

Robert D. Phillips ★  
VOLUME II

UNCLASSIFIED

TECHNICAL MANUAL  
*for*  
TRANSMITTING SET, RADIO,  
MODEL GPT-10K



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

★  
Issue Date: 1 March 1962





# 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.

### *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:

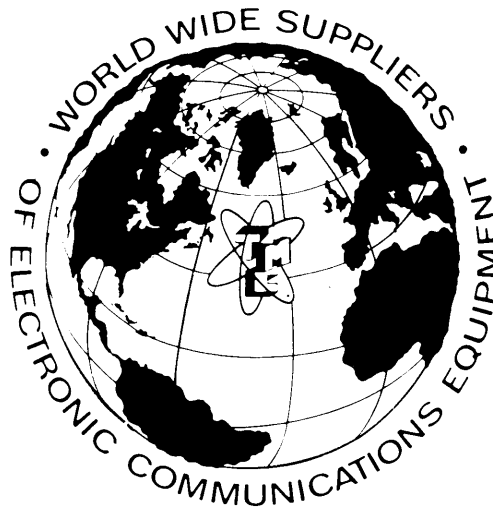
THE TECHNICAL MATERIEL CORPORATION  
Engineering Services Department  
700 Fenimore Road  
Mamaroneck, New York

★  
PART I OF VOLUME II

GENERAL DESCRIPTION

*for*

TEST AND EXCITER FRAME  
EQUIPMENT



THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y.

OTTAWA, CANADA

★  
Issue Date: 1 March 1962



## FOREWORD

Technical Materiel Corporation's general purpose transmitter (ten kilowatt, PEP) Model GPT-10K is a two-frame assembly that falls into two broad categories, namely, equipments with conventional exciter and test units (see preface, page vi) and equipments with synthesized exciter and test units (see preface, page vii). The difference between these two classes of equipments may be ascertained by comparison of the following literature.

### GPT-10K Equipped With Conventional Exciter and Test Equipment:

Volume I, Technical Manual for Transmitting Set Radio, Model GPT-10K, 1 January 1962.

Volume II, Technical Manual for Transmitting Set Radio, Model GPT-10K, 1 March 1962.

### GPT-10K Equipped With Synthesized Exciter and Test Equipment:

Volume I, Technical Manual for Transmitting Set Radio, Model GPT-10K, 1 January 1962.

Volume II, Technical Manual for Sideband Generator, Models SBG-1 and SBG-2, 1 March 1962.

It should be noted that the Manual entitled "Volume I, Technical Manual for Transmitting Set Radio, Model GPT-10K", is common to both classes of equipments. This means that the larger frame of the two-frame assembly is identical for both classes of equipments.

The smaller frame of the two-frame assembly is considerably different in these two cases. In the first case, the exciter and test frame is stacked with conventional-type exciters, oscillators, and auxiliary equipment. In the second case, the exciter frame is stacked with frequency-translation units synthesized from a precision 1-mc standard.

Within a given class of equipments, minor differences occur as dictated by customer needs. For example, a conventional GPT-10K(T) has two variable frequency oscillators and no frequency shift exciter whereas a conventional GPT-10K(A) has one variable frequency oscillator and one frequency shift exciter. Similarly, synthesized GPT-10K's differ among themselves depending on the units stacked in the exciter frame.

Figure numbers on drawings are given in three parameters such as I-1-1 to indicate volume of manual, section of manual, and serial number of drawing. In the text, reference is made only to the last two parameters unless the referenced drawing is in other volumes.

The following table presents a compilation of equipment units by TMC versus Military designations for the two volumes of SBE-excited GPT-10Ks together with TMC's colloquial designation. The following Table of Contents for Volume II shows the arrangement of the "building block" books that describe the modular equipment units mounted on the GPT-10K's exciter and test frame.

