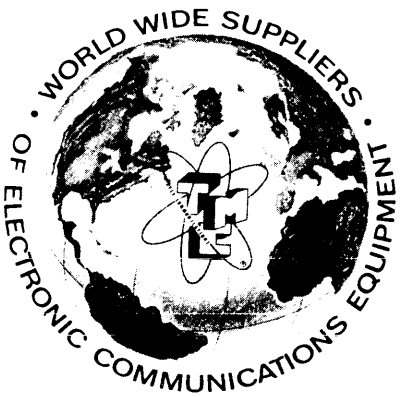

TECHNICAL MANUAL

FOR

10KW HF/ISB TRANSMITTER
HFT-10K
SERIES/J

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THE TECHNICAL MATERIEL CORPORATION

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PREFACE

This technical manual discusses the information you will require to install, operate and maintain the HFT-10K/J High Frequency Transmitter. This manual is intended for operators and technicians who will be responsible for the proper functioning of the equipment.

This text is compiled in three parts:

HFT-10K/J	-	Transmitter System	Part I
MMX-2B	-	Multi-Mode Exciter	Appendix A
HFL-10K	-	High Gain Linear Power Amplifier	Appendix B

You should read this manual in sequence, section by section, to become totally familiar with the transmitter. After completing this manual, you should be able to install, operate, and depending on your level of technical training, perform maintenance to the component level.

Changes are periodically made to this manual through publication of TECHNICAL NEWSLETTERS that are distributed to users of the equipment. The REGISTRATION CARD located at the front of this manual should be completed and sent to:

THE TECHNICAL MATERIEL CORPORATION
700 Fenimore Road
Mamaroneck, New York 10543 U.S.A.

Attention: Technical Data Group

Your name and address will be entered on permanent TMC records and applicable publications automatically mailed to you. Requests for related publications should be made to your TMC representative, to a TMC field office in you area, or to TMC at the above address.

Request for spare parts forms are provided at the back of this manual for your use.

To facilitate the maintenance of accurate records on the operation of the equipment, a SERVICE LOG and FIELD REPORT are also included.

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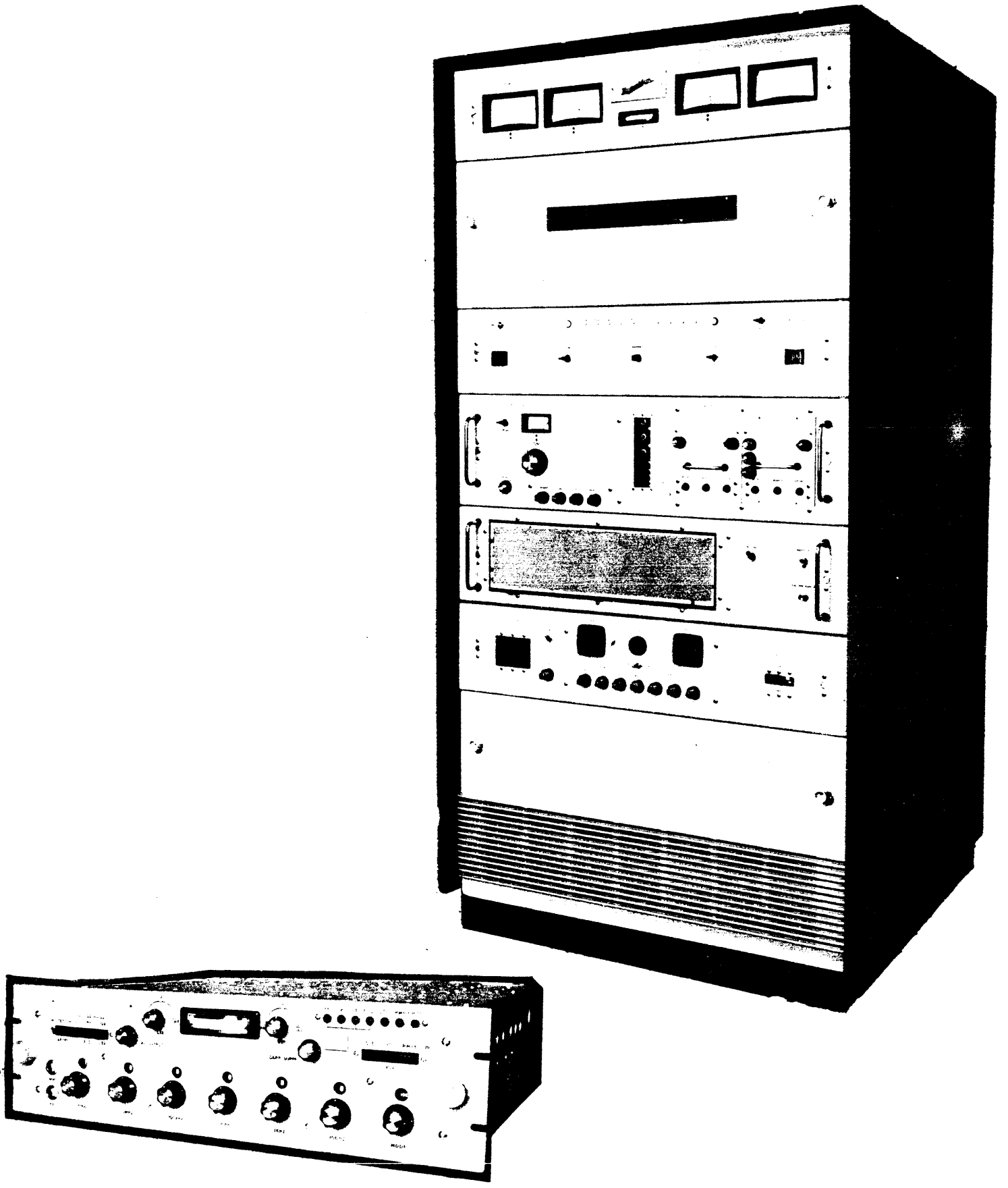


Figure 1-1. High Frequency Transmitter, Model HFT-10K/J

SECTION 1

GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION

This manual presents operating and maintenance instructions for High Frequency Transmitter HFT-10K/J designed and manufactured by The Technical Materiel Corporation, Mamaroneck, New York. This manual includes a general description of the equipment; installation and operating procedures; principles of operation; maintenance and troubleshooting data; and a parts list.

The High Frequency Transmitter HFT-10K/J, hereinafter referred to as the transmitter (figure 1-1), consists of a solid state, multi-mode exciter. Refer to Appendix A, hereinafter all reference to the exciter will simply state exciter and the reader will refer to Appendix A. The exciter is used in conjunction with high frequency linear power amplifier HFL-10K. The Exciter is capable of providing CW (continuous wave), AM (amplitude modulated equivalent) full carrier, FSK (frequency shift keyer), FAX (facsimile) and optional ISB (independent sideband) modes of operation. The high frequency linear power amplifier amplifies the exciter output to provide 10 killowatts (PEP) and average throughout the frequency range of 2 to 30 mHz. The transmitter is readily adaptable for shipboard, aircraft, and land installations. Table 1-1 lists the transmitter components.

