TECHNICAL MANUAL

for

INTERMEDIATE FREQUENCY AMPLIFIER AM-3295/FRR-60(V) MODEL HFI-1

THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y. OTTAWA, ONTARIO

TECHNICAL MANUAL

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THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y. OTTAWA, ONTARIO

IN 3001C

Issue Date: 1 April 1963

NOTICE

DESCRIPTION OF
MODEL HFIB-1 INTERMEDIATE
FREQUENCY AMPLIFIER

TMC Model HFIB-1 Intermediate Frequency Amplifier is the same as Model HFI-1 with the addition of 2 code-energized stepping switches. One stepping switch is mechanically coupled to the shaft extension of each of CHANNEL A and B IF BANDWIDTH KC sel ctor switches. Both front panel control knobs remain on, for manual operation of the HFIB-1, if desired. This addition to the basic HFI-1 Intermediate Amplifier makes the HFIB-1 adaptable to function as a modular unit of TMC's TechniMatiC* receiver systems.

The primary function of the stepping switches is to mov the control to a position in response to a parallel binary digit code from a remote control center. The secondary function is to present information, in the same code, reflecting the control position at any instance; this is used as a readback checkout by the remote operator.

For stepping switches, the code is in 4-bit form and contained in 4 wires, each wire containing a "1" or "0" bit. The "1" bit wire has a connection to an external 28 VDC source; the "0" bit contains no connection. The 4-bit readback output code is contained in 5 wires. The "1" bit wire contains a connection with the 5th (common) wire; the "0" bit wire contains no connection. Input code-to-position response is as follows:-

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* Trademark applied for.

Add ndum #2 to Technical Manual for Int rmediat Amplifi r Mod 1 HFI-1

Code	Stepping Switch Position	CHANNEL A/B BAND-WIDTH KC Position
1000	1	1 DSB
0100	2	6 DSB
0010	3	15 DSB
1001	4	3.5U SSB
1100	5	3.5L SSB
0110	6	7.5U SSB
1011	7	7.5L SSB
1101	8	--------
1110	9	--------
0111	10	--------
0011	11	--------
0001	12	--------

CW

The switch rotates the shaft clockwise as viewed from the HFIB-1 control panel. For the switch to go from position #3 to #1 (either automatically or manually) it must first rotate through positions #4 through #12.

Figure A shows the location of the two stepping switches. Each stepping switch is mounted in its own bracket to the rear apron of the chassis with its drive shaft coupled to the rear extension of the IF BANDWIDTH KC switch shaft. Wiring from ach stepping switch is brought out through two receptacles (J6219-1 & -2 and J6219-3 & -4) in the stepping switch bracket. Receptacles J6219-2 and -4 are for code input wiring; J6219-1 and -3 are for readback output. The basic stepping switch ass mbly consists of 2 wafers driven by a solenoid actuator on the nd of its shaft.

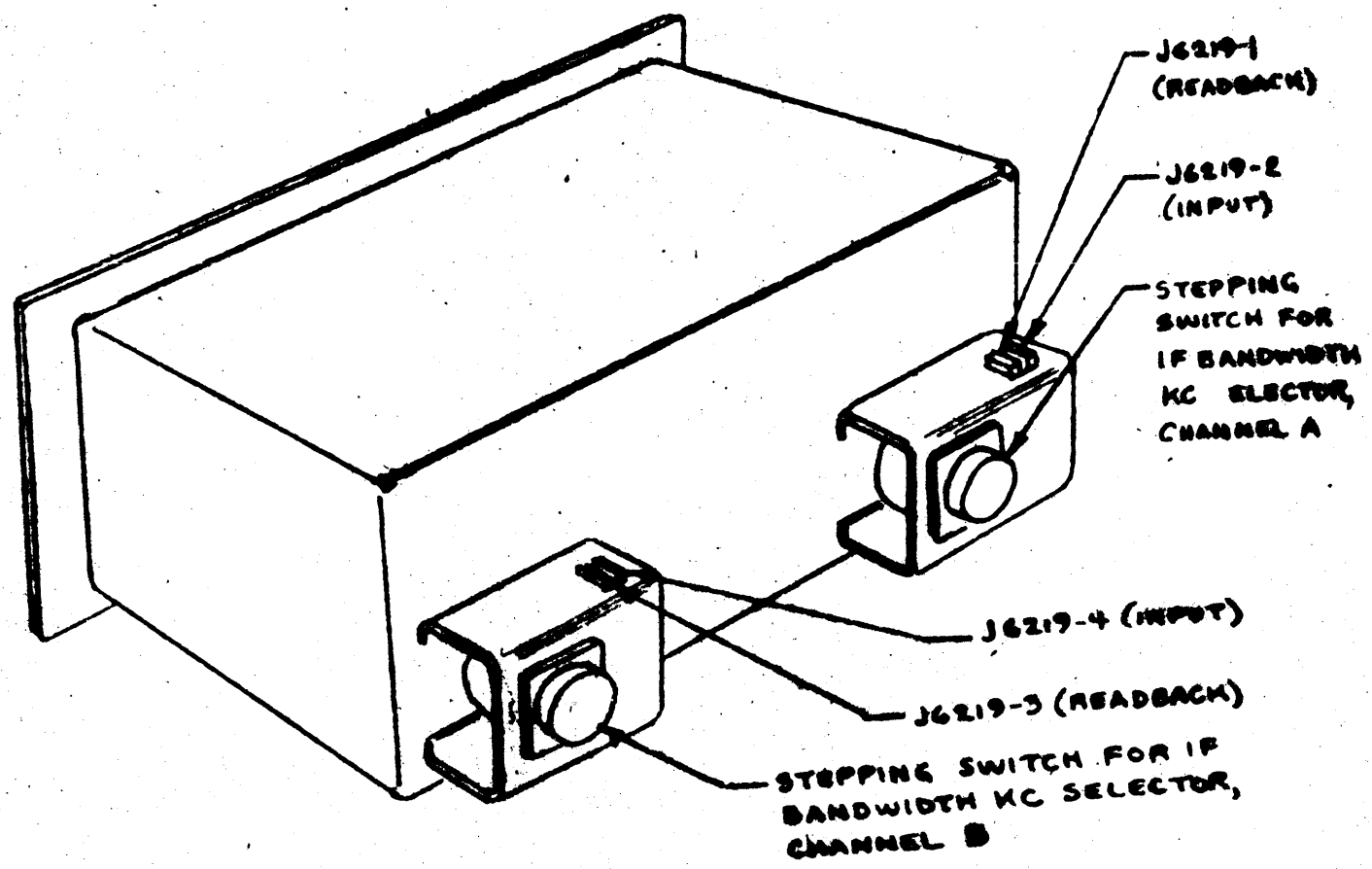
Figure B is a schematic wiring diagram of a typical st pping switch and includes the necessary code input and readback output connections. Cod feeder equipment may have any form as long as the output (repres nt d by relays her) mak s and breaks the connections as shown to a 28 VDC sourc . A complete revolution

of the switch (through its 12 positions) takes approximately 500 milliseconds.

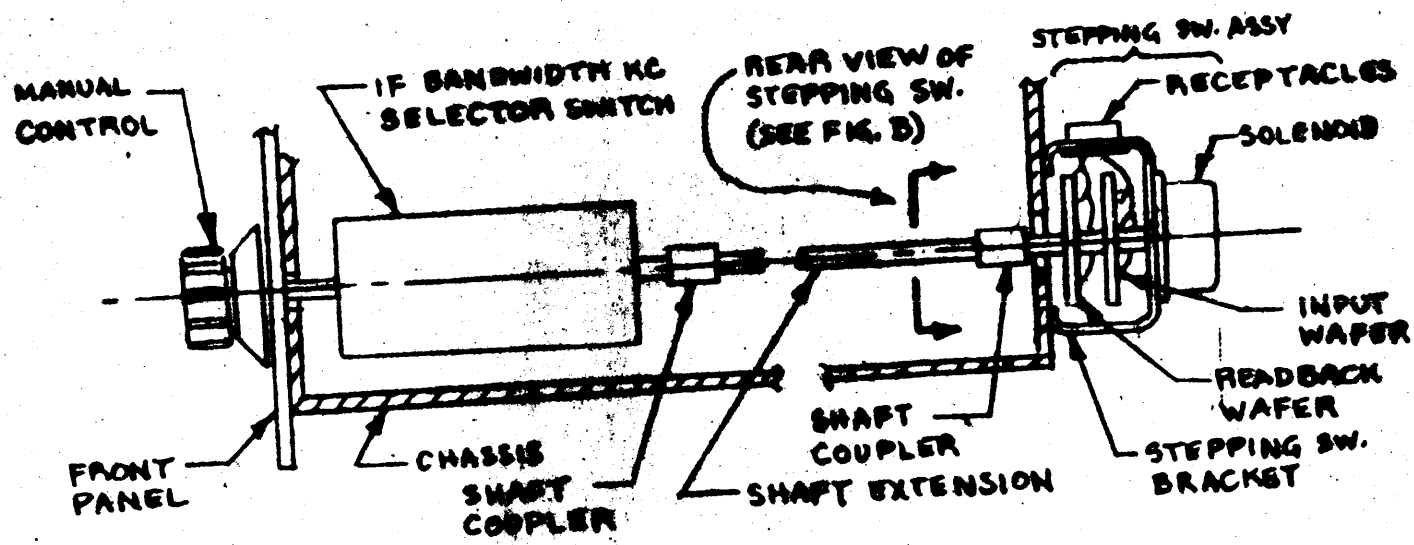
Input (See Figure B).- Basically, every time the solenoid coil becomes connected to the external 28 VDC source, it moves its rotary actuator enough degrees to advance the switch by one position. After the stroke, a spring returns the actuator to its original position and the switch remains in its advanced position. If the new switch position still connects the 28 VDC to the coil, the process is repeated. The switch continues to step around in this manner until the 28 VDC supply becomes cut off. The connections to the supply are made and broken by the combined positions of 4 external relays and the far and near side rotors on the switch input wafer. Figure C shows the relays in the 1000 code position with the switch stabilized in the 1000 code (#1) position. The coil has become cut off from the 28 VDC source.

An interrupter (see Figure C) built into the switch is operated by a cam on the shaft. The interrupter momentarily disconnects the coil circuit at the end of each stroke in order to prevent a double stroke.

Readback Output (See Figure B). - Each position of th input wafer is followed by the readback wafer. The rotor contact on the far side of the readback wafer is used; the rotor contact on the near side is not used. For each switch position, a 4-bit code appears at pins A, B, C and D of the output receptacle. A "1" bit is represented by connection of that wire with the 5th wire (at pin E); a "0" bit is repres nt d by a brok n connection with th 5th wire.



REAR ANGLE VIEW OF MFIB-1



DETAIL A. STEPPING SWITCH MOUNTING (TYPICAL)

FIGURE A, LOCATION OF STEPPING SWITCHES, MFIB-1

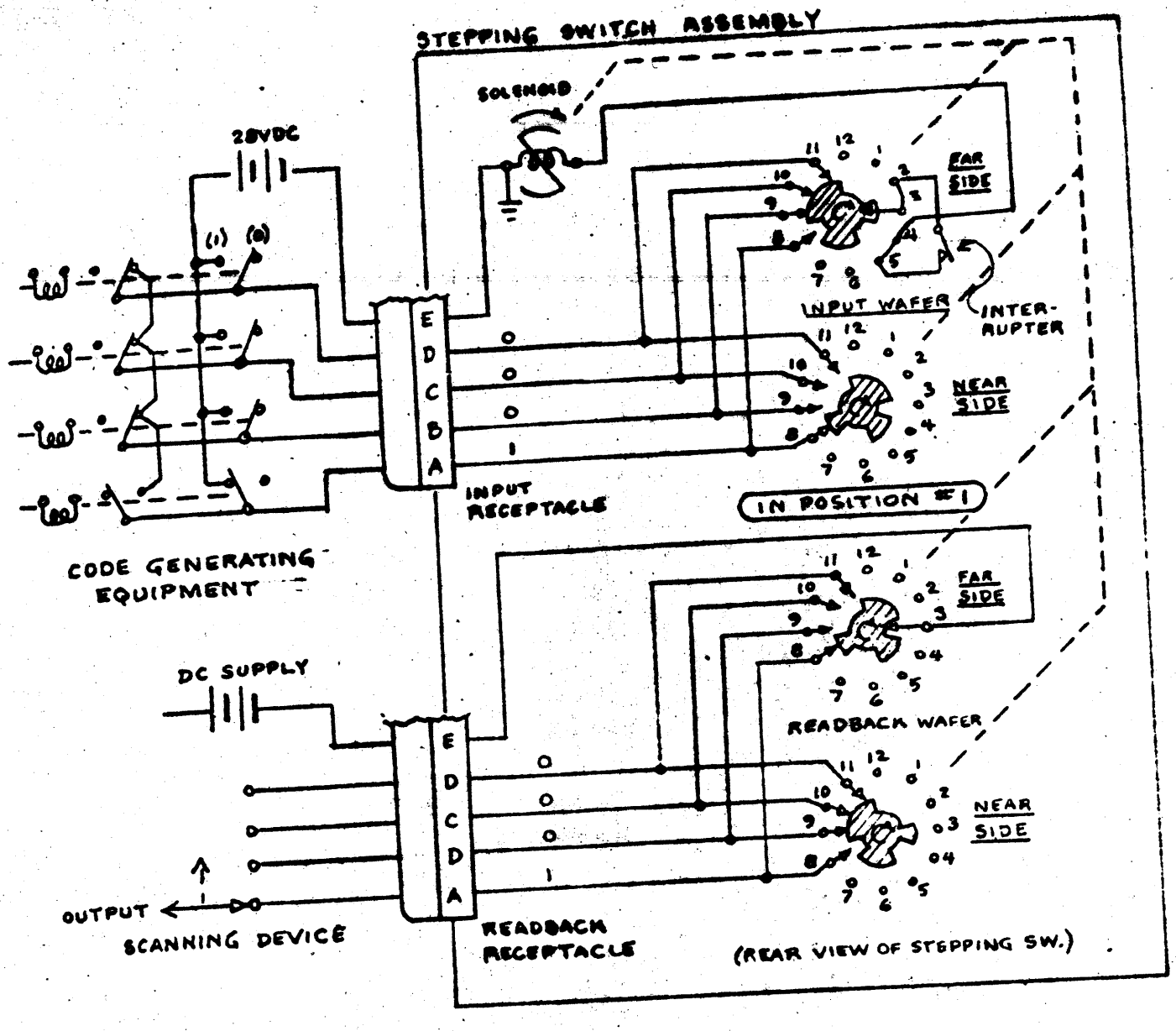


FIGURE INPUT AND OUTPUT WIRING CONNECTIONS TO STEPPING SWITCH ASSEMBLY

THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,*fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes*furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

CHANGE NO. 1

INSTRUCTION BOOK CHANGE NOTICE

Date October 11, 1963

Manual affected: Intermediate Frequency Amplifier IN -3001C
Model HFI-1

page 7-4

(a) For T102 add TT-157 as an additional part number

(b) Following Description of T102 add:

"Note"

Use Part No. TT-158 when ordering replacement 3.5 kc USB or 3.5 kc LSB IF transformers.
Use Part No. TT-157 when ordering replacement for 1 kc, 6 kc, 15 kc, and 7.5 kc USB and 7.5 kc LSB IF transformers."

CHANGE NO. 2 HFI-1

INSTRUCTION BOOK CHANGE NOTICE

Date June 3, 1964

Manual affected: Intermediate Frequency Amplifier IN -3001C
Model HFI-1

1. Pages 7-1 and 7-2. Parts List.

   Remove and destroy pages 7-1 and 7-2 of the manual. Replace with new pages 7-1 and 7-2 provided with this change notice.

2. Pages 7-5 and 7-6. Parts List.

   Remove and destroy pages 7-5 and 7-6 of the manual. Replace with new pages 7-5 and 7-6 provided with this change notice.

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamar neck, New York

Attn.: Director of Eng. Services.

SECTION 7
PARTS LIST

7-1. INTRODUCTION.

Reference designations have been assigned to identify all component parts of the equipment. They are marked on the equipment, adjacent to the part they identify, and are included on drawings, diagrams, and in the parts list. The letters of a reference designation indicate the kind of part (generic group), such as resistor, capacitor, electron tube, etc. The number differentiates between parts of the same generic group.

Column 1 lists the reference designations of the various parts in alphabetical and numerical order. Column 2 gives the name and description of the various parts. Column 3 indicates how a part is used within a major component. Column 4 lists each Technical Materiel Corporation drawing or part number.

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 kc; bandwidth 250.140 to 253.600 kc ±50 cps; input impedance 300 ohms; output impedance 50,000 ohms max. (Used in AX-303, 3.5 USB only.)	Sideband Filter	FX-168
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 kc; bandwidth 246.400 to 249.860 kc, ± 50 cps; input impedance 300 ohms; output impedance 50 K ohms max. (Used in AX-304, 3.5 LSB only.)	Sideband Filter	FX-169
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 kc; bandwidth 242.400 to 249.775 kc ± 100 cps; input impedance 300 ohms; output impedance 50 K ohms max. (Used in AX-305, 7.5 LSB only.)	Sideband Filter	FX-173
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 kc; bandwidth 250.225 to 257.600 kc; input impedance 300 ohms; output impedance 50 K ohms max. (Used in AX-306, 7.5 USB only.)	Sideband Filter	FX-172
Z1	FILTER, BANDPASS: symmetrical; carrier frequency 250 kc; bandwidth 246.9 to 253.1 kc, ± 75 cps; input impedance 300 ohms; output impedance 50 K ohms max. (Used in AX-311, 6 kc symmetrical only.)	Bandpass Filter	FX-174
Z1	FILTER, BANDPASS: symmetrical; carrier frequency 250 kc; bandwidth 249.450 to 250.550 kc, ± 25 cps; input impedance 300 ohms; output impedance 50 K ohms max. (Used in AX-312, 1 kc symmetrical only.)	Bandpass Filter	FX-175

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
A6001	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 249.450 to 250.550 kc ± 25 cps at 3 db down; amplification 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; power requirements 6.3 v, 40 to 4000 cps, single phase and 200 vdc.	IF Amplifier 1 kc	AX-312
A6002	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth 246.9 to 253.1 kc ± 75 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps, single phase and 200 vdc.	IF Amplifier 6 kc	AX-311
A6003	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 242.50 to 257.50 kc at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps, single phase and 200 vdc.	IF Amplifier 15 kc	AX-313
A6004	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 250.140 to 253.600 kc ± 50 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps, single phase and 200 vdc.	IF Amplifier 3.5 kc Upper Sideband	AX-303
A6005	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 246.400 to 249.860 kc ± 50 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps single phase and 200 vdc.	IF Amplifier 3.k kc Lower Sideband	AX-304
A6006	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 250.225 to 257.6 kc ± 100 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps, single phase and 200 vdc.	IF Amplifier 7.5 kc Upper Sideband	AX-306

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
A6007	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 250.225 to 257.600 kc ± 100 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 100 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps, single phase and 200 vdc.	IF Amplifier 7.5 kc Lower Sideband	AX-305
			SYMBOL SERIES 6200
C6201	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf; +80 -20%; 500 vdcw.	Cathode Bypass	CC-100-32
C6202	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf; +80 -20%; 500 vdcw.	Plate Decoupling	CC-100-24
C6203	Same as C6202.	RF Bypass	
C6204	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 220,000 uuf; +80 -20%; 500 vdcw.	Cathode Bypass	CC-100-33
C6205	Same as C6202.	Screen Decoupling	
C6206	Same as C6202.	Plate Decoupling	
C6207	Same as C6201.	Plate Decoupling	
C6208	Same as C6201.	RF Bypass	
C6209	Same as C6201.	RF Bypass	
C6210	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 uuf; ±10%; 500 vdcw.	RF Bypass	CC-100-9
C6211	Same as C6210.	RF Bypass	
C6212	Same as C6201.	RF Bypass	
C6213	Same as C6202.	RF Bypass	
C6214	Same as C6201.	RF Bypass	
C6215	Same as C6201.	RF Bypass	
C6216	Same as C6202.	RF Bypass	
C6217	Same as C6201.	RF Bypass	
C6218	Same as C6201.	RF Bypass	
C6219	Same as C6201.	RF Bypass	
C6220	Same as C6201.	RF Bypass	
C6221	Same as C6201.	RF Bypass	
C6222	Same as C6201.	RF Bypass	

CHANGE NO. 3

INSTRUCTION BOOK CHANGE NOTICE

Date February 18, 1965

Manual affected: Intermediate Frequency Amplifier AM-3295/FRR-60(V) IN 3001C

Issue Date: 1 April 1963

This correction affects Section 7 (Parts List) by providing a complete replacement. The replacement consists of pages 7-1 through pages 7-13 with page 7-14 blank.

This correction also incorporates the corrections requested by changes 1 and 2; and as a result, changes 1 and 2 are superseded and cancelled when this correction has been placed in the manual.

ACTION REQUIRED: Remove Section 7 and changes 1 and 2 from the manual and substitute the attached Section 7 instead.

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenim re R ad, Mamaroneck, New Y rk

Attn.: Director of Eng. Services.

SECTION 7
PARTS LIST

7-1. INTRODUCTION

Reference designations have been assigned to identify all electrical parts of the equipment. These designations are used for marking the equipment (adjacent to the part they identify) and are included on drawings, diagrams and the parts list. The letters of a reference designation indicate the kind of part (generic group), such as resistor, capacitor, transistor, etc. The number differentiates between parts of the same generic group. Sockets associated with a particular plug-in device, such as transistor or fuse, are identified by a reference designation which includes the reference designation of the plug-in device. For example, the socket for tube V101 is designated XV101. To expedite delivery, when ordering replacement parts, specify the TMC part number and the model number of the equipment.

