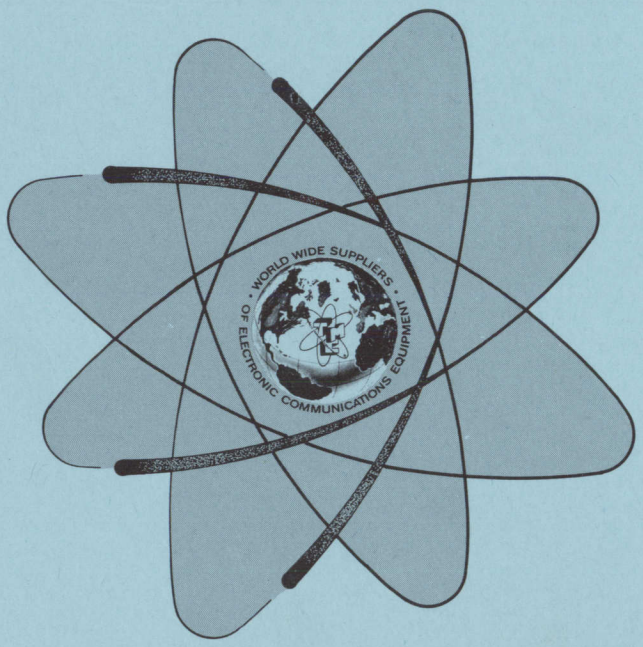
MASTER COPY

TECHNICAL MANUAL

for

GENERAL PURPOSE TRANSMITTER

MODEL GPTR-1KE/4



THE TECHNICAL MATERIEL CORPORATION

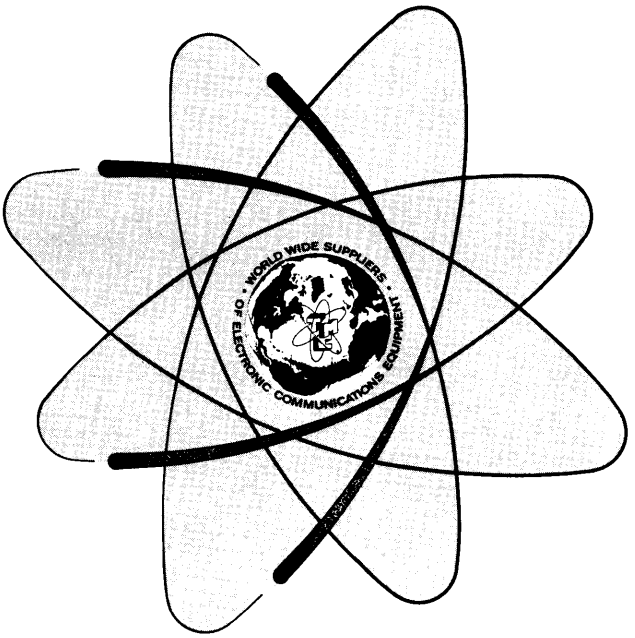
MAMARONECK, N.Y. OTTAWA, ONTARIO

Printed in U.S.A.

TECHNICAL MANUAL
for

GENERAL PURPOSE TRANSMITTER

MODEL GPTR-1KE/4



THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

Printed in U.S.A.

IN 1093

Issue Date: MARCH 1975

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.

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

SECTION 1

GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION

The Technical Materiel Corporation of Mamaroneck, New York, designed and manufactured the Model GPTR-1KE/4 General Purpose Transmitter. A predominant feature of the design is the provision for the operation of the essential controls of the transmitter from a location other than the transmitter site. The transmitter will provide an average power output of 500 watts (1 KW peak envelope power) on one of eight predetermined crystal controlled carrier frequencies. It will transmit in any of five operational modes; CW (continuous wave), AME (amplitude modulation equivalent), PC (pilot carrier), SC (suppressed carrier), or MCW (modulated continuous wave). In the sideband modes the transmitter will operate on either the upper or lower sideband or both, providing in effect, a sixth operating mode, ISB (independent sideband).

The operating modes of the GPTR-1KE/4 transmitter in relation to the emission classification is shown in table 1-1.

TABLE 1-1. EMISSION CLASSIFICATION FOR THE GPTR-1KE/4

Operating Mode	Abbreviation	Emission Code
Continuous Wave	CW	A1
Amplitude Modulation Equivalent	AME	A3H
Pilot Carrier	PC	A3A
Modulated Continuous Wave	MCW	A2H
Upper Sideband	USB	A3J
Lower Sideband	LSB	A3J
Independent Sideband	ISB	A3B

The ADC-5 Analog Digital Control system provides the remote control capability for the transmitter. The system consists of a AX5189 Remote Programmer with an associated tone generating unit and the AX5190 Decoder which translates the tone signals to control settings in the transmitter.

In addition the decoder sends back indications of the transmitter status to the remote site.

The exciter generates 100 mw PEP (peak envelope power) which is raised to the 50 watt average power level by the HFL-100 amplifier. The TMA-1K amplifier completes the amplification of the rf signal to 1 KW PEP.

1-2. PHYSICAL DESCRIPTION

Four of the modular units which make up the transmitter are housed in a single cabinet located at the transmitter site; the HFL-100 High Gain Amplifier, the TMA-1K Linear Power Amplifier, the SME(R)-5 Exciter and the AX5190 Decoder Unit (tone package). The fifth unit, the AX5189 Remote Programmer together with its tone package mount in a separate cabinet located at the remote control station to control the operation of the other transmitter components from that location.

All of the controls and indicators are, for efficient operation, located on the front panels of the units. The connections for input signals and system interconnections are made at the rear of each unit or at the interface panel at the rear of the transmitter cabinet. However, at the remote station front panel jacks have been supplied for microphone and key inputs.

1-3. REFERENCE DATA

The technical characteristics of the GPTR-1KE/4 transmitter are shown in table 1-2. Table 1-3 lists the power amplifying tube complement of the system.

TABLE 1-2. TECHNICAL SPECIFICATIONS

Operating Frequencies:	Preselected between 2.0 and 30.0 MHz on eight crystal controlled channels.
Frequency Stability:	Maximum deviation is ±10 Hz over an ambient temperature range of 0 to 50C with temperature controlled crystal oscillators.
Modes of Operation:	Six switch-selected modes as shown in table 1-1. FAX and FSK are optional.
Power Output:	1000 watts PEP or 500 watts average.
Output Impedance:	50 ohms, unbalanced.
VSWR:	Maximum of 2:1 without performance degradation.
Tuning:	Remote, automatic or manual (local only).

TABLE 1-2. TECHNICAL SPECIFICATIONS (cont)

ALDC:	Automatic Load and Drive Control circuit improves linearity, limits distortion, and maintains a relatively constant output level during high modulation peaks and load changes.
Spurious Response:	At least 50 db down from full PEP output.
Power Requirement:	Approximately 1.8 Kw (dependent on optional equipment incorporated) at 115/230 volt, single phase, 50/60 Hz.
Environmental Limitations:	Operating -0 to 50C with up to 90 percent humidity. Storage -40 to 85C and up to 95 percent humidity.
Features:	Safety interlocks, overload protection, fused power inputs, forced air cooling, monitored inputs and outputs.
Size:	23 inches wide, less than 4-1/2 ft. high 2 1/2 ft. deep (max). Mounted in customer selected standard cabinet.
Weight:	Less than 200 pounds. Actual weight depends on optional equipment incorporated.

TABLE 1-3. TUBE COMPLEMENT

Unit	Reference Designation	Part Number or Type	Function
HFL-100	V101	12HG7*	1st Amplifier
	V102	12HG7*	2nd RF Amplifier
	V103	4CX350	3rd RF Amplifier
TMA-1K	V101	8163*	Power Amplifier
	V102	8163*	Power Amplifier

*Operated in parallel

1-4. OTHER PUBLICATIONS

Technical manuals have been prepared for the several individual units which comprise the Model GPTR-1KE/4 transmitter. Perusal of these publications prior to working with or on the transmitter is strongly recommended. Specific detail pertinent to the installation, operation or repair of the modular units is often only found in these presentations.

SECTION 2

INSTALLATION

2-1. RECEIVING AND INSPECTION

Experienced personnel in the TMC test facility have ascertained that the GPTR-1KE/4 met all operational requirements prior to shipment. The transmitter was then partially disassembled and the modular units separately packed. Separate packaging increases the ease with which the transmitter components are handled and reduces the possibility of damage in transit. Fragile parts, power amplifier tubes, for instance, are often removed and afforded special protection. Wiring harnesses are usually secured to the interior of the cabinet.

Upon arrival at the installation site the contents of each crate or carton should be carefully examined to be sure that the equipment sustained no damage in shipping. A claim against the carrier should be filed if damage for which he is responsible is discovered. Assistance in rectifying such damage will be provided by The Technical Materiel Corporation by describing repair methods and recommending replacement parts.

A packing list is provided with each shipment. Review it carefully to be certain that all material has been received. Carefully inspect all packing material so that no parts or equipment such as hardware, cables or connectors are discarded.

2-2. POWER REQUIREMENTS

The transmitter will operate from a 115 or a 230 volt single phase power source. Each unit is factory wired to accommodate the voltage level indicated by the customer. A change in source voltage level will require that the transformer primary windings be rewired. The internal interconnection diagram in the unit technical manuals show the necessary wiring changes which should be made prior to installation. The protective fuses must also be changed. The power source must be capable of supplying up to 1.8 Kw.