**TABLE OF EQUIPMENT UNITS OR ASSEMBLIES OF TRANSMITTING SET, RADIO, GPT-10K**

AN/FRT-39 (TMC vs Military Designations)	AN/FRT-39A (TMC vs Military Designations)	TMC COLLOQUIAL DESIGNATION
<b>AUXILIARY FRAME CHASSIS</b> (Conventional exciter and test equipments)		
Sideband Level Monitor Model SLM-1	Sideband Level Monitor Model SLM-2	SLM-1, or -2
Frequency Spectrum Analyzer Model FSA vs Spectrum Analyzer Group AN/URM-116	Frequency Spectrum Analyzer Model FSA vs Spectrum Analyzer Group AN/URM-116	FSA
<u>a.</u> Analyzer Model SA-1 vs Analyzer Spectrum TS-1236/URM-116	<u>a.</u> Analyzer Model SA-1 vs Analyzer Spectrum TS-1236/URM-116	<u>a.</u> SA
<u>b.</u> Power Supply Model PS-12 vs Power Supply PP-2206/URM-116	<u>b.</u> Power Supply Model PS-12 vs Power Supply PP-2206/URM-116	<u>b.</u> PS-12
Transmitting Mode Selector Model SBE-2 vs Modulator- Power Supply Group AN/URA-23	Transmitting Mode Selector Model SBE-3 vs Modulator- Power Supply Group AN/URA-28	SBE-1, or -2
<u>a.</u> Exciter Unit Model A-1516 vs Oscillator Radio Frequency O-503/URA-23	<u>a.</u> Exciter Unit Model AO-101 vs Oscillator Radio Frequency O-672/URA-28	<u>a.</u> A-1516 or AO-101
<u>b.</u> Power Supply Model A-1397 vs Power Supply PP-1769/URA-23	<u>b.</u> Power Supply Model A-1397 vs Power Supply PP-1769/URA-23	<u>b.</u> A-1397
Monitor Control Panel Model MCP-1 vs Control Panel SB-971/FRT-39	Monitor Control Panel Model MCP-2 vs Control Panel SB-971A/FRT-39	MCP
_____	Isolation Keyer Model AK-100	ISK
Variable Frequency Oscillator Model VOX-2 vs Oscillator, Radio Frequency O-330/FR	Variable Frequency Oscillator, Model VOX-5 vs Oscillator, Radio Frequency O-330 (B)/FR	VOX



**TABLE OF EQUIPMENT UNITS OR ASSEMBLIES OF TRANSMITTING SET, RADIO, GPT-10K (C nt.)**

AN/FRT-39 (TMC vs Military Designations)	AN/FRT-39A (TMC vs Military Designations)	TMC COLLOQUIAL DESIGNATION
Frequency Shift Exciter Model XFK vs Control, Electrical Frequency C-2749/URT	Frequency Shift Exciter Model XFK vs Control, Electrical Frequency C-2749/URT	XFK
Two-Tone Generator Model TTG vs Generator, Signal 0-579/URT	Two-Tone Generator Model TTG vs Generator, Signal 0-579/URT	TTG
Auxiliary Power Panel Model APP-1	Auxiliary Power Panel Model APP-1	APP-1
Auxiliary Frame Assembly Model AX-180	Auxiliary Frame Assembly Model AX-180	AX-180
MAIN FRAME CHASSIS		
RF Amplifier Model vs Amplifier, Radio Frequency AM-2103A/URT	RF Amplifier Model vs Amplifier, Radio Frequency AM-2103A/URT	IPA
a. RF Amplifier Model RFC-1	a. RF Amplifier Model RFC-1	a. RFC-1
b. Power Supply Model AX-104	b. Power Supply Model AX-104	b. AX-104
Power Amplifier Section Model T1-102	Power Amplifier Section Model T1-102	PA
Main Power Supply Section	Main Power Supply Section	Main Power supply
a. High-Voltage Coil and Blower Compartment	a. High-Voltage Coil and Blower Compartment	a. Coil/blower units or compart- ment
b. High-Voltage Resistor/Capacitor Compartment	b. High-Voltage Resistor/Capacitor Compartment	b. Resistor/ capacitor units or compartment
c. Main Power Transformer Compartment	c. Main Power Transformer Compartment	c. Main power transformer
High-Voltage Rectifier Section Model T1-104	High-Voltage Rectifier Section Model T1-104	T1-104