HFI-1 IF AMPLIFIER
SYMBOL SERIES 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 KC; bandwidth 250.140 to 253.600 KC ±50 cps; input impedance 300 ohms; output impedance 50,000 ohms max. (Used in AX303, 3.5 USB only)	FX168
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 KC; bandwidth 246.400 to 249.860 KC ±50 cps; input impedance 300 ohms; output impedance 50,000 ohms max. (Used in AX304, 3.5 LSB only)	FX169
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 KC; bandwidth 242.400 to 249.775 KC ±100 cps; input impedance 300 ohms; output impedance 50,000 ohms max. (Used in AX305, 7.5 LSB only)	FX173
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 KC; bandwidth 250.225 to 257.600 KC ±100 cps; input impedance 300 ohms; output impedance 50,000 ohms max. (Used in AX306, 7.5 USB only)	FX172
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 KC; bandwidth 246.9 to 253.1 KC ±75 cps; input impedance 300 ohms; output impedance 50,000 ohms max. (Used in AX311, 6 KC symmetrical only)	FX174
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 KC; bandwidth 249.450 to 250.550 KC ±25 cps; input impedance 300 ohms; output impedance 50,000 ohms max. (Used in AX312, 1 KC symmetrical only)	FX175

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C101	NOT USED	
C102	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, +80% -20%; 500 WVDC.	CC100-24
C103	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 200, 000 uuf, +80% -20%; 25 WVDC.	CC100-33
C104	Same as C102.	
C105	Same as C103.	
C106	Same as C102.	
C107	Same as C102.	
C108	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100, 000 uuf, +80% -20%; 500 WVDC.	CC100-32
C109	Same as C102.	
C110	Same as C102.	
C111	CAPACITOR, FIXED, PLASTIC DIELECTRIC: 1.00 uf, ±10%; 200 WVDC.	CN112A105K2
C112	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100, 000 uuf, +80% -20%; 100 WVDC.	CC100-28
C113	Same as C103.	
C114	Same as C108.	
C115	CAPACITOR, FIXED, MICA DIELECTRIC: 560 uuf, ±5%; 500 WVDC; char. C.	CM20C561J03
CR101	SEMICONDUCTOR DEVICE, DIODE: silicon; max. peak inverse voltage 175 volts; max. RMS voltage 125 volts; 30 ma at 25°C and 15 ma at 150°C; peak recurrent 120 ma; max. surge current 0.5 amp.	1N463
CR102	Same as CR101.	
CR103	Same as CR101.	
J101	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 round #16 male contacts; straight type.	JJ245

HFI-1 IF AMPLIFIER
SYMBOL SERIES 100

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
J102	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 round male contact; teflon insulation; miniature BNC type.	JJ211
L101	COIL, INTERMEDIATE FREQUENCY: tuned; operating frequency 250 KC; consists of three capacitors, one 220 uuf and two 1,000 uuf, one resistor 10,000 ohms.	AC137
P101	NOT USED	
R101	NOT USED	
R102	NOT USED	
R103	NOT USED	
R104	RESISTOR, FIXED, COMPOSITION: 100 ohms, ±10%; 1/2 watt.	RC20GF101K
R105	RESISTOR, FIXED, COMPOSITION: 27,000 ohms, ±10%; 1/2 watt.	RC20GF273K
R106	RESISTOR, FIXED, COMPOSITION: 3,300 ohms, ±10%; 1/2 watt.	RC20GF332K
R107	RESISTOR, FIXED, COMPOSITION: 47 ohms, ±10%; 1/2 watt.	RC20GF470K
R108	Same as R104.	
R109	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, ±10%; 1/2 watt.	RC20GF223K
R110	Same as R106.	
R111	RESISTOR, FIXED, COMPOSITION: 470 ohms, ±10%; 1/2 watt.	RC20GF471K
R112	RESISTOR, FIXED, COMPOSITION: 220,000 ohms, ±10%; 1/2 watt.	RC20GF224K
R113	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, ±10%; 1/2 watt.	RC20GF103K
R114	Same as R106.	
R115	Same as R109.	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R116	RESISTOR, VARIABLE, COMPOSITION: 50,000 ohms, ±10%; 0.5 watt at 70°C; linear taper.	RV106UX10C-503A
R117	RESISTOR, FIXED, COMPOSITION: 560 ohms, ±10%; 1/2 watt.	RC20GF561K
R118	RESISTOR, FIXED, COMPOSITION: 330 ohms, ±10%; 1/2 watt.	RC20GF331K
R119	RESISTOR, FIXED, COMPOSITION: 1 megohm, ±10%; 1/2 watt.	RC20GF105K
T101	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 KC operating frequency; consists of two 1000 uuf capacitors and one 56,000 ohm resistor. (Used in AX313, 15 KC symmetrical only)	TT156
T102	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 KC operating frequency; consists of two capacitors one 470 uuf and one 320 uuf. (Used in AX303 and AX304, 3.5 USB/LSB only)	TT158
T102	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 KC operating frequency; consists of two capacitors one 470 uuf and one 320 uuf; two resistors one 33,000 ohms and one 68,000 ohms. (Used in AX305, AX306, 7.5 USB/LSB and AX311, AX312, AX313, 6, 1, 15 KC symmetrical only)	TT157
T103	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 KC operating frequency; consists of one capacitor 1000 uuf.	TT159
V101	TUBE, ELECTRON: remote cut-off pentode; 7 pin miniature.	6BA6
V102	TUBE, ELECTRON: sharp cut-off pentode; 7 pin miniature.	6CE5
V103	Same as V102.	
XV101	SOCKET, ELECTRON TUBE: 7 pin miniature.	TS102P01
XV102	Same as XV101.	
XV103	Same as XV101.	

HFI-1 IF AMPLIFIER
SYMBOL SERIES 6000

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A6001	AMPLIFIER, INTERMEDIATE FREQUENCY: 1 KC; carrier frequency, 250 KC; bandwidth, 249.450 to 250.550 KC, ±25 cps at 3 db down; amplification 54 db input to output over-all gain; input voltage, 2 mv RMS; output voltage, 1000 mv RMS; input impedance, 50 ohms; power requirements 6.3 V, 40 to 4000 cps, single phase and 200 VDC.	AX312
A6002	AMPLIFIER, INTERMEDIATE FREQUENCY: 6 KC; carrier frequency, 250 KC; bandwidth, 246.9 to 253.1 KC, ±75 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv RMS; output voltage, 1000 mv RMS; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 V, 40 to 400 cps, single phase and 200 VDC.	AX311
A6003	AMPLIFIER, INTERMEDIATE FREQUENCY: 15 KC; carrier frequency, 250 KC; bandwidth, 242.50 to 257.50 KC at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv RMS; output voltage, 1000 mv RMS; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 V, 40 to 400 cps, single phase and 200 VDC.	AX313
A6004	AMPLIFIER, INTERMEDIATE FREQUENCY: 3.5 KC USB; carrier frequency, 250 KC; bandwidth, 250.140 to 253.600 KC, ±50 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv RMS; output voltage, 1000 mv RMS; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 V, 40 to 400 cps, single phase and 200 VDC.	AX303
A6005	AMPLIFIER, INTERMEDIATE FREQUENCY: 3.5 KC LSB; carrier frequency, 250 KC; bandwidth, 246.400 to 249.860 KC, ±50 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv RMS; output voltage, 1000 mv RMS; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 V, 40 to 400 cps single phase and 200 VDC.	AX304

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A6006	AMPLIFIER, INTERMEDIATE FREQUENCY: 7.5 KC USB; carrier frequency, 250 KC; bandwidth, 250.225 to 257.6 KC, ±100 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv RMS; output voltage, 1000 mv RMS; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 V, 40 to 400 cps, single phase and 200 VDC.	AX306
A6007	AMPLIFIER, INTERMEDIATE FREQUENCY: 7.5 KC LSB; carrier frequency, 250 KC; bandwidth, 250.225 to 257.600 KC, ±100 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv RMS; output voltage, 100 mv RMS; input impedance 50 ohms; output impedance, 50 ohms; power requirements 6.3 V, 40 to 400 cps, single phase and 200 VDC.	AX305

HFI-1 IF AMPLIFIER
SYMBOL SERIES 6200

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C6201	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100, 000 uuf, +80% -20%; 500 WVDC.	CC100-32
C6202	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20, 000 uuf, +80% -20%; 500 WVDC.	CC100-24
C6203	Same as C6202.	
C6204	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 200, 000 uuf, +80% -20%; 25 WVDC.	CC100-33
C6205	Same as C6202.	
C6206	Same as C6202.	
C6207 thru C6209	Same as C6201.	
C6210	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1,000 uuf, ±10%; 500 WVDC.	CC100-9
C6211	Same as C6210.	
C6212	Same as C6201.	
C6213	Same as C6202.	
C6214	Same as C6201.	
C6215	Same as C6201.	
C6216	Same as C6202.	
C6217 thru C6223	Same as C6201.	
C6224	Same as C6202.	
C6225	Same as C6202.	
C6226	CAPACITOR, FIXED, MICA DIELECTRIC: 110 uuf, ±10%; 500 WVDC; char. B.	CM15B111K
C6227	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10, 000 uuf, GMV; 500 WVDC.	CC100-16

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR6201	SEMICONDUCTOR DEVICE, DIODE: germanium; min peak inverse voltage for zero dynamic impedance 70 V; continuous reverse working voltage 60 V; average forward current 60 ma; recurrent peak forward current 150 ma; forward surge current (1 sec.) 500 ma.	1N294
CR6202	Same as CR6201.	
CR6203	SEMICONDUCTOR DEVICE, DIODE: silicon; max. peak inverse voltage 175 V; max. RMS volts 125 V; 30 ma at 25°C and 15 ma at 150°C; peak recurrent 120 ma; max. surge current 0.5 amp.	1N463
CR6204	Same as CR6203.	
CR6205	SEMICONDUCTOR DEVICE, DIODE: germanium; max. peak reverse voltage for zero dynamic impedance 50 V; continuous reverse working voltage 40 V; average forward current 60 ma; peak forward current (1 sec.) 1.0 amp.	1N56A
CR6206	Same as CR6205.	
EV6201	SHIELD, ELECTRON TUBE: 9 pin miniature.	TS103U03
EV6202	SHIELD, ELECTRON TUBE: 7 pin miniature.	TS102U02
EV6203	Same as EV6201.	
J6201	CONNECTOR, RECEPTACLE, ELECTRICAL: 14 male contacts, rated at 17.0 amps.	JJ200-2
J6202	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 round female contact; teflon insulation; BNC type.	JJ172
J6203 thru J6206	Same as J6202.	
J6207	CONNECTOR, RECEPTACLE, ELECTRICAL: RF; 1 round female contact; straight type; series BNC to BNC.	UG625B/U
J6208	Same as J6207.	
J6209	Same as J6202. Part of W6202.	

HFI-1 IF AMPLIFIER
SYMBOL SERIES 6200

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
J6210	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 round #16 female contacts; straight type.	JJ216
J6211 thru J6216	Same as J6210.	
L6201	COIL, RADIO FREQUENCY: fixed; inductance, 50.0 uh; resonant frequency 0.04 mc; max. DC resistance 110 ohms.	CL226-5
L6202	Same as L6201.	
L6203	Same as L6201.	
L6204	COIL, RADIO FREQUENCY: 2.5 mh, ±10%; max. DC resistance 100 ma; molded.	CL140-1
L6205	COIL, RADIO FREQUENCY: fixed; 56.0 uh, ±10%; 3.0 ohms DC resistance; molded case.	CL240-56
M6201	VOLTMETER: DC; 0-2 volts linear scale; 0-50 ua movement; 2.37 inch square case.	MR157
M6202	Same as M6201.	
P6201	CONNECTOR, PLUG, ELECTRICAL: RF type; 1 round female coaxial contact; straight type, miniature bayonet lock.	PL204
P6202 thru P6207	Same as P6201.	
P6208	CONNECTOR, PLUG, ELECTRICAL: RF type; 1 male contact; straight type. Part of W6201.	PL169
P6209	Same as P6208. Part of W6201.	
R6201	RESISTOR, FIXED, COMPOSITION: 6,800 ohms, ±10%; 1/2 watt.	RC20GF682K
R6202	RESISTOR, FIXED, COMPOSITION: 3,900 ohms, ±10%; 1/2 watt.	RC20GF392K
R6203	RESISTOR, FIXED, COMPOSITION: 100 ohms, ±10%; 1/2 watt.	RC20GF101K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R6204	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, ±10%; 1/2 watt.	RC20GF472K
R6205	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, ±10%; 1/2 watt.	RC20GF104K
R6206	RESISTOR, FIXED, COMPOSITION: 390 ohms, ±10%; 1/2 watt.	RC20GF391K
R6207	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, ±10%; 1/2 watt.	RC20GF473K
R6208	RESISTOR, FIXED, COMPOSITION: 56,000 ohms, ±10%; 1/2 watt.	RC20GF563K
R6209	Same as R6204.	
R6210	RESISTOR, FIXED, COMPOSITION: 47 ohms, ±10%; 1/2 watt.	RC20GF470K
R6211	Same as R6206.	
R6212	RESISTOR, VARIABLE, COMPOSITION: 500 ohms, ±10%; 0.5 watt at 70°C; linear taper.	RV106UX10C-501A
R6213	Same as R6212.	
R6214	RESISTOR, FIXED, FILM: 39,000 ohms, ±1%; 0.25 watt.	RN75B3902F
R6215	Same as R6214.	
R6216	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, ±5%; 1/2 watt.	RC20GF103J
R6217	Same as R6216.	
R6218	RESISTOR, FIXED, COMPOSITION: 390,000 ohms, ±10%; 1/2 watt.	RC20GF394K
R6219	Same as R6218.	
R6220	RESISTOR, FIXED, COMPOSITION: 68,000 ohms, ±10%; 1/2 watt.	RC20GF683K
R6221	RESISTOR, VARIABLE, COMPOSITION: 5 megohms; ±20%; 2 watts; taper A.	RV4NAYSD50-5B

HFI-1 IF AMPLIFIER
SYMBOL SERIES 6200

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R6222	RESISTOR, VARIABLE, COMPOSITION: 25,000 ohms, ±20%; 1 watt; taper F; consists of a SPST normally open switch, rated at 3.0 amperes at 117 VAC.	RV4NBYSD25-3F
R6223	Same as R6221.	
R6224	Same as R6210.	
R6225	Same as R6203.	
R6226	RESISTOR, FIXED, COMPOSITION: 330 ohms, ±10%; 1/2 watt.	RC20GF331K
R6227	RESISTOR, FIXED, COMPOSITION: 6,800 ohms, ±10%; 1 watt.	RC32GF682K
S6201A	SWITCH SECTION, ROTARY: 1 section, 7 positions; contacts rated at 1 amp, 28 volts or 5 amps at 110 VAC; mycalex insulation.	WS127
S6201B	SWITCH SECTION, ROTARY: 1 section, 7 positions; contacts rated at 1 amp, 28 volts or 5 amps at 110 VAC; bakelite insulation.	WS126
S6201C	Same as S6201B.	
S6202A	Same as S6201A.	
S6202B	Same as S6201B.	
S6202C	Same as S6201B.	
S6203	SWITCH, ROTARY: 1 section, 2 positions; contacts rated at 2 amps at 28 VDC or 1 amp at 110 VAC.	SW116
T6201	TRANSFORMER, RADIO FREQUENCY: frequency response -150 KC to 4 MC within 3 db; primary impedance 50 ohms, secondary impedance 5,000 ohms; polarized.	TZ107
T6202	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 KC operating frequency; consists of one capacitor 1000 uuf.	TT160
T6203	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 KC operating frequency; consists of one capacitor 600 uuf.	TT161

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
TP6201	TERMINAL, FEED-THRU, INSULATED: 0.740" lg. x 3/16" dia.; 3/32 press-fit stud; teflon; insulated for 200 V.	TE169-1
TP6202	Same as TP6201.	
TP6203	Same as TP6201.	
V6201	TUBE, ELECTRON: medium-mu dual triode; 9 pin miniature.	6CM7
V6202	TUBE, ELECTRON: remote-cutoff pentode; 7 pin miniature.	6BA6
V6203	TUBE, ELECTRON: high-mu, twin-triode; 9 pin miniature.	12AX7
W6201	CABLE ASSEMBLY: RF; consists of two connectors, P6208 and P6209.	CA480-16-4.50
W6202	CABLE ASSEMBLY: RF; consists of one connector J6209.	CA480-14-9.00
XV6201	SOCKET, ELECTRON TUBE: 9 pin miniature.	TS103P01
XV6202	SOCKET, ELECTRON TUBE: 7 pin miniature.	TS102P01
XV6203	Same as XV6201.	

CHANGE NO. 4

INSTRUCTION BOOK CHANGE NOTICE

Date February 24, 1965

Manual affected: Intermediate Frequency Amplifier AM-3295/FRR-60(V) Model HFI-1 **IN** 3001C

Issue Date: 1 April 1963

The purpose of this change is to provide a new set of schematic diagrams (Section 8 of subject manual) which eliminates certain typographical errors.

ACTION REQUIRED: Remove Section 8 of the manual and replace with Section 8 attached hereto which consists of pages 8-1, 8-2, 8-3, 8-4, 8-5/8-6.

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

Attn.: Director of Eng. Services.

