TECHNICAL MANUAL

for

HIGH FREQUENCY GENERAL PURPOSE TRANSMITTER HFTM 10 KJ

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

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MAMARONECK, N.Y. OTTAWA, ONTARIO

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NOTICE

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 February 1, 1972

Manual affected: General Purpose Transmitter Model HFTM-10KJ IN 1042

Please make the following pen and ink corrections as indicated below:

1. On page 1-4, TABLE 1-3:

   Change Power Amplifier tube type from 8794 to 4CX10,000J

2. On page 3-3, TABLE 3-1:

   Change the Plate current values of the PA, IPA, 2ND Amp and 1ST Amp as follows:

   PA Plate current from .75 amps to .50 - .650 amps

   IPA Plate current from 200 ma to 210 - 230 ma

   2ND AMP Plate current from 250 ma to 220 - 240 ma

   1ST AMP Plate current from 60 ma to 60 - 70 ma

NOTE

The RF Amplifier tube quiescent current values specified are for optimum distortion in SSB operation. When operating in FSK or CW modes quiescent currents may be set for values lower than specified.

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.

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

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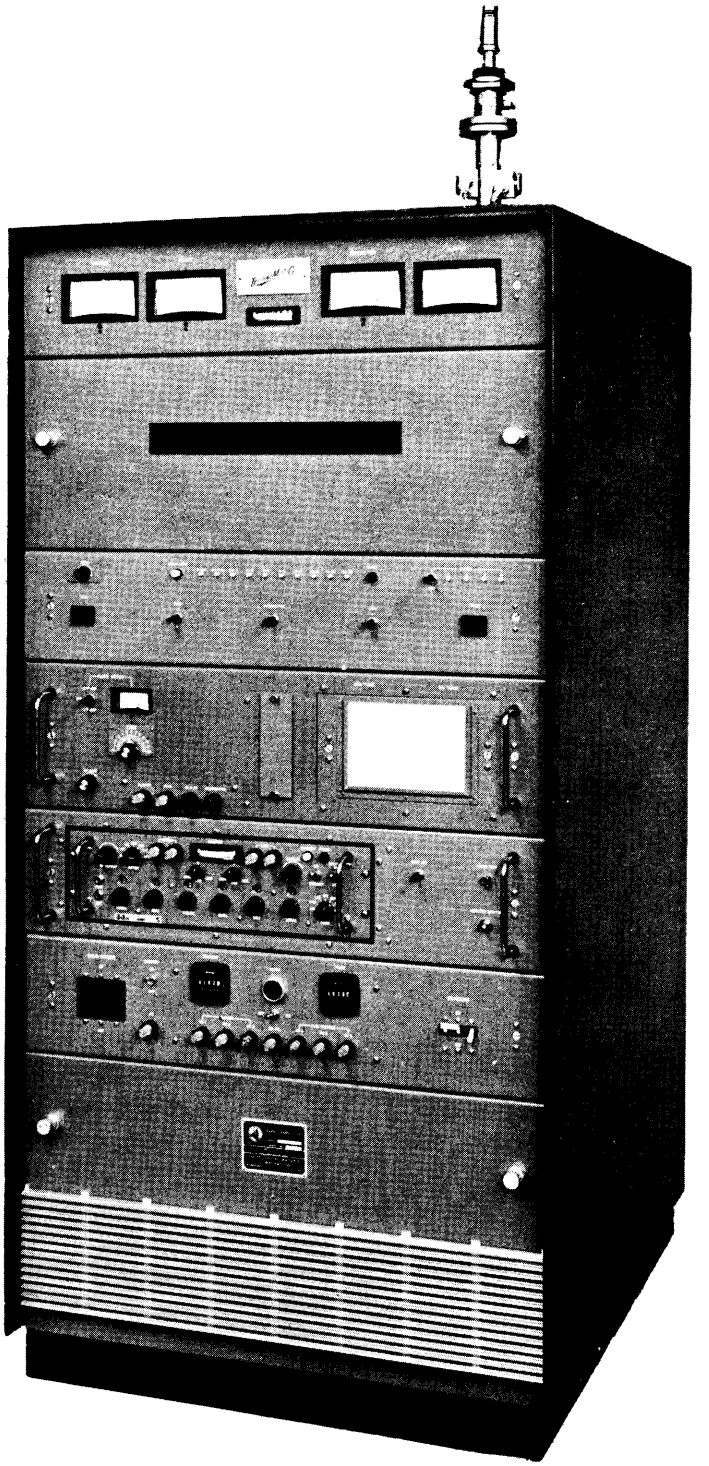


Figure 1-1. HFTM-10KJ, General Purpose Transmitter

SECTION 1
GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION

This manual presents the system instructions for the General Purpose Transmitter, Model HFTM-10KJ, 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.

General Purpose Transmitter, Model HFTM-10KJ (figure 1-1), hereinafter referred to as the HFTM-10KJ, or the transmitter, consists of a solid state, multimode, exciter, MMX(M)-2, used in conjunction with a high frequency linear power amplifier, HFLM-10K. The exciter is capable of providing CW (continuous wave), AM (amplitude modulation), SSB (single sideband) including AME (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 kilowatt (PEP) or average power throughout the frequency range of 2 to 29.9999 MHz. The transmitter is readily adaptable for shipboard, aircraft, and land installations. Table 1-1 lists the transmitter components as they appear in figure 1-1.

NOTE

Essentially, the HFLM-10K consists of all components illustrated in figure 1-1 with the exception of the MMX(M)2 multimode exciter (located in exciter drawer).

TABLE 1-1. COMPONENTS OF GENERAL PURPOSE TRANSMITTER HFTM-10KJ

Nomenclature	Common Name
AX5083-2	Main Meter Panel
AX5114-2	Power Amplifier
AX5082	Main Control Panel
AX5113-2	IPA Drawer
AX5110-2	Exciter Drawer (with MMX exciter installed
	Main Power Panel
AP-148	Main Power Supply
AF110	Harmonic filter (not shown) (located within PA section)

1-2. PHYSICAL DESCRIPTION

As shown in figure 1-1, the transmitter consists of a single frame, 69 inches high by 33-1/2 inches wide by 38 inches deep, which houses all the components which comprise the HFLM-10K power amplifier in addition to the MMX(M)2 exciter. The HFLM-10K consists of a two stage broadband linear amplifier, intermediate power amplifier, power amplifier and associated power supplies and control circuits. Primary power and external input connections to the transmitter are made through either of two access holes in the rear and side of the equipment base assembly. Power for the MMX(M)2 is provided via the AC input terminals located in the HFLM-10K. RF power is routed through a directional coupler and harmonic filter mounted in the HFLM-10K to the output connector (J703) located at the top of the HFLM-10K. Heavy, high voltage components of the HFLM-10K are mounted on a chassis bolted to the base of the equipment frame. The Exciter Drawer and IPA components of the HFLM-10K are slide mounted in the transmitter frame for easy access and maintenance purposes.

