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COMPILED [illegible] CHECKED	TITLE: THEORY OF OPERATION FOR THE TMC MODEL HFA-1	
APPROVED BP	AUDIO AND DETECTION DECK	

THEORY OF OPERATION FOR THE TMC MODEL

HFA-1 AUDIO AND DETECTION DECK.

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. STOCK NO. 459M

1. INTRODUCTION:

For explantory purposes, the HFA-1 can be broken down into five sections:

A. Detection
B. Isolation Amplifiers
C. Audio frequency amplifiers
D. Audio sync tone relay
E. RCC SYN Relay

Excluding the audio sync tone and RCC SYN relay, the above sections are duplicated (i.e. channel A and channel B). Copies of CK-535, CK-227, and CK-576 should be obtained for further clarification of explanations to follow.

2.j DETECTION DESCRIPTION:

There are two detectors provided in each channel : A product detector for CW and Sideband Reception, and a diode detector for AM reception.

2.1 PRODUCT DETECTOR (V-7003 or V-7011). It can be seen from CK-536, two inputs, sideband (provided through the isolation amplifier V-7001B or V-7009), and local oscillator or carrier, combine in the detector to produce an audio output proportional to the product of the applied voltages. That is, the audio output is comprised of beat notes or hetrodynes between the carrier oscillator and individual sidebands of the incoming signal. The HFS-1 utilizes the pentagrid converter type of product detector where the oscillator and signal grids provide the two inputs.

2.1.1 CARRIER: The carrier injection of the product detector is provided by either the frequency synthesizer, AFC, of the beat frequency oscillator.

2.1.2 INTERNAL BEAT FREQUENCY OSCILLATOR: There are two internal beat frequency oscillators provided in the HFA-1 Channel A and Channel B BFO. The BFO tubes, V-7009A, function only with it's associated detection switch in the CW position. The BFO is a Vackar variable frequency type oscillator with L-7000, C-7053, C7006, C-7008 and C-7007, or L-7032, C-7031, C-729, and C-7030 as the frequency determining components.

2.2 A.M. DETECTOR (CR-7000 or CR-7001): The AM detectors in the HFA-1 are of the diode type: CR-7000 and CR-7001 are used for this function.

2.2.1 FUNCTION: The signal present at the I.F. amplifier deck output, HF1-1, consists of a carrier having modulation sidebands symmetrically located above and below the carrier frequency by an amount equal to the original modulating frequencies. (Note: This is only true when symmetrical type filter plug-in drawers are used in the HFI-1). The purpose of the A.M. detector is to demodulate the output signal from the IF amplifier and present at the detector output the original modulating frequencies. When this signal is applied to the rectifier diodes, current will flow only during the part of the R.F. cycle when the plate is positive with respect to the cathode, so that the output of the diode consists of half-cycles of R.F. The resistors and capacitors, R-7020, C-7018 and C-7019, or R-7071, C-7043, and C-7044, (Channels A and B respectively) constitute a low pass filter to suppress the radio frequency component of the output of the rectifier, leaving a D.C. component that varies in the same way as the modulation on the original signal.

3. ISOLATION AMPLIFIERS: Each channel on the HFA-1 contain three different isolation amplifiers. Basically, they perform the same function - to isolate two stages.

3.1 CATHODE FOLLOWER: Two cathode followers, V-7004 and V-7012, are provided for their associated channels in the HFA-1. The output of the detector, a varying d.c. voltage, is applied to the grid of the cathode follower through a coupling capacitor, C-7020 or C-7045. The cathode follower output is designed for 1000 ohm output impedance. This was necessary to accommodate a high or low pass filter deck, HAF-1, which was also designed for an input and output impedance of 1000 ohms. When the HAF-1 is not utilized, a jumper cable is inserted between J-7004 and J-7005, or J-7011 and J-7012

3.2. I.F. ISOLATION AMPLIFIER: The I.F. Isolation amplifiers V-7002, and V-7010 are operated in the class A fashion for good linearity characteristics. The plate

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Transformers T-7000 and T-7004 couple the plate of the amplifier to a 50 ohm load at approximately one volt. The main purpose of this amplifier was to provide a 50 ohm output jack, J-7000 and J-7007, and isolation for an external unit such as the DVM-4 (visual monitor).

3.3 PRODUCT DETECTOR ISOLATION AMPLIFIER: The I.F. isolation amplifier, V-7001B and V-7009B provide isolation for their associated product detectors. It can also be seen that "pulling" of the BFO when operating the HFA-1 in the CW position is prevented.

4. AUDIO FREQUENCY AMPLIFIERS

Both amplifier channels are operated in the same manner excluding the audio sync tone relay which will be discussed later.

4.1 FIRST, SECOND, AND THIRD A.F. AMPLIFIER: The first, second and third A.F. amplifiers operate in the conventional Class A manner. The low input impedance of the first A.F. amplifier, 1000 ohms, is used for the purpose discussed in section 3.1.