TABLE 1-1. COMPONENTS OF TRANSMITTER HFT-10K/J

NOMENCLATURE	COMMON NAME
Refer to Appendix A	Multi-Mode Exciter
HFL-10K	High Frequency Linear Power Amplifier

1-2. PHYSICAL DESCRIPTION

The transmitter consists of a single cabinet, 68-3/4 inches high by 33-1/2 inches wide by 38-3/4 inches deep, which houses all the components which comprise the HFL-10K power amplifier in addition to the exciter. The HFT-10K/J consists of a main meter panel, a power amplifier, an IPA drawer, an exciter drawer, a main power panel, a main power supply, and an optional harmonic filter. Primary power connections are made through the access hole on the base assembly. External exciter transmitter control connections are made to the exciter remote assembly. Transmitter r-f power is routed through a directional coupler mounted in the opening located on top of the transmitter.

1-3. REFERENCE DATA

Table 1-2 lists the technical specifications of the equipment.

TABLE 1-2. TECHNICAL SPECIFICATIONS

FREQUENCY RANGE:	2 to 30 mHz.
OPERATING MODES:	SSB, ISB, CW, AM, FSK and FAX.
POWER OUTPUT:	10,000 watts 2 tone PEP with appropriate exciter(10 kw average). Four channel ISB with SBG-4 or TMX adapter.
OUTPUT IMPEDANCE:	50 ohms unbalanced with 3:1 vswr EIA flange for 1-5/8 inch coaxial.
STABILITY AND FREQUENCY CONTROL	Depends on exciter used.
TUNING:	Automatic or manual. Automatic has manual override.
REMOTE OPERATION:	Facilities for remote operation including mode, frequency, power level and readback available.
SPURIOUS SIGNALS:	At least 60 db below full PEP output.
HARMONIC SUPPRESSION:	Second harmonic at least 50 db down from PEP output. Third harmonic at least 65 db down from PEP output.
HARMONIC FILTERS:	Available fixed for all frequencies above 30 mHz or bandswitched for lower frequencies. Resultant harmonics conform to latest requirements.
AUDIO INPUT:	Depends on exciter used.
METERING:	Meters with special illuminated overload protection.
NOISE:	Power supply ripple 55 db down from full PEP output. Other 70 db down--special "white noise" protection.
COOLING:	Filtered, forced air cooling semi-pressurized cabinet.
ENVIRONMENTAL:	Designed to operate in any ambient temperature between the limits of 0 and 50°C for any value of humidity to 90%.

TABLE 1-2. TECHNICAL SPECIFICATIONS (con't)

SPECIAL FEATURES:	Adjustable power output levels with overload and bias protection, and alarm. Controlled and adjustable ALDC. Safety interlocks at all high voltage points.
PRIMARY POWER:	210, 220, 230, 250 volts, 50/60 Hz, 3 phase, Delta or Wye (other voltages available on special request).
POWER REQUIREMENTS:	Maximum 27,000 watts. All solid state power supply.
SIZE:	33-1/2 inches wide x 38-3/4 inches deep x 68-3/4 inches high standard.
INSTALLED WEIGHT:	Approximately 1300 pounds.
SHIPPING WEIGHT.	Approximately 1660 pounds.
SIZE OF LARGEST SHIPPING CONTAINER:	43 inches wide x 49 inches long x 81 inches high.
COMPONENTS AND CONSTRUCTION	Manufactured in accordance with JAN/ MIL wherever practicable.

SECTION 2

INSTALLATION

2-1. INITIAL UNPACKING AND INSPECTION

The HFT-10K/J was assembled, calibrated, and tested at the factory before shipment. Inspect all packages for possible damage during transit. 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 furnishing of replacement parts. Carefully unpack each crate as indicated by the packing list provided with the transmitter shipment. Inspect all packing materials for parts that may have been shipped as loose items (cabinet hardware, connectors, technical manuals, etc.).

2-2. POWER REQUIREMENTS

The transmitter requires a three phase source voltage of 230 vac, 50/60 Hz. The maximum power requirement is 27,000 watts.

The transmitter can operate with a 440 vac power source providing the proper transformers are in place.

When a 440 vac power source is available the High Voltage Transformer T801 TMC part number TF437 must be used in place of TF203. The screen transformer T802 TMC part number TF438 must be used in place of TF386, also a 440 vac power source must have an additional transformer TF342 (T805).

2-3. INSTALLATION

A minimum number of assemblies, subassemblies, components and hardware have been disassembled from the equipment and separately packaged, thus reducing the possibility of equipment damage in transit. The method of disassembly and separate packaging also permits realistic equipment handling.

Cables, wires, and other miscellaneous items that are disconnected during equipment disassembly are tagged and taped to the equipment. The information on a given tag indicates the designated terminal on a component to which the tagged item must be connected. Make sure all cables and wires have been connected as designated on tags and that all packing material, tags, and tape have been removed before sealing up the cabinet or section of the cabinet with a front panel drawer.

Connect the MMX-2B to the HFL-10K using appropriate cables. With the unit fully assembled, install the cabinet in the desired location, leaving a minimum two-foot clearance on the top and all sides for maintenance and installation purposes.

2-4. PRE-OPERATIONAL CHECK

Although the transmitter has been aligned and thoroughly checked against the manufacturer's specifications prior to shipment, it is necessary to ensure correct installation and proper operation by referring to the applicable Appendicies to perform the transformer checks of the HFL-10K and initial checkout of the MMX-2B.

SECTION 3

OPERATOR'S SECTION

3-1. GENERAL

The controls of the exciter provide rapid transmitter r-f frequency selection of AM, USB, LSB or ISB (optional) intelligence in the 2 to 30 mHz. transmission range. Tuning is accomplished manually or automatically.

3-2. OPERATING CONTROLS

For detailed functions of all operating controls and indicators of the HFT-10K/J, refer to the applicable HFL-10K and exciter Appendicies.

3-3. STARTING CONTROLS SETTINGS

Generally, before main power is applied, all operating controls should be set to OFF or maximum counterclockwise position. Set the exciter ON/STANDBY switch to STANDBY. Starting control settings are provided in the operating procedures presented in paragraphs 3-6 and 3-7.

3-4. OPERATING PROCEDURE

a. GENERAL. An extensive interlock and overload system is designed into the transmitter. However, a single incorrect control setting could overload certain components, resulting in equipment malfunctioning.

A definite operating sequence as outlined in this manual should be rigidly followed. Once the operating technique is mastered, it should be consistently followed to ensure continuing proper operation of the equipment and prevent possible malfunctions.

Before applying power to the transmitter, check that antenna or dummy load connections are properly made.

b. TUNING CONSIDERATION:

1. GENERAL. Before the transmitter is tuned for any specified mode of operation, it should be initially tuned and loaded on a carrier frequency. This procedure should be followed, even if suppressed carrier operation is desired. After the transmitter is tuned to the carrier frequency, either or both sidebands are generated by applying the proper modulating signals required by the particular mode of operation. The carrier level may then be reinserted or bypassed, as desired.

2. CARRIER FREQUENCY VERSUS ASSIGNED FREQUENCY. When operating in certain modes, the carrier frequency may be significantly different than the assigned frequency, and will therefore affect the choice of frequency to be selected in the exciter. Carrier frequency is defined as that position in the r-f spectrum reserved for the carrier, whether or not the carrier is present. The assigned frequency is a reference frequency designed to identify or reserve a given portion of the r-f spectrum.