SECTION 8
SCHEMATIC DIAGRAMS

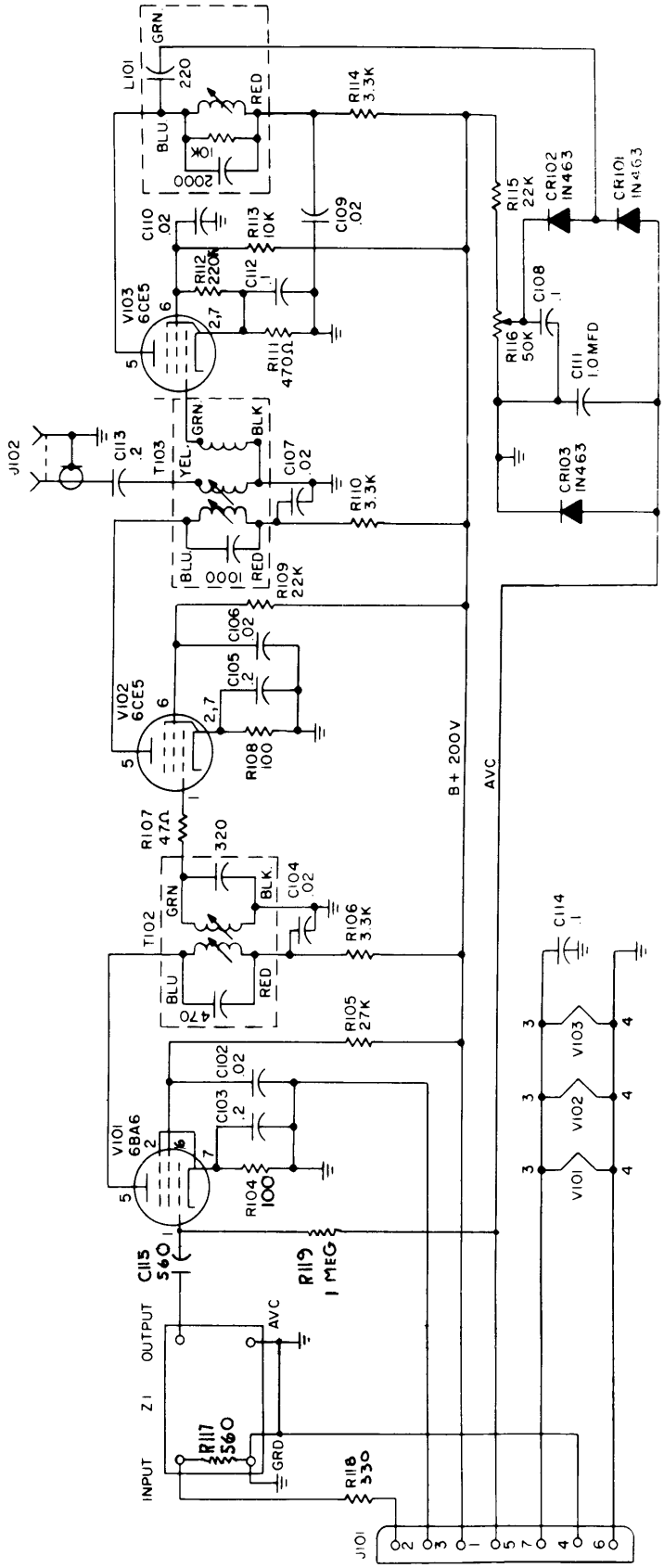


Figure 8-1. 3.5 KC USB/LSB, Schematic Diagram

CK519E

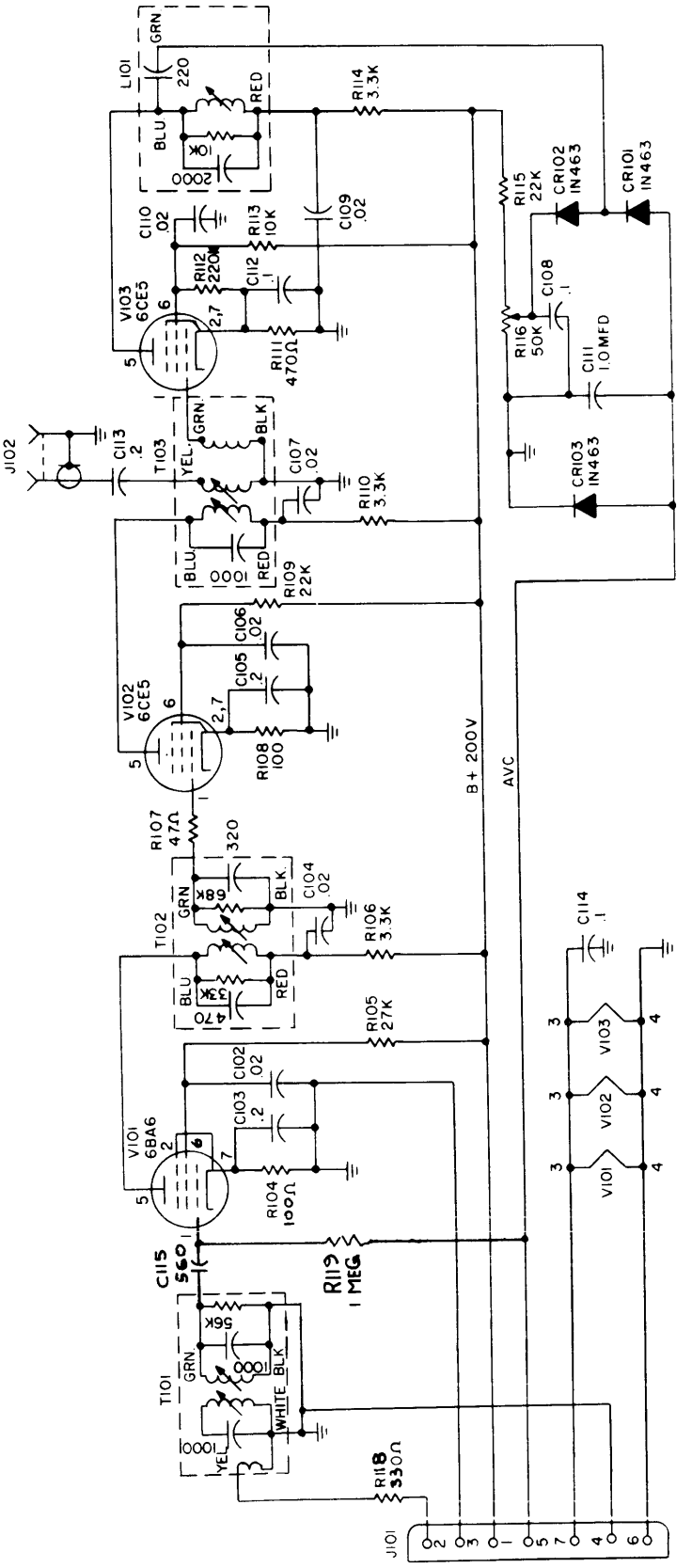


Figure 8-2. HFI-1, 15 KC Symmetrical, Schematic Diagram

CK520E

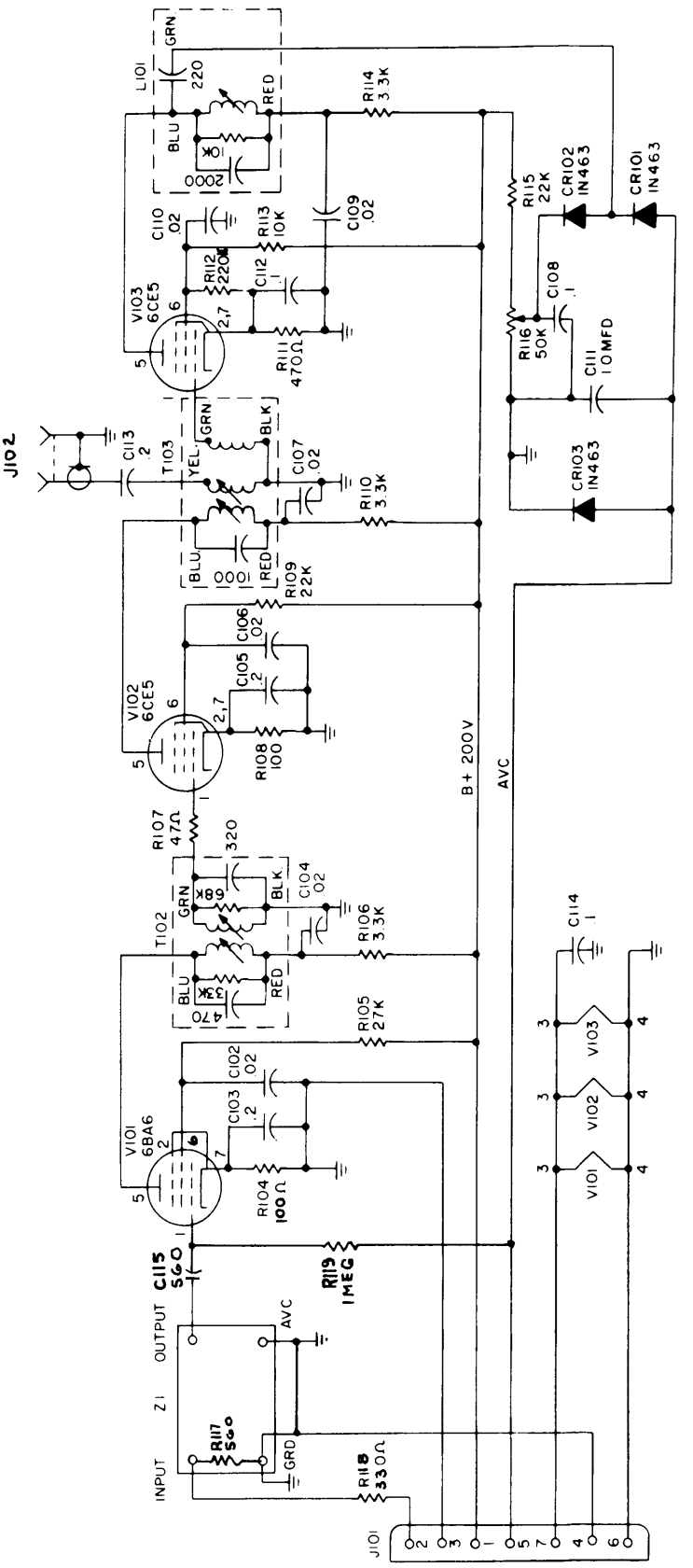
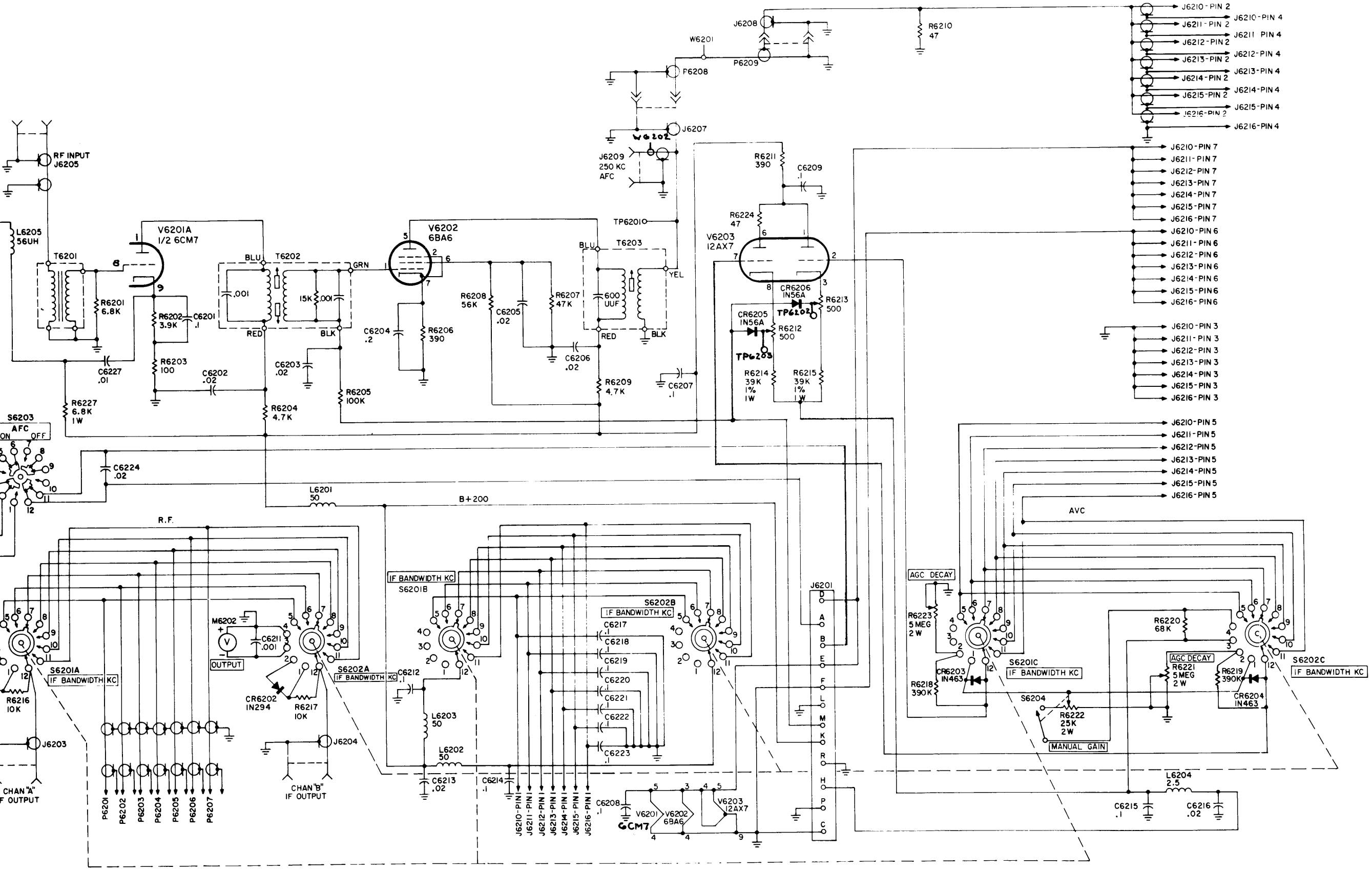


Figure 8-3. HFI-1, 1 and 6 KC Symmetrical, and 7.5 KC USB/LSB, Schematic Diagram

CK521E



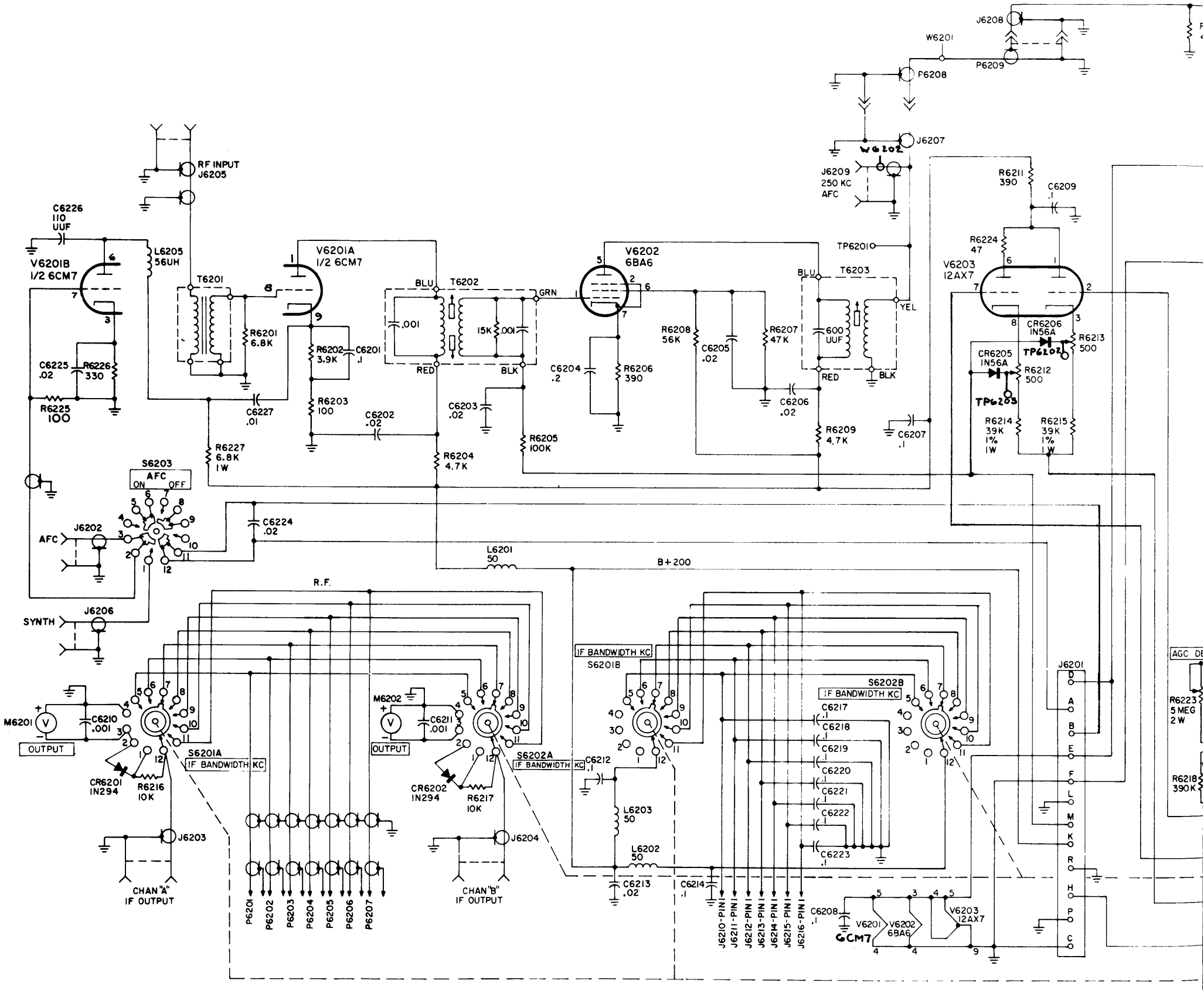
LAST SYMBOLS

C6227
CR6206
J6217
L6205
M6202
P6209
R6227
S6204
T6203
TP6203
V6203
W6202

UNLESS OTHERWISE SPECIFIED

RESISTANCE VALUES ARE OHMS, 1/2 WATT.
CAPACITANCE VALUES ARE MICRO FARADS
INDUCTANCE VALUES ARE MILLI HENRYS.

Figure 8-4. HFI-1, 250 KC Converter Without IF Strips, Schematic Diagram


RF INPUT J6205
C6226 110 UUF
V6201B 1/2 6CM7
L6205 56UH
T6201
V6201A 1/2 6CM7
R6201 6.8K
R6202 3.9K
C6201 .1
C6225 .02
R6226 330
R6225 100
C6227 .01
R6227 6.8K 1W
R6203 100
C6202 .02
BLU
T6202
GRN
.001
15K
.001
RED
BLK
C6203 .02
R6204 4.7K
R6205 100K
V6202 6BA6
C6204 .2
R6206 390
R6208 56K
C6205 .02
R6207 47K
C6206 .02
R6209 4.7K
BLU
T6203
600 UUF
YEL
RED
BLK
TP6201
C6207 .1
J6208
W6201
P6209
P6208
J6207
W6202
J6209 250 KC AFC
R6211 390
C6209 .1
R6224 47
V6203 12AX7
CR6206 IN56A
R6213 500
TP6202
CR6205 IN56A
R6212 500
TP6203
R6214 39K 1% 1W
R6215 39K 1% 1W
S6203
AFC
ON OFF
J6202
AFC
C6224 .02
L6201 50
B+200
R.F.
J6206
SYNTH
M6201
C6210 .001
OUTPUT
S6201A
IF BANDWIDTH KC
CR6201 IN294
R6216 10K
J6203
CHAN "A" IF OUTPUT
M6202
C6211 .001
OUTPUT
S6202A
IF BANDWIDTH KC
CR6202 IN294
R6217 10K
J6204
CHAN "B" IF OUTPUT
P6201
P6202
P6203
P6204
P6205
P6206
P6207
IF BANDWIDTH KC
S6201B
S6202B
IF BANDWIDTH KC
C6212 .1
L6203 50
L6202 50
C6213 .02
C6214 .1
C6217 .1
C6218 .1
C6219 .1
C6220 .1
C6221 .1
C6222 .1
C6223 .1
J6201
J6210-PIN 1
J6211-PIN 1
J6212-PIN 1
J6213-PIN 1
J6214-PIN 1
J6215-PIN 1
J6216-PIN 1
C6208 .1
V6201 6CM7
V6202 6BA6
V6203 12AX7
AGC DE
R6223 5 MEG 2 W
R6218 390K

CK522H

CHANGE NO. 5

INSTRUCTION BOOK CHANGE NOTICE

Date March 10, 1965

Manual affected: Intermediate Frequency Amplifier AM-3295/FRR-60(V) Model HFI-1 IN 3001C

Issue Date: 1 April 1963

Attached herewith are simplified schematics Figure 4-3, 4-4, and 4-5 which corrects certain typographical errors in the schematics.

ACTION REQUIRED: Remove current pages 4-3, 4-4 and substitute the attached sheets.

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenim re R ad, Mamar neck, New York

Attn.: Direct r of Eng. Services.