1-3. REFERENCE DATA

Table 1-2 lists the technical characteristics of the equipment. Table 1-3 lists the power tube complement of the transmitter.

TABLE 1-2. TECHNICAL SPECIFICATIONS

Frequency Information	
Range	2 to 29.9999 MHz is Standard; 1.5 to 29.9999 MHz is optional.
Stability Synthesized	One part in 10^8 per day is standard.
Operational	
Modes	CW, AM, AME, USB, LSB, two-channel ISB, FSK and FAX capability is available.
Carrier Suppression	Continuously adjustable throughout the range of -55 db up to full output by front panel control.
Power Output	10,000 watts PEP or AVERAGE (CW) continuous, key-down service.
Output Impedance	50 ohms nominal unbalanced; 70 ohms nominal Optional.
VSWR	Maximum of 2:1 without degrading performance.
Tuning	Manual.
ALDC	Automatic Load and Drive Control to improve linearity, limit distortion, and maintain a relatively constant out-

TABLE 1-2. TECHNICAL SPECIFICATIONS (continued)

ALDC (continued)	put level during high modulation peaks and load changes. Front panel control allows adjustment of the level at which the ALDC takes effect.
Power Distortion and Noise Ratings	
Spurious Signals	At least 50 db down from full PEP output.
Unwanted Sideband	50 db or getter rejection referenced to full PEP output.
Intermodulation	Distortion products are at least 35 db below either tone of a standard two-tone test at full rated PEP.
Audio	
Sideband Response	Customer selection of one of the following bandpasses: ±1.5 db, 250-2700 Hz ±1.5 db, 250-3040 Hz ±1.5 db, 250-3500 Hz ±1.5 db, 250-6080 Hz
Input	1) Two independent 600-ohm channels, balanced or unbalanced. -20 dbm to +5 dbm input will permit full power output. 2) Built-in microphone preamplifier for low level dynamic microphone. Front panel selection and jack. Mike input -55 db into 47K ohms with front panel jack.
Keying Information	
CW	Key jack on front panel and terminals on input chassis allow up to 300 WPM carrier keying, dry contact.
FSK	50 to 100 baud with neutral or polar keying.
FAX	+1 to +10 vdc will provide a linear shift of 800 Hz.

TABLE 1-2. TECHNICAL SPECIFICATIONS (continued)

Installation and Environmental Data

Environmental	Operates 0 to +50° C with up to 90% relative humidity.
Cooling	High capacity, filtered, forced air.
Primary Power	230 vac 50/60 Hz, three phase (380, 440 vac optional upon customer request).

TABLE 1-3. TRANSMITTER TUBE COMPLEMENT

Reference Designation	Part Number or Type	Function
V1301	8233	1ST AMP
V1302	4CX350A	2ND AMP
V1401	8576	Intermediate Power Amplifier
V701	8794	Power Amplifier

SECTION 2
INSTALLATION

2-1. INITIAL UNPACKING AND INSPECTION

The HFTM-10KJ 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 or 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 (mounting hardware, connectors, technical manuals, etc.).

2-2. POWER REQUIREMENTS

The HFTM-10KJ requires a three phase source of 230 vac, 50/60 Hz at approximately 25,000 watts. At customer request, 380, 440 vac operation is available with an externally mounted auto transformer.

2-3. INSTALLATION

The installation procedures for Linear Power Amplifier, HFLM-10K are outlined in Section 2 of the HFLM-10K technical manual. Installation drawings, outlined dimensional diagram and schematic diagrams for the HFLM-10K are also applicable to the HFTM-10K. However, when installing modular units into the transmitter frame refer to figure 5-1, HFTM-10KJ overall front view for equipment location.

a. Electrical Interconnections

Once the modular units (IPA Drawer, Exciter Drawer) have been mounted into the transmitter frame refer to figure 2-1 Component Interconnect Diagram in conjunction with figure 2-2 Exciter Interconnect Diagram and connect all plugs to their respective jacks. All interconnecting cables are marked with their J numbers and mating P numbers at the plug for ease of installation.

b. External Signal Input Connections

External input connections are made at the Input Chassis Assembly located in the rear portion of the transmitter directly below the exciter drawer. Audio intelligence CW, FSK and FAX input connections are made at jack J3001 on the input chassis assembly. The mating plug for J3001 is supplied as a loose item. Refer to figure 2-2 Exciter Interconnect and make the external signal input connections to mating plug, MS3106B32-7P prior to connecting to J3001.

NOTE

The HFTM-10KJ leaves the factory wired for local control operation. Mating plugs that connect to Input Chassis Jacks J3002 and J3003 are supplied as loose items, and are prewired with connections between pins on each plug for local transmitter operation. These mating plugs supplied as loose items must be connected to J3002 and J3003 on the Input Chassis. When Remote control of the HFTM-10K is desired refer to paragraph 2-3c for remote control connections.

c. Remote Transmitter Control Connections

(1) Remove mating plugs connected to Input Chassis jacks J3002 and J3003 (MS3106B24-2BS and MS3106B32-7S respectively) supplied as loose items.

(2) On the mating plug for J3003:
Remove jumper between pins "S" and "Y" (H.V. ON/OFF).
Remove jumper between pins "d" and "h" (Overload reset).

(3) On the mating plug for J3002:
Remove jumper between pins "L" and "N" (External Interlocks).

(4) Connect external equipment cables for remote transmitter control of the following:
a. H.V. ON/OFF, J3003 "S" and "Y" ("S" grounded).
b. Overload Reset, J3003 "d" and "k" (contact closure).
c. External Interlocks, J3002 "L" and "N" (contact closure).

(5) Secure mating plugs to their respective Input Chassis jacks, J3002 and J3003.

d. Transmitter Push to Talk (PTT) Connections

The HFTM-10K PTT circuit operates in conjunction with the transmitter bias control circuit and must be closed to operate the transmitter. Therefore, a jumper is connected between pins "P" and "R" on Input Chassis jack J3002. This PTT circuit is also hardwired in parallel with the MMX(M)2 exciter PTT circuit. If transmitter PTT operation is desired the jumper between pins "P" and "R" on Input Chassis jack J3002 must be removed.

e. Remote and Local Exciter RF Input Connections (100 milliwatts min.)