**TABLE OF EQUIPMENT UNITS OR ASSEMBLIES OF TRANSMITTING SET, RADIO, GPT-10K (Cont.)**

AN/FRT-39 (TMC vs Military Designations)	AN/FRT-39A (TMC vs Military Designations)	TMC COLLOQUIAL DESIGNATION
Relay Panel Assembly Model T1-106	Relay Panel Assembly Model T1-106	Relay control panel
Indicator Control Panel	Indicator Control Panel	Indicator control panel
PA TUNE/PA LOAD Panel Assembly	PA TUNE/PA LOAD Panel Assembly	PA tuning/loading panel or units
Main Power Panel Assembly	Main Power Panel Assembly	Main power control panel
Meter Panel Assembly	Meter Panel Assembly	Meter panel

**TABLE OF CONTENTS  
FOR  
VOLUME II**

<u>Part</u>	<u>TITLE OF COMPONENT MANUAL</u>
I	General Description of Test and Exciter Frame Equipment
II	Frequency Spectrum Analyzer, FSA
III	Transmitting Mode Selector, SBE-2 or SBE-3
IV	Variable Frequency Oscillator, VOX-5
V	Frequency Shift Exciter, XFK
VI	Two-Tone Generator, TTG
VII	Auxiliary Frame Assembly AX-180, E/W Meter Panel AX-107, Sideband Level Monitor SLM-1 or -2, Monitor Control Panel MCP-1 or -2, Isolation Keyer AK-100, and Auxiliary Power Panel APP-1.

