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UNCLASSIFIED

TECHNICAL MANUAL

*for*

**AUDIO FILTER  
MODEL HAF-1  
(F-712/FRR-60V)**



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

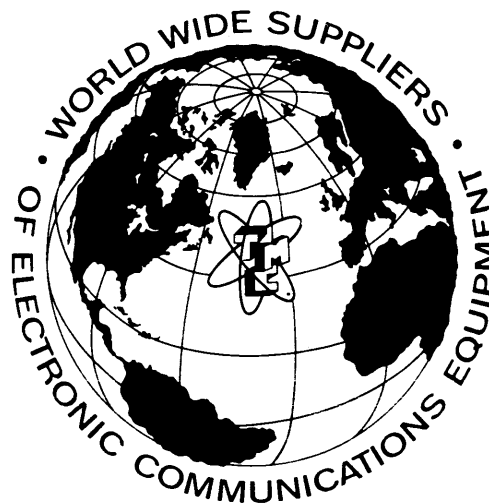
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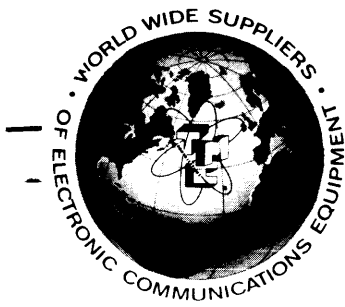
THE TECHNICAL MATERIEL CORPORATION  
MAMARONECK, N.Y.

OTTAWA, CANADA

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## NOTICE

THE CONTENTS AND INFORMATION CONTAINED IN THIS INSTRUCTION MANUAL IS PROPRIETARY TO THE TECHNICAL MATERIEL CORPORATION TO BE USED AS A GUIDE TO THE OPERATION AND MAINTENANCE OF THE EQUIPMENT FOR WHICH THE MANUAL IS ISSUED AND MAY NOT BE DUPLICATED EITHER IN WHOLE OR IN PART BY ANY MEANS WHATSOEVER WITHOUT THE WRITTEN CONSENT OF THE TECHNICAL MATERIEL CORPORATION.



# THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S   E N G I N E E R S

700 FENIMORE ROAD

MAMARONECK, N. Y.

## W a r r a n t y

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 HAF-1



INSTRUCTION BOOK CHANGE NOTICE

Date 4/10/64

Manual affected: AUDIO FILTER MODEL HAF-1 IN -306

Page 7-3

Under SYM column change "L7200" to read "L7201"

Under DESCRIPTION column for L7201 change "dc resistance 130 ohms"; to read "dc resistance 80 ohms";

Page 7-4

Under SYM column change "L7201" to read "L7200"

Under DESCRIPTION column for L7200 change "dc resistance 410 ohms"; to read "dc resistance 210 ohms";

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.



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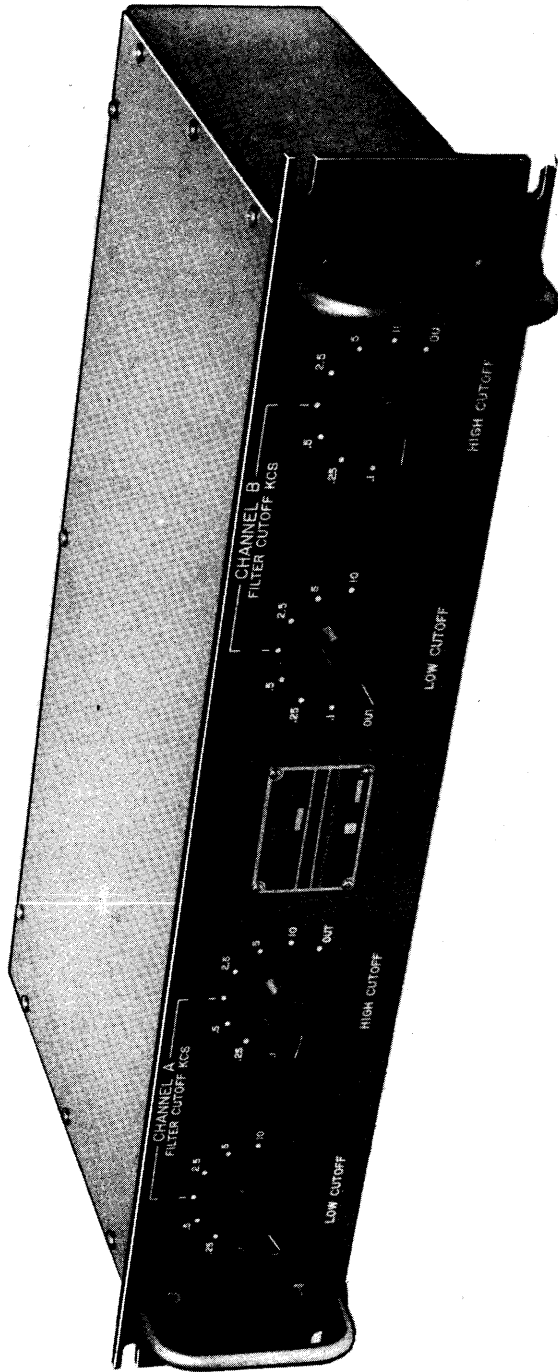


Figure 1-1. Audio Filter, Model HAF-1, Front Angle View



## SECTION 1 GENERAL DESCRIPTION

### 1-1. PHYSICAL DESCRIPTION

Model HAF-1 Audio Filter is shown in figure 1-1. The unit weighs 10 lbs and requires 3-1/2 inches of height and 14 inches of depth in a standard 19-inch relay rack. It is supported by its 3/16-inch-thick control panel. Input and output jacks are located on back of the unit.

### 1-2. FUNCTIONAL DESCRIPTION

The HAF-1 is a passive dual channel audio band-pass filter that consists of two independent hi-pass and lo-pass filters. Either filter may be switched through a range of 0.1 kc to 10 kc in seven steps or switched out. The hi-pass and lo-pass filters provide low cutoff and high cutoff points, respectively, for the band to be passed. Designed primarily for audio amplifiers in TMC's receiver systems, the HAF-1 affords a large selection of audio bandwidths by the operator in order to eliminate particular types of interference due to environment, terrain or local

transmitters. The two hi-pass/lo-pass filter systems (channels) are provided for use in ISB (independent sideband) reception.