(1) Remote operation: RF IN, connect to J3004
RF OUT, connect to J3006
P1001 connect to J1005 REMOTE (P1001 is located in IPA Drawer on rear section of IPA Chassis)

(2) Local operation: Connect P1001 to J1006, LOCAL

f. Remote and Local ALDC Connections (0 to -10 vdc)

(1) Remote operation: ALDC IN connect to pin "L" on Input Chassis J3001
ALDC OUT connect to pin "e" on Input Chassis J3001

(2) Local operation: Connect a jumper between pins "e" and "L" on Input Chassis jack J3001

g. External 1 MHz Input (1 vrms)

Connect external 1 MHz to Input Chassis jack J3005.

NOTE

The 1 MHz EXT/INT switch (located on rear of MMX(M)2 must be in the EXT position when using external 1 MHz input.

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 technical manual to perform the high voltage transformer check of the HFLM-10K and initial checkout of the MMX(M)2.

NOTE

If the HFTM-10K is connected for remote operation, the remote transmitter control equipment must complete the following circuits before the transmitter can become operational:

High Voltage (HV ON/OFF)
External Interlocks (EXT INTLKS)
Overload Reset (OVLD RESET)
Push To Talk (XMTR PTT) controlled by MMX EXCITER ON/PTT switch.

a. Remote Pre-operational Check

(1) Utilize remote equipment and close the circuits listed in the above NOTE.

(2) Apply primary power to transmitter and set the transmitter controls as indicated below

MAIN POWER breaker	ON
EXCITER ON/OFF switch	ON
SCREEN breakers	ON
RF GAIN control	maximum counter clockwise

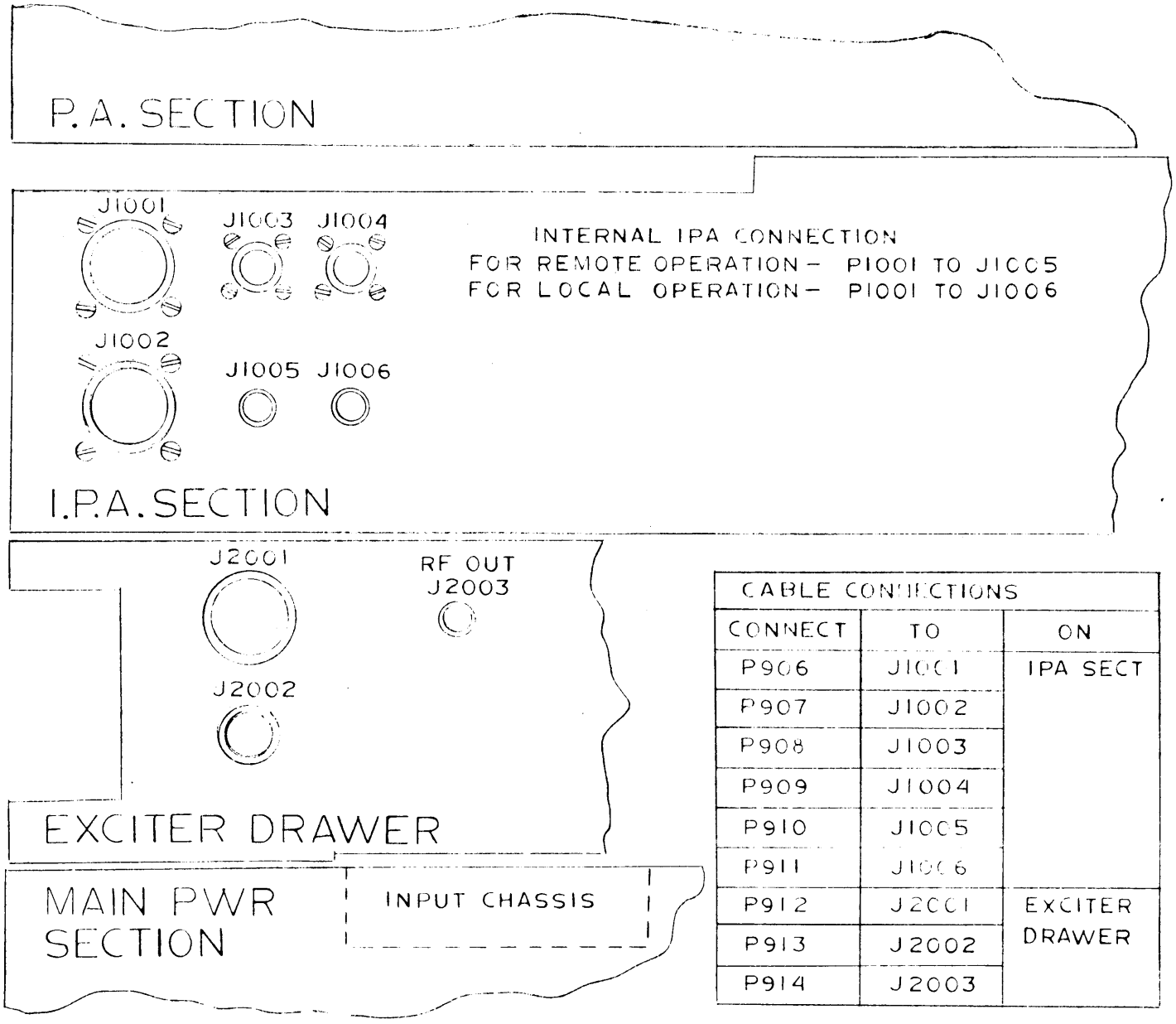
NOTE

High Voltage can only be applied provided that interlock lamp is lit and 5 minute time delay cycle has elasped.

Press HIGH VOLTAGE (H.V.) pushbutton to light pushbutton indicator subsequently applying high voltage. Once high voltage is on utilize remote equipment to control transmitter circuits as desired (H.V. ON/OFF, EXT INTLKS; OVLD RESET).

Bear in mind that, the transmitter high voltage must initially be turned on locally before remote control operation can be accomplished.

Refer to Section 3 for operating procedures.