2-3. INITIAL INSTALLATION

a. GENERAL DISCUSSION. Due consideration must be given as to the placement of the transmitter cabinet. Since the GPTR-1KE/4 is an air-cooled system adequate ventilation must be provided. Convenience of operation and the relationship to associated equipment must also be considered. Clearance to allow the modular units to be extended on the slide mountings and easy access to the rear of the transmitter are necessary.

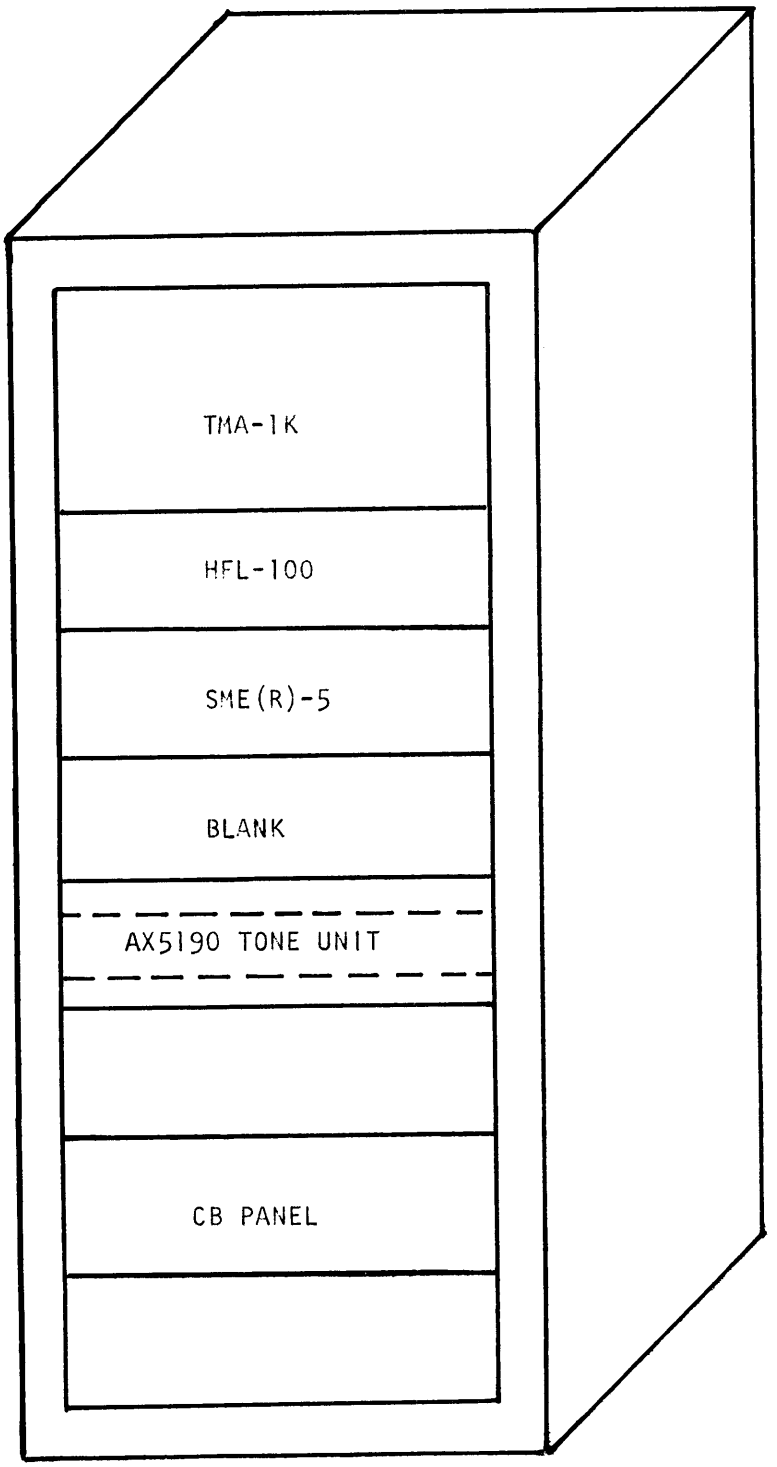


Figure 2-1. Modular Components - GPTR-1KE/4 Transmitter

Before starting to reassemble the transmitter all packing material should be removed from the cabinet and wiring harness.

b. UNIT INSTALLATION. The tracks for the slide mountings which support the modular components of the transmitter are already mounted in the cabinet. It is therefore, a simple task to slide the units into the correct position as shown in figure 2-1.

The circuit breaker panel is not usually disassembled from the cabinet nor are the blank panels which occupy the space of unincorporated optional equipment. Care must be exercised when positioning the units to avoid any entanglement with installed wiring. When the units are in place, they should be firmly secured by means of the panel locks, or with the mounting hardware supplied.

c. ELECTRICAL CONNECTIONS. A standard wiring harness has been installed in the GPTR-1KE/4 cabinet. This harness makes provision for the installation of the available optional equipment most commonly added to the basic transmitter configuration, namely an ATSA-3 Antenna Tuning System and a TIS Tone Intelligence System. If not initially incorporated, these equipments can be easily added at a later date with a minimum of additional wiring. The harness connections are shown in figure 2-2.

An interface panel mounted at the rear of the transmitter cabinet is provided to support the mating jacks for unit interconnections and for most of the external connections to be made to the transmitter. The layout of this panel showing the locations of these connections is shown in figure 2-3.

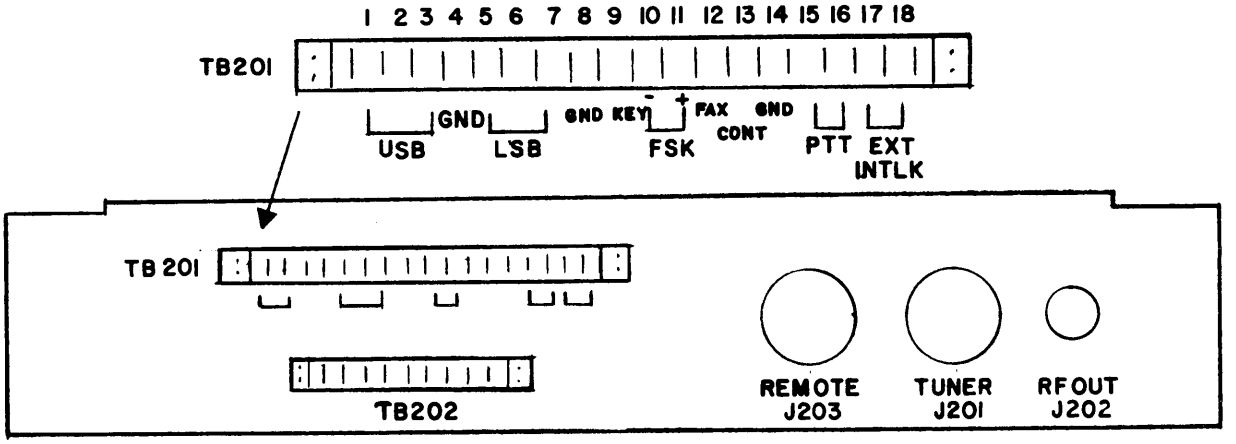


Figure 2-3. Interface Panel, Model GPTR-1KE/4

JOB #

CUSTOMER _____

ADDRESS _____

_____

_____

JOB DESCRIPTION _____

INVOICE #	
CUST. ORDER #	
DATE ORDERED	
DATE WANTED	
SALESMAN	

_____

_____

_____

_____

_____

_____

Stock _____

_____

Run _____

No. Plate _____

Color Ink _____

Running size _____

Amt. up _____

Trim _____

1 side _____ 2 sides _____

Collating _____ Stapling _____

Folding _____

Round Corner _____ Punching _____

Padding _____

Type Binding _____

Inserting _____ Perf _____ Carbon _____

Numbering from _____ to _____

EXTRA WORK					
MAKE READY					
Plates					
Stock					
Run					
Ink					
Halftones					
Composition					
Binders					
Total					

REMARKS _____

_____

_____

_____

PRICES _____

TAX _____

TOTAL _____

WARNING

BEFORE MAKING ANY ELECTRICAL CONNECTIONS TO THE TRANSMITTER BE CERTAIN THAT NO CONNECTION HAS BEEN MADE TO ANY POWER SOURCE AND THAT THE POWER SUPPLY JACK IS TAGGED TO PREVENT ACCIDENTAL USE.

(1) Internal Connections. Reference to the internal interconnection diagram, figure 2-2, will assist the installer in properly making the connections required. The terminal boards and jacks at the rear of the modular units have been marked with the appropriate "TB" or "J" number. Connectors on the wiring harness have been similarly identified. Check the numbers carefully for, unless all optional equipment is installed, some connectors will not be used.

(2) External Connections. After completing all of the external connections described in the paragraphs which follow, primary power must be supplied to the transmitter through the connector located at the lower left rear corner of the equipment cabinet. A plug (PL190-NG) which mates with this connector is furnished as a "loose item" to facilitate the fabrication of this power cable.

Mating connectors for the terminal boards and jacks on the interface panel where the external connections to the transmitter are made are also furnished as "loose items". These items are used to terminate the control and signal cables which must be fabricated by the customer.

The customer fabricated cabling carrying the operational and control signals terminates at TB201 and TB202 on the interface panel. Shielded wire (except as noted) should be used to fabricate this cable. The proper connections are shown in table 2-1 and table 2-2.