Most government agencies define the assigned frequency as the center of a frequency band assigned to a station. The assigned frequency and the carrier frequency may or may not be the same. In practice, the assigned frequency is often suffixed by the carrier frequency in parenthesis for clarification.

EXAMPLE 1 - For an upper sideband transmission, with the carrier completely suppressed and with a total r-f bandpass extending from 300 Hz above Fc (carrier frequency) to 3 kHz, the assigned frequency is 1650 Hz above the non-existent carrier frequency.

EXAMPLE 2 - For an ISB (independent sideband) transmission, with audio intelligence covering 350-7500 Hz per sideband, with or without carrier suppression, the assigned frequency and the carrier frequency are one and the same with both occupying the center of the transmitted spectrum.

3. PEAK ENVELOPE POWER VERSUS AVERAGE POWER INDICATION. A common misapprehension continues to exist over the ratio between average and PEP (peak envelope power) in high-power transmitters, particularly when multichannel (multitone) transmissions are used. The PEP during modulation can be many times that of the average power indicated on the HFT-10K/J PA OUTPUT meter. Thus, the transmitter average power must be reduced sufficiently to avoid a serious peak overload to the transmitter, with consequent flattopping and possible damage.

3-5. TRANSMITTER CARRIER TUNING PROCEDURE

The operational procedure presented in paragraph 3-6 contains the manual tuning procedure wherin all operating controls are adjusted by the operator. Paragraph 3-7 contains the automatic tuning procedure that is accomplished once the transmitter has been satisfied with all signal and voltage inputs required for automatic tuning. The numbers in parenthesis following each operating control and indicator locate the controls and indicators in the associated technical front panel illustration.

CAUTION

In the automatic mode of operation, the HFL-10K cannot perform the automatic bandswitching function unless properly interfaced with the appropriate exciter. Without the appropriate exciter, bandswitching must be performed manually prior to starting the automatic tuning cycle (as indicated in the manual tuning procedure). See Appendix A for the exciter in use.

3-6. MANUAL TUNING PROCEDURE

The manual tuning procedure (carrier only) for the HFT-10K/J transmitter is outlined in Table 3-1, Figure 3-1 locates references ( ).

TABLE 3-1 MANUAL TUNING PROCEDURE (CARRIER ONLY)

STEP	OPERATION	NORMAL INDICATIONS
1	Set MAIN POWER circuit breaker (30) and EXCITER ON/OFF switch (31) to ON positions.	All transmitter blowers operate. TECHNIMATIC light (3) and PA BAND indicator (12) illuminate. STANDBY indicator on the exciter illuminates.
2	Set SCREENS circuit breaker (33) to ON.	INTERLOCK indicator (8) lights (provided that all safety interlocks are closed and the time delay cycle has been completed)
3	Set MAN/AUTO switch (9) to MAN.	No indications at this time; however, automatic tuning circuitry is disabled.
4	Set ALARM ON/OFF switch (34) to OFF.	If ALARM ON/OFF switch had been in the ON position with high voltage removed, the audible high voltage alarm would be on. This switch disconnects alarm circuitry.
5	Set RF GAIN control (20) fully counterclockwise.	No indications.

NOTE

The transmitter is equipped with protective overload circuitry incorporated in meters on the transmitter. If an overload occurs in either the PA PLATE current, PA SCREEN current, IPA plate current or at the transmitter output in the form of excessive vswr, the corresponding meter face will light to indicate an overload has occurred in that circuit of the transmitter. Also, each of these meters has an overload indicator that can be adjusted to trip at a value set by the operator.

TABLE 3-1. MANUAL TUNING PROCEDURE (cont)

STEP	OPERATION	NORMAL INDICATIONS
6	Adjust the OVERLOAD INDICATOR (adjustment screw located directly below each meter face) on each meter for the following:	
	PA PLATE current	3-1/2 amperes
	PA SCREEN current	80 ma
	IPA plate current	800 ma
	REFLECTED power	as desired
7	Select band by holding BAND-SWITCH control (7) first to left until a PA band indicator (12) lights, then holding BAND-SWITCH control to the right until the next PA band indicator lights. Continue this operation until the associated band indicator lights for the desired operating frequency.	PA band indicator (12) lights to indicate PA frequency band selected.

NOTE

The transmitter contains four preset average output power levels which are adjustable and selected at the front of the transmitter. Before applying excitation to the transmitter one of the four preset power levels should be selected. (to calibrate the four levels, refer to the HFL-10K Appendix B). With the power properly calibrated they are automatically adjusted from the internal ALDC circuits. In power level 1, the transmitter will tune to 3 kw, in power level 2 it will tune to 5 kw, in power level 3 it will tune to 8 kw, and in power level 4 the transmitter will tune to 10 kw. When tuning the transmitter manually, the ALDC circuit remains activated and will limit the transmitter power output in accordance with the power level selected, corresponding to the desired power output.

TABLE 3-1. MANUAL TUNING PROCEDURE (cont)

STEP	OPERATION	NORMAL INDICATIONS
*8	Remove bias control cover on IPA drawer to expose bias adjust potentiometers (PA BIAS, IPA BIAS and 2ND AMP BIAS)	
* These steps are not part of the normal operating procedure, and should only be performed periodically in the order indicated.		
9	Press HIGH VOLTAGE switch (10) to light indicator. (It may be necessary to press HIGH VOLTAGE switch twice).	HIGH VOLTAGE switch lights when high voltage is on.
*10	Adjust PA BIAS control for an indication of 0.65 ampere on the PA PLATE CURRENT meter (2).	PA PLATE CURRENT meter indicates quiescent current of 0.65.
*11	Adjust IPA bias control for an indication of 200 ma on IPA plate current meter (19).	IPA plate current meter (19) indicates quiescent current of 200 ma. (190 ma to 210 ma)
*12	Hold PLATE METER switch (18) up and adjust 2ND AMP BIAS control for an indication of 200 ma.	IPA plate current meter (19) indicates IPA quiescent current of 200 ma when PLATE METER switch is in 2ND AMP position. (190 ma to 210 ma)
*13	Replace bias control cover, press HIGH VOLTAGE switch (10) to remove high voltage, and extend IPA drawer out on its chassis tracks to expose 1ST AMP BIAS control.	HIGH VOLTAGE indicator goes out and PLATE meters indicate zero.
*14	Pull IPA drawer interlock shaft outward to defeat interlock, and press HIGH VOLTAGE switch (10) to apply high voltage.	HIGH VOLTAGE indicator lights and PLATE meters indicate PA and IPA plate currents.