CABLE CONNECTIONS		
CONNECT	TO	ON
P906	J1001	IPA SECT
P907	J1002	
P908	J1003	
P909	J1004	
P910	J1005	
P911	J1006	
P912	J2001	EXCITER DRAWER
P913	J2002	
P914	J2003	

Figure 2-1. Intraconnect Diagram

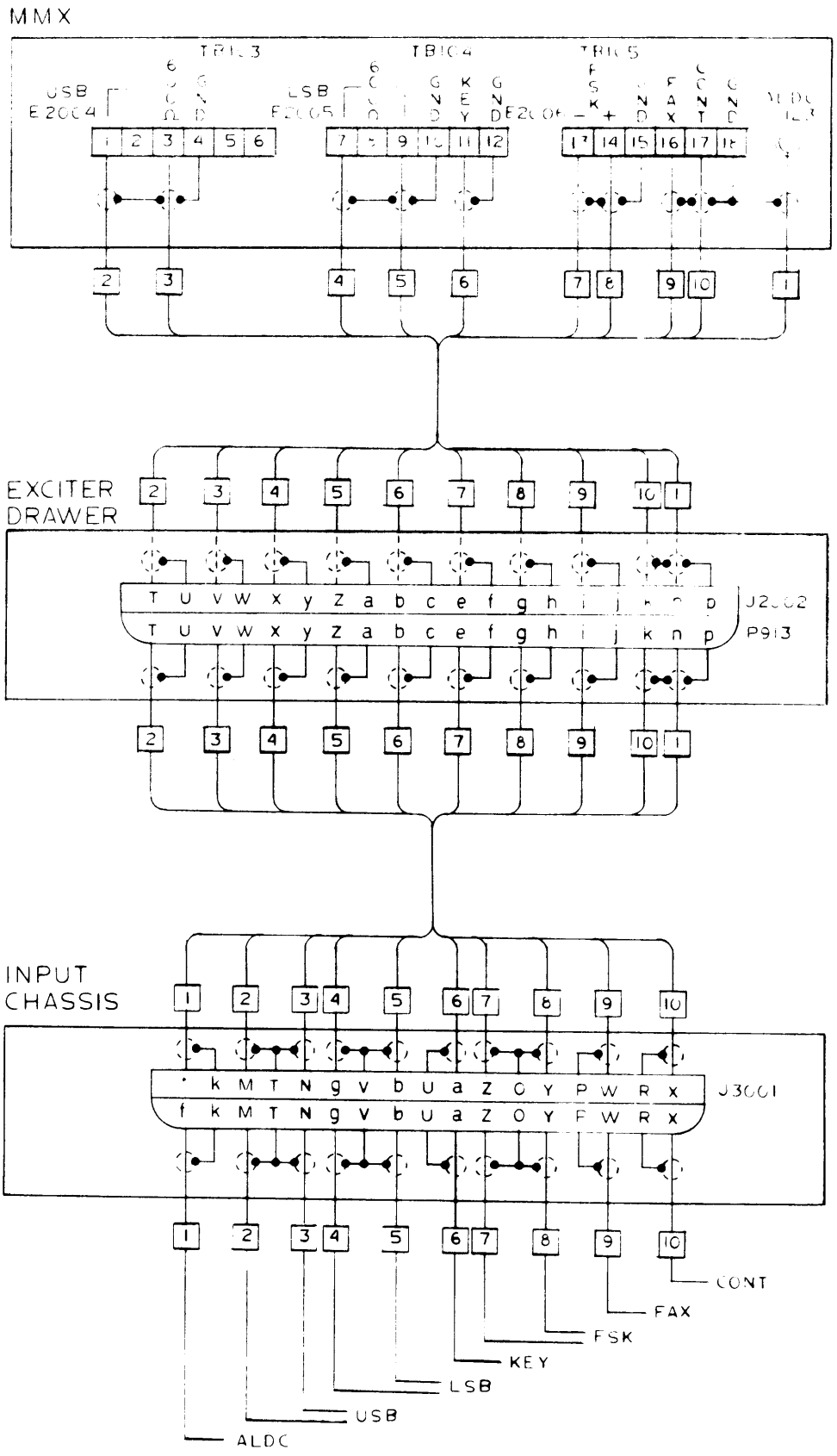


Figure 2-2. Exciter Interconnect Diagram

SECTION 3
OPERATOR'S SECTION

3-1. GENERAL

The controls of the MMX(M)2 provide rapid transmitter rf frequency selection of AM, USB, LSB, or ISB (optional) intelligence in the 2 MHz to 29.9999 MHz transmission range. Tuning is accomplished manually in 100 Hz increments using MMX(M)2 controls. The HFLM-10K provides continuous adjustment of rf output power up to 10 kilowatts PEP or 10 kilowatts average.

3-2. OPERATING CONTROLS

For detailed functions of all operating controls and indicators of the HFTM-10KJ, refer to the applicable HFLM-10K and MMX(M)2 technical manuals.

3-3. STARTING CONTROL SETTINGS

Generally, before main power is applied, all operating controls should be set to OFF or maximum counterclockwise position. Set the MMX(M)2 ON/STANDBY switch to STANDBY. Starting control settings are provided in the basic operating procedure presented in paragraph 3-4.

3-4. OPERATING PROCEDURE

Local and external operation of the HFTM-10KJ is provided in Table 3-1, and Table 3-2 respectively which illustrates the manual tuning procedure for CW (carrier only) operation. Once the exciter has been re-adjusted for the desired type of intelligence and emission mode, the application of drive must be adjusted to a point that the pre-adjusted ALDC control voltage will hold the transmitter power output constant to avoid exceeding the PEP rating of the transmitter.

TABLE 3-1. TRANSMITTER OPERATING PROCEDURE

STEP	OPERATION	NORMAL INDICATIONS
1	Place MAIN POWER breaker to the ON position.	Main blower and IPA blower must operate. Technimatic light and Band Indicator must illuminate. INTERLOCK lamp will light if all safety interlocks are closed and the time delay cycle has been completed.
2	Place SCREEN breakers to ON position (both breakers).	No indications.
3	Set ALARM ON/OFF switch to OFF position.	Should alarm switch have been in the ON position with High Voltage removed, the audiable high voltage ALARM would be on.

TABLE 3-1. TRANSMITTER OPERATING PROCEDURE (continued)

STEP	OPERATION	NORMAL INDICATIONS
4	Set EXCITER ON/OFF switch to the ON position.	Applies power to MMX(M)2 and STANDBY lamp lights. (POWER lamp is out)
5	Set TEST KEY in the UP position.	TEST KEY locks in the UP position and closes the exciter CW keyline.
6	Set MMX(M)2 to desired operating frequency.	Frequency indicated on MMX(M)2 front panel readouts.
7	Set MMX(M)2 METER switch to CARR, MODE switch to CW, and EXCITER ON/PTT switch to ON.	No indications.
8	Set MMX(M)2 ON/STANDBY switch to ON.	STANDBY lamp goes out and POWER lamp lights.
9	Rotate MMX(M)2 CARRIER control until MONITOR meter indicates at the FULL mark on the meter face.	MONITOR meter indicates at FULL mark on meter face.
10	Set METER switch to RF position and adjust RF OUTPUT control counterclockwise.	MONITOR meter indicates zero in RF position.
	NOTE The HFLM is equipped with protective overload circuitry incorporated in meters on the meter panel. Should an overload occur 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 illuminate to indicate an overload has occurred in that circuit of the Transmitter. Additionally, each of the aforementioned meters have an overload indicator on the meter face which can be adjusted to trip at a value set by the operator.	
11	Adjust the Overload Indicator (adjustment screw located directly below the meter face on each meter) on each meter for values listed: PA PLATE current PA SCREEN current IPA PLATE current REFLECTED POWER	 3-1/2 amps max. 80 ma. 800 ma. Set to desired value.

