

## MODEL HA-20

## OPERATING AND SERVICE INSTRUCTIONS

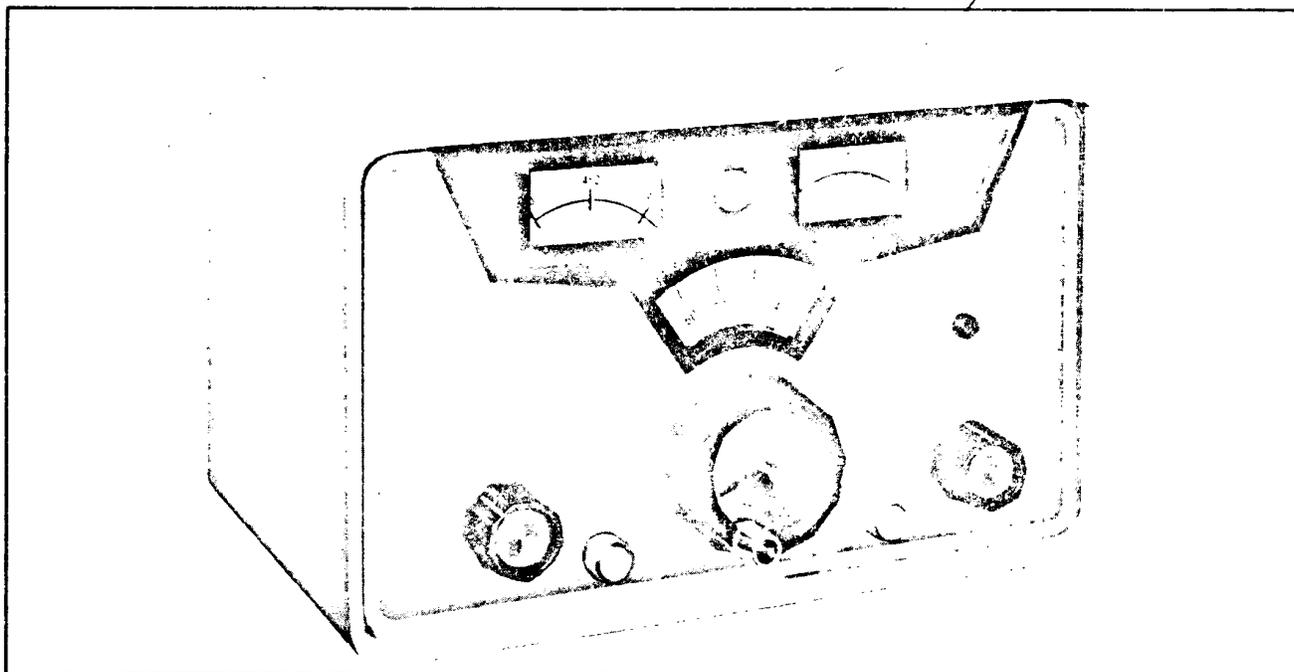


Figure 1. Hallicrafters Model HA-20.

156-008219

## DESCRIPTION

The HA-20 is a self powered accessory unit, for use with an SR-400 or SR-2000 transceiver. It enables the operator to select transmit and receive frequencies that are separated by as much as 500 KC within any band segment. It also provides the choice of two transceive frequencies when manually switched, (HA-20 FUNCTION switch), between R & T and STBY. The HA-20 provides a position, (DUAL R) that permits the operator to monitor two receive frequencies simultaneously, separated by as little as 5 KC or as much as 500 KC. In this position the transmitter portion of the transceiver is inoperative.

The HA-20 calibration may be checked against the 100 KC crystal calibrator in the transceiver. A red panel indicator light provides visual reminder when the HA-20 is controlling the frequency. With the HA-20 OPERATION switch in the OFF or STBY position, normal transceiver operation is restored.

A VSWR indicator, complete with calibrated VSWR meter, METER switch, and METER SENS, control is also included in the HA-20. An external coupler is supplied for sampling the 50-ohm transmission line. This unit will handle the full output of the SR-400 or SR-2000 and may be permanently

connected in the line for full time indication of VSWR or relative transmitter power output. This unit may also be used for checking other antenna systems up to approximately 450 MC. Power required for full scale forward meter reading varies with frequency and will be approximately 90 watts at 1.8 MC and 1 watt at 450 MC.