TABLE 2-1. CONNECTIONS TO TERMINAL BOARD TB201

Terminal No.	Signal Input
1	Upper Sideband (600 ohm)
2	----
3	Upper Sideband (600 ohm)
4	Shields (ground)
5	Lower Sideband (600 ohm)
6	----

TABLE 2-1. CONNECTIONS TO TERMINAL BOARD TB201 (cont)

Terminal No.	Signal Input
7	Lower Sideband (600 ohm)
8	Ground
9	CW key
10	FSK (-)
11	FSK (+)
12	-------
13	Keyed Ground
14	Ground
15	PTT (need not be shielded)
16	PTT ground (need not be shielded)
17	External interlocks (need not be shielded)
18	External ground (need not be shielded)

TABLE 2-2. CONNECTIONS TO TERMINAL BOARD TB202

Terminal No.	Signal
1	Audio Input
2	Audio Input
3	Open
4	Open
5	Ground (Shield)
6	Open
7	Open
8	Open

If an antenna tuning system is to be made part of the transmitter, a cable to carry the control signals from the transmitter to the tuning unit at the antenna base must be installed. This cable may be purchased from TMC or customer fabricated. Reference to the interconnection diagram, figure 2-2, and to the technical manual for the antenna tuning system will enable the installer to make this connection correctly.

2-4. REMOTE CONTROL UNIT

After unpacking and completing the initial physical inspection of the AX5189 remote programmer, initial operational checks are usually conducted at the transmitter site. When these tests are finished the cabinet containing the control unit and the associated tone package (send/receive) is placed in the location from which it is desired to control the transmitter operation.

A power source of 230 volts must be available at the remote station to energize the control unit. A pair of standard 600 ohm shielded transmission lines may be used to interconnect the remote control unit and the GPTR-1KE/4 transmitter. At the transmitter these lines connect to terminals 1 and 2 of TB202 on the interface panel. The shield is connected to terminal 5.

2-5. WIRING MODIFICATION FOR HIGH IMPEDANCE OR CARBON MICROPHONE

Either a high or low impedance dynamic microphone or a carbon microphone may be used to provide audio inputs to the transmitter. Both the transmitter and the programmer are factory wired to accommodate a low Z microphone hence if a decision is made to use either a carbon microphone or a high impedance unit, wiring modifications must be made. The rear panel of the SME(R)-5 exciter is marked to show the proper connections to TB1 but internal changes must be made to the AX5189 programmer. If a high impedance dynamic microphone is to be used make the following changes:

1. Remove R16
2. Install a jumper wire between terminal 21 and terminal 22 on the printed circuit board.
3. Install another jumper wire between terminal 23 and terminal 24.

Figure 2-4, section B, is a plan view of the area of the printed circuit board where these components are located.

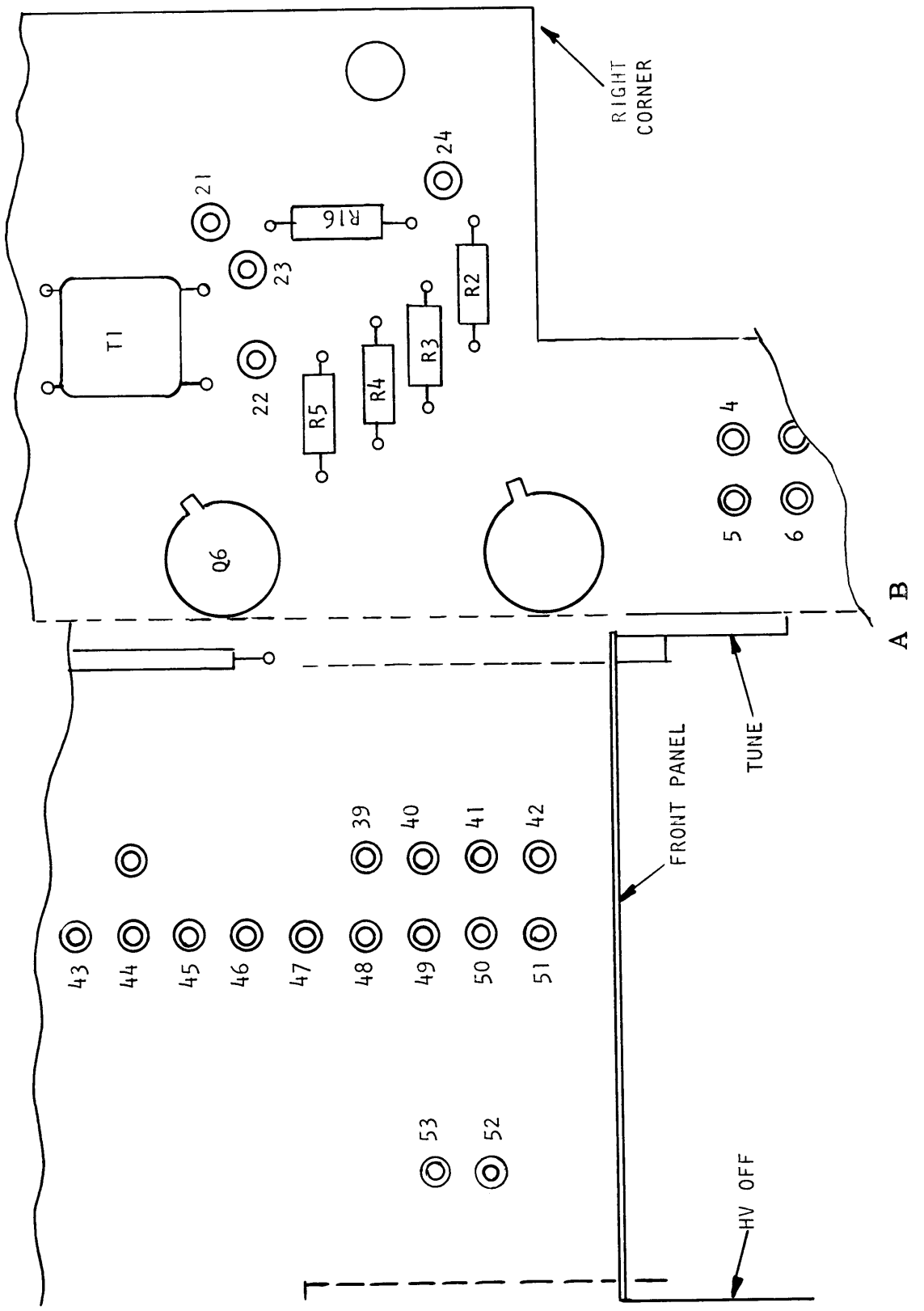


Figure 2-4. Programmer Wiring Modification Terminals for Different Microphones

Make the following changes if a carbon microphone is to be used.

1. Remove R16

2. Install a jumper wire between terminal 21 and terminal 53 on the printed circuit board.

3. Install another jumper wire between terminal 24 and terminal 52.

Terminal 52 and 53 are located between the HV OFF switch and the TUNE switch as shown in figure 2-4, section A.

2-6. FINAL INSPECTION

After all electrical connections have been completed the transmitter should be visually inspected to be sure of the following:

a. The interlocks are operable. The interlocks on the GPTR-1KE/4 transmitter are located on the TMA-1K linear power amplifier unit, and must close when the top and bottom protective covers are secured in place.

b. All electrical connections have been properly made and that the connectors are mechanically secure in the correct positions.

c. The protective top and bottom cover are securely affixed to each modular unit and that the units are secured in the cabinet with panel locks or mounting hardware.

d. The rear cabinet panel is in place and secured with the mounting hardware provided.

e. The antenna system or equivalent dummy load is properly connected to the rf output connector of the transmitter system.

SECTION 3

OPERATORS SECTION

3-1. INTRODUCTION

The GPTR-1KE/4 transmitter will provide one kilowatt PEP (peak envelope power) or 500 watts average power in any of six operating modes. This section gives instructions for tuning, operating and monitoring the transmitter. These instructions consider only the basic transmitter. Should any of the available optional equipment be added the procedures must be modified to include the operation of the additional units. Reference to the individual technical manuals for the added equipment will assist the operator in making these modifications. Under normal conditions the transmitter automatically tunes to a frequency band to accommodate the selected carrier frequency and any compatible additional equipment will also be automatically controlled.

3-2. OPERATING CONTROLS AND SEQUENCE

The individual technical manual for each modular component of the transmitter shows the location and function of each control and indicator. The operator must be knowledgeably familiar with this information before attempting to adjust or operate the GPTR-1KE/4.

These instructions present an approved sequence of operation. It is important that such a sequence be habitually followed to prevent undue stress on system components.

3-3. PRELIMINARY CONTROL SETTINGS

Before applying any power to the transmitter the operator must be certain that the antenna or suitable dummy load is connected to the rf output connector (J202 on the interface panel). The position of the controls in accordance with table 3-1 must be verified by the operator as the first step in transmitter use.