TABLE 3-1. TRANSMITTER OPERATING PROCEDURE (continued)

STEP	OPERATION	NORMAL INDICATIONS
12.	Select bandswitch position by holding BANDSWITCH control first to left, until band indicator lights, then holding BANDSWITCH control to the right until the next band indicator lights.	Band Indicator will illuminate to indicate frequency band selected.
	NOTE The quiescent current values stated below are for the best sideband distortion. However, the figures in parenthesis are the lower and upper limits for quiescent current settings. When operating in the CW mode readjust the bias controls to the lower limits indicated for better efficiency in the CW mode.	
13	Remove Bias Control cover on the front of the panel IPA Drawer to expose bias adjustment controls, adjust PA BIAS controls for max bias.	PA BIAS adjusted to max clockwise. IPA BIAS adjusted to max clockwise. 1ST and 2ND AMP BIAS adjusted to max clockwise.
14	Press HIGH VOLTAGE pushbutton to light H.V. indicator. (It may be necessary to press HIGH VOLTAGE pushbutton twice to reset overload if necessary	HIGH VOLTAGE indicator will illuminate RED when High Voltage is ON.
15	Adjust PA BIAS control for an indication of .75 amps on the PA PLATE current meter.	PA PLATE current meter indicates quiescent current of .75 amperes. (.5 amps to .75 amps)
16	Adjust IPA BIAS control for an indication of 200 ma on PLATE meter.	IPA PLATE meter indicates quiescent current of 200 ma. (150 ma to 200 ma)
17	Press IPA METER SELECT switch up. Holding the switch up, adjust 2ND AMP BIAS control for indication of 250 ma on IPA PLATE meter.	IPA PLATE meter will indicate 250 ma when METER SELECT switch is pressed up. (150 to 250 ma)
18	Press IPA METER SELECT switch down. Holding the switch down adjust, 1ST AMP BIAS control for indication of 60 ma on IPA PLATE meter.	IPA PLATE meter will indicate 60 ma when METER SELECT Switch is pressed down. (40 ma to 60 ma)

TABLE 3-1. TRANSMITTER OPERATING PROCEDURE (continued)

STEP	OPERATION	NORMAL INDICATIONS
19	Rotate RF OUTPUT control on MMX(M)2 clockwise until MONITOR meter indicates approximately 2.	MONITOR meter indicates 2.
	NOTE During initial tuning of the HFTM-10K, RF output power will be increased or decreased with the RF GAIN control on the HFTM-10K IPA drawer front panel.	
20	Rotate ALDC control counterclockwise and adjust RF GAIN control on HFTM-10K (do not change MMX(M)2 RF OUTPUT control setting) clockwise slightly to cause an increase in IPA PLATE current indication on PLATE meter (not to exceed 250 ma).	PLATE meter will indicate increase in meter reading not to exceed 250 ma.
21	Slowly adjust the IPA TUNE control for a noticeable dip in IPA PLATE current, and an increase PA PLATE current indication on PA PLATE current meter.	The rotation of IPA TUNE control will cause IPA output to be applied to PA. At this time the PA PLATE current meter will indicate an increase from quiescent.
	CAUTION When Tuning Power Amplifier do not exceed a PA PLATE current reading of two (2) amperes. Should an overload occur, HIGH VOLTAGE indicator will go out. To reset the HIGH VOLTAGE switch, decrease RF drive (RF GAIN counterclockwise) and press to light HIGH VOLTAGE indicator. (HIGH VOLTAGE pushbutton must be pressed twice to energize High Voltage).	
22	Operate PA LOAD control (Press control down (-) to set load capacitor at minimum (note LOAD SENSE meter, zero indication corresponds to minimum).	LOAD SENSE meter will indicate zero (0), which corresponds to the relative C value of load capacitor.
23	Operate the PA TUNE Control (Press control down or up) as necessary to cause a noticeable resonant dip in PA PLATE current meter indication	PA PLATE current meter will indicate resonant dip and OUTPUT METER will indicate power output.

TABLE 3-1. TRANSMITTER OPERATING PROCEDURE (continued)

STEP	OPERATION	NORMAL INDICATIONS
24	Operate PA LOAD capacitor (press control UP) to cause a further increase in PA OUTPUT.	OUTPUT meter indicates a further increase as transmitter is loaded into antenna or dummy load.
	NOTE Steps 23 and 24 have to be repeated until the HFTM is properly loaded into antenna or 50 ohm dummy load.	
25	Readjust IPA TUNE control for a dip and further increase in PA OUTPUT meter indication.	PA OUTPUT meter may indicate a slight increase in meter reading.
26	Rotate RF GAIN control (on HFTM) clockwise to increase PA output power level to 12 kilowatts (as indicated on the OUTPUT meter).	PA OUTPUT meter indicates 12 kilowatts average output power.
27	Rotate the ALDC control (located on the front panel) until the PA OUTPUT commences to decrease. Continue to adjust the ALDC control clockwise until the PA OUTPUT meter indicates 10 kilowatts.	PA OUTPUT meter indication decrease from 12 kilowatts to 10 kilowatts.
28	Rotate the RF GAIN control (on HFTM) clockwise and note the PA OUTPUT meter indication. The OUTPUT indication should not increase above 10 kilowatts. However, should the PA OUTPUT indication increase above the previous setting of 10 kilowatts, continue to rotate the ALDC control clockwise to reduce the PA OUTPUT meter indication to 10 kilowatts.	NOTE After completion of step 28 connect a monitoring device at exciter monitor jack (scope or spectrum analyzer). Measure the amplitude of the exciter output when PA OUTPUT meter indicates 10 kilowatts. Record the amplitude measured, and when changing frequency or emission mode, re-establish the same reference amplitude as measured.
	NOTE The ALDC adjustment procedure outlined in steps 26 through 28 should be repeated in the CW (key down) mode prior to operating on a new frequency and/or emission mode.	
29	Set TEST KEY to center position to open the CW keyline.	PA OUTPUT meter will indicate zero. PLATE current meter indications will reduce to quiescent values previously set.