TABLE 3-1. MANUAL TUNING PROCEDURE (con't)

STEP	OPERATION	NORMAL INDICATIONS
*15	Set PLATE METER switch (18) to 1ST AMP position and adjust 1ST AMP BIAS control for 40 ma (1ST AMP BIAS control located on underside of IPA drawer). After adjustment is completed, remove high voltage, reinsert IPA drawer interlock, and push in and secure IPA drawer.	IPA plate current meter (19) indicates 40 ma with PLATE METER switch in 1ST AMP position. (30 ma to 40 ma).
16	Set the TEST KEY switch (35) to the up position.	
	The following explanation is used for an MMX series exciter. Refer to Appendix A for the appropriate exciter used.	
17	Set the controls on the exciter as follows; METER switch to RF position, CARR SUPPR switch to FULL position, ON/STANDBY switch to ON position, EXCITER ON/PTT switch to the EXCITER ON position. MODE switch to CW position, frequency selector switches to the desired carrier frequency (refer to paragraph 3-4b.), RF OUTPUT control for an output of approximately 100 milliwatts.	MONITOR meter on the exciter reads approximately 2 with 100 milliwatt output.
	NOTE During initial manual tuning of transmitter, r-f output power will be increased or decreased with the RF GAIN control (20).	
18	Press the HIGH VOLTAGE switch (10) to light indicator, and adjust RF GAIN control (20) clockwise slightly to cause increase in IPA plate current indication on PLATE current (19), not to exceed 250 ma.	HIGH VOLTAGE switch indicator (10) illuminates and IPA plate current (19) indicates an increase in meter reading not to exceed 250 ma.

*These steps are not part of the normal operating procedure and should only be performed periodically in the order indicated.

TABLE 3-1. MANUAL TUNING PROCEDURE (cont)

STEP	OPERATION	NORMAL INDICATIONS
19	Adjust IPA TUNE control (21) for a noticeable increase and peak in PA plate current indication on PA PLATE current meter (2).	The rotation of IPA TUNE control applies IPA output to PA, indicating resonance, At this point, PA PLATE current meter (2) indicates an increase in quiescent current.
	CAUTION During tuning of power amplifier do not exceed a PA PLATE current meter reading of 1.0 ampere. If an overload should occur, the HIGH VOLTAGE indicator will go out. To reset high voltage, decrease r-f drive to minimum and press to light HIGH VOLTAGE indicator. (HIGH VOLTAGE switch must be pressed twice to energize high voltage).	
20	Operate PA TUNE control (11) (press control down or up in small increments), as necessary, to cause a noticeable resonant dip in PA PLATE current meter (2) indication.	PA PLATE current meter indicates resonant dip and PA OUTPUT meter (5) indicates power output.
21	Operate PA LOAD control (17) (press control + or - in small increments), as necessary, to produce a maximum reading on PA OUTPUT meter (5).	PA OUTPUT meter indicates a further increase in power output during loading process.
22	Operate the PA LOAD control (17) (Press control up or down), as necessary to cause LOAD SENSE meter (6) to indicate at or near zero reading.	PA OUTPUT meter (5) indicates highest value when transmitter is properly loaded into antenna or load.
	NOTE Proper tuning can also be accomplished by observing LOAD SENSE meter (6) for a zero to 100 reading at a level of 1kw.	

TABLE 3-1. MANUAL TUNING PROCEDURE (con't)

STEP	OPERATION	NORMAL INDICATIONS
23	Re-adjust IPA TUNE control (21) for further increase in PA OUTPUT meter indication.	PA OUTPUT meter (5), may indicate a slight increase in meter reading.
24	Rotate RF GAIN control (20) clockwise to increase PA output power level to desired preset power level.	PA OUTPUT meter (5) indicates desired output level.
25	Set the TEST KEY switch (35) to its center or neutral position.	PA OUTPUT meter indication goes to zero.
	NOTE Upon completion of manual tuning on carrier, the transmitter is ready for operation in an intelligence mode. Exciter control positions for the various modes of operation are outlined in Appendix A. The above outlined procedure has presented a logical sequence for manually tuning the HFT-10K/J on a selected carrier frequency at the desired or rated average power output level. Refer to paragraph 3-8 for power output indications under multichannel transmissions, before the reapplication of excitation to the transmitter.	

3-7. AUTOMATIC TUNING PROCEDURE

The automatic tuning procedure (carrier only) for the HFT-10K/J transmitter is outlined in table 3-2.

TABLE 3-2. AUTOMATIC TUNING PROCEDURE (CARRIER ONLY)

STEP	OPERATION	NORMAL INDICATIONS
1	Set MAIN POWER circuit breaker (30) and EXCITER ON/OFF (31) switch to the ON positions.	All transmitter blowers operate. TECHNIMATIC light (3), PA band indicator (2) and POWER level indicator (14) light.
2	Set SCREENS circuit breakers (33) to ON.	INTERLOCKS indicator (8) lights (provided that all safety interlocks are closed and the time delay cycle has been completed).

TABLE 3-2. AUTOMATIC TUNING PROCEDURE (con't)

STEP		
3	Set ALARM ON/OFF switch (34) to OFF position.	If ALARM ON/OFF switch had been in the ON position with high voltage removed, the audible high voltage alarm would be on. This switch disconnects high voltage alarm circuitry.
4	Set the MAN/AUTO switch (9) to the AUTO position.	Automatic tuning circuitry is enabled.
	The following explanation is used for an MMX series exciter. Refer to Appendix A for the appropriate exciter used.	
5	Set the controls on the exciter as follows: METER switch to RF position, CARR SUPPR switch to FULL position, ON/STANDBY switch to ON position, EXCITER ON/PTT switch to the EXCITER ON position, MODE switch to CW position, frequency selector switches to the desired carrier frequency (refer to paragraph 3-4b), RF OUTPUT control for an output of approximately 100 milliwatts (reading of about 2 on the MONITOR meter).	In the exciter the POWER indicator should illuminate and the MONITOR meter should read approximately 2. The bandswitches in the IPA and PA sections should position automatically; the proper bandswitch indicator (12) for the band including the selected carrier frequency, should illuminate.
6	Select the desired output power level with POWER ADJ switch (15). When POWER ADJ switch is in the up position, one of four preset power levels is selected.	The POWER level indicator (14) illuminates to indicate the power level selected. (The levels are fully adjustable and can be set by the operator; refer to section 5 of the HFL-10K, Appendix B for information pertaining to power level adjustments.)
*7	Set the MAN/AUTO switch (9) to the MAN position.	Automatic tuning circuitry is disabled.

*NOTE: These steps are not a part of the normal operating procedure and should only be performed periodically in the order indicated.

TABLE 3-2. AUTOMATIC TUNING PROCEDURE (cont)

STEP	OPERATION	NORMAL INDICATIONS
*8	Ensure that the RF GAIN CONtrol (20) is set for minimum (fully counterclockwise), and press the HIGH VOLTAGE switch (10) to light indicator. (It may be necessary to press the HIGH VOLTAGE Switch twice.)	HIGH VOLTAGE switch indicator (10) illuminates. The following meter indications should be observed: PA plate current = 0.65 amperes, IPA plate current = 200 ma; 2ND AMP plate current = 200 ma; 1ST AMP plate current = 40 ma. (Plate current for the 1ST and 2ND AMP'S will be indicated on PLATE METER (19) with PLATE METER switch (18) in the respective positions.)
	NOTE If the values for quiescent current in step 8 are not met, refer to steps 8 thru 15 of the manual procedure, Table 3-1, for setting bias controls.	
*9	Press HIGH VOLTAGE switch (10) to remove high voltage, and set the MAN/AUTO switch (9) to the AUTO position.	HIGH VOLTAGE switch indicator (10) will go out. Automatic tuning circuitry will be enabled.
10	Press HIGH VOLTAGE switch (10) to light indicator and press TUNE switch (16).	High voltage is applied to transmitter and automatic tuning takes place. At the completion of the automatic tuning cycle, READY indicator (16) lights indicating transmitter tuning completed at a power output level selected by operator.
11	Set ALARM ON/OFF switch (34) to ON position.	Alarm is now armed.
	NOTE The transmitter automatic tuning should be completed in approximately 10 seconds; however, incorrect control settings can cause excessive tuning time resulting in a fault indication. If the FAULT indicator (13) lights, check for correct band indication and excitation level before depressing TUNE/READY switch again. If the FAULT indicator lights again, refer to the HFL-10K Appendix B for automatic-tuning adjustment procedures.	