## INSTALLATION

To install the HA-20 with either the SR-400 or SR-2000, proceed as follows:

1. Remove the 11-pin jumper plug from the ACCESSORY socket (rear of transceiver).
2. Install the 11-pin cable plug from the HA-20 in the same socket.
3. Connect the 50-ohm coaxial cable from transceiver ANTENNA output to VSWR coupler receptacle marked TRANSMITTER.
4. Connect the 50-ohm antenna cable to VSWR coupler receptacle marked ANTENNA.
5. Connect the black wire from VSWR coupler to terminal marked FWD on rear of HA-20.
6. Connect the red wire to terminal marked REV.

7. Connect the outer shield of this 2 wire cable to terminal marked GND.

8. Install AC line cord into receptacle supplying 105/125 volts, 60 cycles, 20 watts.

#### CAUTION

To prevent meter damage, rotate METER SENS. control counterclockwise to MIN. until transmitter power output level has been established. Rotate clockwise as necessary to obtain desired meter indication.

#### OPERATION

Tune the transceiver on the desired band. Set the FUNCTION switch on the transceiver to REC.

1. Rotate the HA-20 FUNCTION switch to STBY and allow several minutes for warmup.

2. To check the HA-20 dial calibration, turn on the crystal calibrator in the transceiver. Tune the transceiver dial to the 100 KC point nearest the desired frequency and peak PRESELECTOR.

3. Rotate the HA-20 FUNCTION switch to R & T.

4. Rotate the HA-20 dial to the 100 KC point nearest the desired frequency and rotate the HA-20 CAL. ADJ. control as necessary to obtain zero beat.

5. Turn off the crystal calibrator in the transceiver.

6. Rotate the HA-20 dial to the desired frequency and repeak the PRESELECTOR on the transceiver if necessary.

7. Rotate the HA-20 FUNCTION switch to "T". At this time the transceiver VFO is restored to operation. The HA-20 will control the transmit frequency and the transceiver VFO will control the receive frequency. No further manual switching is required.

#### CAUTION

When phone operation is used, the HA-20 must be kept within the phone portion of the band. The PRESELECTOR should always be tuned to the transmit frequency.

Some degradation in receiver gain may be noted on the lower frequency bands, when receiving a frequency far removed from the fre-

quency at which the transmitter was tuned. As stated above, the PRESELECTOR should always be tuned to the transmit frequency.

To restore normal transceiver operation, turn the HA-20 OPERATION switch to STBY or OFF.

#### VSWR METER OPERATION

Preliminary checks on any antenna system should be made at reduced power, to avoid possible transmitter damage and to minimize QRM.

1. Tune transmitter to desired operating frequency.

2. Place HA-20 METER switch in CALIB. position.

3. Adjust HA-20 METER SENS. control and/or transmitter output level for exactly full scale meter reading (CAL mark).

4. Without disturbing level adjustments, turn HA-20 METER switch to VSWR and read the standing wave ratio on the upper meter scale.

Checks may be made at the low, mid and high frequency portions of a band to determine the antenna characteristics, so that proper matching adjustments may be made.

Adjustments on the antenna system should always be made for the lowest possible VSWR reading at the frequency you normally operate. Readings higher than 2:1 should be considered excessive and steps should be taken to correct the antenna system. Never attempt to prune the coaxial feed-line to reduce this reading. The adjustment must be made at the antenna.

As previously stated, this VSWR meter may be used for checking other antenna systems. No AC power is required for the HA-20 when using the VSWR meter; therefore, it can be used at any convenient place.

#### CIRCUIT FUNCTION VS. OPERATION SWITCH POSITION

OFF	117 VAC line open. Bias line to transceiver VFO grounded. Transceiver VFO operates in receive and transmit.
STBY	117 VAC applied to HA-20. Filament, B+ and dial lights on. Bias line to transceiver VFO grounded. HA-20 VFO biased off by transceiver. Transceiver VFO operates in receive and transmit.