TABLE 3-1. PRELIMINARY CONTROL SETTINGS

Modular Unit	Control	Setting
Circuit Breaker Panel	Main Circuit Breaker	ON
SME(R)-5	UPPER SIDEBAND	OFF
	LOWER SIDEBAND	OFF
	MODE	CW
	CHANNEL	any
	ON/OFF switch	ON

TABLE 3-1. PRELIMINARY CONTROL SETTINGS (cont)

Modular Unit	Control	Setting
HFL-100	AC ON/OFF switch	OFF
	LOCAL/REMOTE switch	REMOTE
	HV ON/OFF switch	OFF
	IP/RF switch	IP
	RF GAIN	fully counterclockwise
TMA-1K	MANUAL/AUTO/REMOTE switch	REMOTE
	AC switch	down position (off)
	HV switch	down position (off)

3-4. OPERATING PROCEDURES

The GPTR-1KE/4 is primarily designed as an automatically tuned transmitter controlled at the transmitter site or at a remote station. The controls on the AX5189 Remote Programmer duplicate the essential controls on the transmitter and make it possible to operate the system from a location some distance from the transmitter installation. Intelligence inputs may also be made from the remote station.

The tuneable components of the GPTR-1KE/4 are automatically adjusted to accommodate the selected carrier frequency when the RESET pushbutton on the TMA-1K unit is pressed. Pressing the TUNE pushbutton on the AX5189 unit when operating from the remote station will cause the same adjustments to take place.

Table 3-2 gives the procedural steps to be taken to tune the transmitter in the normal manner at the transmitter site. A change in the operating frequency may be accomplished by the following the directions given in table 3-3.

Provision has been made in the design of the transmitter to tune each of the units manually should such an operating technique be required. Naturally, such a procedure is more complex and requires more skill and understanding on the part of the operator. It can only be accomplished at the transmitter site. Following the steps given in table 3-4 will enable the local site operator to manually tune the transmitter.

The procedure for tuning the transmitter from the remote station is similiar to that used when automatically tuning the system at the transmitter site. In addition, the control signals must be sent to the transmitter site. The remote site tuning procedure is given in table 3-5.

a. LOCAL TRANSMITTER TUNING. As outlined in the preceding paragraphs the following tables detail the methods of tuning the transmitter at the transmitter site.

NOTE

The controls should be positioned as outlined in table 3-1 before initiating any tuning procedure.

TABLE 3-2. LOCAL TUNING ON CARRIER

NOTE

To operate the GPTR-1KE/4 from the transmitter site is is necessary to provide a ground connection to terminal 17 of TB201 on the interface panel. Place a jumper wire between terminal 17 and terminal 18.

Step No.	Modular Unit	Operation	Normal Indication
1	SME(R)-5	Select operating frequency with CHANNEL selector switch.	Index on knob indicates channel selected.
2	SME(R)-5	Select operating mode with MODE selector switch.	Index on knob indicates mode selected.
3	SME(R)-5	Adjust UPPER SIDEBAND and/ or LOWER SIDEBAND switches to accommodate intelligence inputs.	Index on knob indicates selection.
4*	CB PANEL	Set circuit breakers to ON position.	AC indicator lamp lights.
5*	SME(R)-5	Set ON/OFF switch to ON.	POWER indicator lamp lights.
6	HFL-100	Set AC switch to ON position.	AC indicator lights.
7	TMA-1K	Set AC switch to up position (ON).	AC indicator lamp lights. Band indicator lights.

TABLE 3-2. LOCAL TUNING ON CARRIER (cont)

Step No.	Modular Unit	Operation	Normal Indication
		CAUTION Allow sufficient time for tube filaments to heat (at least one minute) before proceeding.	
8	HFL-100	Set HV switch to ON position.	HV indicator lamp lights. IP meter indicates 50-70 ma.
9	TMA-1K	Set HV switch to up (on) position.	HV indicator lamp lights. IP meter indicates approximately 200 ma.
10	TMA-1K	Press RESET button to initiate automatic tuning.	When amplifiers are tuned, the OUTPUT meter will indicate a maximum or peak value showing resonance has been achieved and the READY indicator lights.
		NOTE When the transmitter is tuned and the READY indicator lights, the tune carrier is removed, the ALDC circuit is activated and normal operation restored.	
11	TMA-1K	Adjust ALDC control so that maximum allowable output is not exceeded.	OUTPUT meter indicates average rf output power.
		*NOTE Except for the initial start up or if the transmitter has been completely shut down for an extended period of time steps 4 and 5 of table 3-2 are not required. Good operating practice dictates that power be continually supplied to the SME-5 exciter so that the crystal controlled oscillators be stabilized.	

This completes the local automatic tune sequence and the system is prepared to receive intelligence.

TABLE 3-3. RETUNING TO A NEW FREQUENCY

NOTE

It is assumed in this table that the transmitter is energized and operating.

Step No.	Modular Unit	Operation	Normal Indication
1	HFL-100	IMPORTANT - Rotate RF GAIN control fully counterclockwise.	OUTPUT meter on TMA-1K unit indicates minimum output.
2	TMA-1K	Set HV switch to down (off) position.	HV indicator lamp goes off.
3	SME(R)-5	Rotate CHANNEL selector switch to desired channel.	Index on knob indicates channel selected. Bandswitches in HFL and TMA units rotate (audible).
4	HFL-100 & TMA-1K	Note band selection.	Band indicators show selected band.

CAUTION

Be certain that band selected is the one which will accommodate the operating frequency.

5	TMA-1K	Set HV switch to up (on) position.	HV indicator lamp lights. IP meter indicates approximately 200 ma.
6	TMA-1K	Press RESET button to initiate automatic tuning.	At resonance output increases. READY indicator lights.
7	HFL-100	Rotate RF GAIN control clockwise to obtain the required output.	OUTPUT meter on TMA-1K indicates output level.

This completes the retuning sequence.

TABLE 3-4. MANUAL TUNING PROCEDURE

Step No.	Modular Unit	Operation	Normal Indication
1	SME(R)-5	Select operating frequency with CHANNEL selector switch.	Index on knob indicates channel selected.
2	SME(R)-5	Select operating mode with MODE selector switch.	Index on knob indicates mode selected.
3	SME(R)-5	If applicable adjust UPPER SIDEBAND and LOWER SIDEBAND switches to accommodate intelligence inputs.	Index on knob indicates selection.
4	HFL-100	Set LOCAL/REMOTE switch to LOCAL.	Index on knob indicates selection.
5	TMA-1K	Set MANUAL/AUTO/REMOTE switch to MANUAL.	Index on knob indicates selection.
6*	CB Panel	Set circuit breakers to ON position.	AC indicator lamp lights.
7	HFL-100	Set AC switch to ON position.	AC indicator lights.
8	TMA-1K	Set AC switch to up position (on).	AC indicator lights. Band indicator lights.
9*	SME(R)-5	Set ON/OFF switch to ON.	POWER indicator lamp lights.

CAUTION

Allow sufficient time for tube filiments to heat (at least one minute) before proceeding.

10	HFL-100	Set HV switch to ON position.	HV indicator lamp lights. IP meter indicates 50-70ma.

TABLE 3-4. MANUAL TUNING PROCEDURE (cont)

Step No.	Modular Unit	Operation	Normal Indication
11	HFL-100	Press and release the BAND pushbutton sequentially until bandswitch is positioned properly for the selected operating frequency.	Band indicators light to indicate selected band.
12	TMA-1K	Press and release the BAND pushbutton sequentially until bandswitch is properly positioned for the selected operating frequency.	Band indicators light to indicate selected band.

CAUTION

Be certain that band selected is the one which will accommodate the operating frequency.

13	TMA-1K	Set HV switch to up (on) position.	HV indicator lamp lights. IP meter indicates 300 ma.
14	TMA-1K	Operate the TUNE lever switch to obtain the required normal indication.	OUTPUT meter indicates the highest obtainable output (peak) when resonance is achieved.

NOTE

A peak reading on the OUTPUT meter should be accompanied by a decrease (dip) in the magnitude of the plate current as indicated on the IP meter. When the transmitter is tuned automatically, the READY indicator lights to indicate completion of tuning. The transmitter is then ready for transmission of intelligence. When the transmitter is tuned manually, the operator must determine, by the observation of normal indications, that the transmitter is properly tuned and ready to transmit intelligence. Refer to paragraph 3-5 for intelligence operation.

TABLE 3-4. MANUAL TUNING PROCEDURE (cont)

Step No.	Modular Unit	Operation	Normal Indication
15	TMA-1K	Adjust the ALDC control so that maximum allowable output is not exceeded.	OUTPUT meter indicates average rf output power.

*NOTE

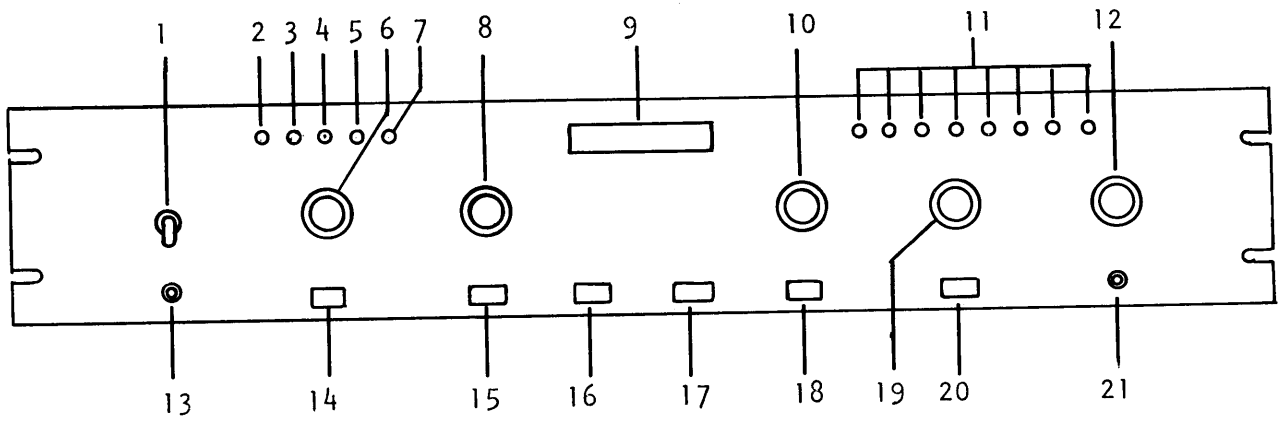
Except for the initial start up or if the transmitter has been completely shut down for an extended period of time steps 6 and 9 of table 3-4 are not required. Good operating practice dictates that power be continually supplied to the SME-5 exciter so that the oven temperature for the cystal controlled oscillators be stabilized.