TABLE 3-1. TRANSMITTER OPERATING PROCEDURE (continued)

STEP	OPERATION	NORMAL INDICATIONS
30	Operate either of the following keying devices: TEST KEY on front panel, external test key plugged into KEY jack on MMX front panel, or external keying device connected to Input Chassis jack J3001.	Meter indications will fluctuate as the keying device makes and brakes.
	NOTE The procedural steps outlined in Table 3-1 (steps 1 thru 29) should be performed when changing operating frequency and transmission modes.	

TABLE 3-2. EXTERNAL OPERATION

STEP	OPERATION	NORMAL INDICATIONS
	CW OPERATION	
1	Refer to Table 3-1 and repeat steps 1 thru 29.	Same as Table 3-1. (Steps 1 thru 29)
2	Operate external keying device.	Same as Table 3-1. (Step 30)
	PTT OPERATION	
3	Refer to Table 3-1 repeat steps 1 thru 29.	Same as Table 3-1. (Step 1 thru 29)
4	Set EXCITER ON/PTT switch to PTT position and rotate the exciter RF OUTPUT control counterclockwise.	PA and IPA PLATE current meters will indicate at or near zero. (Open PTT lines will cause transmitter to be biased at or near cutoff).
5	Set MODE switch on exciter to desired transmission mode, set METER switch to USB or LSB as desired, and apply audio to LSB or USB input, (or both) and adjust MIKE/LINE control(s) to desired level.	MONITOR meter indicates the presence of audio. (Exciter output should be monitored on oscilloscope or spectrum analyzer to avoid overmodulating.)
	NOTE For MIKE input adjust MIKE/LINE control(s) counterclockwise; for LINE input adjust MIKE/LINE control clockwise. DO NOT CHANGE HFTM-10K RF GAIN control setting.	

TABLE 3-2. REMOTE OPERATION (continued)

STEP	OPERATION	NORMAL INDICATIONS
6	Once audio level has been determined, close Push to Talk device, and adjust exciter output to reference amplitude measured in Table 3-1 step 28.	When Push to Talk device is not activated the HFTM will be biased off (maximum bias, no meter indications on front panel). Activation of the PTT device will reestablish normal bias, and the transmitter will provide output when audio is applied.

3-5. TRANSMITTER EXTERNAL CONTROL

NOTE

The HFTM 10KJ provides externally controlled provisions for the following actions listed below, bear in mind that, before the listed remote control functions can be utilized the HFLM must be initially turned on, and adjusted for rated or desired output power and emission mode.

a. External RF Gain

Increase or decrease PA output with external RF gain control to re-establish predetermined power level.

b. External ALDC

Adjust negative voltage (0 to -10 vdc) device as necessary in the CW mode to maintain 10 KW average power indication on the PA OUTPUT meter.

c. External High Voltage ON/OFF

Open external H.V. ON/OFF device to remove high voltage, should any overload on the HFTM trip upon closing H.V. ON/OFF device, reduce remote RF gain and close remote overload reset device, and close High Voltage ON/OFF device to reapply high voltage. Increase remote RF gain to predetermined value indicated on PA OUTPUT meter.

d. External Interlocks

When it is desired to use the external interlock feature, once the external interlock has been opened the remote H.V. ON/OFF device must be engaged twice before the high voltage will come on again (press once to reset main overload relay, and a second time to apply high voltage).

3-6. EMERGENCY OPERATION

Under emergency conditions, when a failure of the MMX(M)-2 has occurred, CW keying of the HFTM-10K can be accomplished by connecting a signal generator to the input of the HFTM-10K. Keying of the signal generator

will provide emergency CW transmission at the signal generator frequency.

NOTE

The signal generator frequency and output power should be within the range normally provided by the MMX(M)-2.

SECTION 4
PRINCIPLES OF OPERATION

4-1. FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

Figure 4-1 is a functional block diagram of the HFTM-10KJ which consists of an MMX(M)2 Multimode Exciter providing excitation voltage to the HFLM-10K. The exciter accepts remote or local intelligence inputs and provides at least 100 milliwatts of rf power to the HFTM-10K within the operating range of 2 MHz to 29.9999 MHz in any one of the following modes: AM, AME, SSB, ISB, CW, FSK, or FAX. The amplifier portion of the transmitter provides linear amplification of the exciter rf output and provides ten kilowatts PEP or average power within the operating frequency range of the exciter. The power amplifier output is fed through a lowpass harmonic filter which attenuates the second harmonic content of frequencies from 17 MHz and higher. The output is then routed through a directional coupler to the output connector and to a 50 ohm load or antenna.

The HFTM-10K provides an ALDC (Automatic Load and Drive Control) feedback voltage to the exciter which prevents the output power from exceeding a preset power level. The ALDC circuit in the exciter automatically compensates for high modulation peaks and load changes, providing a relatively constant output level.

The transmitter is adaptable for external control operation, and excepts external inputs to provide the following control functions:
High Voltage ON/OFF, overload reset, external interlocks, external RF GAIN and external ALDC.

Refer to the associated manuals for detailed principles of operation for the MMX( )-2 exciter and HFLM-10K, High Frequency Linear Power Amplifier.