**T** 117 VAC supplied to HA-20. Filament, B+ and dial lights on. Transceiver VFO operates in receive only. HA-20 VFO operates in transmit only. Red panel light on in transmit only.

**R & T** 117 VAC supplied to HA-20. Filament, B+ and dial lights on. Transceiver VFO turned off. HA-20 VFO controls both transmit and receive frequencies. Red panel light on in transmit and receive.

**DUAL R** 117 VAC supplied to HA-20. Filament, B+ and dial lights on. Transceiver VFO and HA-20 VFO both on transceive. Both VFO's off in transmit. Red panel light on in receive only.

#### NOTE

In DUAL R function the two VFO's will produce a beat note if tuned to less than 5 KC apart.

#### CHASSIS REMOVAL

Remove the four retaining screws at the bottom of the cabinet and slide the chassis and panel assembly out of the front of the cabinet.

#### TUBE AND DIAL LAMP REPLACEMENT

Access to all tubes and dial lamps may be had by removing the four chassis retaining screws at the bottom side of the cabinet and sliding the chassis and panel assembly out of the front of the cabinet.

#### VFO CALIBRATION ALIGNMENT

##### A. Mechanical Index

As each 100 KC mark on the main dial indexes with its fiducial, the zero mark on the knob dial should also index with its fiducial. If there is a fixed error between these dials, remove the tuning knob with a No. 8 Bristol set screw wrench to expose the knob dial bushing. Set the main dial to any 100 KC mark. Loosen the knob dial set screw wrench and rotate the knob dial with respect to the knob shaft until the zero mark lines up with its fiducial. Tighten the set screw. Replace the knob with approximately 1/32-inch clearance between the knob and panel.

If a service operation involved disconnecting the VFO gang from the gear drive, re-index the gang as follows:

1. Rotate the tuning knob clockwise to the mechanical stop.

2. Loosen the two No. 6 Bristol set screws holding the drive gear to the VFO gang shaft.

3. Rotate the gang capacitor to fully mesh the capacitor and tighten one of the set screws.

4. Rotate the knob exactly 30 KC in the counterclockwise direction.

5. Loosen the set screw again and without disturbing the VFO gang setting, turn the tuning knob clockwise to the knob dial zero. (The main dial will now also be indexed at the high frequency end of the dial.)

6. Tighten both set screws securely and replace the VFO compartment cover, before recalibrating the VFO electrically.

##### B. VFO Calibration (Trimmer Adjustment Only).

A trimmer capacity correction is indicated if the dial calibration checks across the dial, at the 100 KC check points, consistently falls to one side of the fiducial and cannot be corrected by the CAL ADJ. control. The main dial and knob dial must be correctly indexed as outlined in VFO calibration alignment, "A" and the calibration check should be run with the transceiver FUNCTION control set at LSB. Recalibrate the VFO as follows:

1. Remove and operate the chassis assembly outside of the cabinet (see chassis removal) to gain access to the adjustment screw of trimmer C4 (figure 3).

2. Set the transceiver controls as follows: BAND SELECTOR at 3.5, OPERATION at REC., FUNCTION at LSB, PRESELECTOR at 80M segment, OFF/CAL at CAL, NOISE BLANKER at OFF, and RIT CONTROL AT OFF.

3. Center the CAL ADJ. control on the Model HA-20 DX adapter. The dot on the knob should fall at top dead center.

4. Set the dial for exactly 3500 KC (red 500 on main dial and black zero on knob dial). Rotate the Model HA-20 FUNCTION switch to the R & T position. Carefully adjust trimmer C4 for zero beat.

5. Check calibration across the dial at the 100 KC check points. If the frequency error is less than approximately 2000 CPS, the calibration is within acceptable limits. If the error increases and exceeds 2000 CPS at the high frequency end of the dial, the VFO will require a coil adjustment in addition to the trimmer adjustment.