This completes the manual tuning sequence.

b. REMOTELY TUNING THE TRANSMITTER. Before the transmitter can be operated or controlled from the remote station it must have been energized and in an operational state. This is accomplished by the local operator who should follow the steps given in table 3-1 and 3-2.

Following this initial tuning, the operator may transfer control of the transmitter to the remote station by resetting the channel-mode and the sideband control switches on the SME(R)-5 exciter to the REMOTE position, the LOCAL/REMOTE switch on the HFL-100 amplifier to the REMOTE position, and the MANUAL/AUTO/REMOTE switch on the TMA-1K power amplifier to the REMOTE position. If installed, the jumper wire between terminals 17 and 18 of TB201 must also be removed. The remote operator can then control the essential transmitter functions.

Figure 3-1 is an outline drawing of the front panel of the AX5189 Remote Programmer. The list accompanying the figure identifies all of the remote station operator's controls by function.



Number	Name	Function
1	Toggle switch "ON"	Controls dc voltage input
2	LED indicator "HV"	Lights to indicate high voltage on
3	LED indicator "FAULT"	Lights to indicate fault in tuning sequence
4	LED indicator "RDY"	Lights to indicate transmitter is correctly tuned
5	LED indicator "PTT"	Lights to indicate push-to-talk circuit is activated
6	Selector switch "LSB"	Selects intelligence input line for lower sideband
7	LED indicator "DC"	Lights to indicate that dc voltage is being supplied
8	Selector switch "LSB"	Selects intelligence input line for upper sideband
9	VU meter	Indicates level of intelligence input
10	Selector switch "CHANNEL"	Selects channel corresponding to carrier frequency
11	LED indicators "1-8"	Light to indicate channel selected
12	Potentiometer - MIC/LVL	Adjusts level of audio input
13	Input jack "KEY"	Provides access for a dry contact key input
14	Pushbutton "LSB"	Initiates lower sideband selection tone signal to transmitter
15	Pushbutton "USB"	Initiates upper sideband selection tone signal to transmitter
16	Pushbutton "HV-ON"	Initiates tone signal to transmitter applying high voltage to tubes
17	Pushbutton "TUNE"	Initiates tone signal to transmitter removing high voltage from tubes
18	Pushbutton "TUNE"	Initiates tone signal to transmitter initiating tune sequence
19	Selector switch "MODE"	Selects operating mode
20	Pushbutton "MODE"	Initiates tone signal to transmitter selecting operating mode
21	Input jack "MIC"	Provides access for a microphone input

Nomenclature

Figure 3-1. Front Panel - AX5189 Remote Programmer

TABLE 3-5. REMOTE TUNING PROCEDURE

Step No.	Operation	Normal Indication
	NOTE Index numbers refer to figure 3-1.	
1	Set the dc control switch (1) to ON.	DC indicator (7) lights. Status indicators (2 & 4) light. Band indicator (11) for tuned channel lights.
2	Press HV OFF button (16) to verify control.	HV indicator (2) goes out.
3	Set MODE selector switch (19) to desired operating mode.	Index on knob indicates selection.
4	Set CHANNEL selector switch (10) to desired channel.	Index on knob indicates selection.
5	Adjust sideband switches (USB and/or LSB) (6 & 8) for proposed intelligence input.	Index on knob indicates selection.
	CAUTION Do not press more than one pushbutton at a time.	
6	Press USB and/or LSB button (15 & 14) as applicable.	None
7	Press MODE button (20).	None
8	Press HV ON button (17).	HV indicator (2) lights.
9	Press TUNE button (18).	When tuning sequence is complete RDY indicator (4) lights.

TABLE 3-5. REMOTE TUNING PROCEDURE (cont)

Step No.	Operation	Normal Indication
	NOTE Should FAULT indicator (3) light, press TUNE button (18) again. Repeated fault indications are a sign of a transmitter malfunction and troubleshooting procedures should be initiated.	

This completes the remote tune sequence and the transmitter is prepared to receive intelligence.

NOTE

When providing audio inputs with a microphone, the RDY indicator (4) will be extinguished when the push-to-talk circuit is activated and the PTT indicator (5) will light. Should the RDY indicator (4) remain lighted the push-to-talk circuit of the transmitter has not been properly energized.

3-5. OPERATING PROCEDURES FOR INTELLIGENCE MODE

Once the GPTR-1KE/4 transmitter has been tuned and a READY indication obtained it may be operated at full power in any operating mode. The mode and power level at which it is operated is determined by the type of intelligence to be transmitted and by local conditions. In any case, neither the 500 watt average power limit, nor the 1 KW PEP limit should be exceeded. Thus in CW and FSK modes of operation the average power rating is the limiting factor since only a single tone is being transmitted. However, in the sideband modes with multi-tone or voice transmission the average output power must be reduced to maintain the PEP rating. As shown graphically and by formula in figure 3-2, as the number of transmitted tones is increased, the average power must be decreased if the PEP limitation is to be met. In making this computation it was assumed that all tones were in phase, which in actual practice does not happen. With certain intelligence, the repetition rate of the peak envelope can be determined as can the ratio of average power to peak envelope power. With most intelligence however, the peaks occur at a random rate and at random amplitude. In actual practice the normal ratio of peak to average power is about 4 or 5 to 1 in sideband transmission.

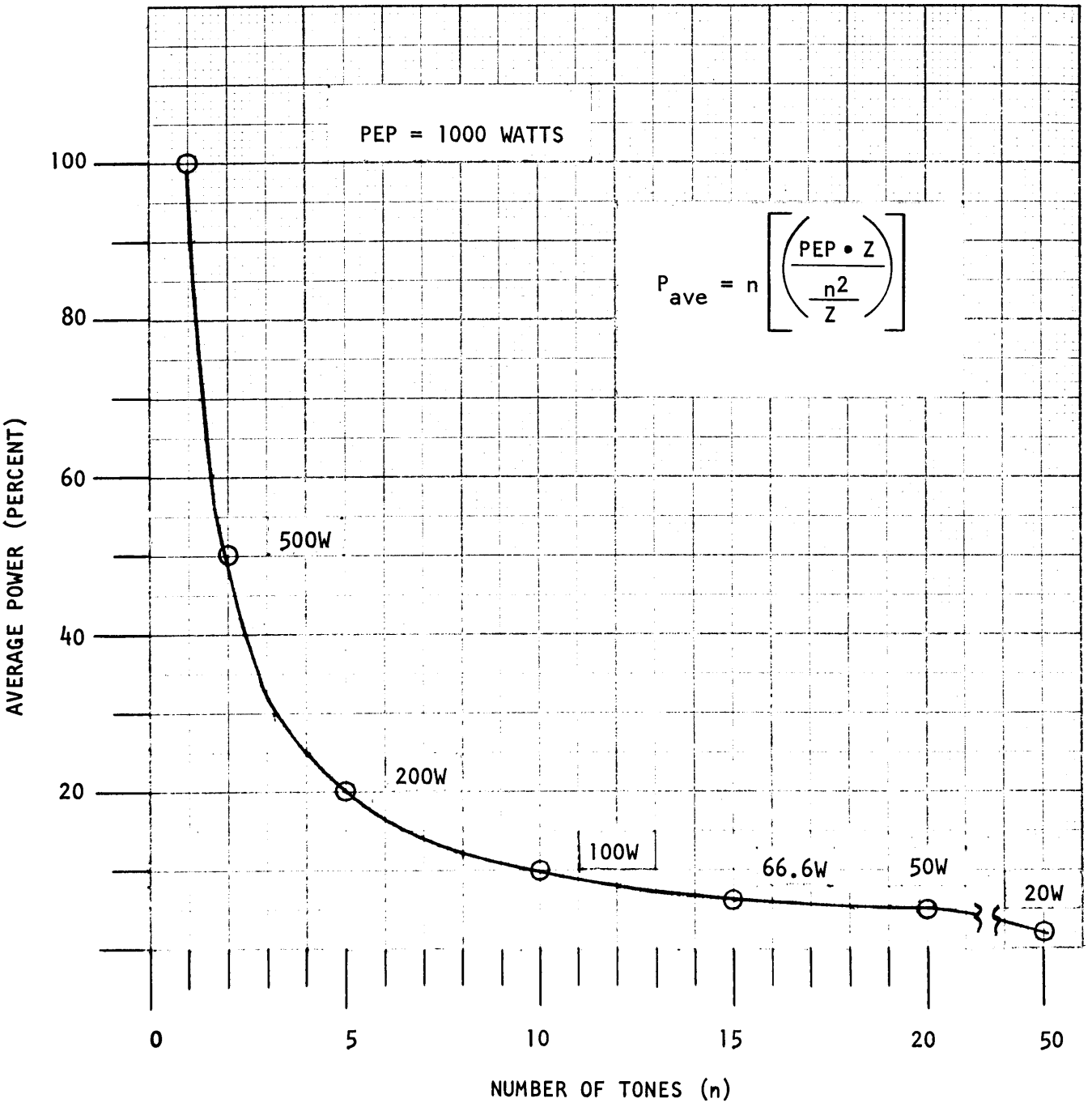


Figure 3-2. Ratio of Average Power to PEP as a function of tones

The ALDC circuit, which is a feature of TMC transmitters, allows the operator to transmit as much average power as possible, while limiting the occasional high peaks of the envelope to a point within the capability of the transmitter at which a minimum of distortion is generated.