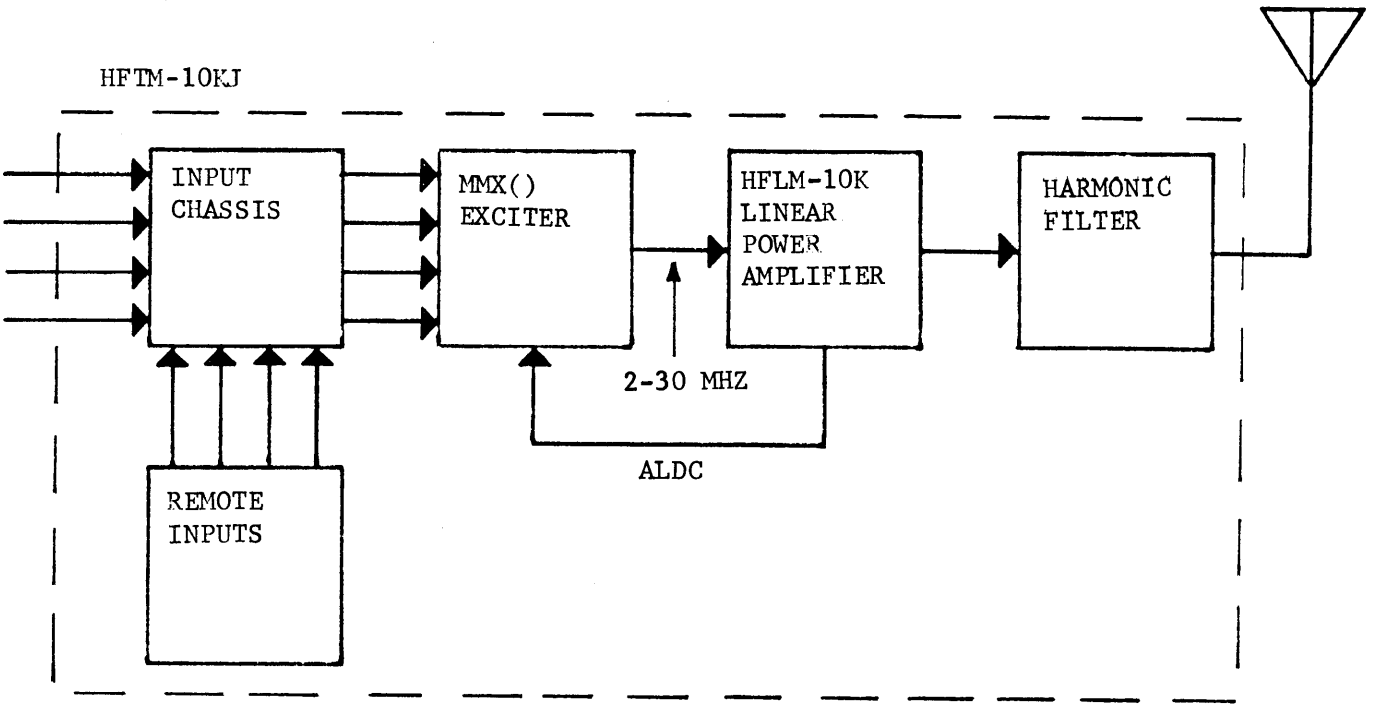


Figure 4-1. Functional Block Diagram

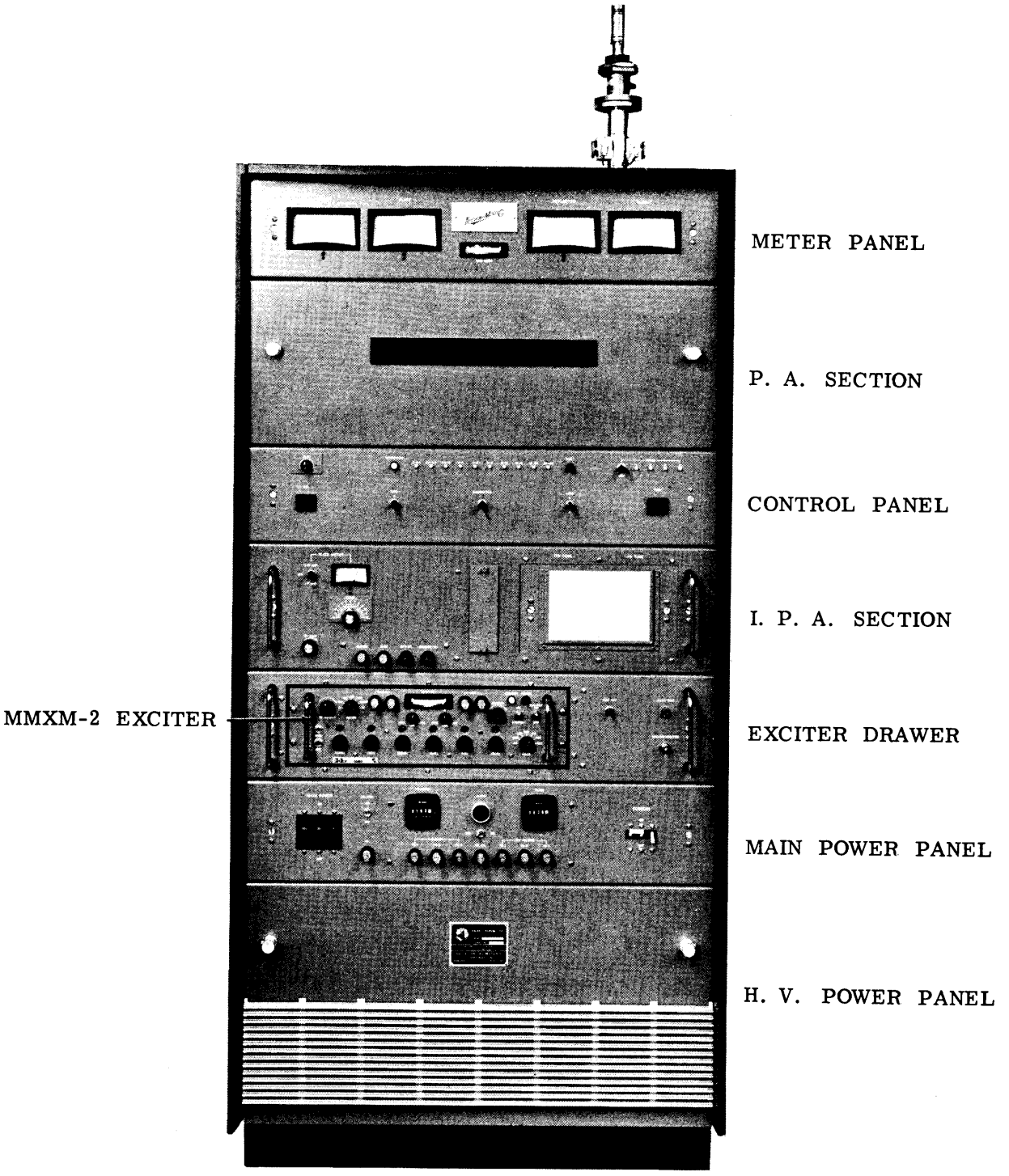


Figure 5-1. HFTM-10KJ, Component Locations, Front View

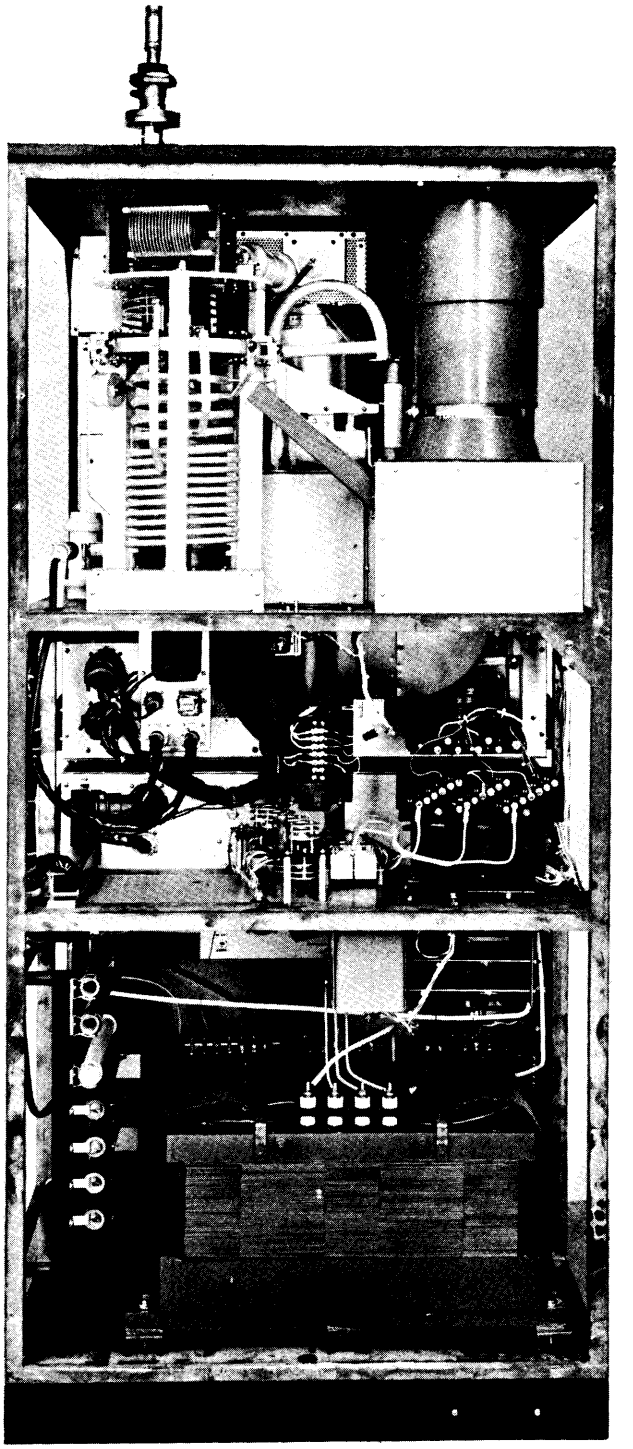


Figure 5-2 HFTM-10KJ, Rear View

SECTION 5
MAINTENANCE

5-1. INTRODUCTION

The HFTM-10KJ is designed for long term, trouble-free operation. When it becomes necessary to perform alignment and/or adjustments to the HFTM, it is recommended that technicians perform the necessary operations outlined in the associated HFLM-10K and MMX(M)2 technical manuals. The following data is provided for troubleshooting and maintenance.

a. Overall Block Diagram (Section 4, figure 4-1).

b. Component Location (figure 5-1).

c. HFTM-10K Rear View (figure 5-2).

d. Exciter Interconnection Daigram (figure 2-2).

5-2. TEST EQUIPMENT REQUIRED

Table 5-1 lists the test equipment required for maintaining and troubleshooting the transmitter. Refer to the MMX(M)2 and HFLM-10K technical manuals for additional equipment required to maintain and troubleshoot these two components.

TABLE 5-1. TEST EQUIPMENT REQUIRED

EQUIPMENT	TYPE
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. MAINTENANCE PROCEDURE

a. Refer to transmitter operating procedure (Table 3-1) for normal indications.

b. Refer to troubleshooting (paragraph 5-6).

c. Refer to maintenance procedures described in the HFLM-10K and MMX(M)2 technical manuals.

5-4. OPERATOR MAINTENANCE

Operators maintenance consist of maintaining recordings of operating transmitter front panel meter readings on a routine basis. During off the air periods the operator should perform the following preventive maintenance procedures:

(1) Check and record exciter operating frequency.

(2) Check and replace or tighten if necessary, all spare fuses, control knobs, indicator lamps, interconnect cabling and external equipment connections.

(3) Clean all air filters and remove dust and foreign matter accumulated during operating periods.

(4) Check mechanical operation of operational controls (tuning knob rotations, (clockwise and counterclockwise) ON/OFF switches and circuit breakers.

(5) Check chassis and terminal strip hardware for looseness, and tighten as necessary.

(6) Check and record the adjustable bias control ranges, and report any abnormalities to supervisor in charge. (refer to Table 3-1, steps 15 thru 18).

(7) Check alarm circuitry to insure operation.