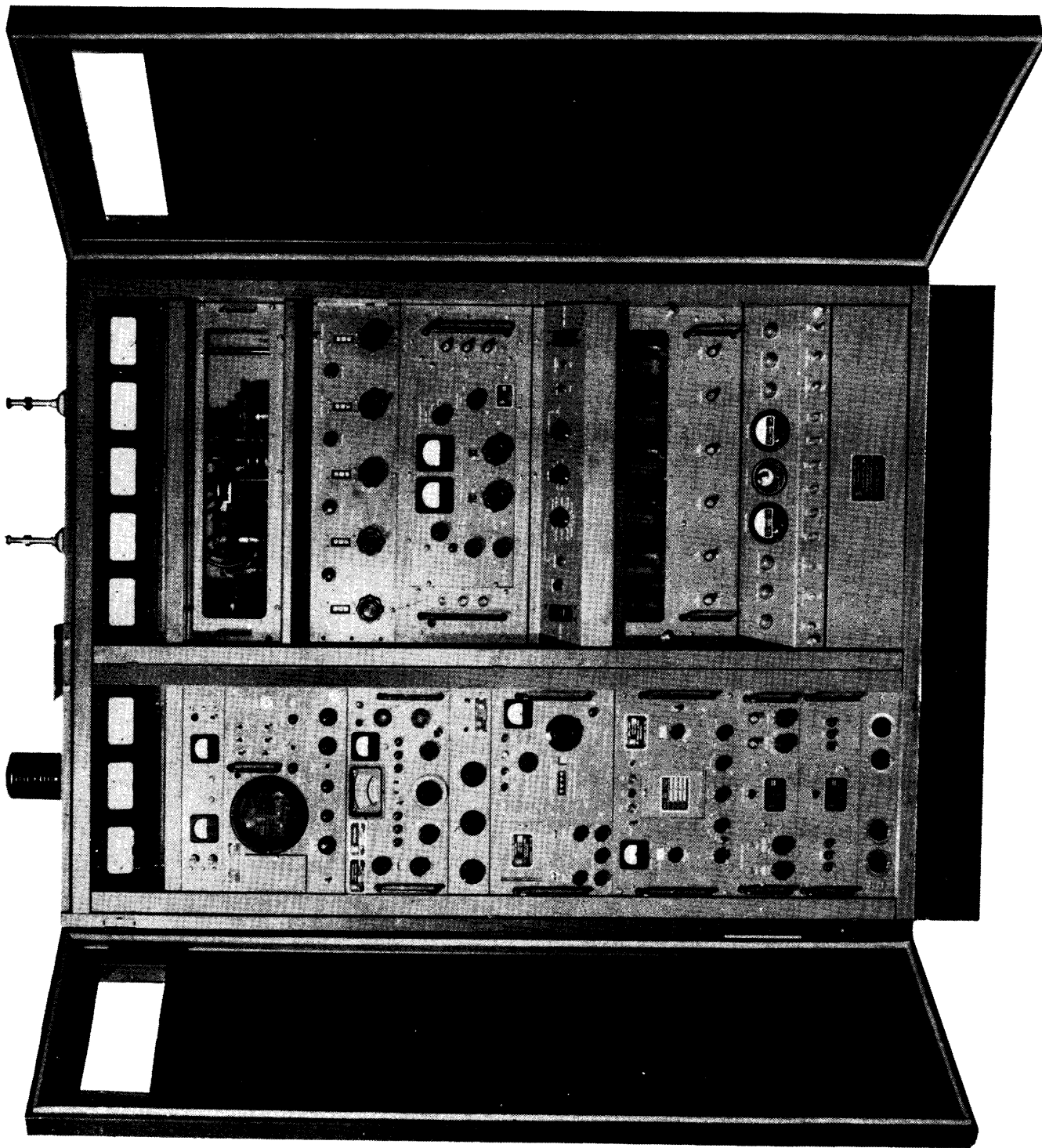


Figure II-0-i. Front View, Model GPT-10K (Non-Synthesized)