The average power, which is indicated on the OUTPUT meter, will necessarily vary with the operating mode and the type of intelligence being transmitted. That portion of the average power used to transmit the carrier frequency is determined by the amount of carrier suppression. In the CW, MCW, and FSK modes the transmission of the carrier is not suppressed; merely modulated or interrupted. The full average power, in this case 500 watts, may therefore be used for its transmission. In the AME mode the carrier is transmitted at a power level 6 db down from PEP or at 250 watts average. When transmitting in the pilot carrier mode 10 watts of power are used, as the carrier is suppressed to the 20 db level. In the suppressed carrier mode the transmission of the carrier is completely suppressed (-55 db) and consumes only three milliwatts of power.

That portion of the available power not used to transmit the carrier frequency is available to transmit intelligence. The nature of the intelligence being the determining factor. For example: a single sideband (A3J) transmission of two tones with the carrier fully suppressed (SUPP CARR mode) could be made at the 500 watt average power level with out exceeding the PEP rating of the equipment. The more complex the intelligence input in terms of the number of tones to be transmitted the lower the average power indication on the OUTPUT meter should be.

Careful adjustments of the ALDC circuit and operator skill in adjusting the RF GAIN and input levels will ensure efficient operation with a minimum chance of equipment damage.

Before operating the transmitter in any intelligence mode recheck the tuning as outlined in table 3-3 or 3-5. If the operating frequency is not to be changed, do not perform step 3 but check the channel setting. Steps 4 through 9 of table 3-2 outline the procedure for applying power to the transmitter. Connect the external signal source to the transmitter. If a microphone is to be used set the VOX/PTT switch on the SME(R)-5 exciter to the PTT position.

a. MONITORING THE TRANSMITTER

Perhaps the most practical method of ensuring that the design limits of the transmitter are not exceeded while making the most efficient use of the power avaliable to transmit intelligence, is to monitor the rf voltage output of the transmitter. When a limit is established, under design conditions, for that voltage the transmitter may be operated in any sideband mode without placing undue stress on the components if the established limit is not exceeded.

It will be seen by reference to figure 3-2 that the design criteria for the maximum average power and PEP (500 watts average 1000 watts peak) is met when two tones are applied to the transmitter. Thus, if a sample of the output is measured through a voltage divider network on an oscilloscope under these conditions, a visual reference will be established indicative of the transmitter design limits.

A numerical reference representing the absolute value of PEP may similarly be established with the use of a peak reading vacuum tube voltmeter with the scale calibrated in terms of RMS value. The Hewlett-Packard Model 410B is such an instrument.

For example: Since Power (P) equals E^2/R, if R is constant P will vary as the square of the voltage. Then, if PEP (max) = 1000 volts and Emax = Reading on VTVM when two tones are applied (e.g. 10 volts) the actual peak envelope power (PEPa) at anytime may be calculated by taking a voltmeter reading (E_r) and using the following formula.

$$PEP(a) = \frac{PEP\ (max)}{\left(\frac{Emax}{Er}\right)}$$

Let us say that a reading of 8.75 is obtained on the voltmeter. The actual PEP of the transmitter at that time is:

$$PEP(a) = \frac{1000}{\left(\frac{10V}{8.75V}\right)}$$

$$= \frac{1000}{1.142}$$

$$= \frac{1000}{1.306} = 765.7 \text{ watts}$$

Note that the figure of 10 volts in the foregoing example was used only to demonstrate the measuring principle. In practice the value would depend upon the design of the voltage divider network but the principle will remain the same.

3-6. OPERATOR MAINTENANCE

WARNING

Before working on the interior of the transmitter disconnect the power supply of the AX5190 Decoder tone package to prevent the accidental application of high voltage by the remote operator.

Day-to-day visual checks of the equipment will detect the most obvious defects; frayed cables, blown fuses, burned-out indicator lamps, cracked glass or broken knobs. A more thorough visual inspection including those components housed in the equipment cabinet should be made at regular intervals. Components showing signs of wear, aging or overheating should be noted and replaced if necessary. Accumulated dust or other foreign material should be removed. A regular program of operator care and the repair or replacement of defective minor parts may prevent serious failures and unnecessary "downtime".

CAUTION

Replacement parts should be identical to the part being replaced to ensure proper operation.

At regularly scheduled intervals each of the units which comprise the transmitter should be removed from the cabinet and given a very thorough cleaning and inspection. Each unit should be tested individually as called for in the technical manual for the unit.

An effective preventive maintenance program will extend the life of the unit and provide prolonged periods of trouble-free service.

SECTION 4

PRINCIPLES OF OPERATION

4-1. GENERAL INFORMATION

Technical Materiel Corporation's Model GPTR-1KE/( ) transmitter was designed to be tuned and operated from a remote station some distance from the transmitter location. To accomplish this a Model ADC-5 Analog Digital Control System has been incorporated into a type GPT transmitter system.

A Model SME(R)-5 exciter, a Model HFL-100 linear amplifier, a Model TMA-1K power amplifier and a Model AX5190 decoder (part of the ADC-5 system) are housed in a standard 19 inch equipment cabinet at the transmitter site. A Model AX5189 programmer (the other component of the ADC-5 system) is located at the remote station. The two locations are interconnected by a pair of 600 ohm transmission lines.

Technical manuals for the individual units of the system discuss their circuitry. This section refers to these units only insofar as they effect the overall system operation.

4-2. SYSTEM OPERATION

A block diagram, figure 4-1, depicts the functional relationship of the transmitter components. The transmitter may be operated from the transmitter site or from a remote station.

Since the GPTR-1KE/( ) is designed primarily for remote operation, this discussion will approach it from that point of view. The transmitter may, however, be operated locally and may be manually tuned should that type of operation be desirable.

a. Channel Selection. The operating frequency is selected by the setting of the CHANNEL selector switch on the AX5189 remote programmer. Up to eight channels are available, each representing a fixed crystal controlled frequency. The final digit in the model number shows the number of channels included in a specific transmitter.

Pressing the TUNE pushbutton on the programmer activates the send/receive tone package associated with it. The tone package generates tone signals, the frequency of which is indicative of the binary code bits representing the channel selected. This signal is transmitted to the transmitter site via the two interconnecting transmission lines. In the transmitter the tone signal activates specific receiver modules in the AX5190 receive/send