#### C. VFO Calibration (Trimmer and Coil Adjustments).

If the dial error progressively increased in the same direction with the high frequency end of the dial running out more than 2000 CPS, both coil L1 and trimmer C4 will require adjustment. Recalibrate the VFO as follows:

1. Set the transceiver and DX adapter controls per steps 2 and 3 in VFO calibration alignment, "B".

2. Set the tuning dial for exactly 4000 KC (VFO = 4350.000 KC) and adjust coil L1 for zero beat.

3. Set tuning dial for exactly 3500 KC (VFO = 4850.000 KC) and adjust trimmer C4 for zero beat.

4. Repeat steps 2 and 3 until both the 3500 KC and 4000 KC settings are exactly on frequency.

5. Check the calibration across the dial at the 100 KC points. If the frequency error is less than 2000 CPS, the calibration is within acceptable limits. If the error is in excess of 2000 CPS at any of the mid points, with the end limits at zero error, the VFO capacitor C5 should be "knifed". This operation should not be attempted by other than qualified personnel thoroughly familiar with the technique.

6. Set the dial at 3800 KC and tune to exact zero beat with the marker crystal oscillator. Switch the FUNCTION control on the transceiver from LSB to USB. If the frequency shifts more than 15 CPS, the VFO corrector trimmer C19 must be adjusted per paragraph D.

#### D. VFO Corrector Adjustment.

The VFO corrector trimmer (C19) shifts the VFO frequency approximately 3000 CPS to correct for the difference in frequency between the upper and lower sideband BFO/carrier crystal frequencies. The trimmer is switched into the VFO circuit in the upper sideband mode. To check the corrector trimmer setting, operate the transceiver in the LSB mode and tune with the DX adapter (R & T position) to zero beat with the 3800 KC marker frequency. Switch to USB mode. There should be less than a 15 CPS change in frequency. If the change is more than 15 CPS, carefully adjust trimmer C19 until the difference between USB and LSB is less than 15 CPS.

#### SERVICE OR OPERATING QUESTION.

For further information regarding operation or servicing of this unit, contact the dealer from whom it was purchased. The Hallicrafters Company maintains an extensive system of Authorized Service Centers where any required service will be performed promptly and efficiently at no charge if this equipment is delivered to the service center within 90 days from date of purchase by the original buyer and the defect falls within the terms of the Warranty. It is necessary to present the bill of sale in order to establish warranty status. After the expiration of the warranty, repairs will be made for a nominal charge. All Hallicrafters authorized service centers display the sign shown below. For the one nearest you, consult your dealer or your local telephone directory.

Make no service shipments to the factory unless instructed to do so by letter, as the Hallicrafters Company will not accept responsibility for unauthorized shipments.

The Hallicrafters Company reserves the privilege of making revisions in current production and assumes no obligation to incorporate such revisions in earlier models.