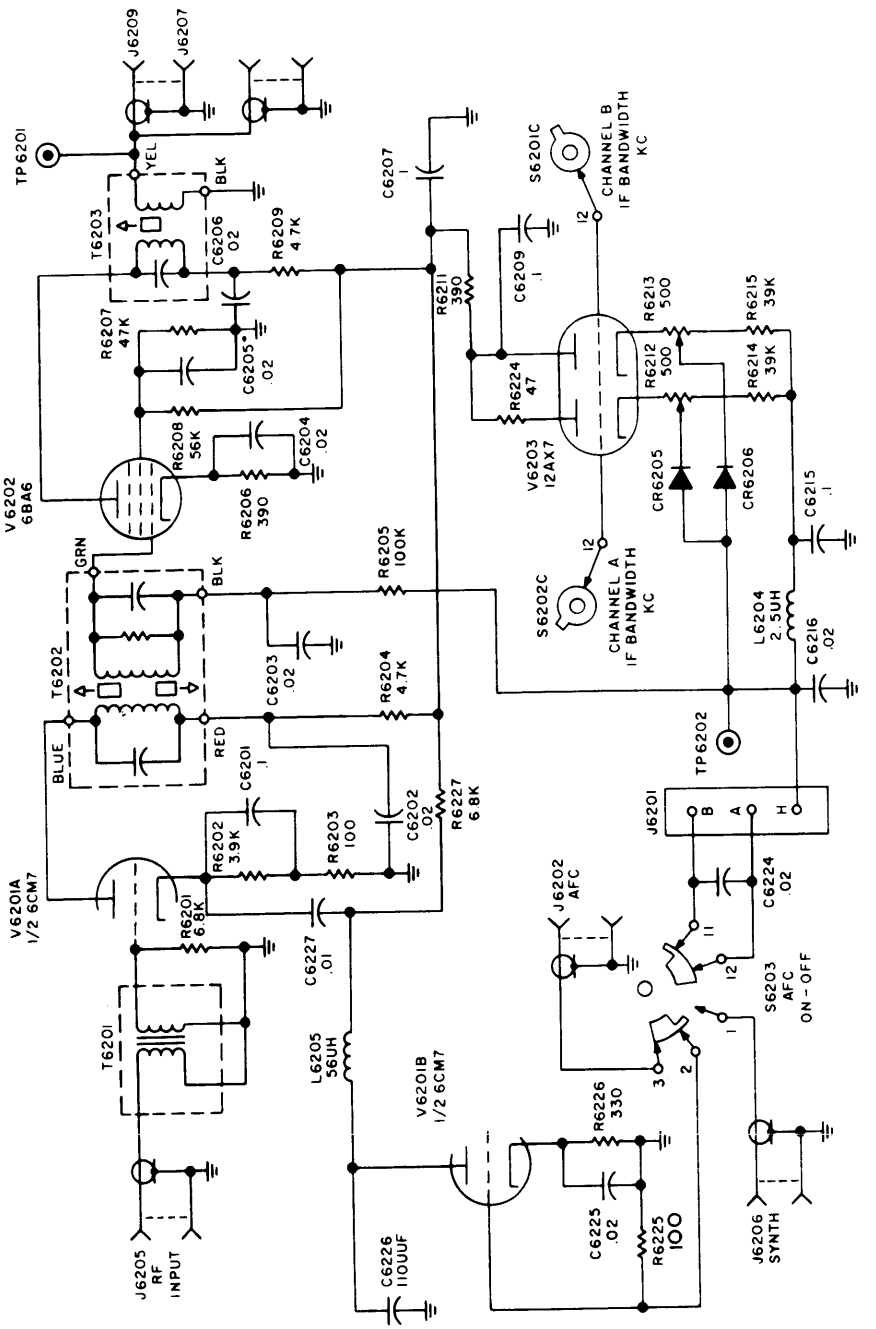


Figure 4-3. 250-KC Converter, IF Amplifier, AGC Comparator, Simplified Schematic

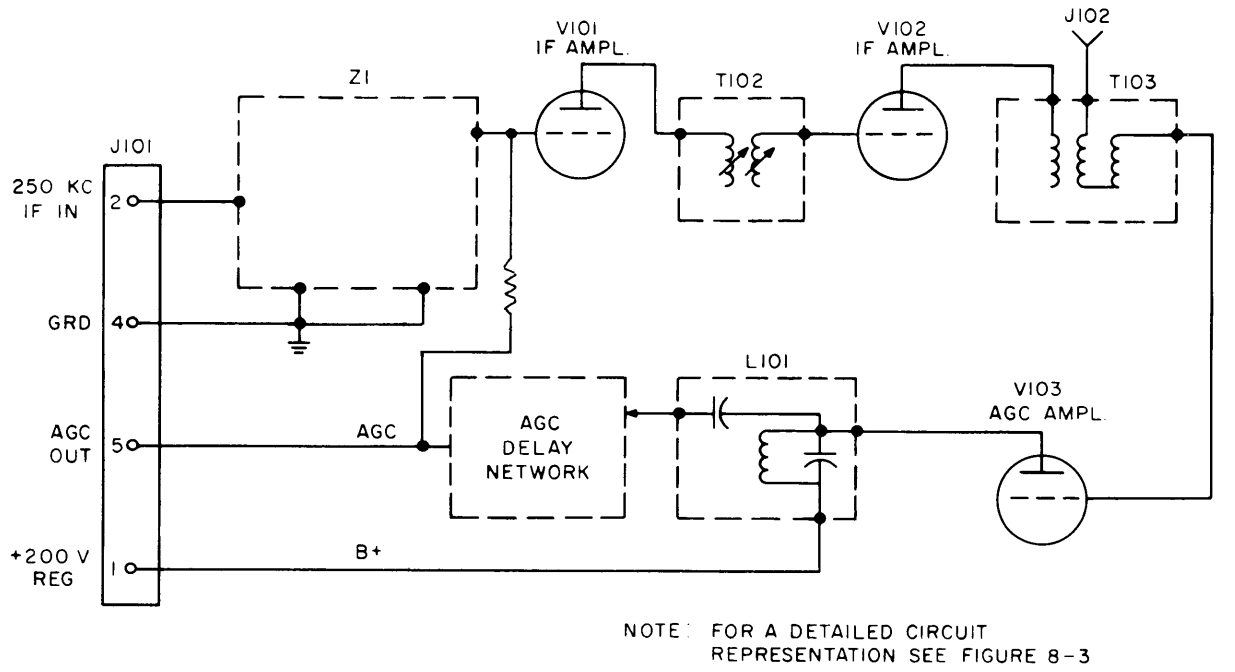


Figure 4-4. 250-KC Lower and Upper Sideband IF Amplifiers, Simplified Schematic

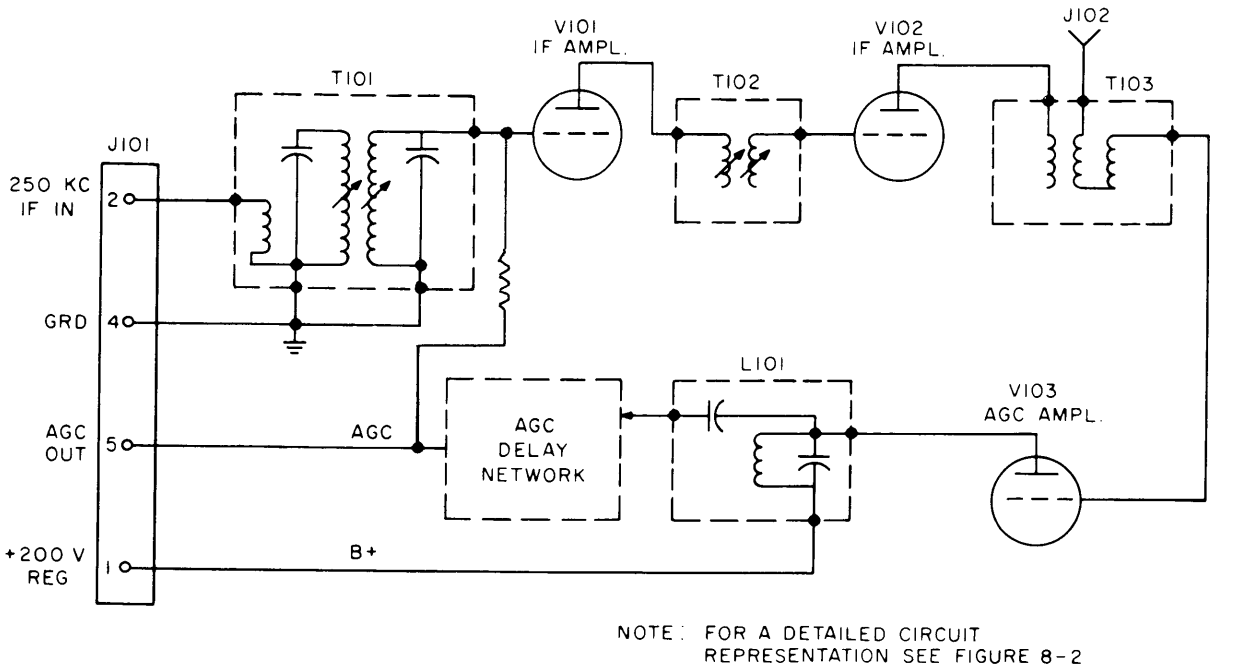


Figure 4-5. 15-KC Symmetrical IF Amplifier, Simplified Schematic

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

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SECTION 4 — PRINCIPLES OF OPERATION (Cont.)

SECTION 5 — TROUBLESHOOTING

SECTION 6 — MAINTENANCE

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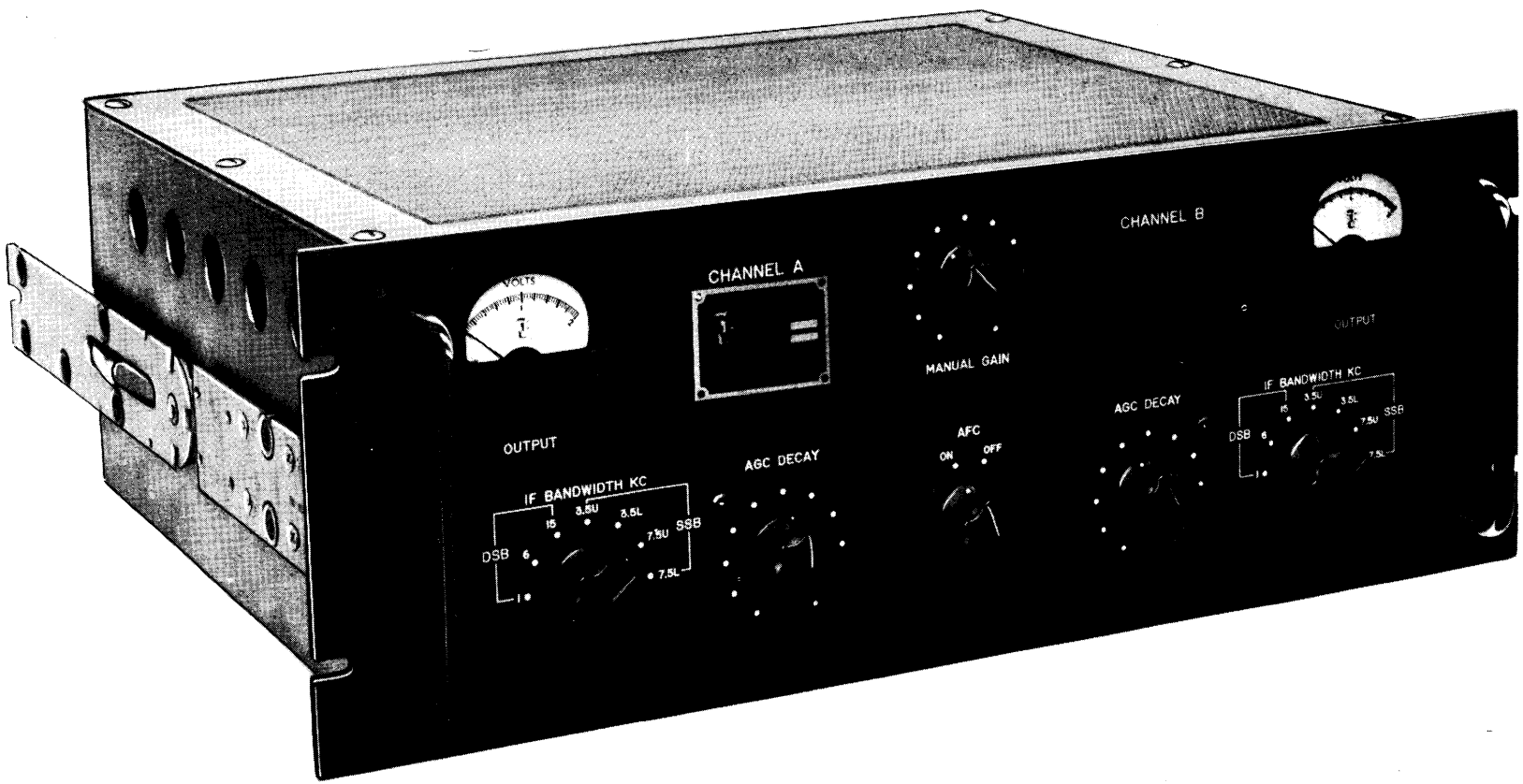
LIST OF TABLES



3001C-1

Figure 1-1. Intermediate Frequency Amplifier, Model HFI-1

SECTION 1
GENERAL DESCRIPTION

1-1. PHYSICAL DESCRIPTION.

The Intermediate Frequency Amplifier, Model HFI-1 (figure 1-1) is mounted on a standard-width 19-inch panel for installation into an equipment rack. Physical dimensions are listed in paragraph 1-3. Dust covers are provided for the top and bottom of the unit. All switches, controls, and meters for operation of the HFI-1 are functionally grouped on the front panel. The channel A switches and meter are grouped at the left, and the channel B switches and meter are grouped at the right. The controls and switches that are common to operation of both channels are grouped in the center of the panel. All vacuum tubes are accessible by removing the top dust cover.

1-2. FUNCTIONAL DESCRIPTION.

The model HFI-1, IF Amplifier Unit, accepts an input frequency of 1.75 megacyles from either an HFR-1, Continuous Tuned RF Amplifier, or an HFF-1, Fixed Tuned RF Amplifier. It also accepts mixing frequencies from either an AFC-3, Automatic Frequency Control Unit, or an HFS-1, Synthesizer. The HFI-1 also provides 250-kc outputs for the HFA-1, Audio Amplifier.

Provisions are made on the rear apron of the HFI-1 to channel the complete IF signal of 15 kc to an HNF-1, Notch Filter, for rejection of an interfering signal and back to the IF amplifier for further processing.

A selection of any one of seven independent IF amplifier channels provides a variation of bandwidth for both upper and lower sideband, and variation in symmetrical bandwidth. Each of the IF amplifiers contains its own AGC circuit. Two output level meters are provided to monitor the output of the selected IF amplifier strips.

Selection of bandwidth and upper and lower sidebands is accomplished by a filter in the input of each IF amplifier, and a switching arrangement at the output of the IF amplifiers. By this arrangement, upper or lower sidebands of 3.5-kc or 7.5-kc bandwidth, or 1-kc, 6-kc, and 15-kc symmetrical bandwidth may be connected to either channel A or channel B.

Incorporated into each IF strip is an AGC amplifier which provides agc voltage to control the gain of the IF amplifier and also supplies an agc voltage to an agc comparator circuit. During channel A and B operation, the comparator circuit compares the agc voltages from each channel and selects the strongest to be used as agc. The agc voltage from the comparator is applied to the common 250-kc IF amplifier and to connector J6201 on the rear panel of the HFI-1. The degree of agc decay is controlled by two AGC DECAY controls located on the front panel.

1-3. TECHNICAL SPECIFICATIONS OF HFI-1.

INPUT	1. 1.75 mc (±3 kc when used with AFC-3) 2. 2 mc
INPUT IMPEDANCE	50 ohms
INTERMODULATION	Intermodulation products are down 45 db from the maximum tone in the desired sideband as a result of two signals in the unwanted sideband.
IF SELECTIVITY	Seven optional bandwidths selected from the following: 1. 250 to 7500 cps USB ±1.5 db 2. 250 to 7500 cps LSB ±1.5 db 3. 250 to 3500 cps USB ±1.5 db 4. 250 to 3500 cps LSB ±1.5 db 5. 1 kc symmetrical ±1.5 db 6. 6 kc symmetrical ±1.5 db 7. 15 kc symmetrical ±1.5 db
OUTPUT	Two 250 kc in a 50-ohm load.
OUTPUT AMPLITUDE	1 volt peak ±1.5 db for the bandpass of the selected filter.
AGC OUTPUT	0-10 volts DC. (Dependent on input signal level.)
AGC (When used with HFR-1 or HFF-1)	Audio output from HFA-1, Audio Amplifier, remains within ±1.5 db for 100-db change in input within the input voltage range of 1 microvolt to 0.1 volt. The AGC circuit has a fast attach time and a front panel adjustable decay time from 1 to 10 seconds. The AGC voltage is derived from the strongest of two IF channel signals. AGC is externally available for diversity operation.
INPUT POWER	6.3 volts AC, +200 volts DC, -105 volts DC. (All are obtained from HFP-1, Power Supply.)
TEMPERATURE AND HUMIDITY	0 to 50°C up to 90% humidity.
STORAGE TEMPERATURE	-20° to 75°C
WEIGHT	25 lbs
DIMENSIONS	8-3/4" x 19" x 14"
COMPONENTS AND CONSTRUCTION	All equipment manufactured in accordance with JAN/MIL specifications wherever practicable.

TABLE 1-1. VACUUM TUBE COMPLEMENT

SYMBOL	TYPE	FUNCTION
V101	6BA6	1st IF amplifier
V102	6CE5	2nd IF amplifier
V103	6CE5	Agc amplifier
V6201	6CM7	Converter and amplifier
V6202	6BA6	IF amplifier (Common)
V6203	12AX7	Agc comparator

SECTION 2
INSTALLATION

2-1. INITIAL INSPECTION.

Each HFI-1 has been calibrated and tested at the factory before shipment. Upon arrival at the operating site, immediately inspect the packing case and its contents for possible damage. Unpack the equipment carefully. Inspect all packing material for parts which may have been shipped as "loose items". With respect to damage to the equipment for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

The equipment is shipped with all tubes and other plug-in components installed. Check that all such components are properly seated in their sockets.

2-2. MECHANICAL INSTALLATION.

The HFI-1 is equipped with a standard 19-inch rack panel and is supplied with slides for mounting in a suitable equipment rack. The mounting slides are "chassis-tilt" type, which allow the chassis to be pulled out of the equipment rack and tilted in a vertical position to expose either the top or bottom of the chassis for greater accessibility and ease of maintenance. Figure 2-1 is the outline dimensional drawing of the HFI-1.

2-3. ELECTRICAL INSTALLATION.

The HFI-1 does not contain its own power supply; therefore, an external regulated power supply,

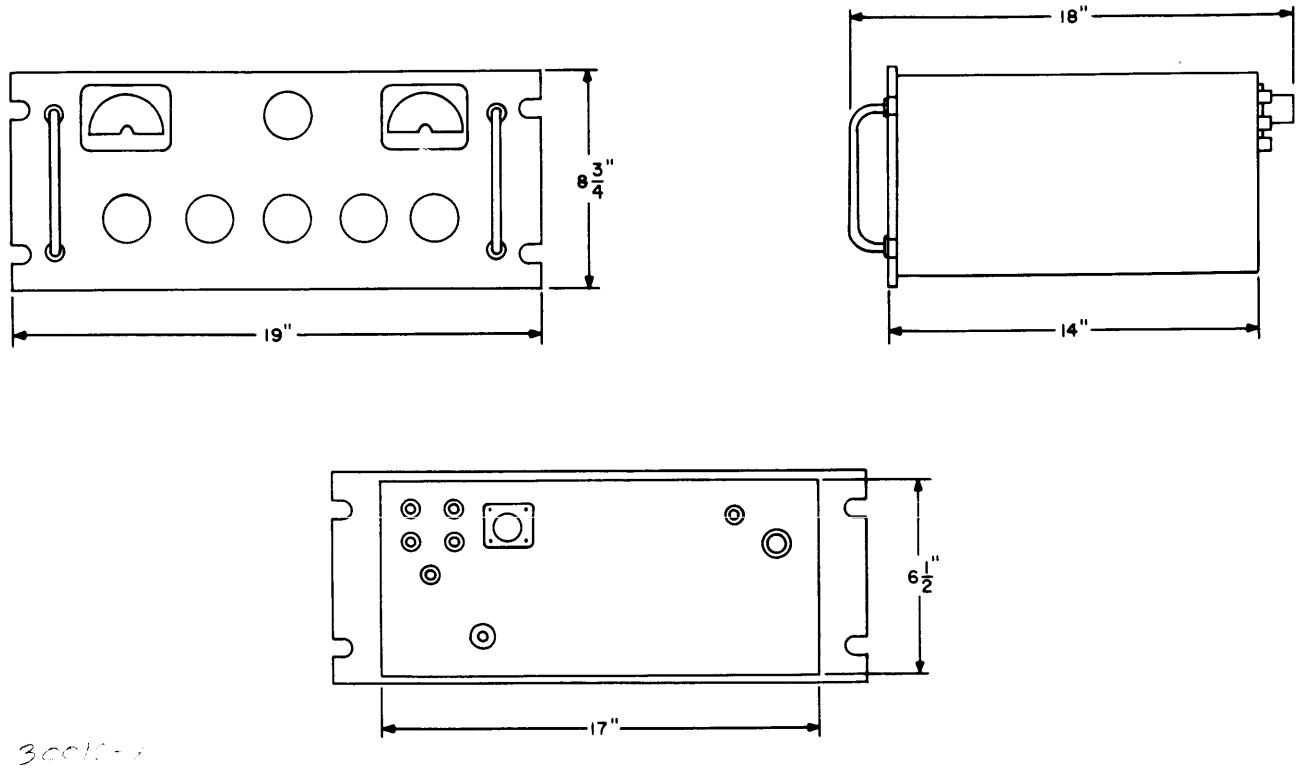


Figure 2-1. Outline Dimensional Drawing, HFI-1

such as the TMC Model HFP-1, is required. The voltage required to operate the HFI-1 is fed to connector J-6201 located on the rear panel. Refer to Table 1-3, Technical Specifications of HFI-1, for operating voltage requirements.

Figure 2-2 illustrates the interconnections, input connections, and output connections for the HFI-1.

2-4. INITIAL ADJUSTMENT.

Before any HFI-1 unit is shipped, it is aligned and thoroughly checked against the manufacturer's specifications. Therefore, no initial adjustments are necessary other than those listed in the Operation Chart, Table 3-2.

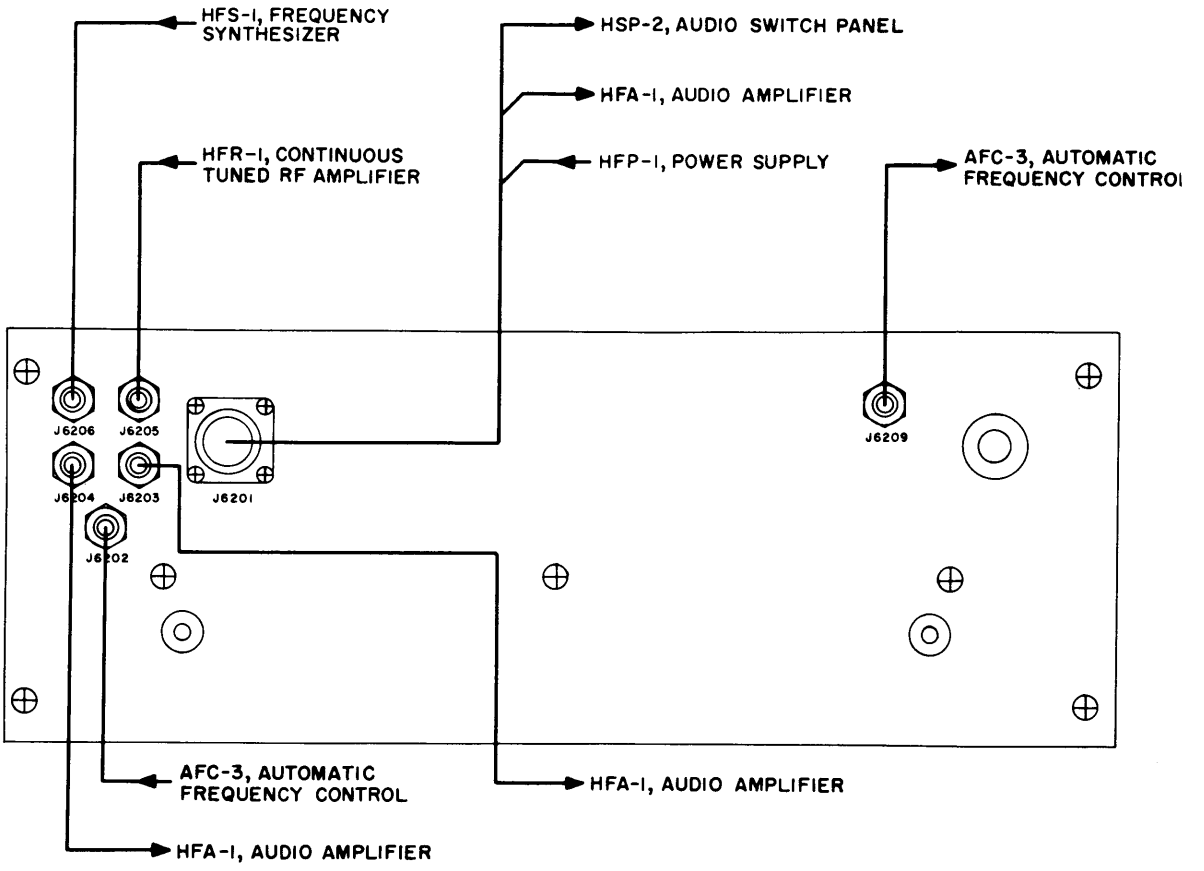


Figure 2-2. Interconnection Diagram, HFI-1

SECTION 3
OPERATOR'S SECTION

3-1. GENERAL.