* These steps are not a part of the normal operating procedure, and should only be performed periodically in the order indicated.

NOTE

Upon completion of automatic tuning on carrier, the transmitter is ready for operation in an intelligence mode. Exciter control position for the various modes of operation are outlined in Appendix A. This procedure has outlined the logical sequence for automatically tuning the HFT-10K/J on a selected carrier frequency at the desired or rated average power output level. Refer to paragraph 3-8 for power output indications under multitone, multi-channel transmissions, before the re-application of excitation to the transmitter.

CAUTION

The aforementioned procedure outlines carrier automatic tuning. However, once the exciter has been adjusted for the desired type of intelligence and emission mode, the re-application of r-f drive from the exciter must be carefully adjusted to avoid exceeding the PEP rating of the transmitter. Figure 3-1 illustrates the relationship between peak and average power in graphic form under multitone condition.

3-8. AVERAGE POWER OUTPUT INDICATIONS

When two tones of equal amplitudes are supplied to a single sideband system, the ratio of PEP to average power (.405 x PEP) .405 x 10 kw = 4.05 kw. This relationship is valid for two tones only. Thus, it is apparent that when the two tones of equal amplitude are applied to the transmitter, the average power will be 4.05 kw when PEP is 10 kw.

NOTE

PA OUTPUT meter indicates average power only. As an option, TMC offers a peak envelope power meter which indicates PEP and average power.

In multichannel, multitone transmission modes where more than two tones are used, a definite relationship exists between the average power as indicated on the PA OUTPUT meter and peak envelope power developed. A chart in graphic form (figure 3-1) indicates the average power meter readings as a function of tones. The graph already contains the correction factor required when measuring multitone envelopes with an average reading meter (5 Kw average reads approximately 4.1 Kw).

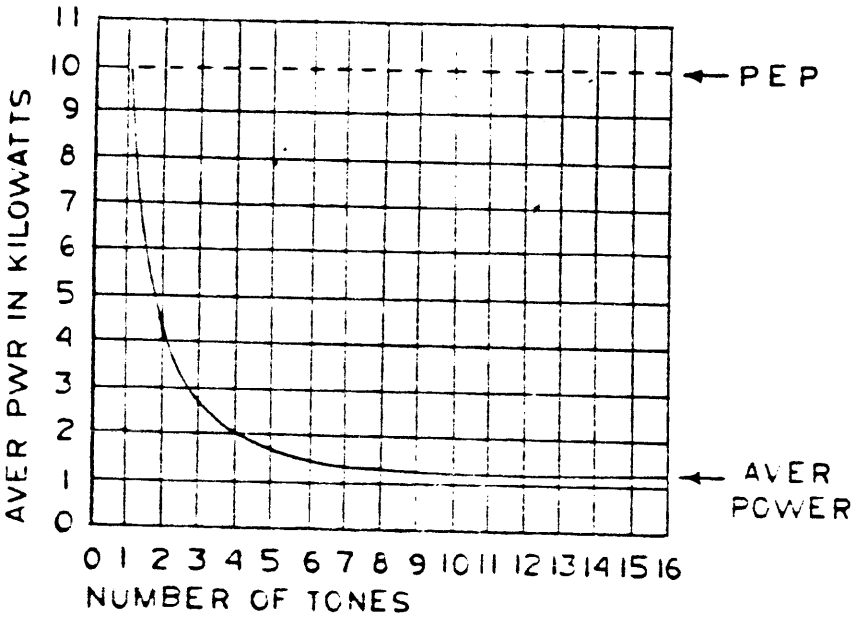


Figure 3-1. Ratio Average Power and PEP as a Function of Tones

SECTION 4

PRINCIPLES OF OPERATION

4-1. OVERALL BLOCK DIAGRAM ANALYSIS

Figure 4-1 is an overall block diagram of the HFT-10K which consists of an Exciter driving an HFL-10K Linear Power Amplifier. The exciter should provide at least 100 milliwatts average r-f power to the HFL-10K within the operating range of 2 to 30 mHz. The HFL-10K provides linear amplification of the r-f output and provides 10 kilowatts PEP within the operating frequency range of the transmitter. The transmitter r-f is applied to a transmitting antenna which matches the 50 ohm output impedance of the HFT-10K/J.

The HFL-10K provides an ALDC (automatic load and drive control) feedback voltage to the exciter which prevents the r-f output of the transmitter from exceeding a preset level. The ALDC circuit in the exciter automatically compensates for high modulation peaks and load changes, providing a relativity constant output level, in addition to limiting distortion and improving linearity. Refer to Appendix A for the appropriate exciter.

Primary power, 230 vac, 50/60 Hz or 440 vac is applied to the HFL-10K; power for the exciter is obtained via the EXCITER ON/OFF switch located on the HFL-10K.

4-2. FUNCTIONAL ASSEMBLY SECTIONS

Refer to the Appendix A and B for detailed principles of operation for the Exciter and the HFL-10K High Frequency Linear Power Amplifier.

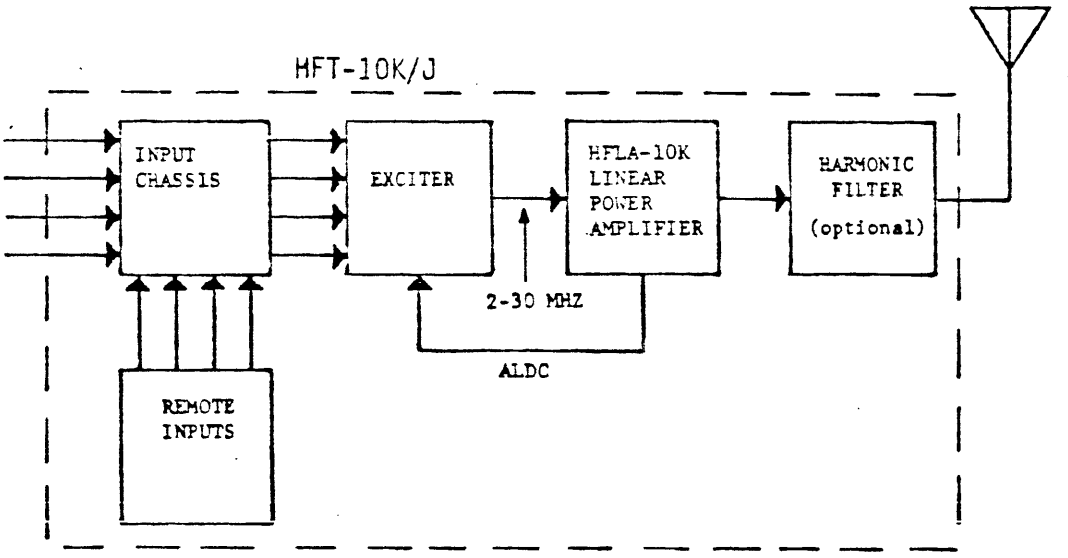


Figure 4-1. Functional Block Diagram

SECTION 5

MAINTENANCE AND TROUBLESHOOTING

5-1. INTRODUCTION

The HFT-10K/J has been designed for long term, trouble-free operation. When it becomes necessary to perform alignment and/or adjustments to the equipment, it is recommended that technicians perform the necessary operations outlined under Field Maintenance. In the appropriate appendix's of this manual should be referred to also for alignment and/or adjustments. The following maintenance aids are provided for troubleshooting and replacement of parts.