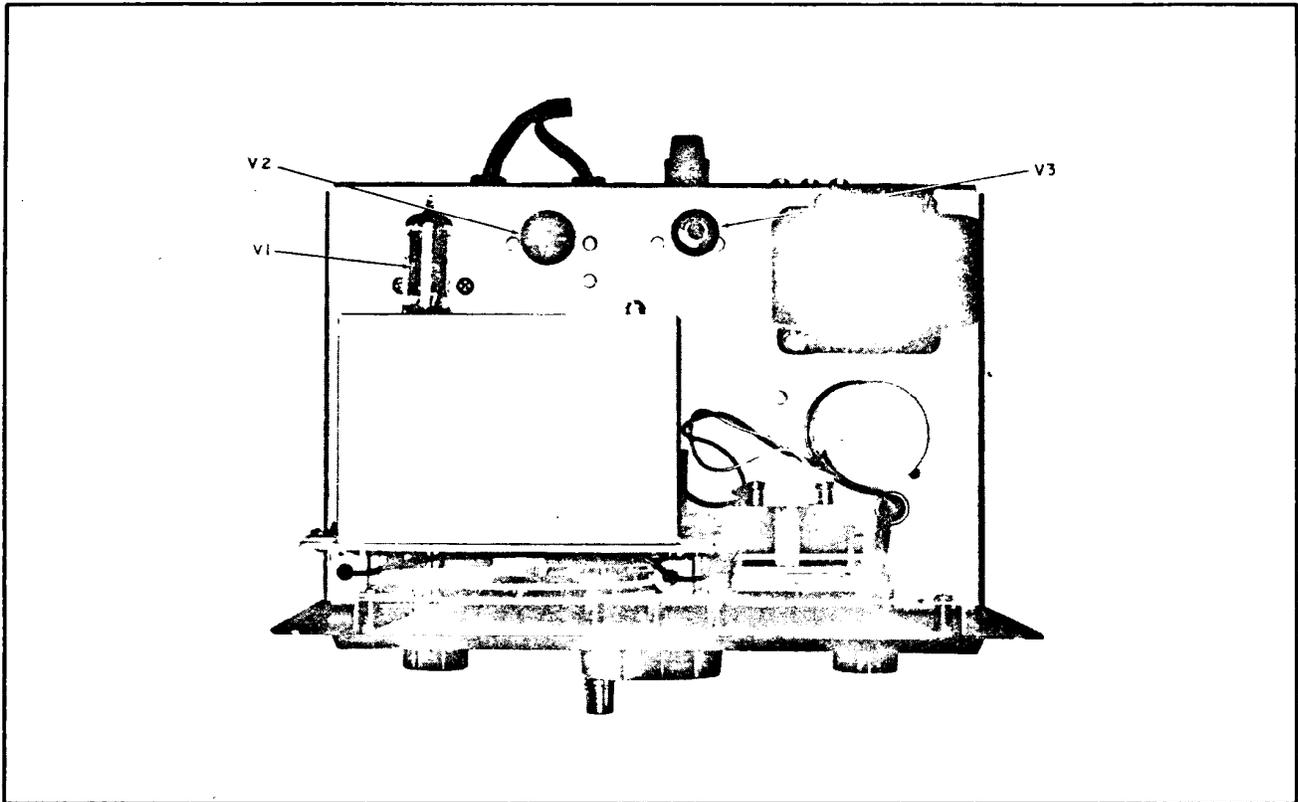


Figure 2. Model HA-20 Top View.

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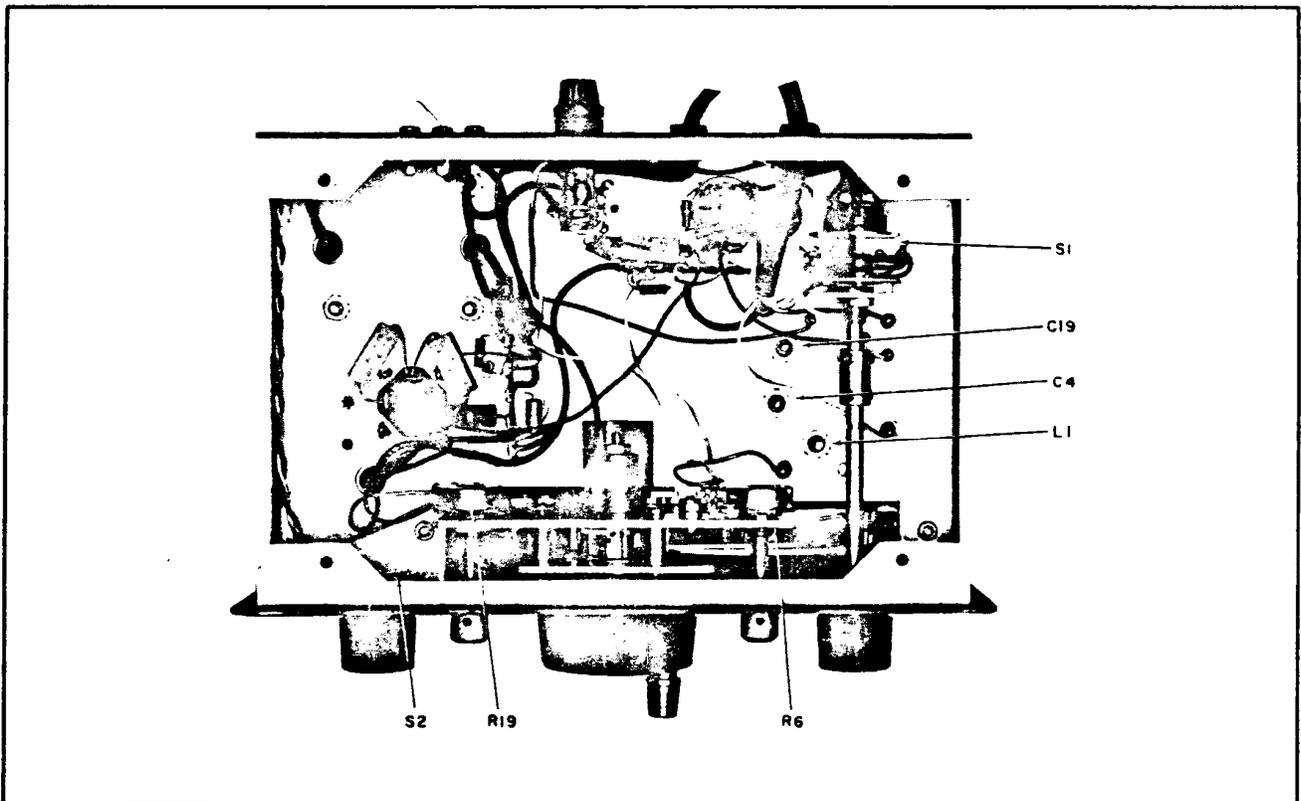