The HFI-1 unit has been designed to operate with a high degree of simplicity and versatility. Each channel has identical controls which are functionally grouped. By using the two IF BANDWIDTH KC front panel switches, either a symmetrical upper or lower band may be switched to channel A or B. This type of versatility is helpful, especially during independent sideband operation where voice information may be transmitted on one sideband while multichannel information may be transmitted on the other sideband. In this manner sideband orientation of information need not be maintained at the transmitter.

3-2. OPERATOR'S INSTRUCTIONS.

Table 3-1 provides equivalent control designations for the operating controls shown in figure 3-1 and the component designations of figure 8-1. Table 3-2 is an operating chart to be used in conjunction with figure 3-1 and table 3-1.

3-3. OPERATOR'S MAINTENANCE.

The operator should note the general settings of panel switches and check the condition of all tubes and interconnecting cables.

All interconnecting cables should be securely connected and all tube shields reinstalled if tubes are checked or replaced.

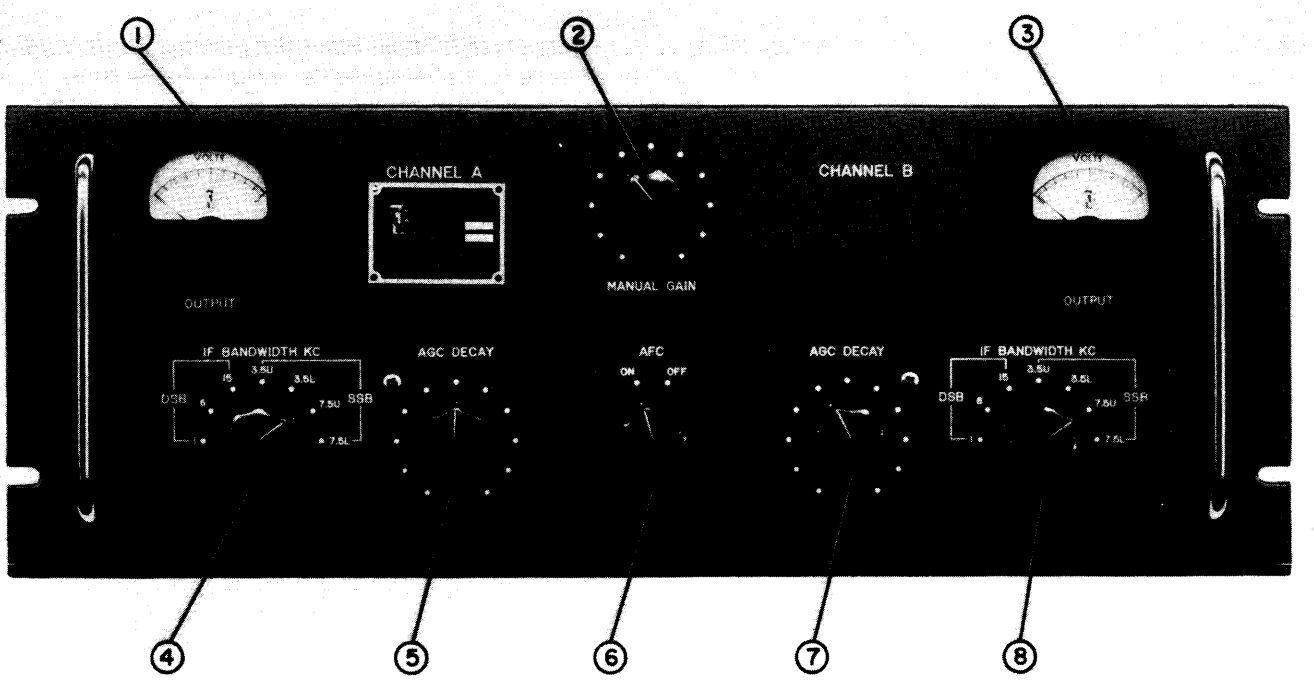


Figure 3-1. Front Panel View of HFI-1, Showing Operating Controls

TABLE 3-1. TABLE OF EQUIVALENT CONTROL DESIGNATIONS

Serial Designation	Panel Designation	Component Ref Designation No.
1	CHANNEL A OUTPUT meter	M6201
2	MANUAL GAIN knob control	R6222
3	CHANNEL B OUTPUT meter	M6202
4	CHANNEL A IF BANDWIDTH KC knob control	S6201
5	CHANNEL A AGC DECAY knob control	R6223
6	AFC ON-OFF knob control	S6203
7	CHANNEL B AGC DECAY knob control	R6221
8	CHANNEL B IF BANDWIDTH KC knob control	S6202

TABLE 3-2. HFI-1 OPERATION CHART

STEP	CONTROL	OPERATION	PURPOSE
1	CHANNEL A IF BANDWIDTH KC switch (4)	Turn to desired channels and bandwidths	Determines channels and bandwidths.
2	CHANNEL B IF BANDWIDTH KC switch (8)	Turn to desired channels and bandwidths.	Determines channels and bandwidths.
3	AFC switch (6)	Turn to OFF if system is synthesized. Turn to ON if AFC is employed.	Connects input from J-6206. Connects input from J-6202.
4	AGC DECAY channel A (5)	Turn to desired setting.	Varies the discharge time constant of the AGC network.
5	AGC DECAY channel B (7)	Turn to desired setting.	Varies the discharge time constant of the AGC network.
6	MANUAL GAIN control (2)	OFF position. Clockwise position	Disables the manual gain circuitry. Voltage is applied to wiper of R-6222 causing the manual gain voltage to overcome the AGC voltage. Gain increases in clockwise direction of the MANUAL GAIN control until the AGC voltage exceeds the manual gain voltage.

SECTION 4
PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

The following descriptions pertain to the Model HFI-1, IF Amplifier Unit. A brief description of circuitry operation is explained in the following text, with no attempt to explain conventional circuitry operation. Each description is referenced to its particular simplified schematic diagram figure number. Simplified block diagrams of the IF plug-in amplifier and the overall HFI-1 unit are also shown in figures 4-1 and 4-2.

4-2. 250 KC CONVERTER, IF AMPLIFIER, AGC COMPARATOR. (See Figure 4-3.)

The RF input, applied at J-6205, is coupled through an IF transformer (T-6201) and is applied to the control grid of the 250-kc converter, V-6201A.

The injection signal, applied to J-6202 and J-6206, is selected by the AFC ON-OFF switch, S-6203. This signal is then amplified by V-6201B and applied to the 250-kc converter cathode circuit.

The 250-kc converter output is then applied to a double-tuned RF transformer (T-6202) and coupled to the control grid of IF amplifier V-6202. This IF amplifier is a conventional IF stage, with a bandpass characteristic exceeding 15 kc and employing agc. The agc voltage appears at the BLACK lug of RF transformer T-6202 via a low pass network comprised of R-6205 and C-6203.

The output of IF amplifier V-6202 is coupled through transformer T-6203, providing an output impedance of 50 ohms to J-6207, J-6209, and an IF signal sampling test point, TP-6201.

The 250-kc output signal, fed through cable W-6201, is applied simultaneously to the input circuits of the seven 250-kc IF plug-in strips.

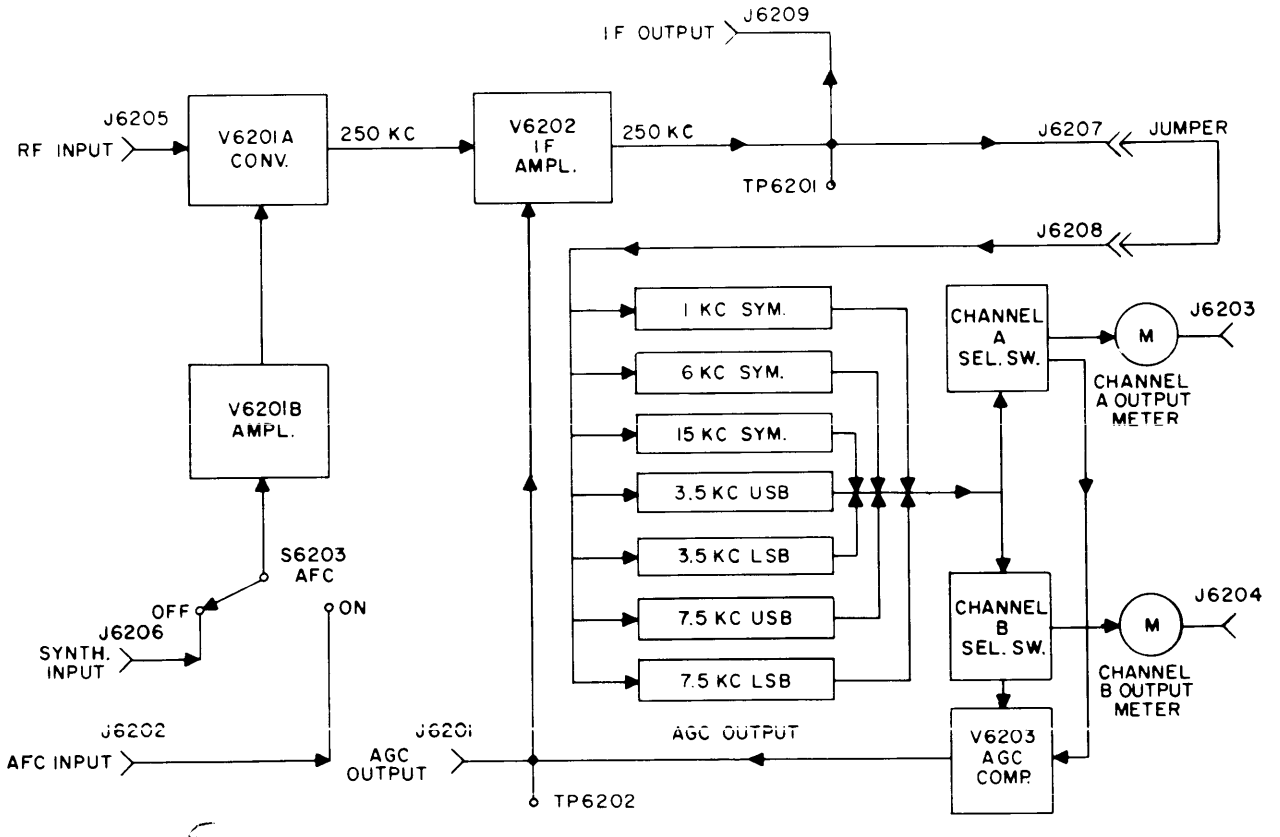


Figure 4-1. Simplified Block Diagram, Model HFI-1

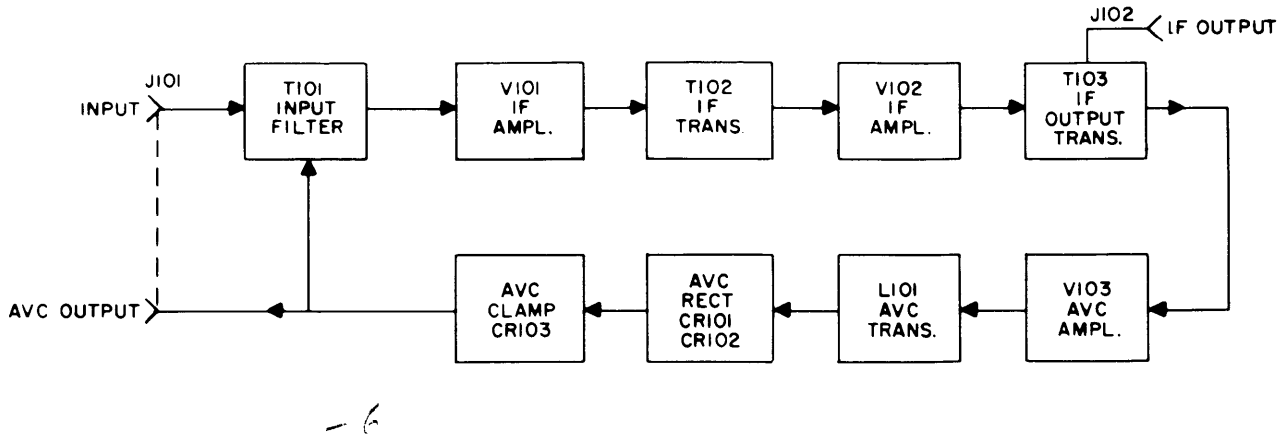


Figure 4-2. Simplified Block Diagram, IF Plug-In Amplifier

The agc comparator, V-6203, receives, at its control grids, two agc voltages corresponding to the IF channels selected by the channel selector switches, S-6201C and S-6202C. The strongest agc signal is then applied, through the cathode circuit and two agc balance controls, R-6212 and R-6213, to the IF amplifier input, an agc sampling test point, TP-6202, and to J-6201.

4-3. 250 KC LOWER AND UPPER SIDEBAND IF AMPLIFIERS.

The seven IF plug-in amplifiers, incorporated in the HFI-1 unit, are all similar in operation, but differ in function. Of the seven IF plug-in units, two are used for 3.5 kc USB and LSB, two for 7.5 kc USB and LSB, and three for 1 kc, 6 kc, and 15 kc symmetrical.

Selection of lower or upper sideband or symmetrical bandwidths is accomplished by a selective filter (Z1) in the input of each IF amplifier, except for the 15 kc symmetrical which is explained in paragraph 4-4.

As shown in figure 4-4, the IF plug-in amplifiers consist of two cascade IF amplifier stages and one AGC amplifier stage. The IF output, from the second IF amplifier (V102), is coupled out to J102 from a secondary winding of IF transformer T103. The signal is also coupled, through another secondary winding of T103, to the AGC amplifier grid.

The AGC amplifier output is then coupled, through a tunable coil (L101), to an AGC rectifier, CR102, and a positive peak clipper, CR101. The AGC is developed and stored in capacitor C111, and discharges through the appropriate AGC decay network.

4-4. 15 KC SYMMETRICAL IF AMPLIFIER.

The 15-kc symmetrical IF amplifier, used in the HFI-1 unit, is identical in operation and circuitry to the 3.5-kc and 7.5-kc IF amplifiers; the only difference is that a tunable transformer rather than a filter is used in the input of the 15-kc symmetrical IF amplifier, as shown in figure 4-5.

4-5 1 KC AND 6 KC SYMMETRICAL IF AMPLIFIER. (See Figure 4-4.)

The 1-kc and 6-kc symmetrical IF amplifiers, used in the HFI-1 unit, are identical in operation and circuitry to the 3.5-kc and 7.5-kc IF amplifiers; the only difference being the type of selective filter used in the input of each IF amplifier.

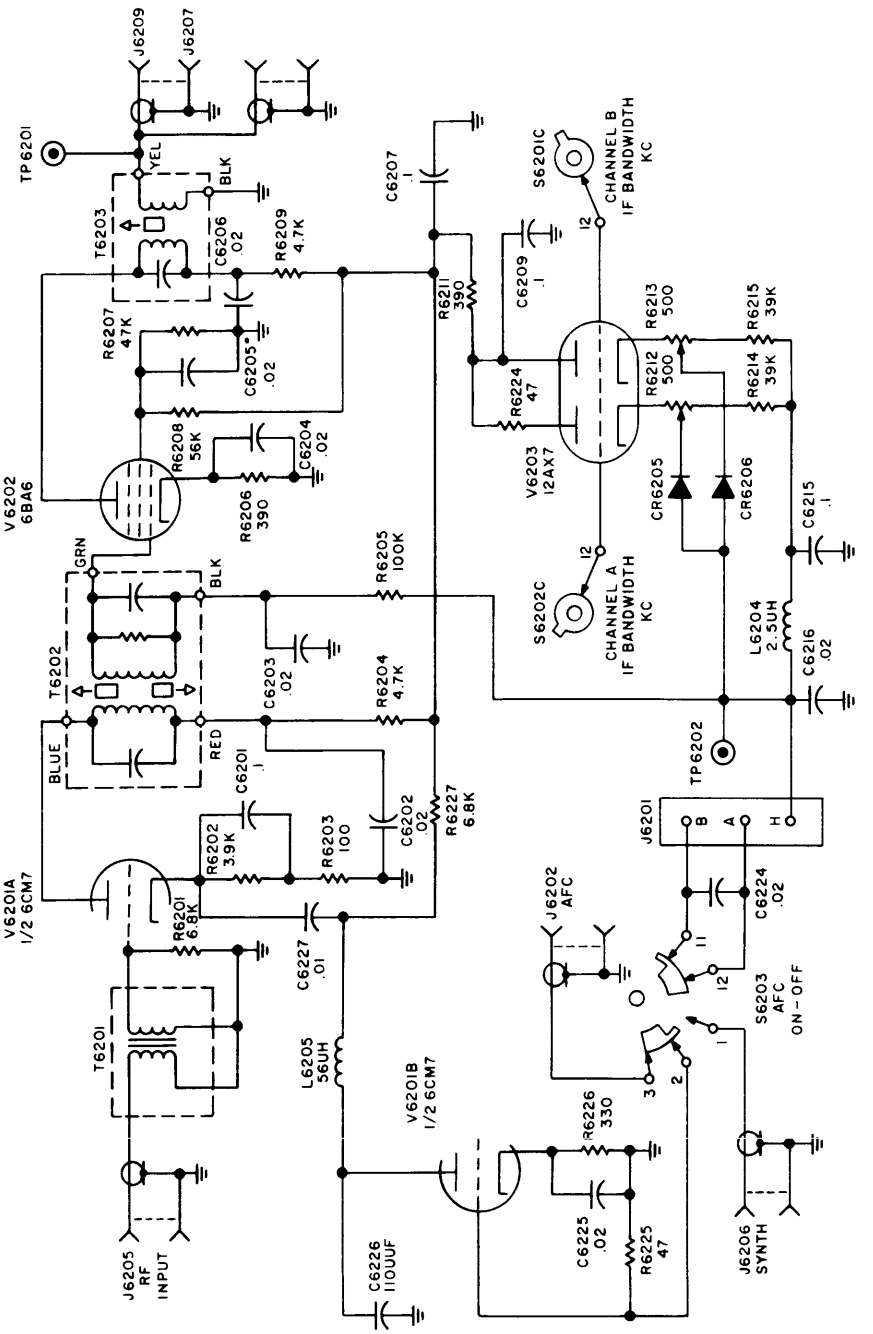


Figure 4-3. 250-KC Converter, IF Amplifier, AGC Comparator, Simplified Schematic

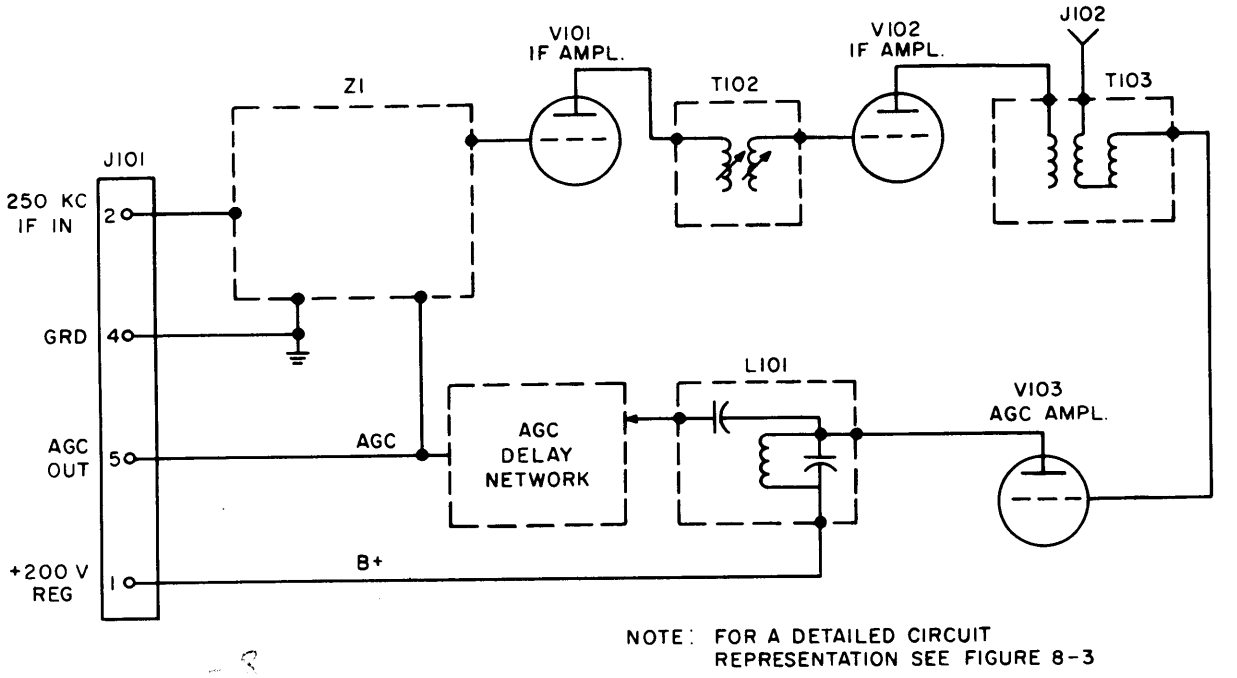


Figure 4-4. 250-KC Lower and Upper Sideband IF Amplifiers, Simplified Schematic

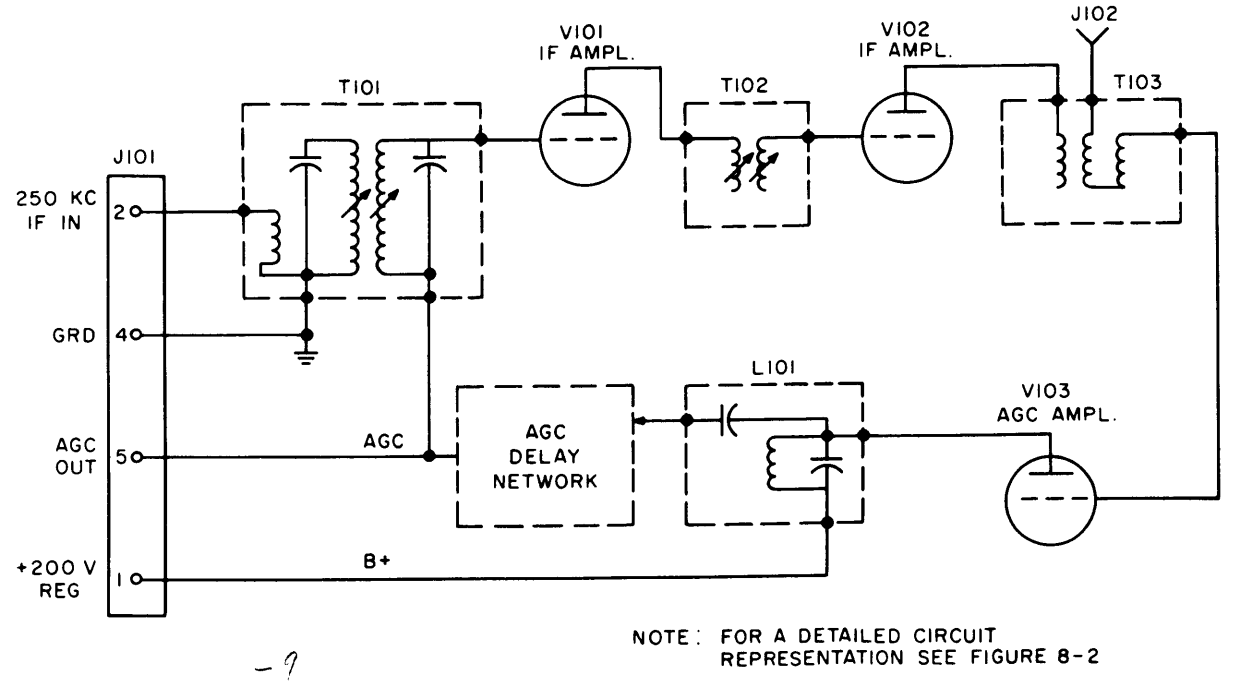


Figure 4-5. 15-KC Symmetrical IF Amplifier, Simplified Schematic

SECTION 5
TROUBLESHOOTING

5-1. INTRODUCTION.