### 1-3. MILITARY NOMENCLATURE

Commercial and military nomenclature for the HAF-1 is as follows:

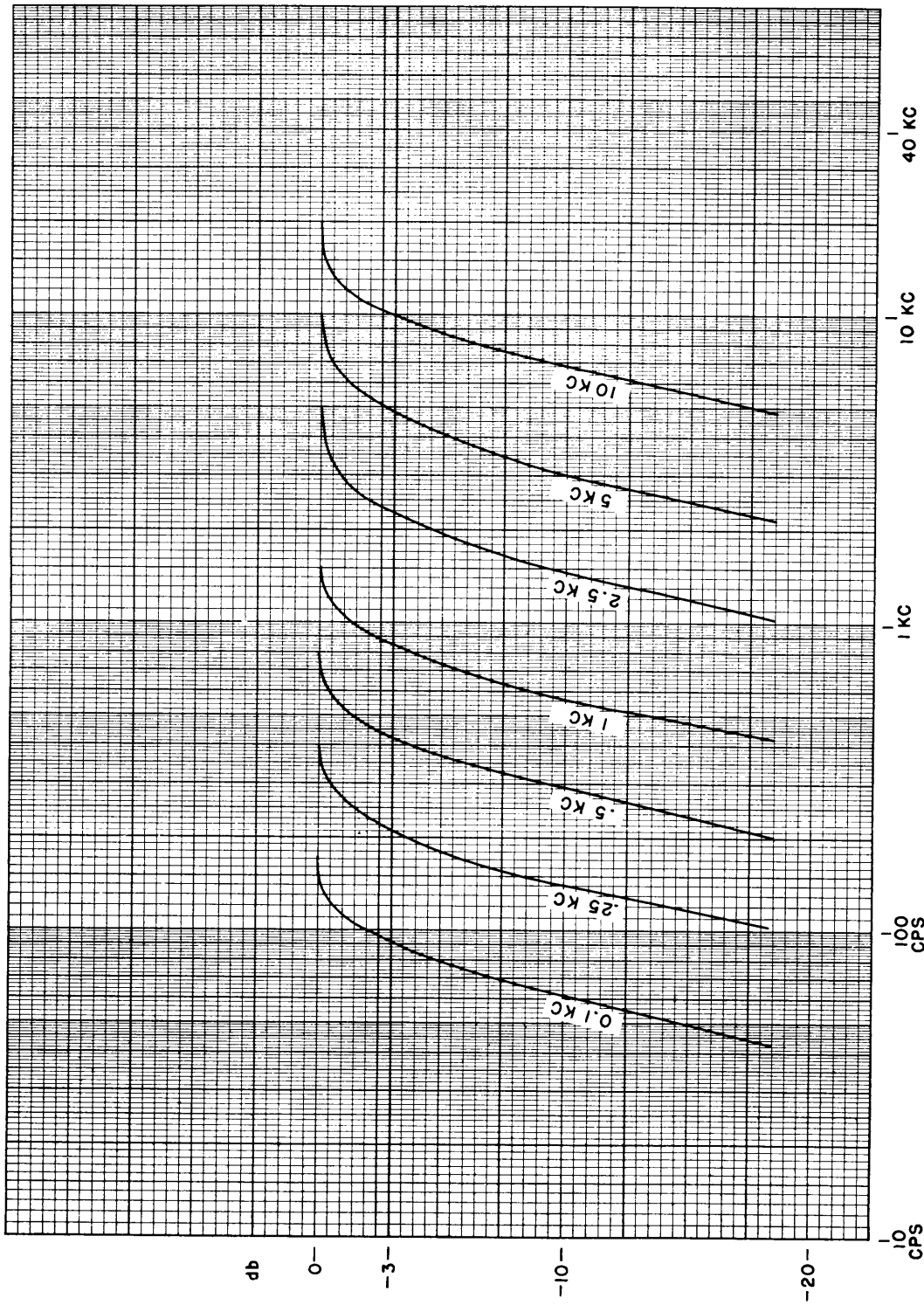
<u>Commercial</u>	<u>Military</u>
Audio Filter, Model HAF-1	Filter, Band Pass - Band Suppression, F-712/FRR-60(V)

### 1-4. REFERENCE DATA

The crated dimensions of the HAF-1 are 21 by 19 by 8 inches. It weighs 31 pounds gross, crated for shipment. Table 1-1 contains additional reference data and figures 1-2 and 1-3 illustrate performance characteristics.