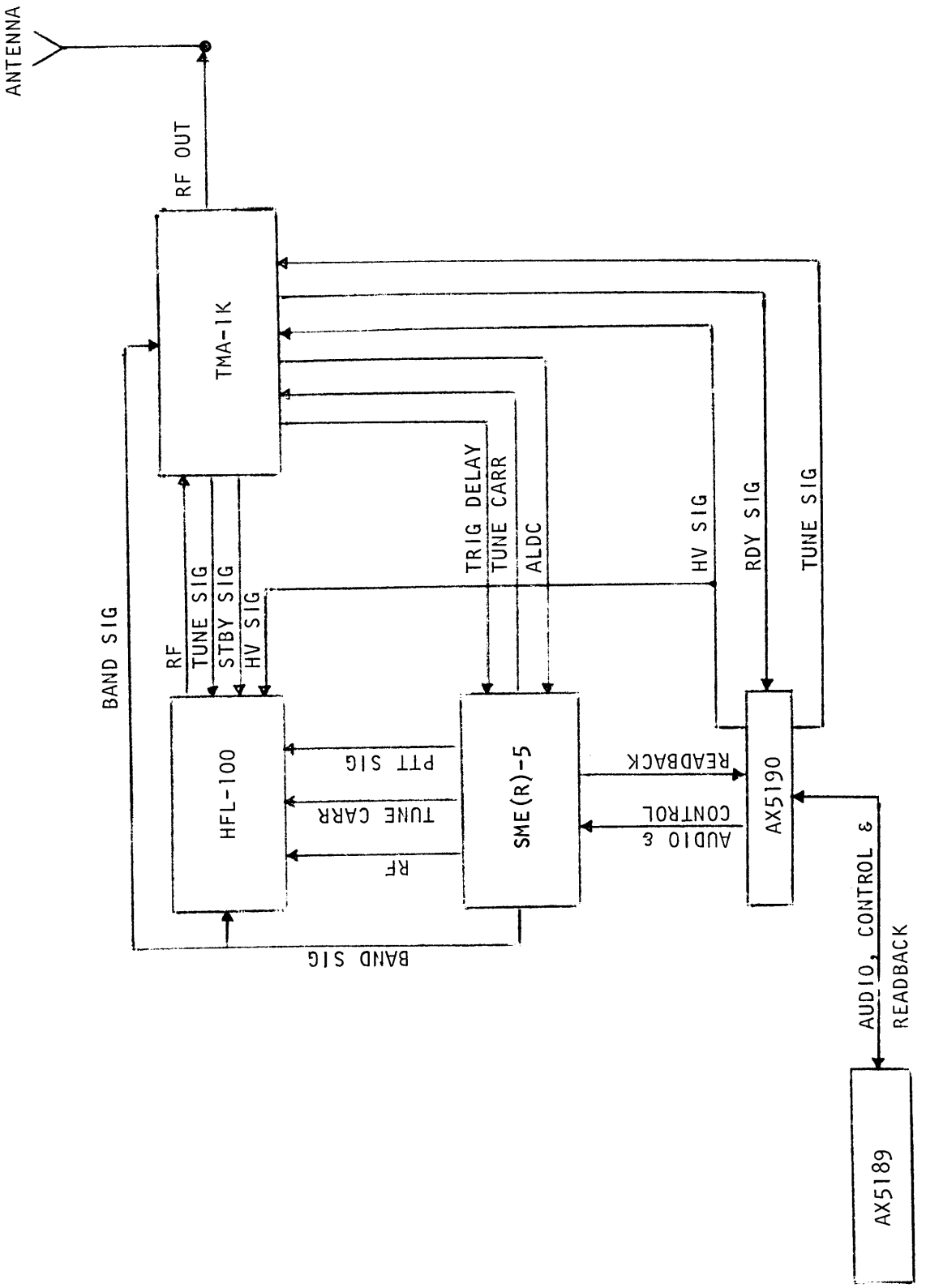


Figure 4-1. Block Diagram, GPTR-1KE/( )

tone package. Through logic circuitry in the tone package, a ground signal is routed via jack J203 on the interface panel to a specific pin of J119 on the SME(R)-5 exciter. Pins A through H of J119 represent channels 1 through 8 respectively. From J119 the ground signal is directed to a terminal (3,4,5,6, R,S,T, or U) on the "Extended Mode and Channel Select" PC board (A11) in the exciter where it activates one of the eight relays on this board.

The activated relay on the A11 PC board directs a 24-volt signal through the "Mixer Doubler" circuit (A13) to the RF Amplifier section of the exciter (A14) where it affects the operation of the amplifier corresponding to the channel selected. The 24-volt signal is also directed to the "Program Board" (A5615).

Diode jumpers on the Program Board direct the signal to the proper pin of J120 to correctly position the band switches in the TMA-1K amplifier and in the HFL-100 amplifier to accommodate the frequency generated in the selected channel.

b. Bandswitching Signal Flow. Each of the pins A through I (except H) of J120 on the SME(R)-5 exciter represent a specific frequency band. They are connected through the transmitter wiring harness to TB101 of the TMA-1K amplifier, terminals 1 through 8.

Table 4-1 describes the interconnections and shows the frequency band associated with each.

TABLE 4-1. BAND SIGNALS FROM THE SME(R)-5 EXCITER

SME(R)-5 J120*	Frequency Band	TMA-1K TB101
A	2.0 - 2.5999	15
B	2.6 - 2.9999	14
C	3.0 - 4.9999	13
D	5.0 - 7.9999	12
E	8.0 11.9999	11
F	12.0 - 15.9999	10
G	16.0 - 23.9999	9
I	24.0 - 29.9999	8

*Note that pin H is omitted in this sequence.

The signal coming into the TMA-1K triggers a SCR, Q101, which causes a ledex motor to rotate the bandswitch to a position which corresponds to the selected carrier frequency. The correct values of inductance and capacitance are inserted in to rf circuit by positioning the bandswitch.

The bandswitching signal voltage is also directed to the HFL-100 amplifier through the transmitter wiring harness. Here it controls the positioning of the bandswitch in that unit in a similar manner. The signal enters the HFL-100 via terminal board TB101 terminals 5 through 12. This interconnection is described in table 4-2 .

TABLE 4-2. BAND SIGNALS TO THE HFL-100

TMA-1K TB101	Frequency Band	HFL-100 TB101
8	24.0 - 29.9999	5
9	16.0 - 23.9999	6
10	12.0 - 15.9999	7
11	8.0 - 11.9999	8
12	5.0 - 7.9999	9
13	3.0 - 4.9999	10
14	2.6 - 2.9999	11
15	2.0 - 2.5999	12

If a Model ATSA-3 antenna tuning system is included in the transmitter the bandswitching signals are also sent to that equipment. Reference to the interconnection diagram will clarify these connections.

c. Mode Selection Circuitry. When the operating mode is selected by positioning the MODE selector switch on the programmer, and the MODE pushbutton pressed, specific tone signals are generated by the send/receive tone package in the AX5189 programmer. These tone frequencies represent the bits of the binary code indicative of the mode selected. They are directed to the transmitter site over the interconnecting transmission lines. In the transmitter the AX5190 decoder translates the tones by means of logic circuits and routes a ground signal to J119 (Pins I, J, K, L or M) on the SME(R)-5 exciter. In the exciter logic circuits on the "Extended Mode and Channel Select" PC board (A11) control the output of the "AF Amplifier and Oscillator" board (A20) so that the carrier signal is correctly suppressed for the operating mode selected.

d. Sideband/Line Selection. The selection of USB or LSB and the input line on each band is also controlled from the remote station by tone signals. The tone signals representing the binary code for the input line selected are transmitted to the AX5190 decoder when either the USB or LSB pushbutton on the AX5189 decoder is pressed. Again, the decoder sends a ground signal to J119 of the exciter. Pins N, P, R, and S represent Line 1, Line 2, MIC/KEY and FSK on the upper sideband. Their counterparts on the lower sideband are represented by pins T, U, V, and W. Within the exciter the ground signal is routed from J119 to the proper pin of either the "Extended Line Select LSB" board (A4) or the "Extended Line Select USB" board (A5). The output signal from either of these PC boards controls the intelligence input to the "IF" board (A9).

e. Tuning Sequence. When the GPTR-1KE/( ) transmitter is being controlled from the remote station pressing the TUNE button on the programmer will initiate the tuning sequence at the transmitter. This signal is conveyed by tone freqencies via the transmission lines. The tune sequence may also be started by pressing the RESET pushbutton on the TMA-1K amplifier.

In either case a ground signal is transmitted to the SME(R)-5 through J120 pin J which activates the tune relay K2 which inserts the tune carrier voltage into the system. This same ground signal also activates the PTT relay to re-apply the grid voltage to V101 and V102 in the HFL-100 amplifier which is removed in a standby mode. With the grid voltage re-applied, there is an indication of plate current on the Ip meter of the HFL-100 amplifier. The value of the plate current is controlled by the tune level control of the SME(R)-5 exciter. The "sense" circuit of the TMA-1K amplifier causes the servo system circuit to direct the rotation of the tuning motor, adjusting the variable tuning capacitor until resonance is achieved. When the tune cycle is complete, the RDY indicator on the programmer lights as does the READY indicator on the amplifier. The tune carrier circuit is deactivated, the ALDC circuit is activated and the system is prepared to receive intelligence. In the PTT mode the PTT line is opened for external control.

f. The ALDC Circuit. The automatic load and drive control circuit of the TMA-1K amplifier develops a small negative voltage which is proportionate to the strength of the output signal. This voltage is sent via the output jack J104 to the SME(R)-5 exciter input jack J127. In the exciter it is directed to pin 7 of the "IF" board (A9). Here it is summoned with the internal IF signal and adjusts the input to PC board A13, the "Mixer-Doubler" circuit thus improving linearity and limiting distortion by eliminating peaks and surges in the rf signal. The rf output level at which the ALDC circuit will function is adjusted by means of a front panel control on the TMA-1K amplifier.

g. Readback Signals. So that the operator at the remote station will know the operating status of the transmitter, binary code signals in the form of tone frequencies are sent from the transmitter to the remote station. These signals are indicative of certain critical transmitter functions, namely HV ON, RDY and PTT. Figure 4-2 is a series of funtional block diagrams which trace the internal signals from the initiation of the control signal at the AX5190 Decoder through the origin of the readback signal then returning to the decoding unit where the tone signals to be sent to the remote station are generated. The FAULT indication is controlled by an internal timing circuit in the AX5189 programmer.