This section explains how to locate and diagnose equipment troubles and maladjustments. The information necessary to remedy the troubles and maladjustments will be found in Section 6 of this manual.

The following aids to troubleshooting are provided:

a. Schematic diagrams.

b. Voltage and resistance tables.

c. Tube location data.

d. Troubleshooting techniques.

e. Troubleshooting chart, based on types of operation.

f. Troubleshooting chart, based on normal indications.

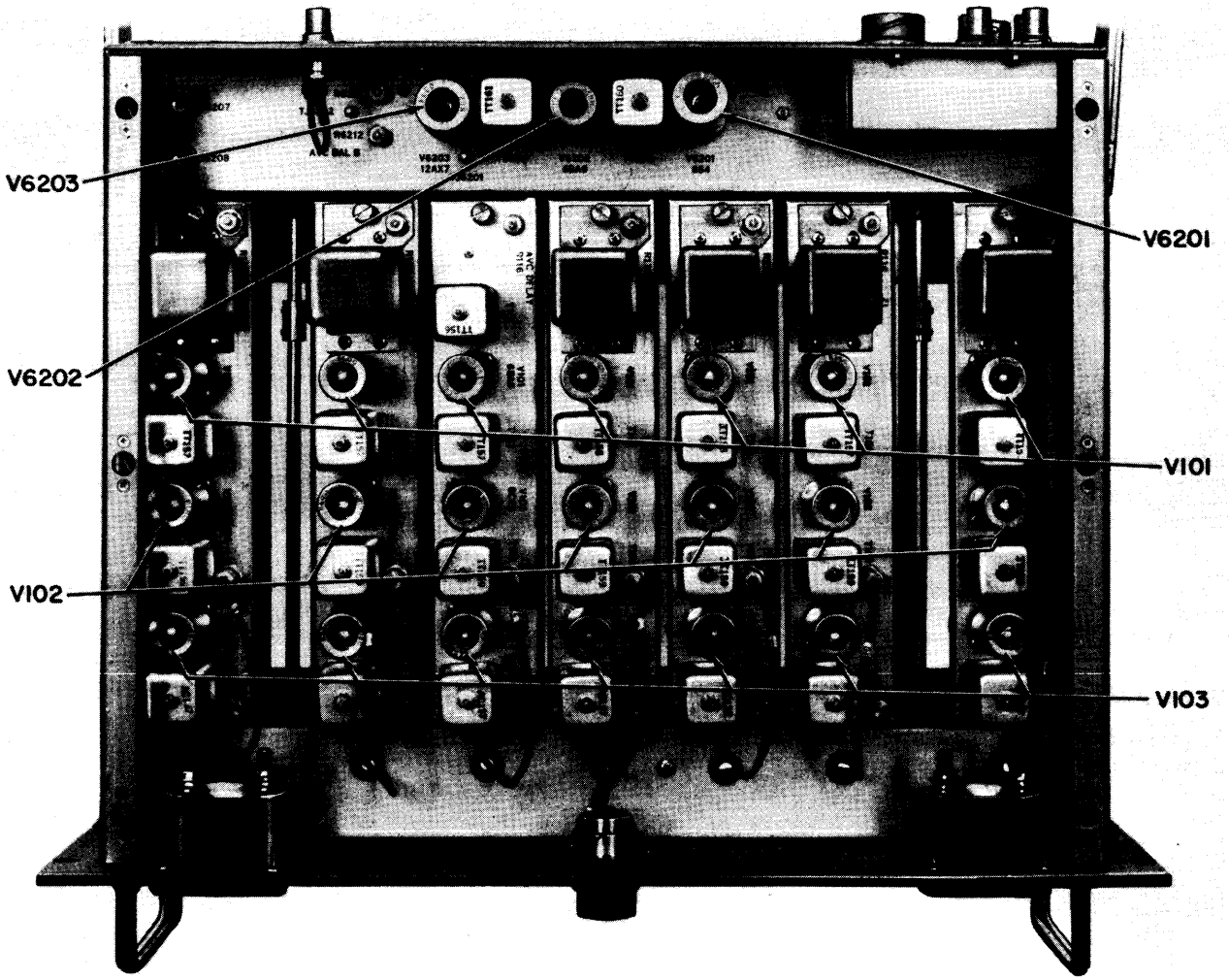


Figure 5-1. HFI-1, Tube Locations

5-2. TROUBLESHOOTING TECHNIQUES.

a. GENERAL CONSIDERATIONS. When a piece of equipment has been working satisfactorily and suddenly fails, the cause of failure may be apparent either because of circumstances occurring at the time of failure or because of symptoms analogous to past failures. In this case, it is necessary to follow a lengthy and orderly course of troubleshooting in order to localize and isolate the faulty part.

A second shortcut in troubleshooting is to ascertain that all tubes and fuses are in proper operating condition and that the proper equipment operating voltages are present. This may eliminate further investigation.

A third shortcut is to examine the equipment section by section for burned out elements, charring, corrosion, arcing, excessive heat, dirt, dampness, etc.

b. TROUBLESHOOTING TABLE BASED ON TYPES OF RECEPTION. The general purpose of this chart is to narrow the area of trouble in one or more sections of the equipment in order to minimize the labor of locating the source of trouble. When the trouble is localized to a section, use should be made of the voltage and resistance charts and the alignment procedures for that section.

c. VOLTAGE AND RESISTANCE TABLES. These tables give nominal values of voltage-to-chassis and resistance-to-chassis at tube elements. Large deviations from the nominal values should be carefully investigated. During this process, accurate schematic diagrams and location data are essential. Refer to Section 8 for HFI-1 schematic diagrams.

d. TROUBLESHOOTING BASED ON NORMAL INDICATIONS. The purpose of this chart is to localize trouble by means of normal operating indications. When performing the action listed in the PRELIMINARY ACTION column, observe for the indication given in the NORMAL INDICATION column. If a normal indication is not observed, perform the procedure given in the REMEDY column. When performing the given REMEDY procedure, refer to the particular figure, table, or paragraph number given in the second column.

TABLE 5-1. TROUBLESHOOTING BASED ON TYPES OF OPERATION

STEP	SYMPTOM	PROCEDURE
1	Channels A and B inoperative	Check tubes V6201, V6202 and their associated circuitry. Check IF plug-in unit operation and interconnection.
2	No AGC action	Check AGC comparator V6203 and associated circuitry.
3	Upper sideband is received normally but lower sideband inoperative on 3.5-kc or 7.5-kc bandwidth.	Check tubes V101 and V102 and associated circuitry in the lower sideband IF amplifier providing the 3.5-kc or 7.5-kc bandwidth.
4	Lower sideband is received normally but upper sideband inoperative on 3.5-kc or 7.5-kc bandwidth.	Check tubes V101 and V102 and associated circuitry in the upper sideband IF amplifier providing the 3.5-kc or 7.5-kc bandwidth.
5	Reception on only one sideband during independent sideband operation.	See steps 3 and 4.

TABLE 5-2. HFI-1 VOLTAGE MEASUREMENTS

TUBE	TYPE	FUNCTION	SOCKET PIN NUMBERS								
			1	2	3	4	5	6	7	8	9
V101	6BA6	IF Amplifier	0	.98	6.3 AC	0	144	88	.98		
V102	6CE5	IF Amplifier	0	1.32	6.3 AC	0	155	130	1.32		
V103	6CE5	AGC Amplifier	0	3.1	6.3 AC	0	180	160	3.1		
V6201	6CM7	Converter and Amplifier	181	126	2.5	0	6.3 AC	140	0	0	9.2
V6202	6BA6	IF Amplifier	0	1.8	6.3 AC	0	180	60	1.8		
V6203	12AX7	AGC Comparator	195	0	*	6.3 AC	6.3 AC	195	0	*	0

CONDITIONS:

All measurements taken with VTVM.
No input signal.
All voltages are with respect to chassis ground.
All voltages are DC unless otherwise noted.

* Depends upon tube and settings of R6212 and R6213. Approximately 0.5 VDC.

TABLE 5-3. HFI-1 RESISTANCE MEASUREMENTS

TUBE	TYPE	FUNCTION	SOCKET PIN NUMBERS								
			1	2	3	4	5	6	7	8	9
V101	6BA6	IF Amplifier	280K	68	FIL	0	42K	62K	68		
V102	6CE5	IF Amplifier	72	100	FIL	0	39K	58K	100		
V103	6CE5	AGC Amplifier	6	430	FIL	0	40K	44K	430		
V6201	6CM7	Converter and Amplifier	10K	12K	330	0	FIL	12K	47	0.8	4K
V6202	6BA6	IF Amplifier	210K	390	FIL	0	6.5K	25K	380		
V6203	12AX7	AGC Comparator	3.2K	4.6K	*	FIL	FIL	3.2K	4.6K	*	0

CONDITIONS:

All measurements taken with ohmmeter, Simpson type 260 or equivalent.
All resistances are to ground.
All power is turned off.

K - One thousand
* - Depends upon tube and settings of R6212 and R6213. Approximately 120K ohms.

TABLE 5-4. TROUBLESHOOTING BASED ON NORMAL INDICATIONS

STEP	FIGURE, TABLE OR PARAGRAPH NUMBER	PRELIMINARY ACTION	NORMAL INDICATION	REMEDY
1	Table 3-2	POWER ON, all front panel controls set at normal operating positions.	Normal operation	If normal indication is not obtained, check interconnecting power from external power supply. Check all interconnecting cables for proper connections.
2	Figure 8-4	Output Level Meters	1 volt	If normal indication is not obtained, check applicable IF plug-in unit connection and operation.
3	Figure 4-3	Test Point TP6201	250-kc output, 1.5-3.0 mv	If normal indication is not obtained, check interconnecting RF input to J6205. Check tubes V6201, V6202 and associated circuitry.
4	Figure 4-3	Test Point TP6202	AGC output (any negative voltage depending upon signal strength)	If normal indication is not obtained, check tube V6203 and associated circuitry. Check interconnection and operation of IF plug-in units.
5	Figure 8-4	J6210 thru J6216, Pin 1	+200 vdc	If normal indication is not obtained, check power input connection to J6201, pin K. If voltage is not present, check connecting cable or external power supply. If voltage is present, check for shorted capacitors in associated circuitry.
6	Figure 8-4	J6210 thru J6216, Pin 2	250-kc IF input, 1.5-3.0 mv	If normal indication is not obtained, check if voltage appears at J6207. If normal indication is obtained, check interconnection. If normal indication is not obtained, perform step 3.
7	Figure 8-4	J6210 thru J6216, Pin 3	Ground	If normal indication is not obtained, check for faulty ground connection or broken wire.
8	Figure 8-4	J6210 thru J6216, Pin 4	Ground	If normal indication is not obtained, perform step 7.
9	Figure 8-4	J6210 thru J6216, Pin 6	Ground	If normal indication is not obtained, perform step 7.
10	Figure 8-4	J6210 thru J6218, Pin 7	Filament Voltage 6.3 vdc	If normal indication is not obtained, check interconnecting power cable and external power supply.

TABLE 5-4. TROUBLESHOOTING BASED ON NORMAL INDICATIONS (C nt.)

STEP	FIGURE, TABLE OR PARAGRAPH NUMBER	PRELIMINARY ACTION	NORMAL INDICATION	REMEDY
11	Figure 8-3	J102	250-kc output signal 1.0 volt rms	If normal indication is not obtained, check appropriate IF plug-in unit interconnections. Check tubes V101, V102 and associated circuitry.
12	Figure 8-4	J6201, Pin H	-105 vdc	If normal indication is not obtained, perform step 10.

SECTION 6
MAINTENANCE

6-1. INTRODUCTION.

Maintenance may be divided into three categories: operator's maintenance, preventive maintenance, and corrective maintenance. Corrective maintenance is sometimes considered as consisting of information useful in locating and diagnosing equipment troubles and maladjustments, existing and/or pending, and information necessary to remedy the equipment troubles and maladjustments. Corrective procedures in this section are those necessary to correct a trouble due to a maladjustment of an alignment control or adjustment. By using these procedures with those presented in Section 5, a trouble may also be localized to a particular section. Operator's maintenance is included in Section 3.

The HFI-1 has been designed to provide long-term trouble-free operation under continuous-duty conditions. It is recommended that any necessary maintenance be done by a competent maintenance technician familiar with troubleshooting techniques. If the trouble cannot be corrected by following the procedure presented in this section and Section 5, it is recommended that the HFI-1 be returned to the Technical Materiel Corporation for servicing.

6-2. PREVENTIVE MAINTENANCE.

a. In order to prevent failure of the equipment due to corrosion, tube failure, dust, or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to.

b. At periodic intervals (at least every 6 months) the equipment should be removed from the rack for cleaning and inspection. All accessible covers should be removed, and the wiring and all components inspected for dirt, corrosion, charring, discoloring, grease; in particular, the tube sockets should be carefully inspected for deterioration. Dust may be removed with a soft brush or vacuum cleaner. Remove dirt or grease from other parts with any good dry cleaning fluid.

WARNING

When using trichlorethylene, make certain that adequate ventilation exists. Avoid prolonged contact with skin.

c. While the HFI-1 unit is out of the rack with covers removed, check the tubes, all of which are accessible from the top of the chassis.

d. Carefully inspect for loose solder connections or screws, especially on solder lugs. Recommended time interval is every 6 to 12 months, depending on the amount of vibration encountered in service.

6-3. CORRECTIVE MAINTENANCE.

The corrective maintenance procedure is essentially Technical Materiel Corporation's factory alignment procedures modified for use in the field. Table 6-1 lists the test equipment necessary for alignment. The alignment procedures are outlined in Tables 6-2 through 6-4. Figure 6-1 locates the alignment controls and adjustments.

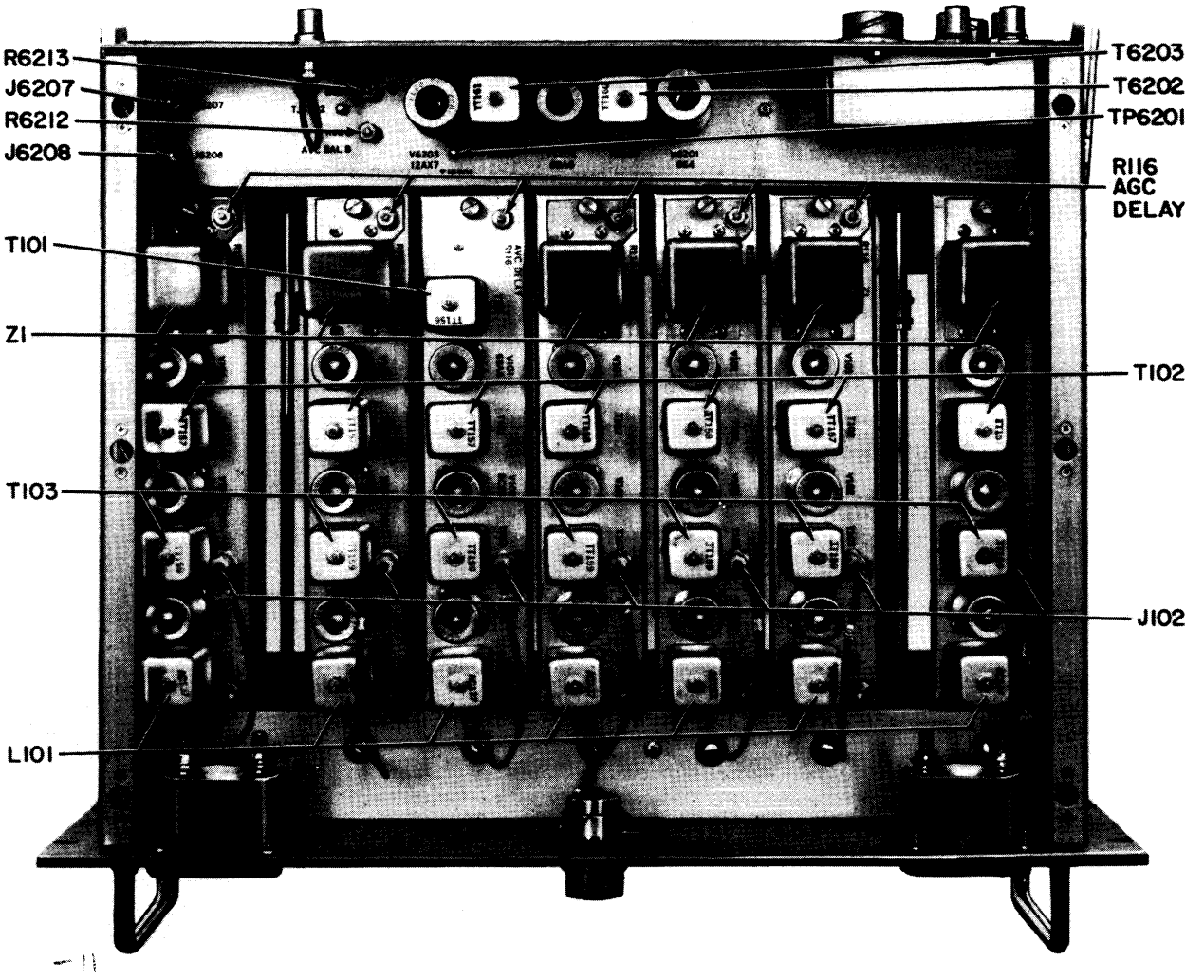


Figure 6-1. Location of HFI-1 Alignment Controls and Adjustments

TABLE 6-1. TEST EQUIPMENT FOR ALIGNMENT

ITEM	MANUFACTURER
A-c vacuum tube voltmeter. (Used as indicator.)	Ballantine Model 314 or equivalent.
R-f generator	Standard Measurements Model 82 or equivalent.
Regulated power supply, +200 vdc, -105 vdc and 6.3 vac output.	TMC Model HFP-1 or equivalent.
Cable terminated with a 50 ohm resistor.	TMC part No. PL-204 and RG-174/U or equivalent. (See figure 6-2.)
Socket, connected to power supply.	TMC part No. JJ-216 or equivalent. (See figure 6-2.)
Vacuum tube voltmeter with r-f probe.	Hewlett Packard Model 410B or equivalent.
100 K ohm, 1 watt resistor to be used in series with r-f probe.	Any manufacturer meeting the necessary specifications.