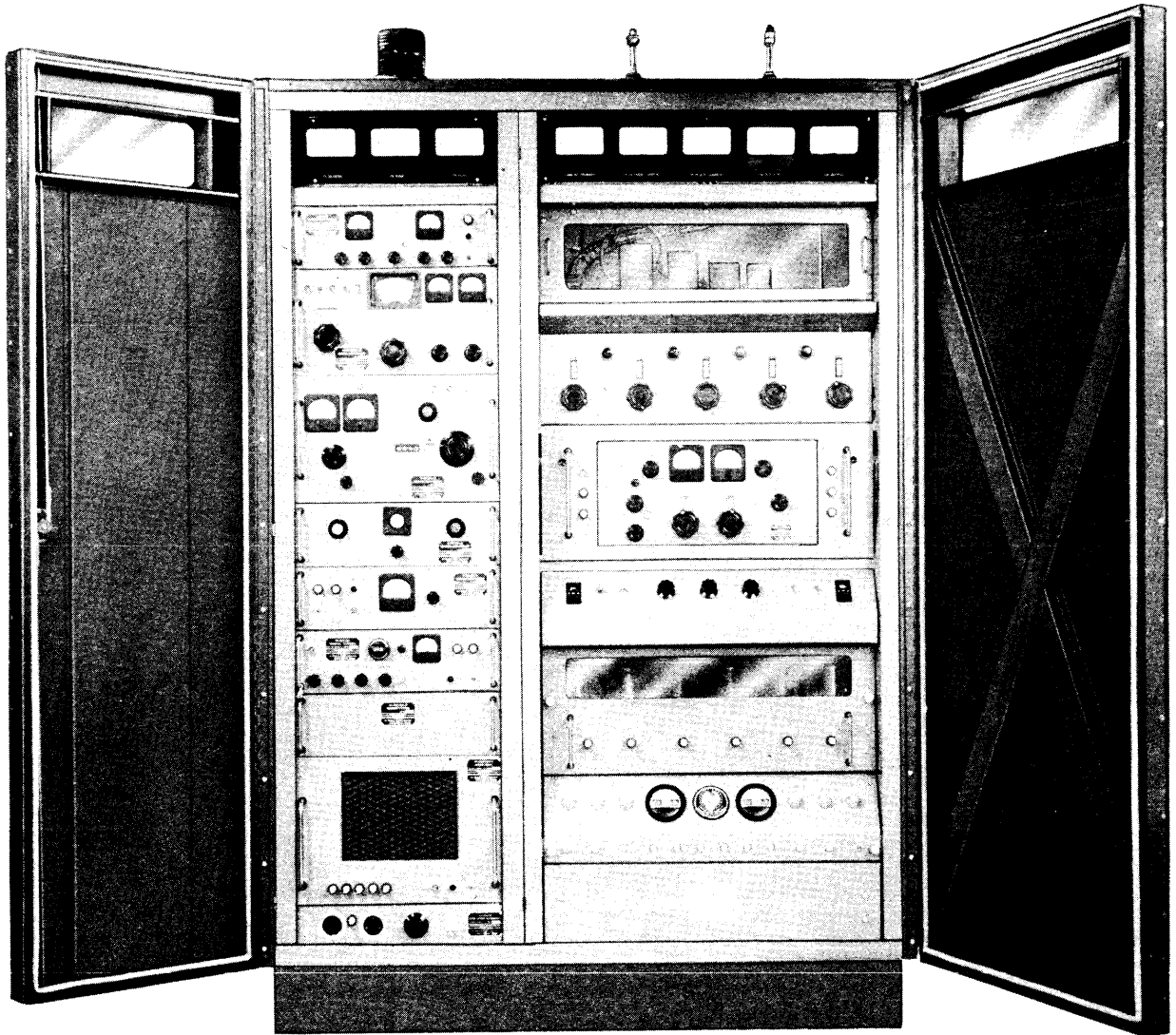


Figure II-0-ii. Front View, Model GPT-10K (Synthesized)

## TABLE OF CONTENTS FOR PART I OF VOLUME II

Paragraph		Page
II-1-1-1.	Introduction . . . . .	1-1
II-1-1-2.	Frequency Spectrum Analyzer (FSA) . . . . .	1-1
II-1-1-3.	Transmitting Mode Selector Models SBE-2 and SBE-3 . . . . .	1-1
II-1-1-4.	Variable Frequency Oscillator Model VOX-5 . . . . .	1-2
II-1-1-5.	Frequency Shift Exciter Model XFK . . . . .	1-2
II-1-1-6.	Two Tone Generator Model TTG . . . . .	1-2
II-1-1-7.	Auxiliary Frame Assembly Model AX-180 E/W . . . . . Non-Removable Equipment Units.	1-2

### LIST OF ILLUSTRATIONS FOR PART I

Figure		Page
II-1-1-1.	Isometric Diagram, Model GPT-10K (Non-Synthesized) . . . . .	1-5-1-6

## PART I — GENERAL DESCRIPTION

### 1-1. INTRODUCTION.

The purpose and functions of Technical Materiel Corporation's Transmitting Set, Radio, Model GPT-10K are briefly described in the companion manual (Volume I). The GPT-10K's exciter and test frame is stacked with conventional-type exciters, oscillators, and auxiliary equipment whose primary function is to expediate proper operation of GPT-10K's main frame equipment.

Panel views of the units on the auxiliary frame chassis are illustrated in the left-hand section of figure II-0-i (page vi of preface); figure II-1-1 presents an isometric diagram of the layout of the major assemblies of the GPT-10K. The following paragraphs present brief descriptions of the units (in removable drawers) mounted in the GPT-10K's exciter and test frames.

### 1-2. FREQUENCY SPECTRUM ANALYZER (FSA).

The FSA is an automatic scanning superheterodyne receiver which permits analysis and identification of one or many RF signals at one time. Each signal within the band being scanned is displayed on a cathode-ray tube as one of a series of inverted V's or "pips." The pip amplitude and position along the calibrated horizontal axis are indicative of signal level and frequency, respectively. A CW signal produces a single pip. Modulated signals (AM, FM, or pulsed) cause a series of pips which indicate sideband distribution and levels.