Figure 3. Model HA-20 Bottom View.

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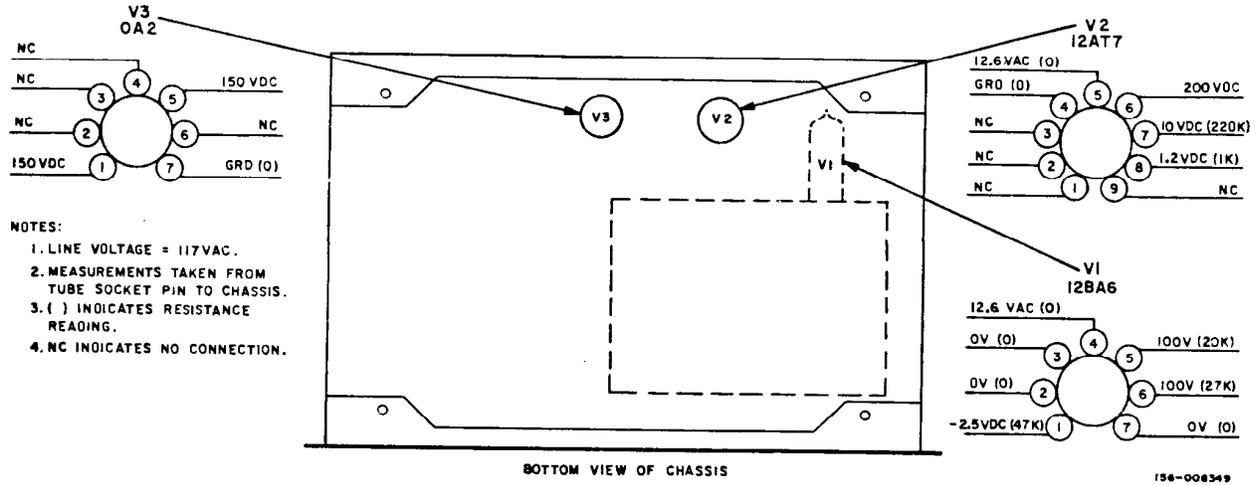


Figure 4. Model HA-20 Voltage and Resistance Chart.