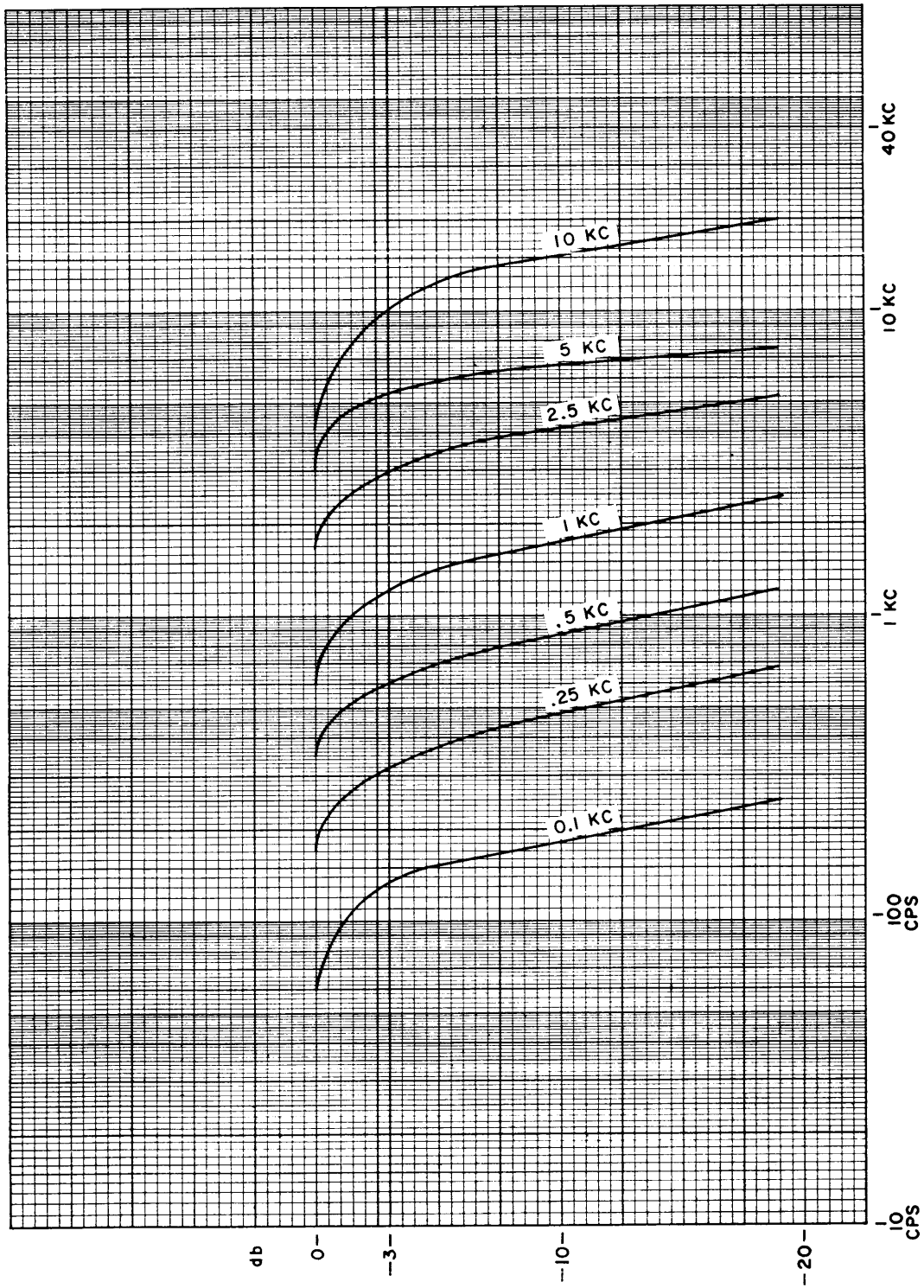
**TABLE 1-1. ELECTRICAL CHARACTERISTICS, HAF-1**

Cutoff frequencies (high and low end):	100 CPS, 250 CPS, 500 CPS, 1 KC, 2.5 KC, 5 KC and 10 KC.
Input impedance:	1000 ohms.
Output impedance:	1000 ohms.
Insertion loss:	Less than 1 db.
Frequency response:	See figures 1-2 and 1-3.
Connections:	4 UG-625/U RF coaxial connectors for inputs and outputs, channels A and B.



NOTE: 0db RESPONSE IS 1-KC WITH ALL FILTERS OUT

Figure 1-2. Frequency Response of Hi-Pass Filter (Low Cutoff), Typical



NOTE: 0db RESPONSE IS 1-KC WITH ALL FILTERS OUT

Figure 1-3. Frequency Response of Lo-Pass Filter (High Cutoff), Typical

## SECTION 2 INSTALLATION

### 2-1. INITIAL INSPECTION.

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

### 2-2. INSTALLATION PROCEDURE

Install HAF-1 in a standard 19-inch relay rack or other housing as desired. The unit may be mounted by its panel and requires no additional support. Two sets of input and output jacks are located on the rear of the unit for channels A and B (see figure 2-1). The jacks are RF coaxial type UG-625/U, BNC series. Mating cables and plugs are shipped with the receiver system rack when the HAF-1 is shipped as part of a Technical Materiel Corporation receiver. Mating plugs are included in the HAF-1 shipment when that unit is shipped alone.

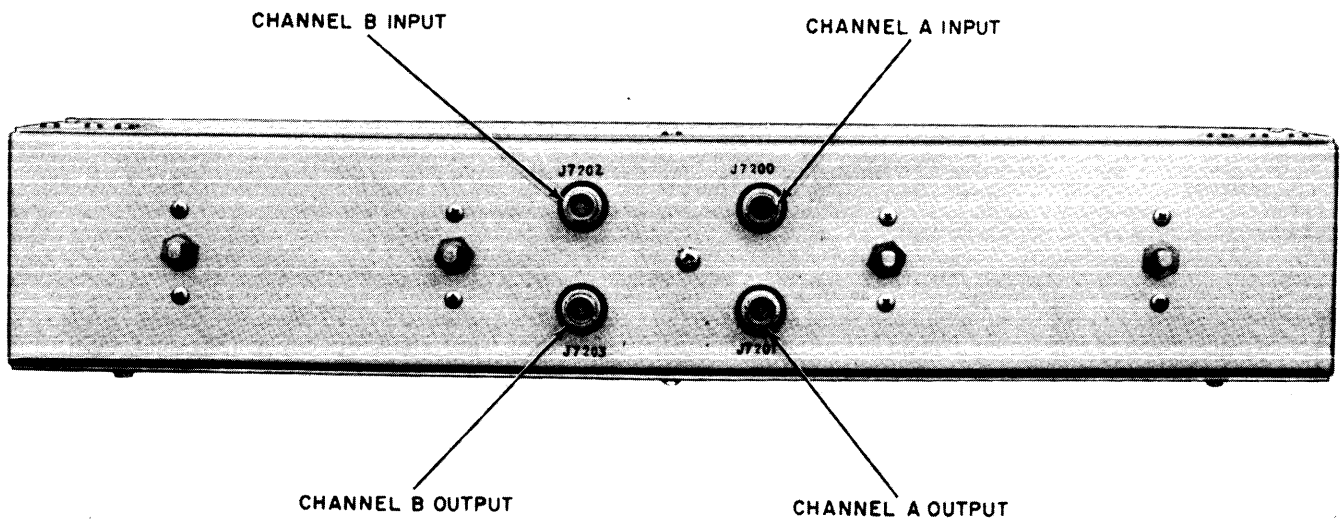


Figure 2-1. Audio Filter, Model HAF-1, Rear View

## SECTION 3 OPERATOR'S SECTION

### 3-1. OPERATOR'S INSTRUCTIONS

Table 3-1 provides equivalent control designations for operating controls shown in figure 3-1 and component designations of figure 8-1.

