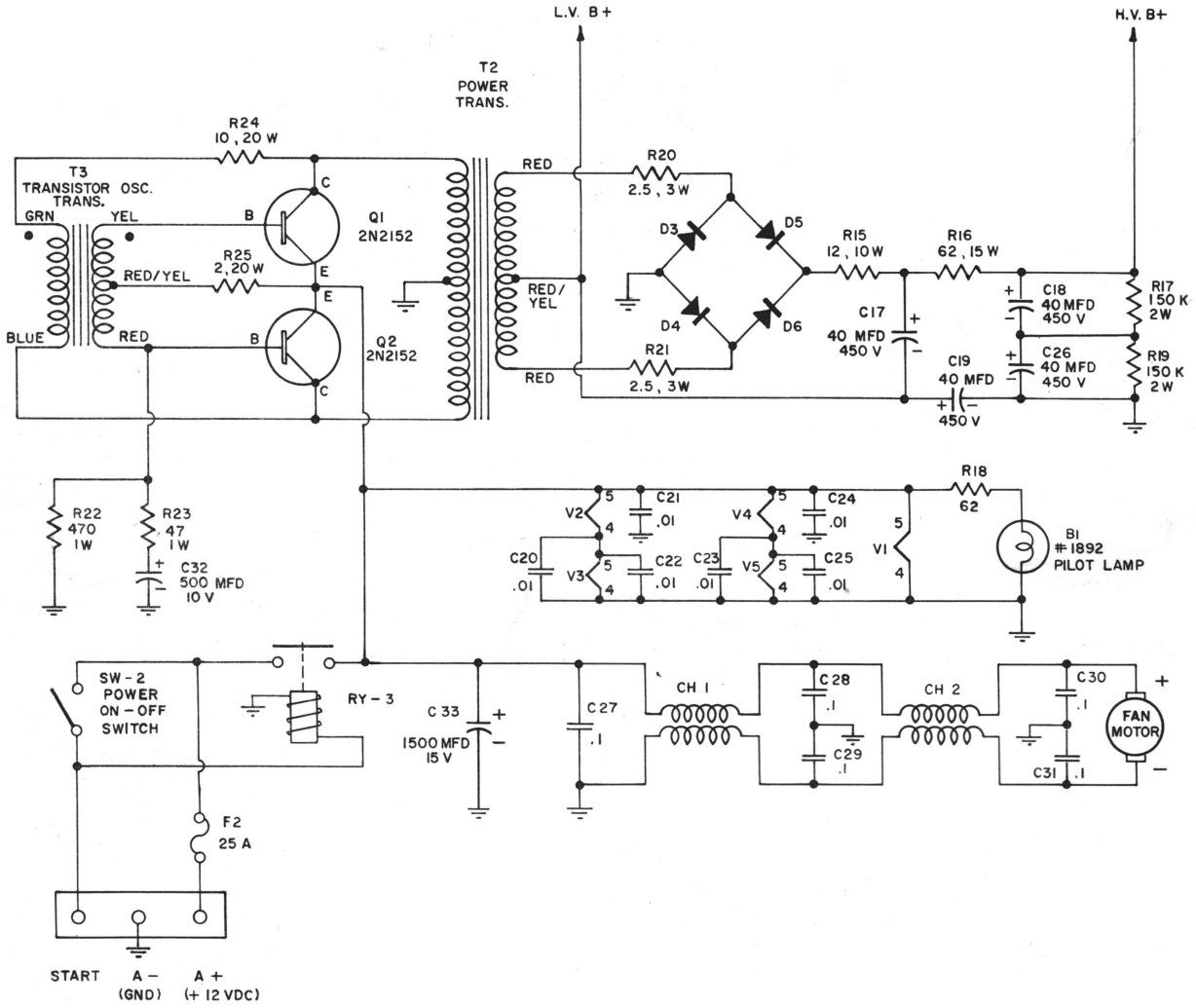
BR-21 (117 VAC)

T1	Transformer, Power	14-010-030
L8, 9	Coil, Line Filter Choke	22-100-006
F1	Fuse, 3AG, 3A	42-010-012
C13, 14, 15	Capacitor, Fixed, Ceramic .01 MFD, 600 VDC	04-102-012
	Fan Motor (AC)	27-040-001

MODEL BR-21 PARTS LIST (continued)

DIAGRAM NO.	DESCRIPTION	SONAR PART NO.
	BR-21 (12 VDC)	
T2	Transformer, Power	14-010-033
T3	Transformer, Transistor Oscillator	14-010-002
Q1, 2	Transistor, Power. 2N2152	19-020-019
RY-3	Relay, SPST, 12 VDC	16-050-001
	Fan Motor (DC)	27-030-001
F2	Fuse, 3AG, 25 A.	42-010-019
CH1, 2	Choke, Bi-Filar	22-100-007
R22	Resistor, Fixed, Composition 470 Ohm, ± 10%, 1 W	01-471-631
R23	Resistor, Fixed, Wirewound 47 Ohm, ± 10%, 1 W	01-470-631
R24	Resistor, Fixed, Wirewound 10 Ohm, ± 10%, 20 W	02-100-622
R25	Resistor, Fixed, Wirewound 2 Ohm, ± 10%, 20 W	02-207-622
C27, 28, 29, 30, 31	Capacitor, Fixed, Ceramic 0.1 MFD, 100 VDC	04-101-003
C32	Capacitor, Fixed, Electrolytic 500 MFD, 10 VDC	06-130-006
C33	Capacitor, Fixed, Electrolytic 1500 MFD, 15 VDC	06-130-033

NOTES



12 VDC POWER SUPPLY