The variable sweep widths (0 to 100 kc, 0 to 2 kc) and preset widths (150 , 500 , 2KC, 10KC, and 30 KC) for any point in the RF spectrum up to several hundred megacycles, in conjunction with the automatic scanning feature and the variable sweep widths make the FSA an ideal tool for research, design, or test applications. It is particularly useful in the operation and testing of the GPT-10K. For example, the FSA quickly evaluates modulation products, sideband levels, noise, residual carrier, spurious oscillation, etc. The wider bands are for search and preliminary analysis; the narrower bands are for detailed analysis. The 150-, 500-, and 2000-cps sweep widths are AFC stabilized.

The FSA is unique in that it offers all the advantages of automatically scanning spectrum presentations, yet enables examination of signals so closely adjacent in frequency that their corresponding deflections normally tend to merge together or even completely mask one another, even with static-wave analyzers. This instrument can, at reduced sweep widths and slow sweep rates, resolve equal amplitude signals

down to 10-cps separation. Signals with an amplitude ratio of 50 db separated by 60 cps are clearly separated.

General descriptive characteristics of the FSA are presented in Part II of Volume II of the manual.

### 1-3. TRANSMITTING MODE SELECTOR MODELS SBE-2 AND SBE-3.

The SBE-2 and SBE-3 are filter-type, single- or double-sideband exciters designed for radio telephone, telegraph, and frequency-shift operation. They are continuously tunable from 2 to 32 mc.

The SBE is primarily intended for use as an exciter in sideband (single, double, independent) transmission with various degrees of carrier insertion, as desired. It is excellently suited to serve as an exciter for any well designed, linear, RF amplifier that requires up to 1-watt (SBE-3) or 3-watts (SBE-2) PEP excitation through 72-ohm input impedance.

A voice-operated control circuit is provided to ensure that transmission will occur only when the operator is speaking directly into the microphone. A squelch circuit is used to prevent the audio from local receivers from operating the voice-operated control circuit. Both are front panel controls and may be easily adjusted for best performance over a wide range of operating conditions. Manual push-to-talk control may be used instead of voice-operated control, if desired.

The following modes of operation may be selected and used with continuously adjustable amounts of carrier insertion:

- (1) Carrier Amplitude Modulation (AM)
- (2) Single Sideband (SSB)
- (3) Double Sideband (DSB)
- (4) Independent Sideband (ISB) (Separate intelligence on each sideband.)
- (5) Frequency Shift Keying (FSK)
- (6) CW Telegraphy (CW)

The power supply for the SBE-2 is the same as for the SBE-3. Front panel views show three fuses and one indicator. The power supply fuses unregulated B+ (125, 180, and 250 volts), regulated B+ (150 volts), and filament (6.3 AC).

General descriptive characteristics of the SBE-2 and SBE-3 are presented in Part II Volume II of the manual.

#### **1-4. VARIABLE FREQUENCY OSCILLATOR MODEL VOX-2.**

The VOX is a precision, direct-reading, variable-frequency device which is designed to provide high-frequency and medium-frequency oscillator injection with extremely high stability.

The VOX provides the following:

(1) High-frequency output voltage, continuously variable over the range of 2 to 64 mc.

(2) Crystal-controlled high-frequency output voltage over the range of 2 to 64 mc (frequency dependent upon crystals used).

(3) Crystal-controlled BFO voltage over the range of 300 to 1000 kc (frequency dependent upon crystals used) for dual-conversion superheterodynes such as the Hammarlund 600 series.

(4) Crystal-controlled IFO voltage over the range of 3.2 to 3.9 mc (frequency dependent upon crystals used) for dual-conversion superheterodyne receivers.

Sufficient output is available from any of the foregoing to control up to three receivers in diversity or the usual requirement of GPT-10K SBEs.

The VOX incorporates a highly stable variable-frequency oscillator, (1) above, with an extremely accurate counter-type dial. Master oscillator frequency determining elements are contained in a temperature-stabilized oven, and these components are carefully selected for high-stability operation. In addition to the variable-frequency feature, provision is made for up to three crystal-controlled positions for high-frequency injection, (2) above.

Additional crystal oscillators provide crystal-controlled beat frequency oscillator voltage, (3) above, and a 3.2- to 3.9-mc crystal-controlled RF output, (4) above, for dual conversion receivers.

General descriptive characteristics of the VOX are presented in Part II Volume II of the manual.