a. Overall block diagram (Section 4, Figure 4-1)

b. Component location diagram (Figure 5-6)

5-2. TEST EQUIPMENT REQUIRED

Table 5-1 lists the test equipment required for maintaining and troubleshooting the transmitter. Refer to Appendix A and B for additional equipment required to maintain and troubleshoot the HFT-10K/J.

TABLE 5-1. TEST EQUIPMENT REQUIRED

Signal Generator	Hewlett-Packard Model 606A, or equivalent
VTVM	Hewlett-Packard Model 410B, or equivalent
Multimeter	Simpson Model 260, or equivalent
Oscilloscope	Tektronix, Model 541A, or equivalent

5-3. OPERATOR'S MAINTENANCE PROCEDURE

a. Refer to transmitter operating procedure (paragraph 3-6 and 3-7)

b. Refer to troubleshooting (paragraph 5-5)

c. Refer to maintenance procedures described in Appendicies A and B.

5-4. PREVENTIVE MAINTENANCE

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

should be pulled out on its sides for internal cleaning and inspection.

The wiring and all components should be inspected for dirt, dust, corrosion, grease or other harmful conditions. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichloroethylene or methyl chloroform may be used, providing the necessary precautions are observed. For detailed preventive maintenance procedures, refer to the applicable Appendicies A and B.

WARNING

WHEN USING TOXIC SOLVENTS, MAKE CERTAIN THAT ADEQUATE VENTILATION EXISTS. AVOID PROLONGED OR REPEATED BREATHING OF THE VAPOR. AVOID PROLONGED OR REPEATED CONTACT WITH SKIN. FLAMMABLE SOLVENTS SHALL NOT BE USED ON ENERGIZED EQUIPMENT OR NEAR ANY EQUIPMENT FROM WHICH A SPARK MAY BE RECEIVED. SMOKING, "HOT-WORK", ETC. IS PROHIBITED IN THE IMMEDIATE AREA.

CAUTION

When using trichloroethylene, avoid contact with painted surfaces, due to its paint-removing effects.

5-5. TROUBLESHOOTING

Troubleshooting the HFT-10K/J consists of isolating faults to either the Exciter or the HFL-10K Power Amplifier. Refer to the Appendix A and B for detailed troubleshooting procedures. Refer to operator's section in Appendicies A and B for normal indications.

a. Disconnect the exciter's r-f output from the HFL-10K and connect the exciter to a 50 ohm 1 watt, non inductive dummy load. Use an oscilloscope to monitor the exciter output, referring to Appendix A for normal indications.

b. Use an ohmmeter to check for continuity of interconnect cabling between the exciter and HFL-10K.

c. Disconnect the exciter and connect a signal generator to the HFL-10K input. Operate the HFL-10K into a dummy load (if available) and monitor the HFL-10K meters for proper operation. (Refer to paragraphs 3-6 and 3-7 and HFL-10K Appendix B for normal indications.)

d. Four (4) maintenance programs are listed for the purpose of assisting in troubleshooting and maintenance of the transmitter. These programs along with the maintenance data supplied in Section 5 of Appendicies A and B will cover some of the possible difficulties encountered in maintaining the HFT-10K/J Transmitter.

These charts or programs do not list all possible difficulties, however, they can be used as a starting point to isolate a particular malfunction. To use the charts, follow these instructions:

1. Determine the nature of the trouble.

2. Find the programs which describes it most completely (refer to program list).

3. Follow the arrow from that block to the first suggested fault. INVESTIGATE.

4. If no trouble is found, follow the arrow to the next fault suggested. INVESTIGATE.

5. If trouble is only partially corrected, find the block which most nearly describes the remaining trouble. INVESTIGATE.

6. Proceed as in Line 3 above.

MAINTENANCE PROGRAM LIST

Maintenance Program "A" IPA Plate Meter reading abnormal.

Maintenance Program "B" 2ND IPA Plate Meter reading abnormal.

Maintenance Program "C" No. HV.

1. Main Blower does not operate.

2. Bandswitch and Interlock lamps out.

Maintenance Program "E" Interlock Lamp does not light.

MAINTENANCE PROGRAM "A"

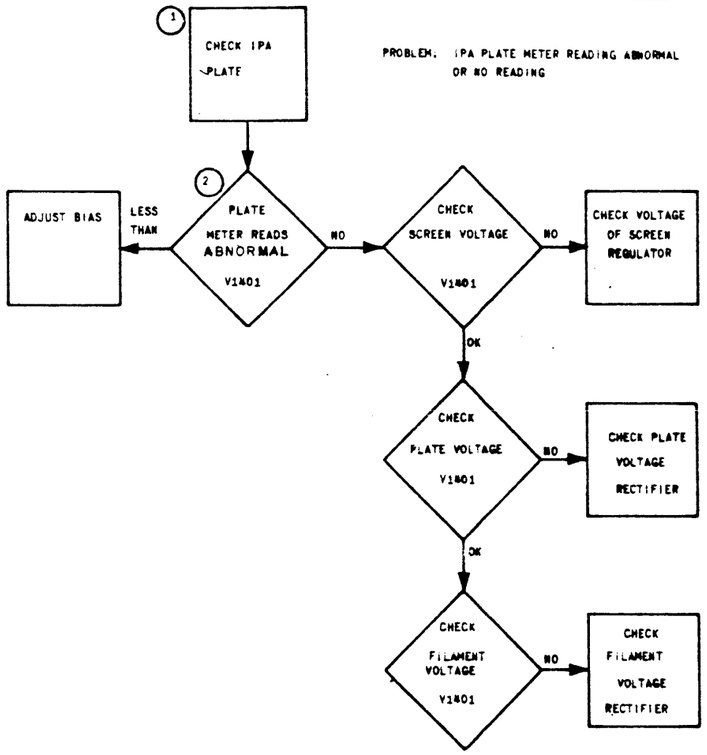
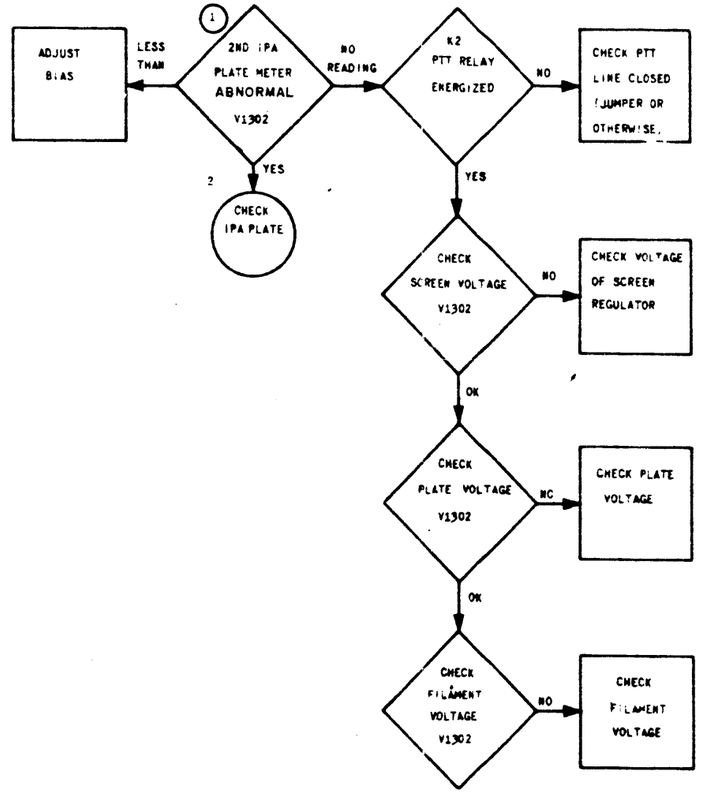