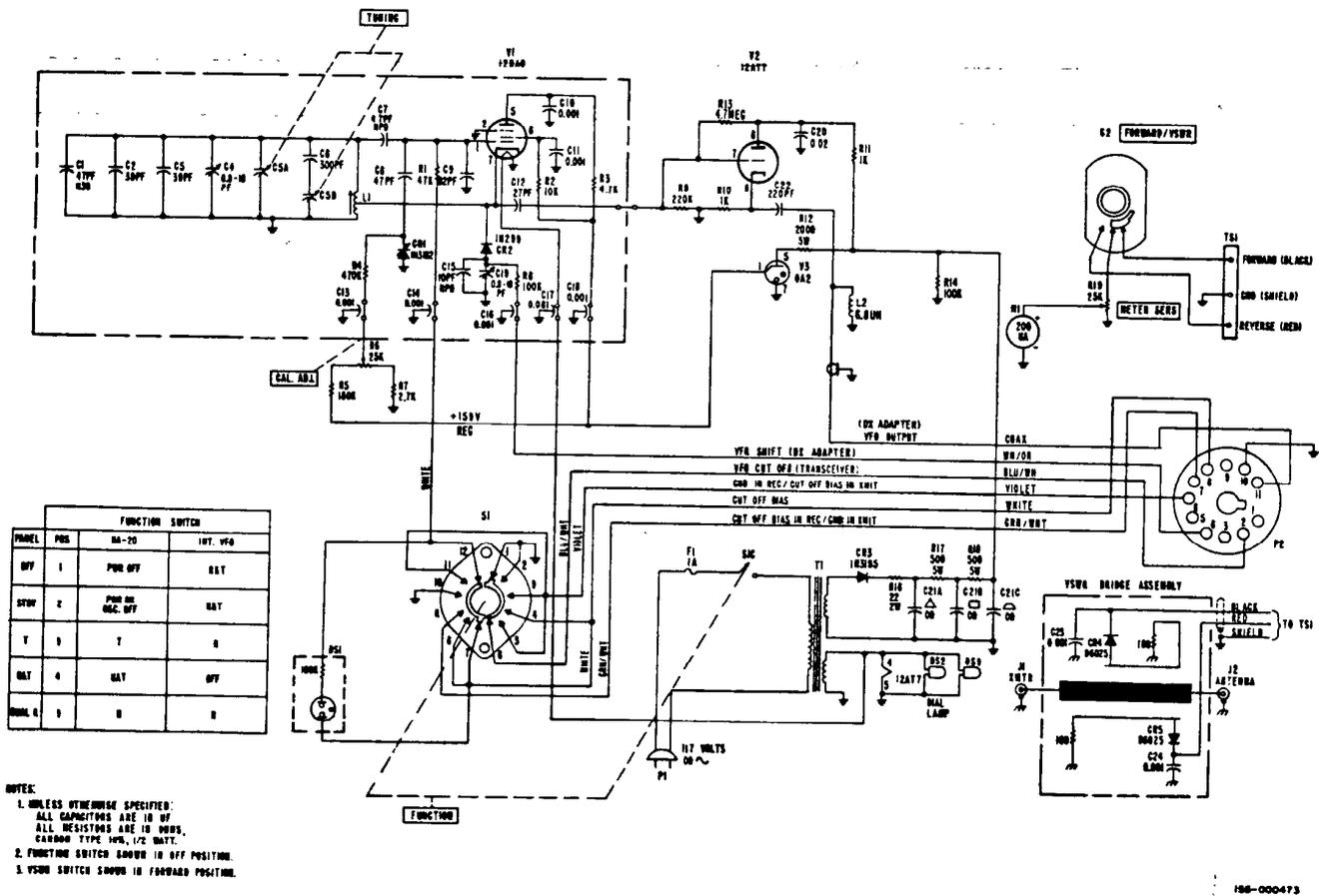


Figure 5. Model HA-20 Schematic Diagram.