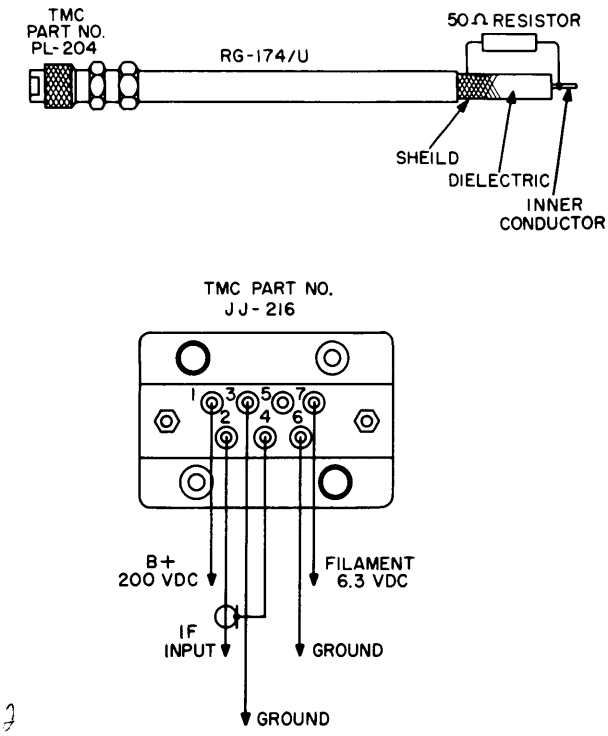


Figure 6-2. Alignment Test Equipment

TABLE 6-2. IF AFC ALIGNMENT

STEP	OPERATION
1	Connect a zero-centered VTVM at the AVC test point. Use lowest scale without overloading meter.
2	Turn time constant A fully clockwise.
3	Turn time constant B fully clockwise.
4	Turn R6212 fully clockwise.
5	Adjust R6213 for zero center. When zero center cannot be obtained, change V6203.
6	Adjust R6212 until the AVC test point voltage becomes slightly negative.
7	Adjust R6212 for zero center.
8	Turn time constant A fully counterclockwise.
9	Adjust R6212 for zero center on VTVM.
10	Turn time constant B fully counterclockwise.
11	Adjust R6213 for zero center on VTVM.
12	AVC test point voltage is not to exceed ±0.1 volt with any change in time constant controls.
13	If AVC test point voltage change exceeds ±0.1 volt, re-adjust R6212 and R6213 for minimum change in voltage at the AVC test point with a maximum change in the AVC time constant controls. R6212 will compensate for time constant B, and R6213 will compensate for time constant A.

TABLE 6-3. CONVERTER ALIGNMENT

STEP	OPERATION
1	Adjust signal generator to 250 kc at 0.05 volt out.
2	Connect coaxial cable from signal generator to J6205.
3	Connect VTVM, with a 100 K resistor in series with the probe tip, using lowest scale, to pin 1 of V6201.
4	Temporarily connect a lead from chassis ground to lug next to R6205 (100 K resistor).
5	Turn bottom slug of T6202 fully counterclockwise.
6	Adjust top slug of T6202 for maximum voltage.
7	Adjust bottom slug of T6202 for minimum voltage.
8	Reduce signal generator to 0.01 volt out.
9	Remove 100 K resistor from VTVM probe tip and connect probe to TP6201.
10	Adjust T6203 for maximum deflection on VTVM.
11	Output voltage at TP6201 should be 0.28 ±0.05 volt.
12	Total bandwidth at 3 db points should be 20 ±1 kc.
13	Remove temporary lead between chassis ground and R6205.
14	This completes alignment of converter.

TABLE 6-4. 250 KC PLUG-IN IF STRIP ALIGNMENT

STEP	OPERATION
1	Ground the AVC bus on TB101 at R102 lug near lettering.
2	Connect signal generator to pin 1 of V102.
3	Adjust signal generator to 250 kc.
4	Connect terminated cable to J102 and indicator.
5	Turn power on. **WARNING** This voltage is lethal and should be treated as such.
6	Adjust signal generator output, as needed, while peaking T103 tuning core on top of can, to produce 1-volt output. Tighten locknut.
7	Temporarily connect indicator to green dot on L101 and peak tuning core located on top of can. Tighten locknut.
8	Reconnect indicator to terminated cable. Connect signal generator to pin 1 of V101.

TABLE 6-4. 250 KC PLUG-IN IF STRIP ALIGNMENT (C nt.)

STEP	OPERATION
9	Reduce signal generator output from previous setting as needed, to produce 1-volt output while peaking tuning cores on top and bottom of T102. (This is an approximate adjustment.)
10	Temporarily place a short jumper from the green dot of T102 to ground. Connect indicator to pin 5 of V101. Peak top tuning core of T102 and tighten locknut.
11	Remove jumper and adjust bottom tuning core of T102 for minimum indicator reading. Tighten locknut.
12	Reconnect indicator to terminated cable. Connect signal generator to RF input of.JJ216.
	NOTE When unit is aligned in the main chassis, connect output of signal generator directly into J6208.
13	Adjust signal generator output as needed while peaking top and bottom tuning cores of T101.
14	Temporarily place a short jumper from the green dot of T101 to ground. Connect indicator to brown dot.
15	Adjust signal generator output as needed while peaking top tuning core of T101. Tighten locknut and remove jumper.
16	Tune bottom core of T101 for minimum output as read on indicator. Tighten locknut.
17	Connect indicator to terminated cable.
18	Adjust signal generator for 1-volt output at 250 kc. Tune signal generator ±9 kc. The indicator reading will drop approximately 0.3 volt.
	NOTE When aligning a unit other than the 15-kc symmetrical IF strip, omit steps 13 through 18. When alignment takes place in the main chassis, the IF strip to be aligned must correspond with both bandwidth selector switches on the front panel.

TABLE 6-4. 250 KC PLUG-IN IF STRIP ALIGNMENT (C nt.)

STEP	OPERATION
D-AVC and GAIN Adjustments	
1	Upon completion of alignment of IF strips, the signal generator must be connected to the IF input of pin 2 of J6201.
2	With indicator connected to J102 there should be 1.0-volt rms output with a minimum of 1.5-mv or a maximum of 3.0-mv input.
	NOTE When checking a unit using an upper sideband filter, tune the signal generator between 251 kc and 252 kc, or when checking a unit with a lower sideband filter, tune the signal generator between 248 kc and 249 kc. All symmetrical filters are checked at 250 kc.
3	Increase signal generator input to produce 1.5-volt rms output.
4	Remove AVC jumper; adjust AVC delay (R116) to produce 1 volt on indicator.
5	This completes the alignment, gain measurement and AVC adjustment of the IF strip.

SECTION 7
PARTS LIST

7-1. INTRODUCTION.

Reference designations have been assigned to identify all component parts of the equipment. They are marked on the equipment, adjacent to the part they identify, and are included on drawings, diagrams, and in the parts list. The letters of a reference designation indicate the kind of part (generic group), such as resistor, capacitor, electron tube, etc. The number differentiates between parts of the same generic group.

Column 1 lists the reference designations of the various parts in alphabetical and numerical order. Column 2 gives the name and description of the various parts. Column 3 indicates how a part is used within a major component. Column 4 lists each Technical Materiel Corporation drawing or part number.

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 kc; bandwidth 250.140 to 253.600 kc ±50 cps; input impedance 300 ohms; output impedance 50,000 ohms max. (Used in AX-303, 3.5 USB only.)	Sideband Filter	FX-168
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 kc; bandwidth 246.400 to 249.860 kc, ± 50 cps; input impedance 300 ohms; output impedance 50 K ohms max. (Used in AX-304, 3.5 LSB only.)	Sideband Filter	FX-169
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 kc; bandwidth 242.400 to 249.775 kc ± 100 cps; input impedance 300 ohms; output impedance 50 K ohms max. (Used in AX-305, 7.5 LSB only.)	Sideband Filter	FX-173
Z1	FILTER, BANDPASS: asymmetrical; carrier frequency 250 kc; bandwidth 250.225 to 257.600 kc; input impedance 300 ohms; output impedance 50 K ohms max. (Used in AX-306, 7.5 USB only.)	Sideband Filter	FX-172
Z1	FILTER, BANDPASS: symmetrical; carrier frequency 250 kc; bandwidth 246.9 to 253.1 kc, ± 75 cps; input impedance 300 ohms; output impedance 50 K ohms max. (Used in AX-311, 6 kc symmetrical only.)	Bandpass Filter	FX-174
Z1	FILTER, BANDPASS: symmetrical; carrier frequency 250 kc; bandwidth 249.450 to 250.550 kc, ± 25 cps; input impedance 300 ohms; output impedance 50 K ohms max. (Used in AX-312, 1 kc symmetrical only.)	Bandpass Filter	FX-175

SYM.	DECRIPTION	FUNCTION	TMC DWG. OR PART NO.
C101	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20, 000 uuf; +80% -20%; 500 vdcw.	AVC Bypass	CC-100-24
C102	Same as C101.	Screen Bypass	
C103	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 220, 000 uuf; +80% -20%; 500 vdcw.	Cathode Bypass	CC-100-33
C104	Same as C101.	AVC Bypass	
C105	Same as C103.	Screen Bypass	
C106	Same as C101.	Plate Decoupling	
C107	Same as C101.	Plate Decoupling	
C108	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100, 000 uuf; +80% -20%; 500 vdcw.	Diode Bypass	CC-100-32
C109	Same as C101.	Plate Decoupling	
C110	Same as C101.	Screen Bypass	
C111	CAPACITOR, FIXED, PLASTIC DIELECTRIC: 1.0 uf; ±10%; 200 vdcw.	AVC Filter	CN112A105K2
C112	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100, 000 uuf; +80% -20%; 500 vdcw.	Cathode Bypass	CC-100-28
C113	Same as C103.	RF Coupling	
C114	Same as C108.	Fil. Bypass	
CR101	SEMICONDUCTOR DEVICE, DIODE: silicon; max peak inverse volts 175 v; max RMS volts 125 v; 30 ma at 25°C and 15 ma at 150°C; peak recurrent 120 ma; max surge current 0.5 amp.	AVC Diode	1N463
CR102	Same as CR101.	AVC Diode	
CR103	Same as CR101.	AVC Clamp	
J101	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 round No. 16 male contacts; straight type.	Power Connector	JJ-245
J102	CONNECTOR, RECEPTACLE, ELECTRICAL: one round male contact; teflon insulation; miniature BNC series.	IF Out	JJ-211
L101	COIL, INTERMEDIATE FREQUENCY: tuned; 250 kc operating frequency; consists of three capacitors one 220 uuf and two 1000 uuf, one resistor 10, 000 ohms.	AVC IF	AV-137
P101	NOT USED		
R101	RESISTOR, FIXED, COMPOSITION: 270 ohms; ±10%; 1/2 watt.	Filter Load	RC20GF271K
R102	RESISTOR, FIXED, COMPOSITION: 100, 000 ohms; ±10%; 1/2 watt.	AVC Decoupling	RC20GF104K
R103	RESISTOR, FIXED, COMPOSITION: 47 ohms; ±10% 1/2 watt.	Grid Decoupling	RC20GF470K
R104	RESISTOR, FIXED, COMPOSITION: 68 ohms; ±10%; 1/2 watt.	Cathode Bias	RC20GF680K

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R105	RESISTOR, FIXED, COMPOSITION: 27, 000 ohms, ±10%; 1/2 watt.	Screen Decoupling	RC20GF273K
R106	RESISTOR, FIXED, COMPOSITION: 3300 ohms; ±10%; 1/2 watt.	Plate Decoupling	RC20GF332K
R107	Same as R103.	Grid Decoupling	
R108	RESISTOR, FIXED, COMPOSITION: 100 ohms; ±10%; 1/2 watt.	Cathode Decoupling	RC20GF101K
R109	RESISTOR, FIXED, COMPOSITION: 22, 000 ohms; ±10%; 1/2 watt.	Screen Decoupling	RC20GF223K
R110	Same as R106.	Plate Decoupling	
R111	RESISTOR, FIXED, COMPOSITION: 470 ohms; ±10%; 1/2 watt.	Cathode Bias	RC20GF471K
R112	RESISTOR, FIXED, COMPOSITION: 0.22 megohm; ±10%; 1/2 watt.	Cathode Bias	RC20GF224K
R113	RESISTOR, FIXED, COMPOSITION: 10, 000 ohms; ±10%; 1/2 watt.	Screen Decoupling	RC20GF103K
R114	Same as R106.	Plate Decoupling	
R115	Same as R109.	Diode Back Bias	
R116	RESISTOR, VARIABLE, COMPOSITION: 50, 000 ohms; ±10%, 1/2 watt.	Diode Back Bias	RV106UX10C503A
T101	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 kc operating frequency; consists of two 1000 uuf capacitors and one 56, 000 ohm resistor. (Used in AX-313, 15 kc symmetrical only.)	Output Transformer	TT-156
T102	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 kc operating frequency; consists of two capacitors, one 470 uuf and one 320 uuf.	Interstage Transformer	TT-158
T103	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 kc operating frequency; consists of one capacitor 1000 uuf.	Output and AVC Interstage Transformer	TT-159
V101	TUBE, ELECTRON: remote cutoff pentode; 7 pin miniature.	IF Amp	6BA6
V102	TUBE, ELECTRON: sharp cutoff pentode; 7 pin miniature.	IF Amp	6CE5
V103	Same as V102.	AVC Amp	
XV101	SOCKET, ELECTRON TUBE: 7 pin miniature.	V101 Socket	TS102P01
XV102	Same as XV101.	V102 Socket	
XV103	Same as XV101.	V103 Socket	

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
A6001	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 249.450 to 250.550 kc ± 25 cps at 3 db down; amplification 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; power requirements 6.3 v, 40 to 4000 cps, single phase and 200 vdc.	IF Amplifier 1 kc	AX-312
A6002	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth 246.9 to 253.1 kc ± 75 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps, single phase and 200 vdc.	IF Amplifier 6 kc	AX-311
A6003	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 242.50 to 257.50 kc at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps, single phase and 200 vdc.	IF Amplifier 15 kc	AX-313
A6004	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 250.140 to 253.600 kc ± 50 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps, single phase and 200 vdc.	IF Amplifier 3.5 kc Upper Sideband	AX-303
A6005	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 246.400 to 249.860 kc ± 50 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps single phase and 200 vdc.	IF Amplifier 3.k kc Lower Sideband	AX-304
A6006	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 250.225 to 257.6 kc ± 100 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 1000 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps, single phase and 200 vdc.	IF Amplifier 7.5 kc Upper Sideband	AX-306

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
A6007	AMPLIFIER, INTERMEDIATE FREQUENCY: carrier frequency, 250 kc; bandwidth, 250.225 to 257.600 kc ± 100 cps at 3 db down; amplification, 54 db input to output over-all gain; input voltage, 2 mv rms; output voltage, 100 mv rms; input impedance, 50 ohms; output impedance, 50 ohms; power requirements 6.3 v, 40 to 400 cps, single phase and 200 vdc.	IF Amplifier 7.5 kc Lower Sideband	AX-305
			SYMBOL SERIES 6200
C6201	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf; +80 -20%; 500 vdcw.	Cathode Bypass	CC-100-32
C6202	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf; +80 -20%; 500 vdcw.	Plate Decoupling	CC-100-24
C6203	Same as C6202.	RF Bypass	
C6204	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 220,000 uuf; +80 -20%; 500 vdcw.	Cathode Bypass	CC-100-33
C6205	Same as C6202.	Screen Decoupling	
C6206	Same as C6202.	Plate Decoupling	
C6207	Same as C6201.	Plate Decoupling	
C6208	Same as C6201.	RF Bypass	
C6209	Same as C6201.	RF Bypass	
C6210	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 uuf; ±10%; 500 vdcw.	RF Bypass	CC-100-9
C6211	Same as C6210.	RF Bypass	
C6212	Same as C6201.	RF Bypass	
C6213	Same as C6202.	RF Bypass	
C6214	Same as C6201.	RF Bypass	
C6215	Same as C6201.	RF Bypass	
C6216	Same as C6202.	RF Bypass	
C6217	Same as C6201.	RF Bypass	
C6218	Same as C6201.	RF Bypass	
C6219	Same as C6201.	RF Bypass	
C6220	Same as C6201.	RF Bypass	
C6221	Same as C6201.	RF Bypass	
C6222	Same as C6201.	RF Bypass	

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
C6223	Same as C6201.	RF Bypass	
C6224	Same as C6202.	Arc Suppressor	
C6225	Same as C6202.	Cathode Bypass, V6201B	
C6226	CAPACITOR, FIXED, MICA DIELECTRIC: 110 uuf; ±10%; 500 vdcw.	RF Bypass, V6201B	CM15B111K
C6227	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf; GMV; 500 vdcw.	Coupling, V6201B	CC-100-16
CR6201	SEMICONDUCTOR DEVICE, DIODE: germanium; min peak inverse voltage for zero dynamic impedance 70 v; continuous reverse working voltage 60 v; average forward current 60 ma; recurrent peak forward current 150 ma; forward surge current (1 sec) 500 ma.	Half-Wave RF Rectifier	1N294
CR6202	Same as CR6201.	Half-Wave RF Rectifier	
CR6203	SEMICONDUCTOR DEVICE, DIODE: silicon; max peak inverse voltage 175 v; max RMS volts 125 v; 30 milliampere at 25°C and 15 milliampere at 150°C; peak recurrent 120 ma; max surge current 0.5 amp.	AVC Gate	1N463
CR6204	Same as CR6203.	AVC Gate	
CR6205	SEMICONDUCTOR DEVICE, DIODE: germanium; max peak reverse volts for zero dynamic impedance 50 v; continuous reverse working voltage 40 v; average forward current 60 ma; peak forward current (1 sec) 1.0 amp.	AVC Gate	1N56A
CR6206	Same as CR6205.	AVC Gate	
J6201	CONNECTOR, RECEPTACLE, ELECTRICAL: 14 male contacts, rated at 17.0 amp.	Power Connector	JJ-200-2
J6202	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 round female contact; teflon insulation, BNC series.	AGC Input	JJ-172
J6203	Same as J6202.	Chan A IF Output	
J6204	Same as J6202.	Chan B IF Output	
J6205	Same as J6202.	RF Input	
J6206	Same as J6202.	Synth. Input	
J6207	CONNECTOR, RECEPTACLE, ELECTRICAL: single contact; female.	Converter Output	UG-625/U
J6208	Same as J6207.	IF Strip Input	
J6209	Same as J6202.	AFC Input	

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
J6210	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 round No. 16 female contacts; straight type.	IF Input	JJ-216
J6211	Same as J6210.	IF Input	
J6212	Same as J6210.	IF Input	
J6213	Same as J6210.	IF Input	
J6214	Same as J6210.	IF Input	
J6215	Same as J6210.	IF Input	
J6216	Same as J6210.	IF Input	
L6201	COIL, RADIO FREQUENCY: fixed; inductance, 50.0 uh; resonant frequency 0.40 mc; max dc resistance 110 ohms.	RF Filter	CL-226-5
L6202	Same as L6201.	RF Filter	
L6203	Same as L6201.	RF Filter	
L6204	COIL, RADIO FREQUENCY: molded; 100 ma; 2.5 mh; ±10%.	RF Filter	CL-140-1
L6205	COIL, RADIO FREQUENCY: fixed; 56.0 uh; ±10%; 3.0 ohms dc resistance; molded case.	RF Filter	CL-240-56
M6201	VOLTMETER: DC; 0-2 volts linear scale; 0-50 ua movement; 2.37 in. square case.	Line Level Indicator	MR-157
M6202	Same as M6201.	Line Level Indicator	
P6201	CONNECTOR, PLUG, ELECTRICAL: RF type; 1 round female coaxial contact; straight type, series miniature bayonet lock.	IF Strip Output	PL-204
P6202	Same as P6201.	IF Strip Output	
P6203	Same as P6201.	IF Strip Output	
P6204	Same as P6201.	IF Strip Output	
P6205	Same as P6201.	IF Strip Output	
P6206	Same as P6201.	IF Strip Output	
P6207	Same as P6201.	IF Strip Output	
P6208	CONNECTOR, PLUG, ELECTRICAL: RF type; 1 male contact; straight type.	Converter Output	PL-169
P6209	Same as P6208.	IF Strip Input	

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R6201	RESISTOR, FIXED, COMPOSITION: 6800 ohms; ±10%; 1/2 watt.	Termination	RC20GF682K
R6202	RESISTOR, FIXED, COMPOSITION: 3900 ohms; ±10%; 1/2 watt.	Cathode Bias	RC20GF392K
R6203	RESISTOR, FIXED, COMPOSITION: 100 ohms; ±10%; 1/2 watt.	Termination	RC20GF101K
R6204	RESISTOR, FIXED, COMPOSITION: 4700 ohms; ±10%; 1/2 watt.	Current Limiting	RC20GF472K
R6205	RESISTOR, FIXED, COMPOSITION: 100,000 ohms; ±10%; 1/2 watt.	Plate Decoupling	RC20GF104K
R6206	RESISTOR, FIXED, COMPOSITION: 390 ohms; ±10%; 1/2 watt.	Cathode Bias	RC20GF391K
R6207	RESISTOR, FIXED, COMPOSITION: 47,000 ohms; ±10%; 1/2 watt.	Screen Bias	RC20GF473K
R6208	RESISTOR, FIXED, COMPOSITION: 56,000 ohms; ±10%; 1/2 watt.	Screen Bias	RC20GF563K
R6209	Same as R6204.	Plate Decoupling	
R6210	RESISTOR, FIXED, COMPOSITION: 47 ohms; ±10%; 1/2 watt.	Terminating	RC20GF470K
R6211	Same as R6206.	Plate Decoupling	
R6212	RESISTOR, VARIABLE, COMPOSITION: 500 ohms; ±10%; 1/2 watt.	Balance Control	RV106UX10C501A
R6213	Same as R6212.	Balance Control	
R6214	RESISTOR, FIXED, FILM: 39 K ohms; ±1%;0.25 watt.	Current Limiting	RN25X3902F
R6215	Same as R6214.	Current Limiting	
R6216	RESISTOR, FIXED, COMPOSITION: 10,000 ohms; ±5%; 1/2 watt.	Multiplier	RC20GF103J
R6217	Same as R6216.	Multiplier	
R6218	RESISTOR, FIXED, COMPOSITION: 390,000 ohms; ±10%; 1/2 watt.	AVC Time Constant Limit	RC20GF394K
R6219	Same as R6218.	AVC Time Constant Limit	
R6220	RESISTOR, FIXED, COMPOSITION: 68,000 ohms; ±10%; 1/2 watt.	Voltage Limiting	RC20GF683K