Figure 5-1. Troubleshooting Chart "A"

MAINTENANCE PROGRAM B



USE CAUTION WHEN MEASURING VOLTAGES

Figure 5-2. Troubleshooting Chart "B"

MAINTENANCE PROGRAM C

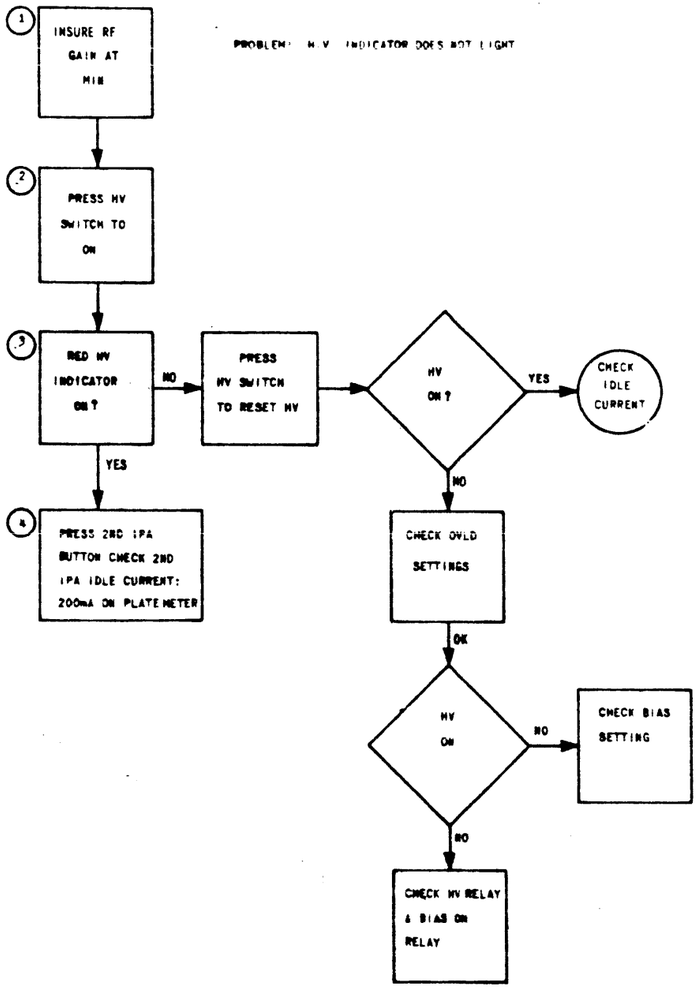


Figure 5-3. Troubleshooting Chart "C"

MAINTENANCE PROGRAM "E"

PROBLEM: INTERLOCK LAMP DOES NOT LIGHT

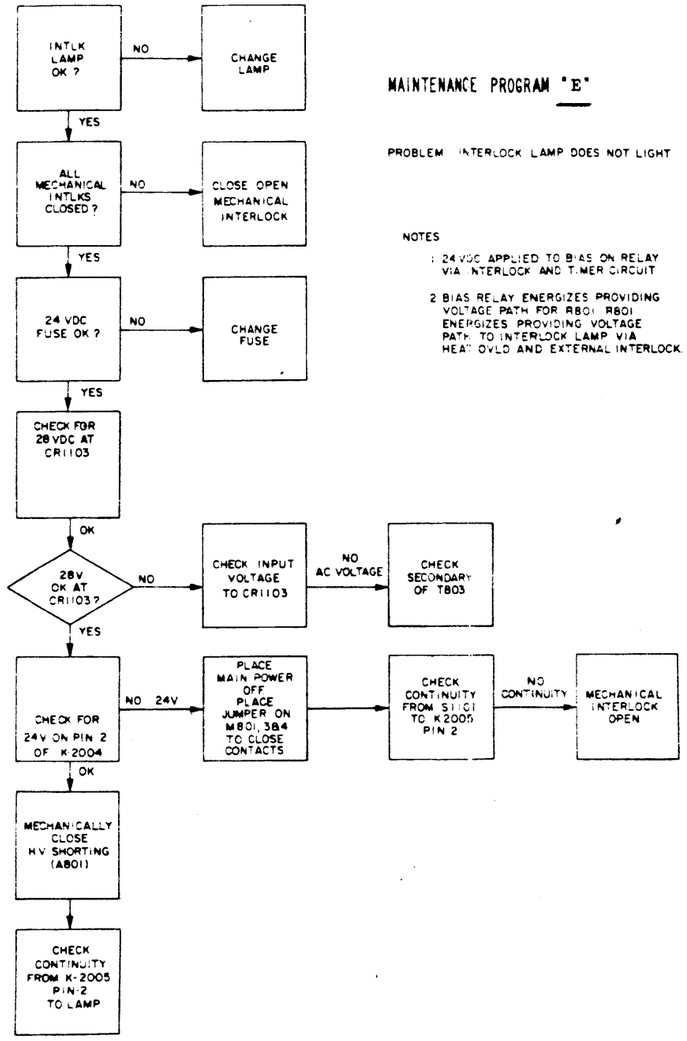


Figure 5-4. Troubleshooting Chart "E"