It is advisable, initially, to place all control knobs in OUT position. Adjustments can then be made by using either LOW or HIGH CUTOFF controls, or both, to remove interference or adjust the audio bandpass.

Switching any control knob to OUT shorts out that filter from the circuit.

### CAUTION

Control knobs rotate 360° without stops in order to be adaptable for TMC automated control systems. Do not place knob in blank (unmarked) position. This will interrupt audio circuit.

If it is required to pass a particular band of frequencies, set HIGH CUTOFF knob at high end of band and LOW CUTOFF knob at low end. That is, to pass a band 2 kc wide starting at 0.5 kc and ending at 2.5 kc through channel B, set LOW CUTOFF knob (3) at 0.5 and HIGH CUTOFF knob (4) at 2.5. As another example, to pass all frequencies above 2.5 kc set LOW CUTOFF knob at 2.5 and HIGH CUTOFF knob at OUT.

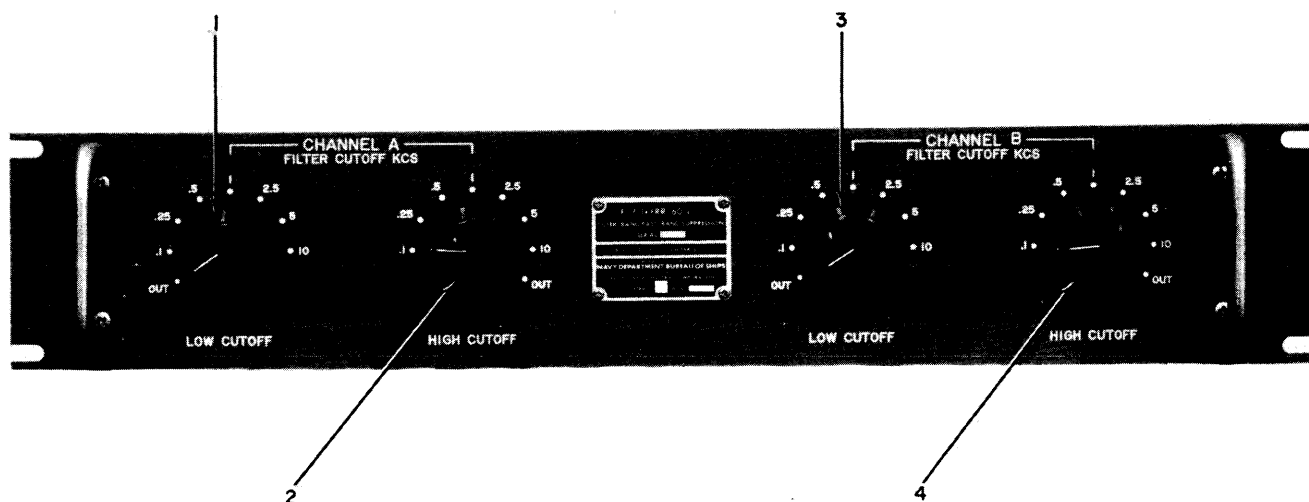


Figure 3-1. Panel View of HAF-1 Showing Operating Controls

**TABLE 3-1. EQUIPMENT CONTROL DESIGNATIONS**

SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION (FIGURE 3-1)	COMPONENT REFERENCE DESIGNATION ON SCHEMATIC (FIGURE 8-1)
1	CHANNEL A LOW CUTOFF	S7201
2	CHANNEL A HIGH CUTOFF	S7200
3	CHANNEL B LOW CUTOFF	S7203
4	CHANNEL B HIGH CUTOFF	S7202



## SECTION 4 THEORY OF OPERATION

### 4-1. GENERAL

Figure 8-1 shows the overall wiring schematic diagram for HAF-1. Channels A and B circuits are identical. Each circuit consists of an adjustable low-pass and an adjustable high-pass filter circuit. The low-pass filter is employed to provide an effective cutoff point for the high end of the band of frequencies to be passed; the high-pass filter sets the low end.

### 4-2. FILTER SWITCHING

Both low-pass and high-pass filters are constant-k type. The low-pass filter is a Pi-type; the high-pass filter is a T-type. Figures 4-1 and 4-2 show resulting HAF-1 circuits in the two extremes in passing low and high audio frequency bands respectively. It is seen, in figure 4-1, that with HIGH CUTOFF switch set at position 1 (0.1 kc) and LOW CUTOFF switch set at position 1 (OUT), the entire HAF-1 circuit is a low-pass Pi-type filter with the hi-pass filter switched out completely. Only frequencies up

to 100 CPS (0.1 kc) will pass through the unit. Referring to figure 8-1, advancing HIGH CUTOFF switch to position 2, 3, etc., progressively cuts out parts of parallel capacitors and portions of the series inductance L7200. This brings the high end of the band upward. When LOW CUTOFF switch is then progressively advanced from OUT to positions 2, 3, etc., parts of the high-pass T-filter circuit are switched in, placing an increasingly higher lower limit on the band to be passed. Figure 4-2 shows the other extreme resulting from the LOW CUTOFF switch set at position 8 (10 kc) and the HIGH CUTOFF switch at position 8 (OUT). The entire HAF-1 circuit is now a T-type high-pass filter, passing only frequencies of 10 kc and over. Subsequent switching of LOW CUTOFF switch to positions 7, 6, etc. (see figure 8-1) progressively switches in larger series capacitance and larger parallel inductance values, thereby lowering the low end of the band to be passed. When HIGH CUTOFF switch is then progressively decreased through 7, 6, etc., parts of the low-pass Pi-filter circuit are switched in, decreasing the upper limit of the band.