#### **1-5. FREQUENCY SHIFT EXCITER MODEL XFK.**

The XFK is a single-unit, frequency-shift exciter designed for fixed station use. The XFK is a high-stability RF oscillator which provides a means of shifting an RF carrier in accordance with the variations of an audio pulse signal. It provides frequency shift telegraph signals in two bands, 1 to 2.5 mc and 2.5 to 6.9 mc.

The XFK replaces the crystal oscillator in a GPT-10K and provides "mark" and "space" carrier shift transmission of teleprinter, telegraph, and facsimile (or telephoto) intelligence. Carrier shift up to 1000

cycles is available; either linear with applied voltage or independent of applied voltage-amplitude variations.

Carrier shift has become the most accepted means of transmitting the above mentioned types of intelligence. The GPT-10K frequency is changed from a low "space" frequency to a higher "mark" frequency in accordance with the input intelligence. At the receiver, the GPT-10K's RF frequency-shift telegraph signals are detected, and a suitable converter changes them to audio or pulse signals. These signals are replicas of the input intelligence at the transmitting terminal (discounting distortion in the overall transmission path) and are fed to audio-frequency receiving equipment at the receiving terminal. For receiving, a Dual Diversity Receiver (such as TMC Model DDR-2) is recommended in conjunction with a Frequency Shift Converter (such as TMC Model CFA).

General descriptive characteristics of the XFK are presented in Part II Volume II of the manual.

#### **1-6. TWO TONE GENERATOR MODEL TTG.**

The TTG was especially designed for operation with the GPT-10K but is readily usable with other transmitting equipment. The unit is a primary source of two groups of test tones. The TTG provides two audio tones. The TTG provides two audio tones, 935 cps and 2805 cps, and two RF output frequencies, 1999 kc and 2001 kc.

The audio oscillator has especially low distortion to ensure an accurate check of distortion in the standard two tone GPT-10K test. Crystal control of the RF oscillators provides stable and dependable frequency output, useful for checking proper operation of the SA.

General descriptive characteristics of the TTG are presented in Part II Volume II of the manual.

#### **1-7. AUXILIARY FRAME ASSEMBLY MODEL AX-180 E/W NON-REMOVABLE EQUIPMENT.**

Refer to figure II-0-i on page vi of preface and to following figure II-1-1-1.

The non-serviceable equipment units mounted on AX-180 include: meter panel, SLM, MCP, AK-100, and APP-1. These units are covered in detail in Part VII Volume II of this manual.

a. METER PANEL. - This unit contains three meters that monitor GPT-10K's PA SCREEN DC voltage, PA BIAS DC voltage and PA PLATE DC voltage.

b. SLM-2. - This unit contains two meters that indicate sideband levels in the LSB-USB filter outputs of the SBE unit.

c. MCP-2. - The MCP-2 unit contains four selectors switches and two toggle switches that channel various outputs to and from associated equipment units.

d. AK-100. - The ISOLATION KEYER AK-100, commonly called an ISK, is an electronic keyer that func-



tionally replaces the well-known relay keyer in RATT lines at transmitter sites.

The ISK is mounted at the rear of Auxiliary Frame Chassis AX-180 and provides facilities for keying the GPT-10K in accordance with signals from an external telegraph key on the teletypewriter equipment.

The front panel contains six fuses, one indicator lamp, and two switches. All remaining parts are mounted on a U-shaped chassis which is secured to the rear of the front panel. A small U-shaped bracket is mounted on the inside of this chassis and contains a keying relay and two adjustable potentiometers. These

potentiometers are accessible through two holes in the lower portion of the front panel. Both holes are covered by snap-caps during normal operation.

e. APP-1. - The Auxiliary Power Panel APP-1, mounted at the bottom of Auxiliary Frame Chassis, AX-180, contains four polarized convenience outlets on the front panel. A U-shaped bracket, mounted on the rear of the front panel, houses a fifth polarized convenience outlet. A terminal board is also mounted on the rear of the front panel behind a protective shield AC voltage is applied to the convenience outlets from the terminal board when the latter is wired to a 115-volt source.