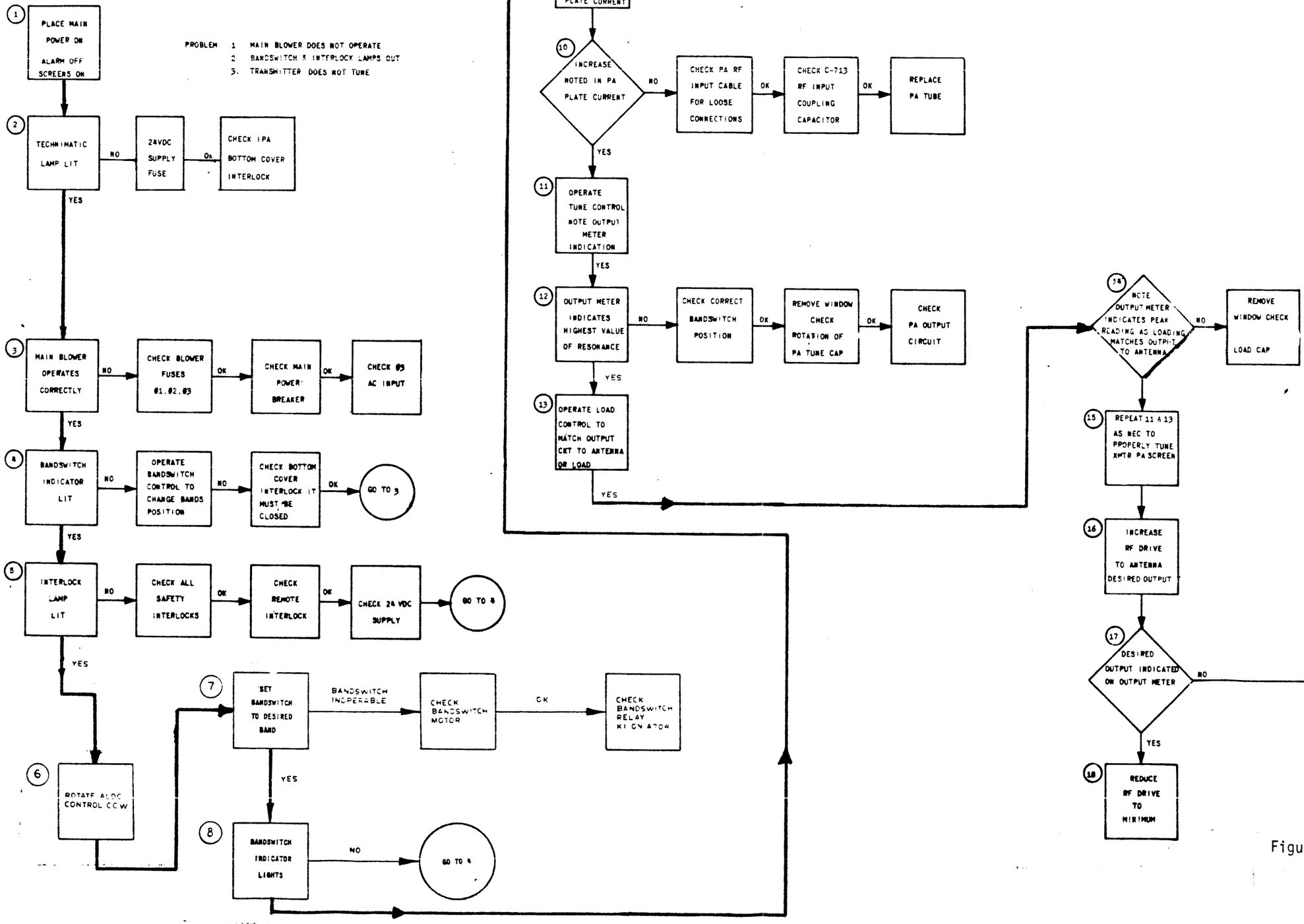


Figure 5-5. Troubleshooting Chart "D"

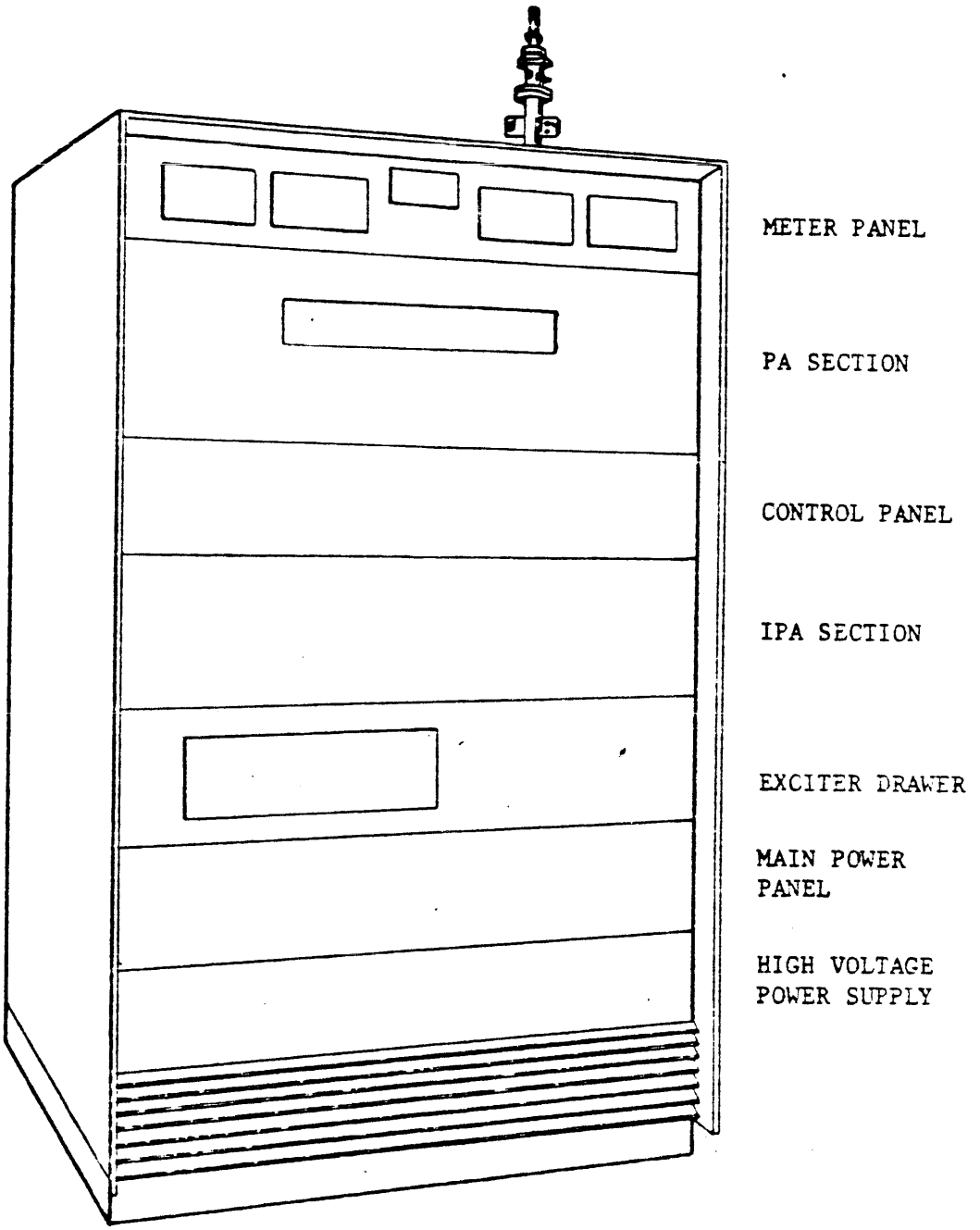


Figure 5-6. Component Location Diagram, HFT-10K/J