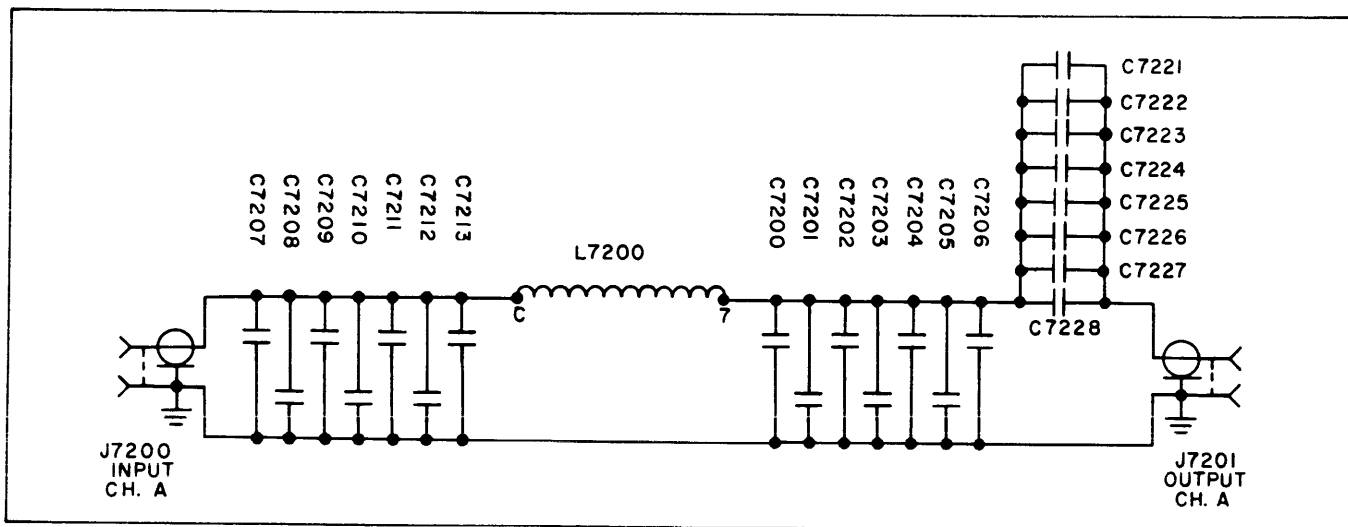


Figure 4-1. Simplified Schematic, HAF-1, Low Cutoff Out, High Cutoff 0.1-kc

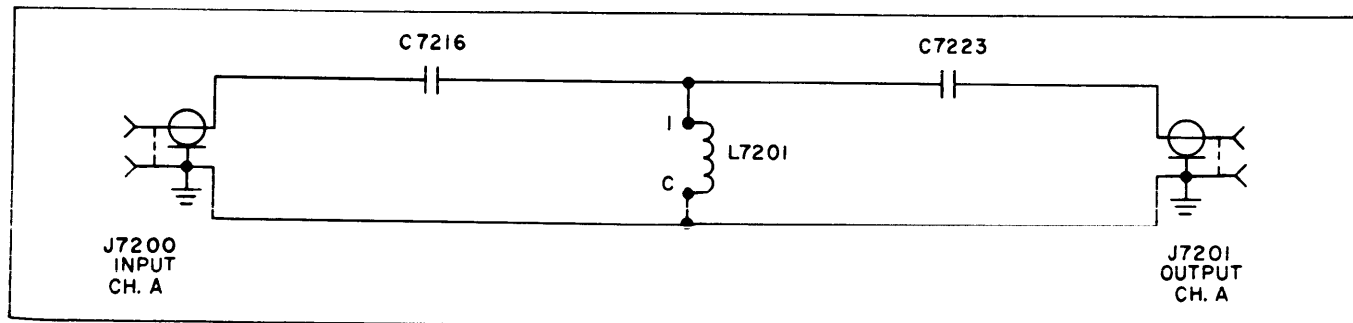


Figure 4-2. Simplified Schematic, HAF-1, Low Cutoff 10-kc, High Cutoff Out

## SECTION 5 TROUBLESHOOTING

### 5-1. GENERAL

Troubleshooting the HAF-1 consists of checking for wiring breaks and burned-out coils and capacitors. This may be accomplished by a continuity check with an ohmmeter for each component or a performance check of the unit as described in paragraph 5-2. The performance check will localize the area of trouble. Figure 5-1 shows the location of major components.

### 5-2. PERFORMANCE CHECK

a. Test Set-up - The following items of test equipment (or their equivalents) are required for the performance check of the HAF-1.

Frequency Counter, Berkeley Model 5500  
AC VTVM, Ballantine Model 300H  
Audio Generator, Hewlett Packard 200AB  
Resistors (1/2 watt), 1.5 K, 2.2 K, 1 K  
and 810 ohms

Connect test equipment as shown in figure 5-2.

#### b. Test Procedure

- (1) Set all four CUTOFF knobs to OUT position.
- (2) Set audio generator to produce 1 kc at 1.0 volt (0 db reference point).
- (3) Check voltage reading at VTVM. It should be 1.0 volt.

(4) Refer to table 5-1. Place CHANNEL A HIGH CUTOFF switch at each switch position listed. Set audio generator for corresponding "reference frequency" point and advance generator frequency control to bring it through "switch position" frequency. Observe the frequency on the counter and the reading on the VTVM. In each case the -3db point should fall near the frequency indicated on figure 1-3 performance curve for that switch position.

(5) Set CHANNEL A HIGH CUTOFF switch at OUT position. Place CHANNEL A LOW CUTOFF switch at each switch position listed in table 5-2. Set audio generator for corresponding "reference frequency" points and proceed as in step 4 referring to figure 1-2.

(6) Set CHANNEL A HIGH and LOW CUTOFF switches at OUT positions. Place CHANNEL B HIGH CUTOFF switch at each switch position listed in table 5-1. Set audio generator for corresponding "reference frequency" points and proceed as in step 4 referring to figure 1-3.

(7) Set CHANNEL B HIGH CUTOFF switch at OUT position. Place CHANNEL B LOW CUTOFF switch at each switch position listed in table 5-2. Set audio generator for corresponding "reference frequency" points and proceed as in step 4 referring to figure 1-2.