## SERVICE REPAIR PARTS LIST

Schematic Symbol	Description	Hallicrafters Part Number	Schematic Symbol	Description	Hallicrafters Part Number
<b>CAPACITORS</b>			<b>CONNECTORS</b>		
C1	47 PF, 5%, N30, Ceramic	491-025470-032	J1,2	Jack, XMTR, ANTENNA	010-100056
C2,3	39 PF, 5%, N150, Ceramic	491-005390-051	P2	Plug, 11-Pin	035-100043
C4	Variable, 0.8-18 PF, Piston Trimmer	044-000643			
C5A,B	Variable, Tuning	048-000597			
C6	300 PF, 2%, Mica	493-110301-324			
C7,8	47 PF, 5%, NPO, Ceramic	491-025470-022			
C9	82 PF, 5%, N80, Ceramic	491-055820-042	S1	Switch, Rotary, FUNCTION	060-002866
C10,11,23,24	0.001 $\mu$ F, 500V, Mica	047-001671	S2	Switch, Rotary, FORWARD/VSWR	060-002867
C12	27 PF, 5%, NPO, Ceramic	491-005270-022			
C13,14,16,17,18	0.001 $\mu$ F, feed-thru, GMV, Mica	047-001308			
C15	10 PF, NPO, Ceramic	491-001100-022			
C19	Variable, 0.8-13 PF, Piston Trimmer	044-000520			
C20	0.02 $\mu$ F, 500V, Mica	047-100471			
C21A,B,C	50/50/50 $\mu$ F, 300V, Electrolytic	045-001330			
C22	220 PF, 10%, 500V, Mica	493-110221-134			
<b>*RESISTORS</b>					
R1	47K Ohm	451-252473	F1	Box, Bottom	066-005111
R2	10K Ohm	451-252103		Cabinet	066-004836
R3	4.7K Ohm	451-252472		Chassis, Main	070-002635
R4	470K Ohm	451-252474		Chassis, VFO	070-002543
R5	180K Ohm	451-252184		Cover	066-005113
R6,19	Variable, 25K Ohm METER SENS and CAL ADJ	025-002509		Cover, Gang VFO	068-004434
R7	2.7K Ohm	451-252272		Escutcheon	007-000903
R8,14	100K Ohm	451-252104		Foot, Rubber (4)	016-201072
R9	220K Ohm	451-252224		Fuse, 1 Amp, 3AG	039-100447
R10,11	1K Ohm	451-252102		Fuseholder (F1)	006-200845
R12	2K Ohm, 5 Watt	445-012202		Gear	026-001002
R13	4.7 Megohm	451-252475		Gear, Dial	026-001172
R16	22 Ohm, 2 Watt	451-652220		Gear, Idler	026-001170
R17,18	500 Ohm, 5 Watt	445-012501		Gear, Pinion	026-001171
				Gear, Pinion Drive	026-001166
				Gear, Spur	026-001089
				Gear, Spur, Fixed	026-001088
				Handle, Knob	030-000793
				Knob, FORWARD/VSWR, FUNCTION	015-001775
				Knob, Knurled, CAL ADJ, METER SENS	015-001755-002
				Knob, TUNING	015-001617
			DS2,3	Lamp, Pilot	039-000797
			DS1	Light, Indicator, Neon	086-000690
				Medallion	007-000850
			M1	Meter	082-000690
				Panel, Front	068-001724
				Plate, Front VFO	063-006821
				Plate, Gear	063-006830
				Plate, Idler Gear	063-006827
				Plate, Pivot	063-006828
				Plate, Top Gang Cover	063-006889
				Socket Assembly, Pilot Light	086-000743
				Socket, Tube, 9-Pin (V2)	006-001112
				Socket, Tube, 7-Pin (V1,V3)	006-001094
				Spur Gear, Dial Scale	026-001174
				Spur Gear, Pinion Shaft	026-001172
				Window, KC	022-000747
				Window (2 Top Dials)	022-000753
<b>COILS AND TRANSFORMERS</b>					
L1	Coil, VFO	050-002418			
L2	Choke, RF, 6.8 $\mu$ H	050-001245			
T1	Transformer, Power	050-002590			
<b>ELECTRON TUBES AND DIODES</b>					
V1	Tube, Type 12AB6	090-900039			
V2	Tube, Type 12AT7	090-900034			
V3	Tube, Type OA2	090-900001			
CR1	Diode, Type 1N3182	019-003316			
CR2	Diode, Type 1N295	019-301980			
CR3	Diode, Type 1N3195	019-002770			
CR4,5	Diode, Type D6025 (Part of VSWR Bridge Assembly)	019-004112			

\*ALL RESISTORS are carbon type, 10%, 1/2 watt unless otherwise stated.

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