(8) Operate Bandswitch control and insure that each band indicator lights upon operating bandswitch control.

(9) Check PA, IPA and Bandswitch motors for signs of overheating.

5-5. TROUBLESHOOTING

NOTE

Before troubleshooting determine if transmitter is connected for external or local operation.

Troubleshooting the HFTM-10K consists of isolating faults to either the MMX(M)2 Exciter or the HFLM-10K Power Amplifier. Once a fault is isolated to a particular unit refer to the associated technical manuals for detailed troubleshooting procedures of the MMX(M)2 or the HFLM-10K. Refer to operator's section for normal indications.

To isolate a fault between the MMX(M)2 exciter and HFLM-10K amplifier proceed as follows:

a. Exciter Check - Disconnect the MMX(M)2 rf output (J123) from the HFLM-10K and connect the MMX(M)2 to a 50 ohm, 1 watt, non-inductive dummy load. Use an oscilloscope to monitor the exciter output, referring to the MMX(M)2 technical manual for normal indications and exciter control positions.

b. External Signal Inputs Connections - Use an ohmmeter or VTVM to check for continuity and/or signal levels via interconnecting cable between the MMX(M)2 and HFLM-10K. (Refer to figure 2-2).

c. HFLM-10K Check - Disconnect the MMX(M)2 and connect a signal generator to the HFLM-10K input. Signal generator output and frequency must be within the range normally provided by the MMX(M)2 exciter. Operate the HFLM-10K into a dummy load (if available) and monitor the HFLM-10K meters for proper operation. (Refer to Table 3-1 and the HFLM-10K technical manual for normal indications. Refer to paragraph 2-3 and check all internal and external jack connections.)

SECTION 6
PARTS LIST

6-1. INTRODUCTION

Reference designations have been assigned to identify all Subassembly/ PC Card parts of the equipment. They are used for marking the equipment 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, unit, subassembly, PC card, transistor, integrated circuit, capacitor tube, electron tube, etc. The number differentiates between parts of the same generic group. Sockets associated with a particular plug-in device, such as electron tubes or lamps, are identified with a reference designation which includes the reference designation of the plug-in device.

NOTE

Parts list data for the HFTM-10K is divided between the HFLM-10K and MMX(M)2 technical manuals. Refer to the applicable technical manual for The Technical Materiel Corporation part numbers when ordering replacement parts.