**TABLE 5-1. HIGH CUTOFF CHECK POINTS**

SWITCH POSITION (IN KCS)	REFERENCE FREQUENCY (IN KCS)
.1	.070
.25	.100
.5	.300
1	.600
2.5	1.0
5	3.0
10	8.0

**TABLE 5-2. LOW CUTOFF CHECK POINTS**

SWITCH POSITION (IN KCS)	REFERENCE FREQUENCY (IN KCS)
.1	.130
.25	.400
.5	.600
1	1.4
2.5	3.5
5	6.0
10	12.0

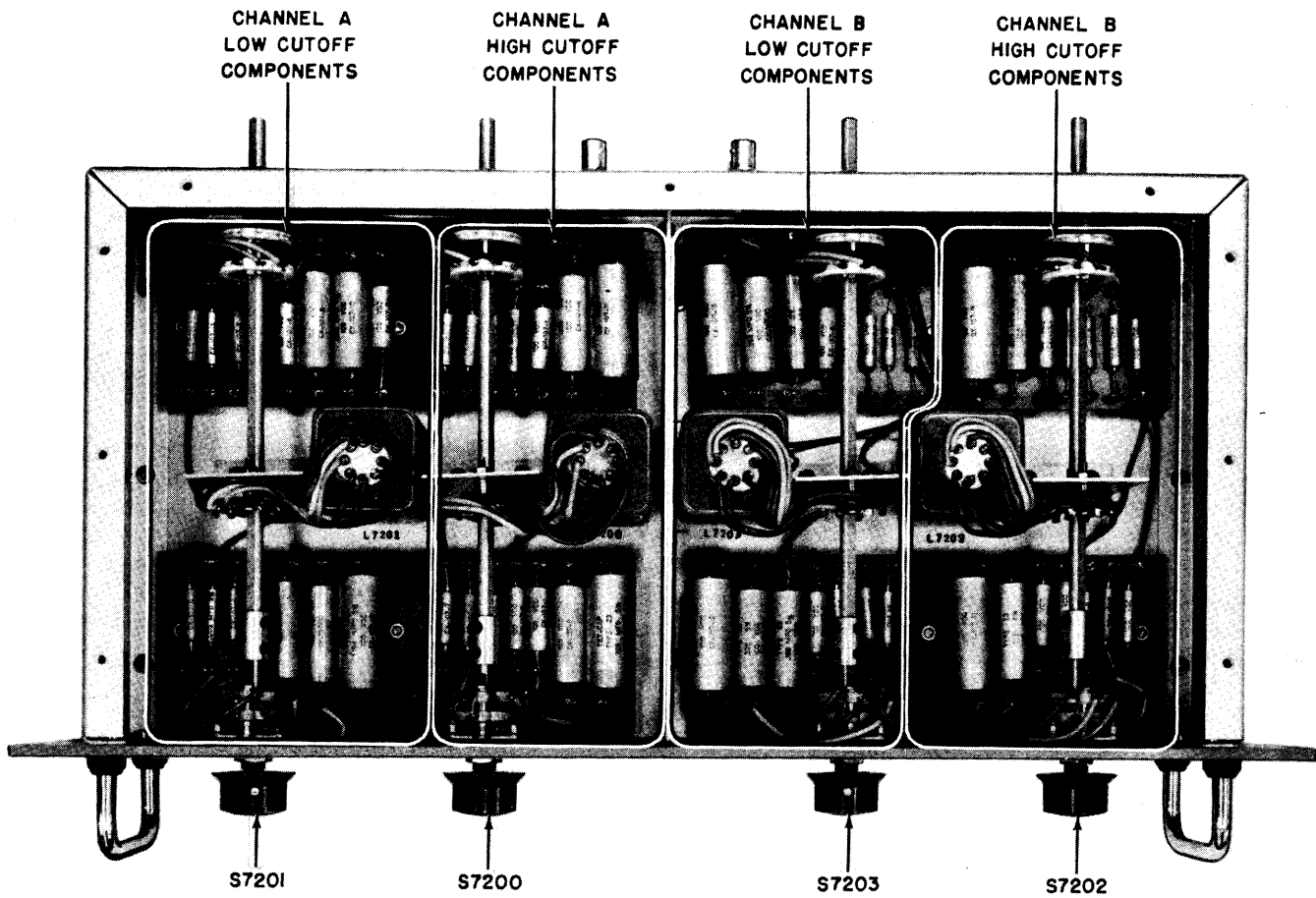


Figure 5-1. Location Diagram of Major Components, HAF-1, Top View

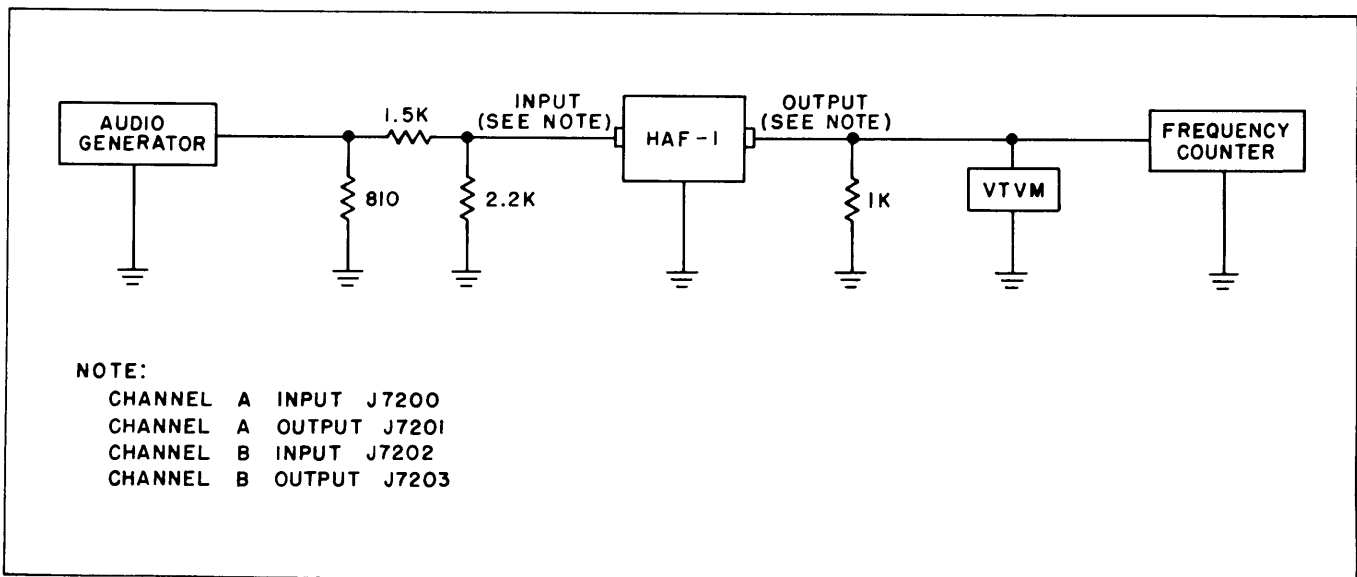


Figure 5-2. Test Set-up for HAF-1 Performance Check

## SECTION 6 MAINTENANCE

### 6-1. GENERAL

Preventive maintenance measures for the HAF-1 Audio Filter consist mainly of a visual check for dust, corrosion, charring, discoloring, grease, and a cleaning if necessary. A regular periodic inspection and cleaning of switch contacts is recommended, using crocus cloth and trichlorethylene.