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R6221	RESISTOR, VARIABLE, COMPOSITION: 5 megohms; ±20%; 2 watts.	AVC Time Constant Adj.	RV4ATRD505B
R6222	RESISTOR, VARIABLE, COMPOSITION: 25,000 ohms; 2 watts.	Manual Gain Control	RV4BTRD253F
R6223	Same as R6221.	AVC Time Constant Adj.	
R6224	Same as R6210.	Isolation	
R6225	Same as R6210.	Grid Bias, V6201B	
R6226	RESISTOR, FIXED, COMPOSITION: 330 ohms; ±10%, 1/2 watt.	Cathode Bias, V6201B	RC20GF331K
R6227	RESISTOR, FIXED, COMPOSITION: 6800 ohms; ±10%; 1 watt.	Plate Load, V6201B	RC32GF682K
R6201A	SWITCH SECTION, ROTARY: 1 section; 7 positions; contacts rated 1 amp, 28 v or 5 amp at 110 vac; mycalex insulation.	RF OUTPUT Selector	WS-127
S6201B	SWITCH SECTION, ROTARY: 1 section; 7 positions; contacts rated 1 amp, 28 v or 5 amp at 110 vac; bakelite insulation.	B+ & AVC Selector	WS-126
S6201C	Same as S6201B.	B+ & AVC Selector	
S6202A	Same as S6201A.	RF OUTPUT Selector	
S6202B	Same as S6201B.	B+ & AVC Selector	
S6202C	Same as S6201B.	B+ & AVC Selector	
S6203	SWITCH, ROTARY: 1 section; 2 positions; contacts rated at 2 amp at 28 vdc or 1 amp at 110 vac.	Selector Switch	SW-116
T6201	TRANSFORMER, RADIO FREQUENCY: frequency response -150 kc to 4 mc within 3 db; primary impedance 50 ohms, secondary impedance 5000 ohms; polarized.	Converter Input	TZ-107
T6202	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 kc operating frequency; consists of one capacitor 1000 uuf.	Coupling	TT-160
T6203	TRANSFORMER, INTERMEDIATE FREQUENCY: tuned; 250 kc operating frequency; consists of one capacitor 600 uuf.	Converter Output	TT-161
TP6201	TERMINAL, FEED THRU, INSULATED: 0.740 in. long x 3/16 in. dia; 3/32 press-fit stud; teflon; insulated 200 v.	Test Point	TE-169-1
TP6202	Same as TP6201.	Test Point	

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
V6201	TUBE, ELECTRON: medium-mu dual triode; 9 pin miniature.	Mixer	6CM7
V6202	TUBE, ELECTRON: remote-cutoff pentode; 7 pin miniature.	RF Amplifier	6BA6
V6203	TUBE, ELECTRON: high-mu twin-triode; 9 pin miniature.	AVC Differential Amplifier	12AX7
XV6201	SOCKET, ELECTRON TUBE: 9 pin miniature.	Tube Socket	TS103P01
XV6202	SOCKET, ELECTRON TUBE: 7 pin miniature.	Tube Socket	TS102P01
XV6203	Same as XV6201.	Tube Socket	
XV6201	SOCKET, ELECTRON TUBE: 9 pin miniature.	Tube Socket	TS103P01
XV6202	SOCKET, ELECTRON TUBE: 7 pin miniature.	Tube Socket	TS102P01
XV6203	Same as XV6201.	Tube Socket	

SECTION 8
SCHEMATIC DIAGRAMS

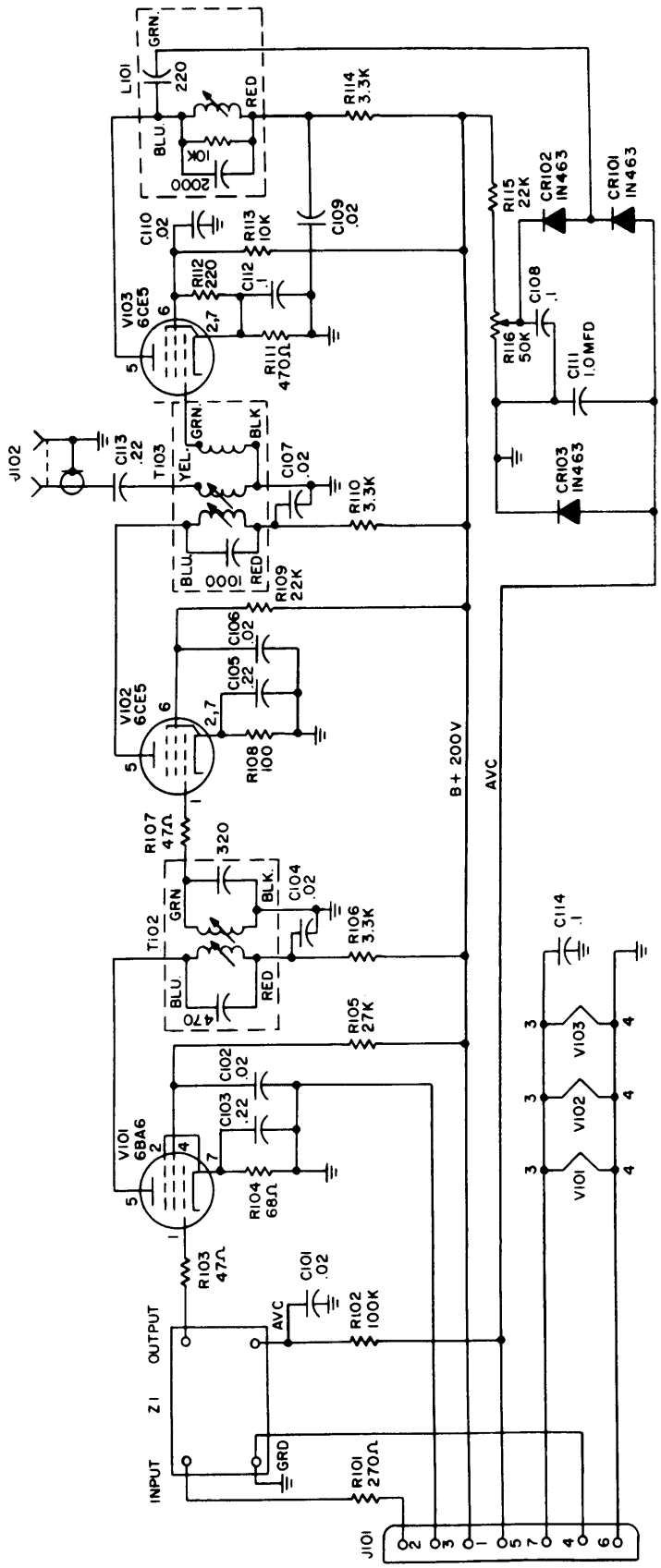


Figure 8-1. 3.5 KC USB/LSB, Schematic Diagram

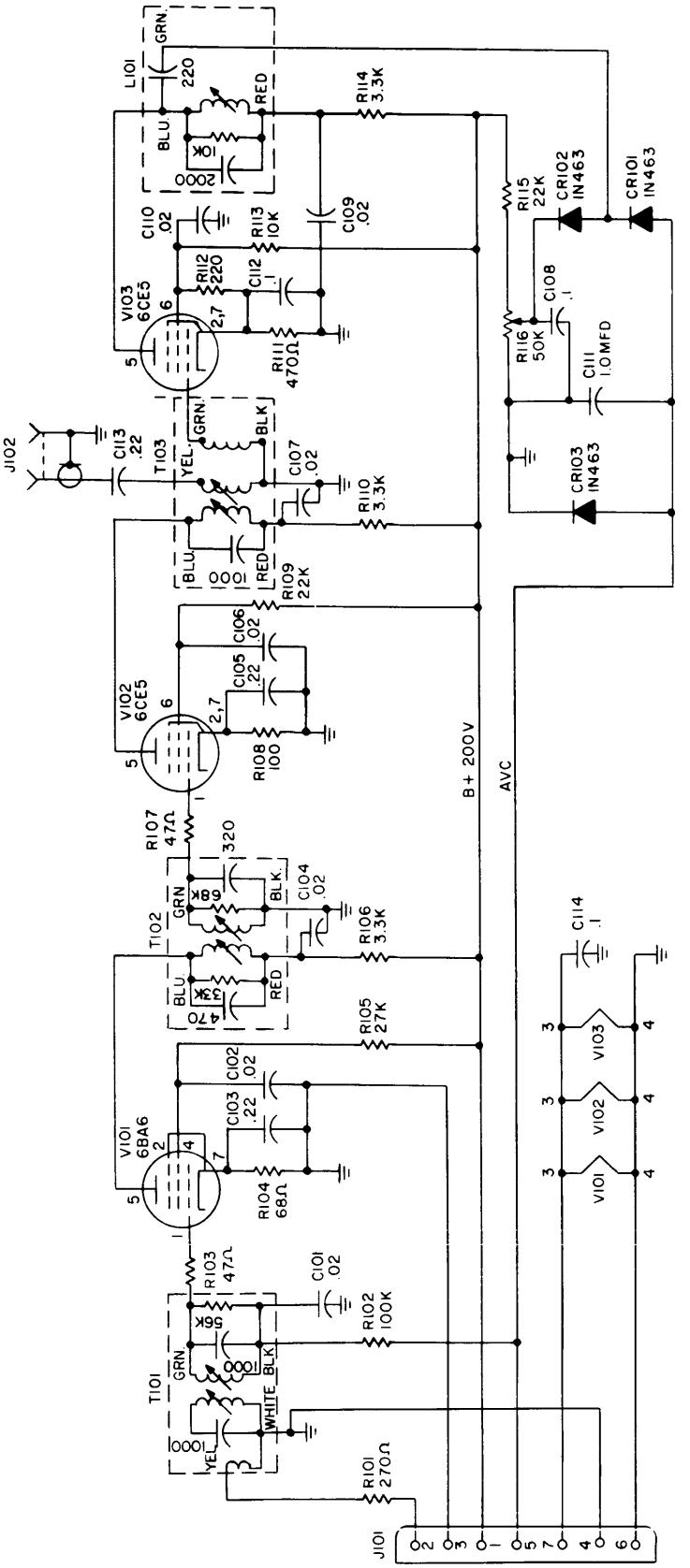


Figure 8-2. HFT-1, 15 KC Symmetrical, Schematic Diagram

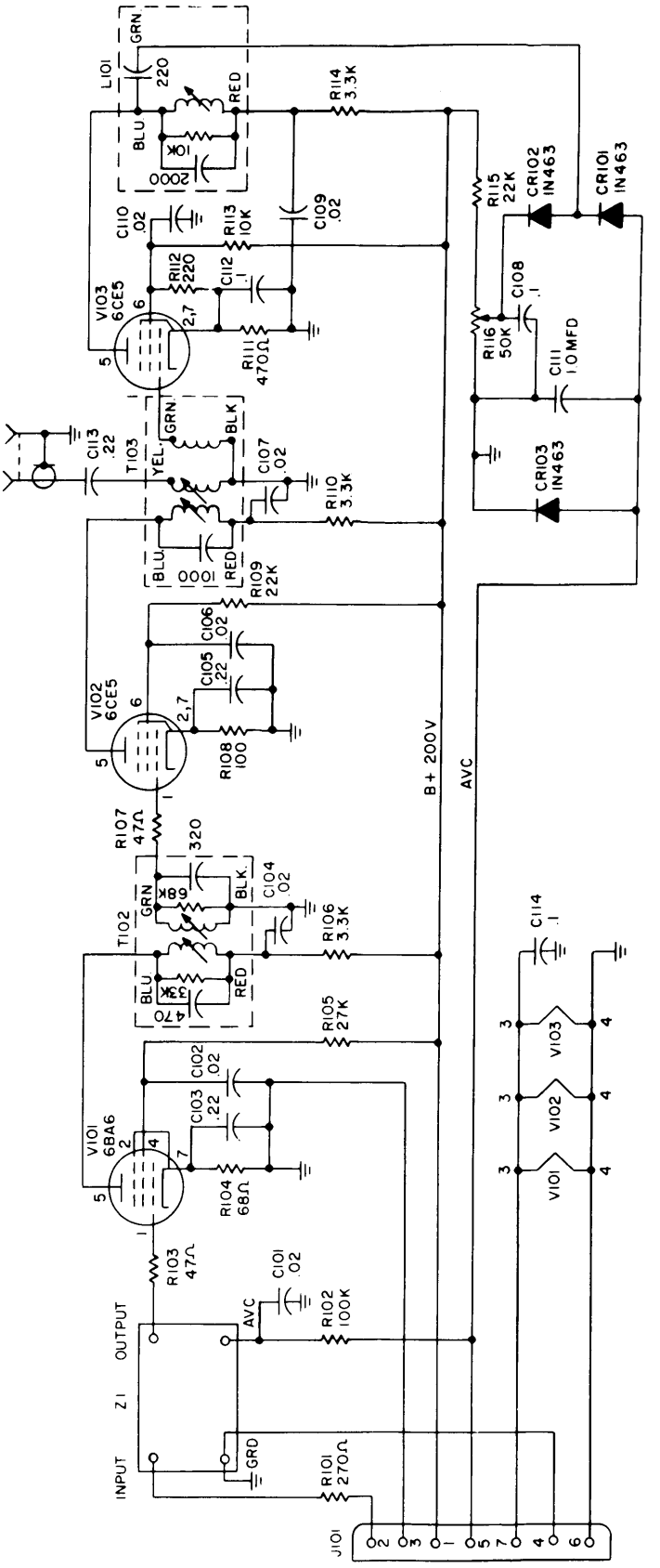
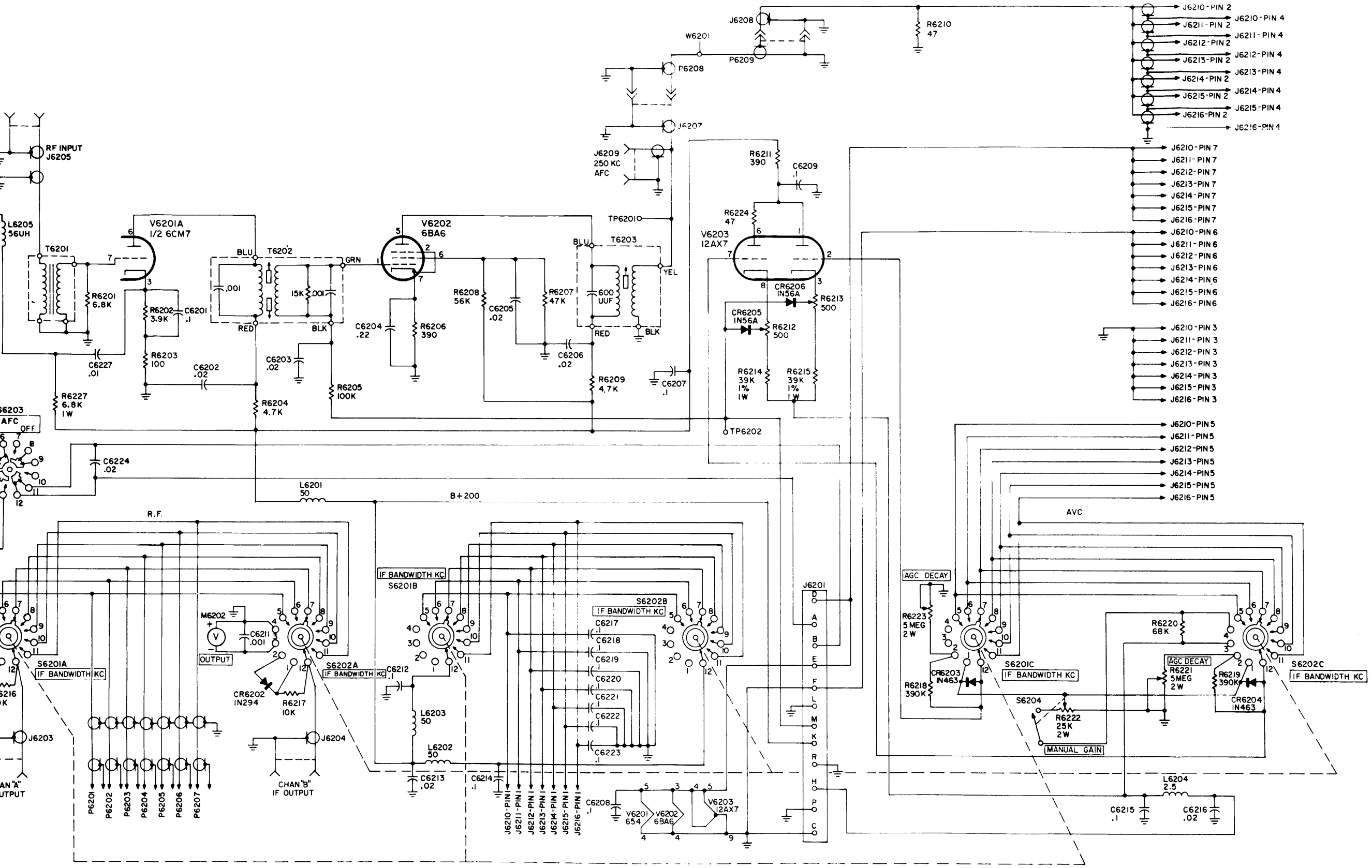


Figure 8-3. HFI-1, 1 and 6 KC Symmetrical, and 7.5 KC USB/LSB, Schematic Diagram



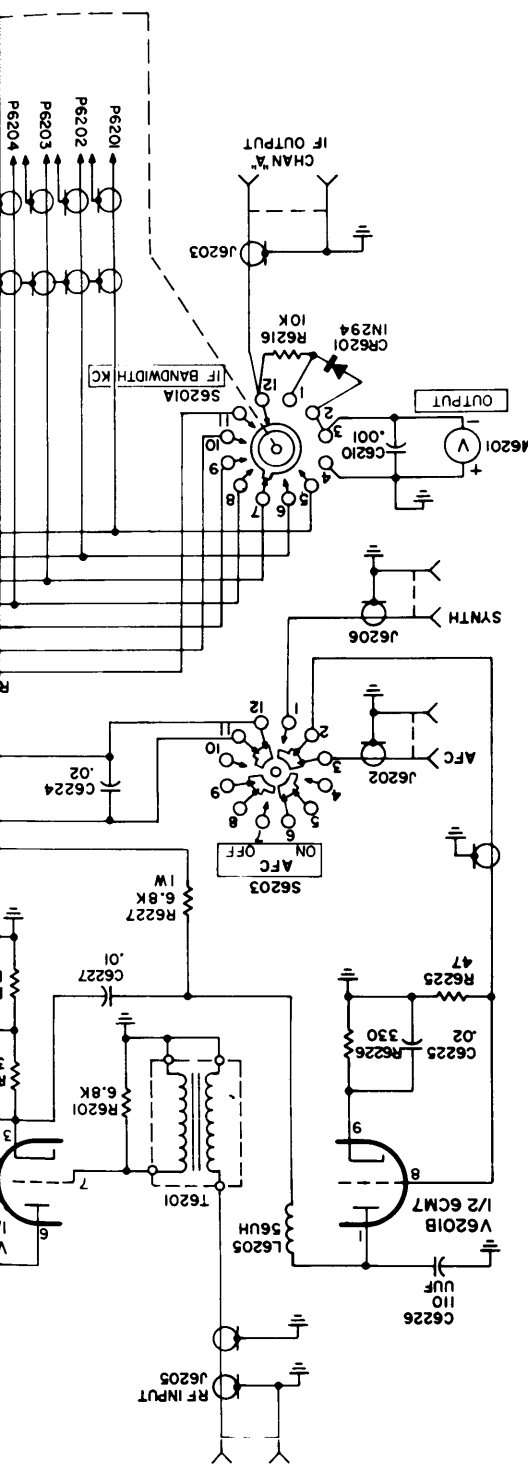
LAST SYMBOLS

C6227
CR6206
J6217
L6205
M6202
P6209
R6227
S6204
T6203
TP6202
V6203
W6201

UNLESS OTHERWISE SPECIFIED

RESISTANCE VALUES ARE OHMS, 1/2 WATT.
CAPACITANCE VALUES ARE MICRO FARADS
INDUCTANCE VALUES ARE MILLI HENRYS.

Figure 8-4. HFI-1, 250 KC Converter Without IF Strips, Schematic Diagram


P6204
P6203
P6202
P6201
IF OUTPUT
CHAN "A"
J6203
R6216
10K
CR6201
IN294
S6201A
IF BANDWIDTH KC
OUTPUT
M6201
C6210
.001
SYNTH
J6206
AFC
J6202
C6224
.02
S6203
AFC
ON OFF
R6227
6.8K
1W
C6227
.01
R6225
47
C6225
.02
R6226
330
R6201
6.8K
T6201
L6205
56UH
V6201B
1/2 6CM7
C6226
110
UUF
RF INPUT
J6205