4.1.1 FEEDBACK: Negative feedback, from the secondary of the output transformer, is injected in the cathode of the second A.F. amplifier to reduce distortion and flatten frequency response.

4.1.2 LINE LEVEL CONTROL: The line level control is placed at the input to the second A.F. amplifier. The overall amplifier output is controlled by it. A separate control is provided for each channel, R-7029 and R-7080.

5.1 PHASE INVERTER: The phase inverter, V-7006B or V-7014B, is a common split-load phase inverter. That is, an amplifier with an equal load in the plate and cathode circuit. In this circuit, plate current flowing through the two resistors, R-7038 and R-7044, or R-7087 and R-7092, results in two equal voltages of opposite phase. These voltages are in turn fed into the push-pull power amplifier stage. The gain of the split-load phase inverter to either output is less than unity.

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5.2 POWER AMPLIFIER: The power amplifier stage, V-7007 and V-7008, or V-7015 and V-7016, is designed to provide 0-1 watt of audio power. The circuit is a conventional push-pull transformer-coupled power amplifier with self bias provided by R-7042 or R-7094. The input signal is supplied by the phase inverter discussed in section 5.1.

5.2.1 ATTENUATOR: A "pad" or attenuator, is placed across the output to provide 0-1 mw of audio power; it is designed to provide a attenuation of 30 db to the 0-1 watt output.

5.3.2 LINE LEVEL METER: Two line level meters, M-7000 and M-7001, are across the 0-1 MW outputs for channel A and B. They present an accurate indication of the amplifier output into a 600 ohm balanced line. R-7106 and R-7109 are used for meter impedance matching purposes.

5.3.3 PHONES JACK: A phone monitor jack for each channel is available on the front panel with its associated gain control. Standard 8000 or 600 ohm headsets may be used.

5.3.4 DIODE LOAD: A terminal on E-7000 or E-7001 is provided for the diode load output. This output is available only if the detection switch is in the AM position

6. RELAY OPERATION:

Two relays are located in the HFA-1 deck, and both perform the following functions.

6.1 AUDIO SYNC TONE RELAY: The purpose of the audio sync tone relay is to provide an audio input from the synthesizer phase detector output (HFS-1), and normal operation of only the channel A amplifier. CK-576 clearly illustrates the location and inputs of the Audio Sync Tone Relay. Completion of the relay B+ ground is returned by a switch in an associated system unit.

6.2 RCC SYN RELAY: It can be seen from the HFA-1 block diagram, CK-576, that this relay provides two choices of 250 Kc carrier injection for the product detectors. Operation utilizing one of the carrier injection sources is possible only with the Detection switch in the SSB position. The relay energizing B+ is applied through the HFA-1 power input jack, J-7010, by a switch in an associated syst m unit; therefor , relay operation is independent of the Detection switch.

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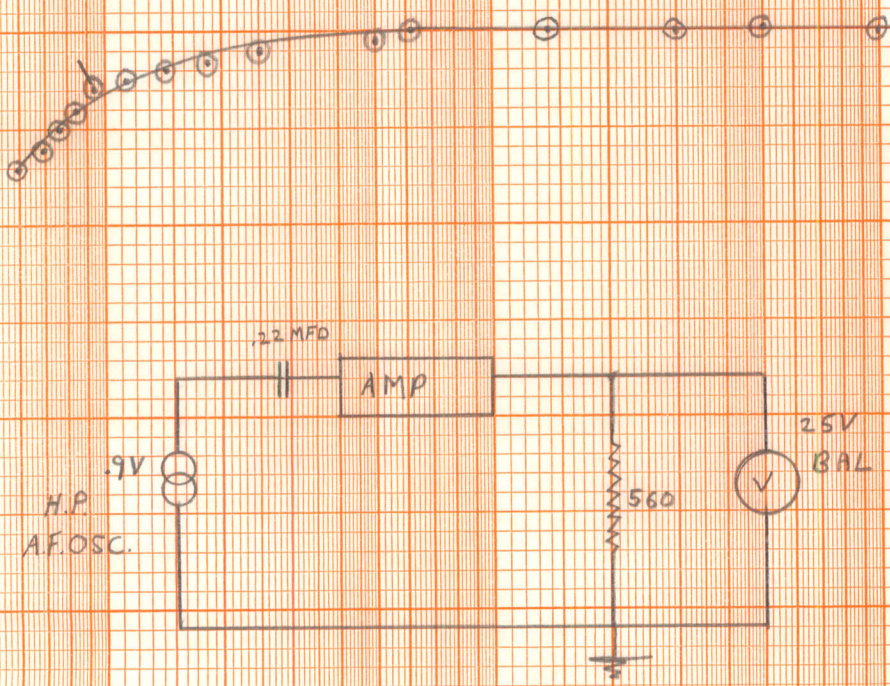
HFA-1 AUDIO RESPONSE

+DB
+10
+5
0
-5
-10
-DB



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