**WARNING**

When using trichlorethylene, make certain

that adequate ventilation exists. Avoid prolonged contact with skin.

### 6-2. PERFORMANCE CHECK

If it is desired to test the performance of the HAF-1 periodically as a measure of preventive maintenance, this may be accomplished per paragraph 5-2 in the Troubleshooting Section.

## SECTION 7 PARTS LIST

### INTRODUCTION

Symbol numbers have been assigned to identify all maintenance parts of the equipment. They appear on the wiring schematics and are marked on the equip-

ment adjacent to the part. The following table lists all such maintenance parts. The TMC part number is the number by which the part may be ordered.

### PARTS LIST

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C7200	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .0255 uf; ±5%; 100 vdcw.	Filter Network	CX-107-3
C7201	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .01275 uf; ±5%; 100 vdcw.	Filter Network	CX-107-7
C7202	Same as C7201.	Filter Network	
C7203	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .765 uf; ±5%; 100 vdcw.	Filter Network	CX-107-11
C7204	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .255 uf; ±5%; 100 vdcw.	Filter Network	CX-107-9
C7205	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .1275 uf; ±5%; 100 vdcw.	Filter Network	CX-107-1
C7206	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .0765 uf; ±5%; 100 vdcw.	Filter Network	CX-107-5
C7207	Same as C7200.	Filter Network	
C7208	Same as C7201.	Filter Network	
C7209	Same as C7201.	Filter Network	
C7210	Same as C7203.	Filter Network	
C7211	Same as C7204.	Filter Network	
C7212	Same as C7205.	Filter Network	
C7213	Same as C7206.	Filter Network	
C7214	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .0398 uf; ±5%; 100 vdcw.	Filter Network	CX-107-4

**PARTS LIST (Cont'd)**

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C7215	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .1194 uf; ±5%; 100 vdcw.	Filter Network	CX-107-6
C7216	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .0199 uf; ±5%; 100 vdcw.*	Filter Network	CX-107-2*
C7217	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .0199 uf; ±5%; 100 vdcw.	Filter Network	CX-107-2
C7218	CAPACITOR, FIXED, PLASTIC DIELECTRIC: 1.194 uf; ±5%; 100 vdcw.	Filter Network	CX-107-12
C7219	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .398 uf; ±5%; 100 vdcw.	Filter Network	CX-107-10
C7220	CAPACITOR, FIXED, PLASTIC DIELECTRIC: .199 uf; ±5%; 100 vdcw.	Filter Network	CX-107-8
C7221	Same as C7214.	Filter Network	
C7222	Same as C7215.	Filter Network	
C7223	Same as C7216.	Filter Network	
C7224	Same as C7217.	Filter Network	
C7225	Same as C7218.	Filter Network	
C7226	Same as C7219.	Filter Network	
C7227	Same as C7220.	Filter Network	
C7228	CAPACITOR, FIXED, ELECTROLYTIC: tantalum; 50 uf; +50% -15%; 60 vdcw; polarized; tubular case.	Coupling	CE-107-1
C7229	Same as C7200.	Filter Network	
C7230	Same as C7201.	Filter Network	
C7231	Same as C7201.	Filter Network	
C7232	Same as C7203.	Filter Network	
C7233	Same as C7204.	Filter Network	
C7234	Same as C7205.	Filter Network	
C7235	Same as C7206.	Filter Network	
C7236	Same as C7200.	Filter Network	

**PARTS LIST (Cont'd)**

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C7237	Same as C7201.	Filter Network	
C7238	Same as C7201.	Filter Network	
C7239	Same as C7203.	Filter Network	
C7240	Same as C7204.	Filter Network	
C7241	Same as C7205.	Filter Network	
C7242	Same as C7206.	Filter Network	
C7243	Same as C7214.	Filter Network	
C7244	Same as C7215.	Filter Network	
C7245	Same as C7216.	Filter Network	
C7246	Same as C7217.	Filter Network	
C7247	Same as C7218.	Filter Network	
C7248	Same as C7219.	Filter Network	
C7249	Same as C7220.	Filter Network	
C7250	Same as C7214.	Filter Network	
C7251	Same as C7215.	Filter Network	
C7252	Same as C7216.	Filter Network	
C7253	Same as C7217.	Filter Network	
C7254	Same as C7218.	Filter Network	
C7255	Same as C7219.	Filter Network	
C7256	Same as C7220.	Filter Network	
C7257	Same as C7228.	Filter Network	
J7200	CONNECTOR, RECEPTACLE. ELECTRICAL: 1 round, female contact; teflon insulation BNC series.	Channel A, Input	JJ-172
J7201	Same as J7200.	Channel A, Output	
J7202	Same as J7200.	Channel B, Input	
J7203	Same as J7200.	Channel B, Output	
L7200	REACTOR: 9.95, 19.9, 39.8, 99.5, 199, 398, 995 mh; total dc resistance 130 ohms; current rating 50 ma from terminal C to terminal 1, 2, 3, 4, 5, 6, 7; insulated for 150 v; hermetically sealed metal case.	Filter Network	CL-288-2