# BASIC TRANSMITTER COMPONENTS GPT-10K

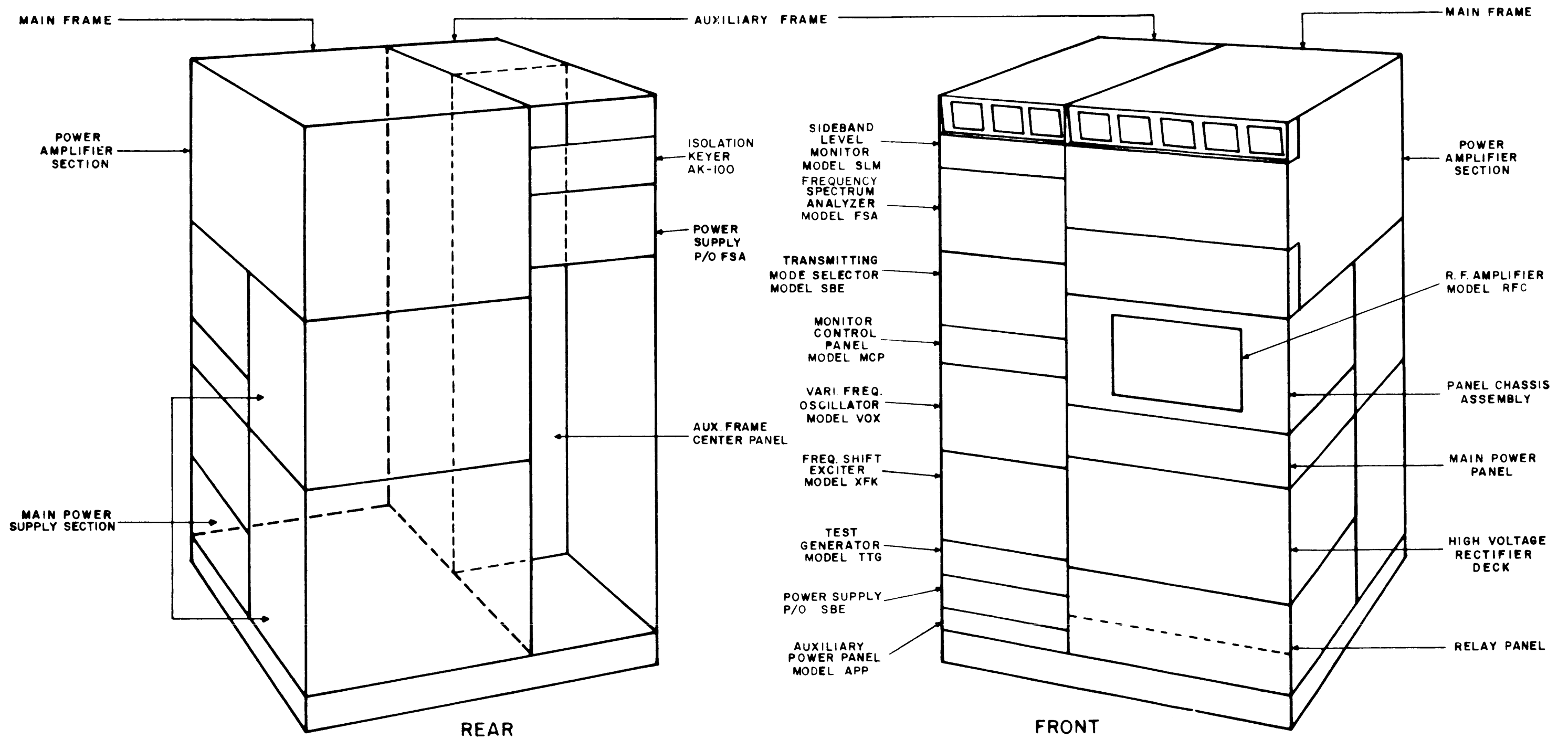


Figure II-1-1-1. Isometric Diagram, Model GPT-10K (Non-Synthesized)