**PARTS LIST (C nt'd)**

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
L7201	REACTOR: 25.5, 51, 102, 255, 510, 1020, 2550 mh; total dc resistance 410 ohms; current rating 200 ma from terminal C to terminal 1, 2, 3, 4; 30 ma from terminal C to terminal 5, 6, 7; insulated for 150 v; hermetically sealed metal case.	Filter Network	CL-288-1
L7202	Same as L7200.	Filter Network	
L7203	Same as L7201.	Filter Network	
S7200 A, B	SWITCH, ROTARY: 2 sections; 8 positions; non-shorting contacts; contact rating 1/4 amp at 250 vdcw.	Channel A, High Cutoff	SW-302
S7201 A, B	Same as S7200A, B.	Channel A, Low Cutoff	
S7202 A, B	Same as S7200A, B.	Channel B, High Cutoff	
S7203 A, B	Same as S7200A, B.	Channel B, Low Cutoff	
S7200C	SWITCH SECTION, ROTARY: 1 section; 8 position; non-shorting contacts; contact rating 1/4 amp, 250 vdc; 1/2 amp, 125 vdc.	Channel A, High Cutoff	WS-128-3
S7201C	Same as S7200C.	Channel A, Low Cutoff	
S7202C	Same as S7200C.	Channel B, High Cutoff	
S7203C	Same as S7200C.	Channel B, Low Cutoff	
S7200D	SWITCH SECTION, ROTARY: 1 section; 8 position; non-shorting type contacts; contact rating 1/4 amp, 250 vdc; 1/2 amp, 125 vdc.	Channel A, High Cutoff	WS-128-1
S7201D	Same as S7200D.	Channel A, Low Cutoff	
S7202D	Same as S7200D.	Channel B, High Cutoff	
S7203D	Same as S7200D.	Channel B, Low Cutoff	



**PARTS LIST (C nt'd)**

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
S7200E	SWITCH SECTION, ROTARY: 1 section; 8 position; non-shorting contacts; contact rating 1/4 amp, 250 vdc; 1/2 amp, 125 vdc.	Channel A, High Cutoff	WS-128-2
S7201E	Same as S7200E.	Channel A, Low Cutoff	
S7202E	Same as S7200E.	Channel B, High Cutoff	
S7203E	Same as S7200E.	Channel B, Low Cutoff	

\*C7216, C7223, C7245 and C7252 capacitors have .005 uf, ±5%, 400 vdcw ratings on earlier models of the HAF-1. The TMC part number for the .005 uf capacitor is CX-107-13.

**SECTION 8**  
**SCHEMATIC DIAGRAM**

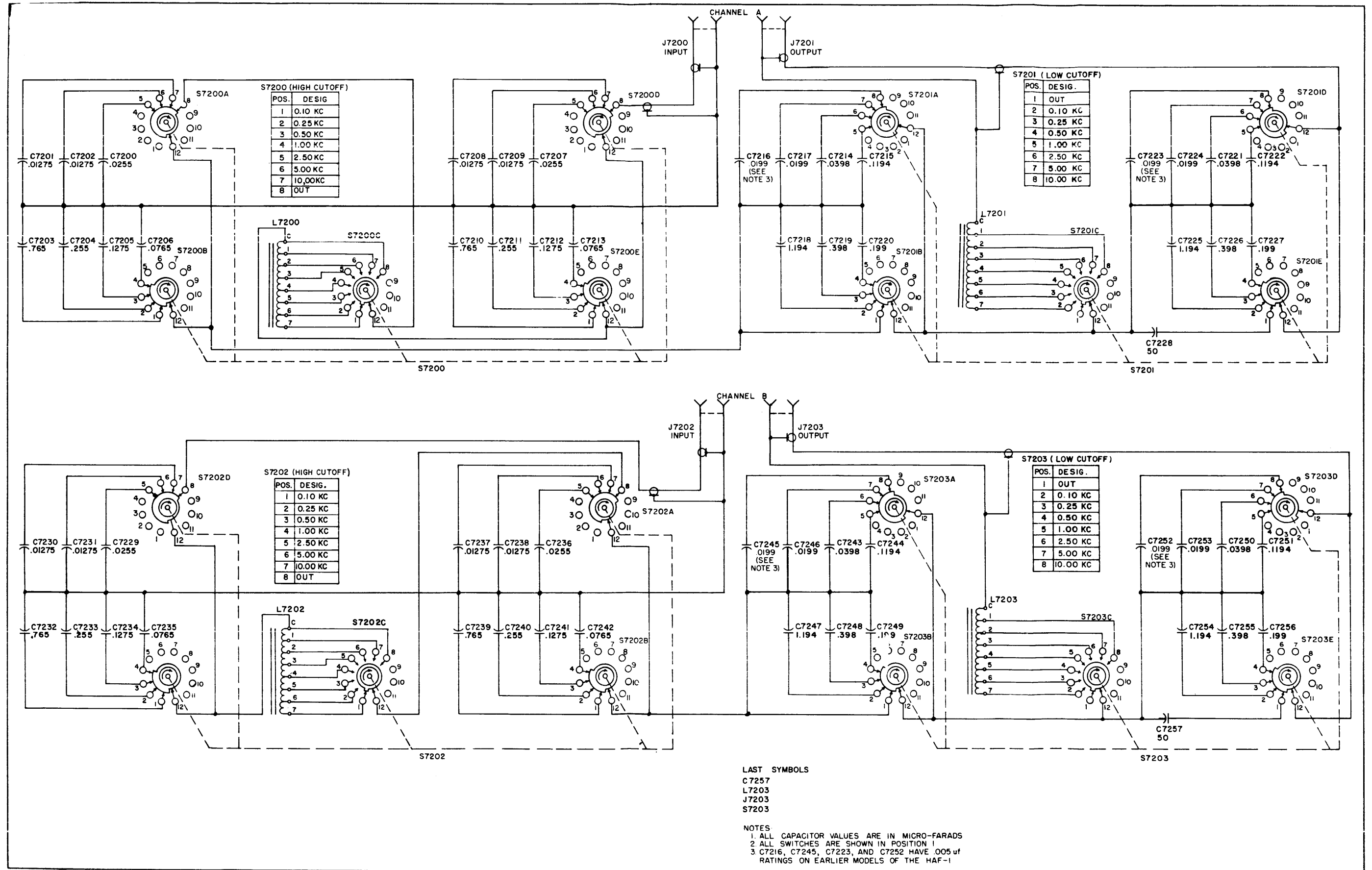


Figure 8-1. Schematic Diagram, HAF-1