(1) HV ON Readback (See figure 4-2A) When the high voltage circuits of the amplifiers are activated, the high voltage control relay K102 in the HFL-100 amplifier is activated. A ground signal circuit is established through the bypassed (jumpered) contacts of the standby relay K101. The signal is routed through TB101 to J203 pin f on the interface panel. From

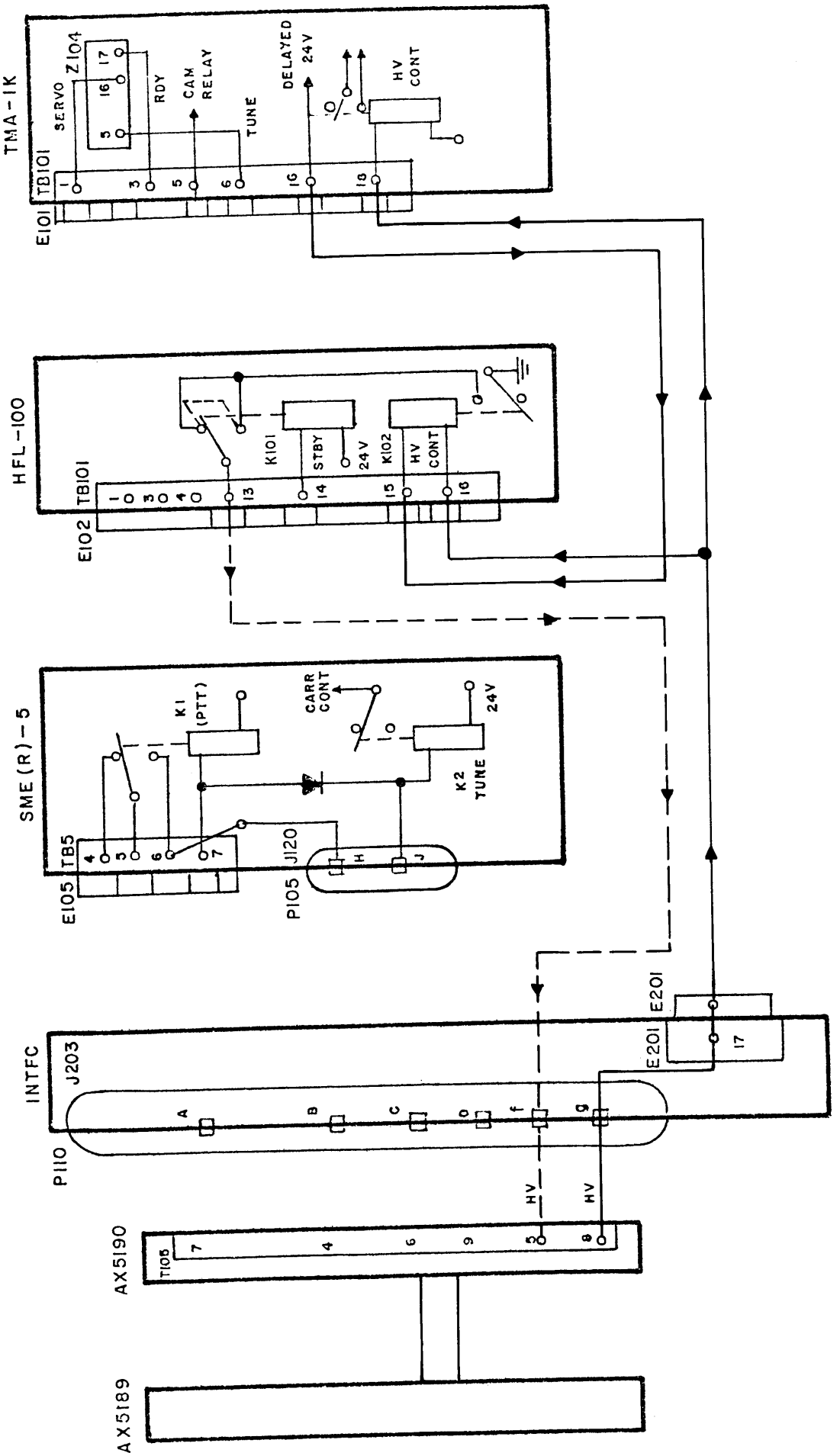


Figure 4-2A. Control and Readback Signals - HV ON

the interface panel it is carried by the cabling associated with P110 (which mates with J203) to terminal 5 of TB105 of the AX5190 decoder. The decoder translates the ground signal to specific tone frequencies which are sent via the transmission lines to the AX5189 programmer at the remote station. The programmer processes the received tones so that the HV indicator on the front panel lights.

(2) RDY Readback (See figure 4-2B) A signal indicative of the completion of the tuning cycle is initiated by the servo system (Z104) in the TMA-1K amplifier. When the cycle is complete, a ground signal, which is routed to terminal 3 of TB101, appears at pin 17 of the servo PC board. The signal is carried through the transmitter wiring harness to pin c of J203 on the interface panel. Through the P110 cable it reaches pin 6 of TB105 of the decoder. The decoder generates the tone signals which when received at the remote station are translated into a ground signal which causes the RDY indicator on the front panel to light.

(3) PTT Control and Indications (See figure 4-2C) Two important operational actions take place when the push-to-talk switch on the microphone is pressed. The SME(R)-5 exciter is switched to the push-to-talk mode and unneeded tone signals are removed from the interconnecting transmission lines. The latter action frees the lines to better accommodate the audio input from the microphone.

When the switch is pressed a relay (K1) in the AX5189 programmer is actuated which initiates the transmission of the tone frequencies indicative of the push-to-talk mode to the transmitter. When received at the transmitter these tones signals are translated to a ground signal which is carried by the cabling to pin A of P110 which mates with J203 on the interface panel. The internal wiring harness carries the signal from this point to TB3 pin 7 on the SME(R)-5 exciter. In the SME(R)-5 the ground signal actuates the push-to-talk relay (K1). With this relay actuated a ground circuit is established through the closed contacts which is directed to pin H of J120. The signal is then routed via the harness through the interface connection (at pin B) to the decoding unit. The receipt of this signal in the AX5190 unit eliminates all of the currently operating readback tones from the transmission lines.

So that the remote operator will have a true picture of transmitter status when the readback tones are eliminated, auxiliary circuits in the AX5189 remote programmer maintain the PTT and HV indications. The RDY indicator will go out however as an indication that the push-to-talk circuit is functioning. A ground circuit established when relay K1 in the programmer is actuated prevents the FAULT circuit from being activated.

(4) TUNE Indications Although no provision has been made for a "tuning indicator" as such, the remote operator will know that the transmitter is in the tune cycle when immediately after pressing the TUNE push-button, the lighted indicators on the front panel (except DC) are extinguished. Thus a status indication is obtained to keep the remote operator

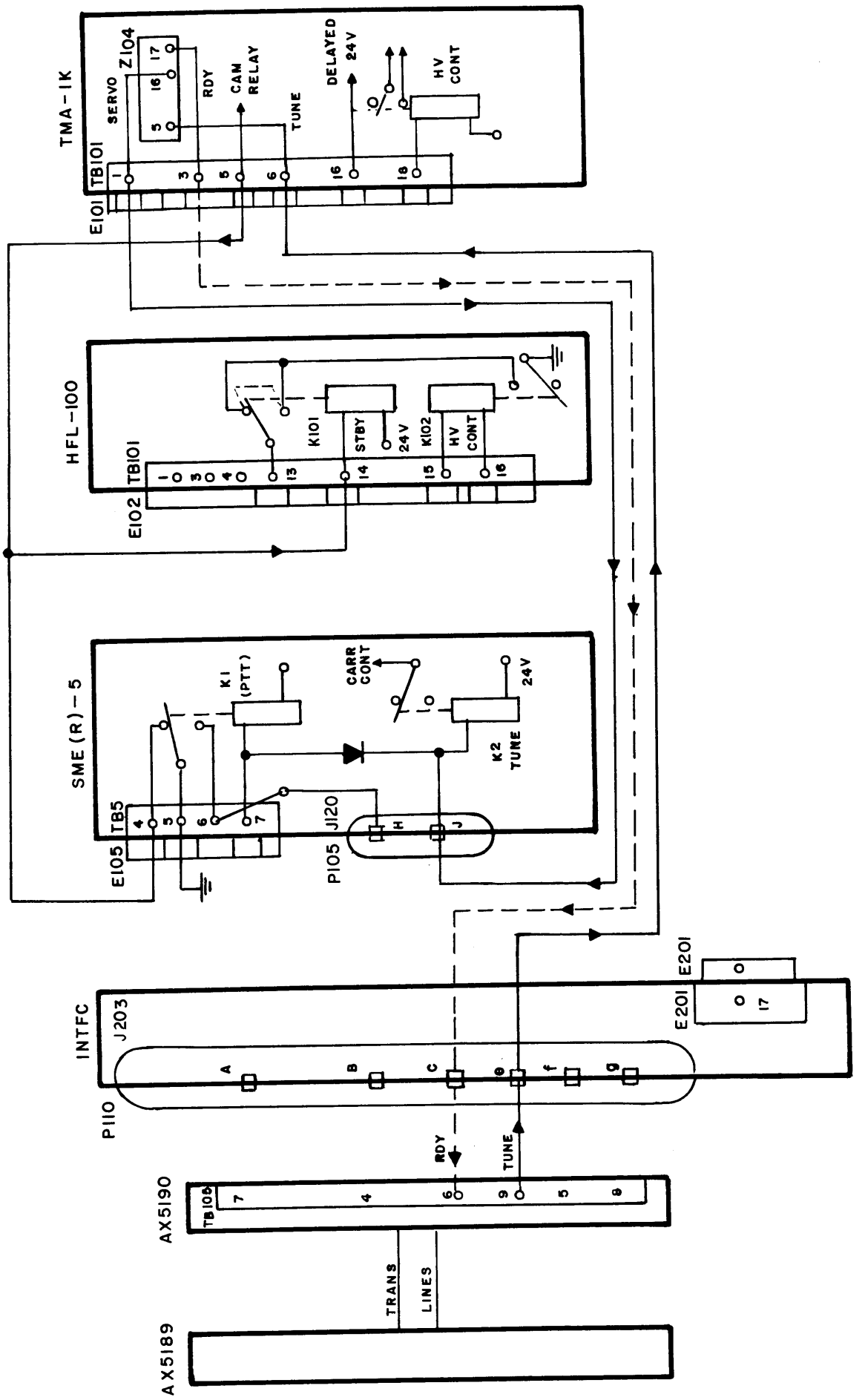


Figure 4-2B. Control and Readback Signals - Tune/Ready

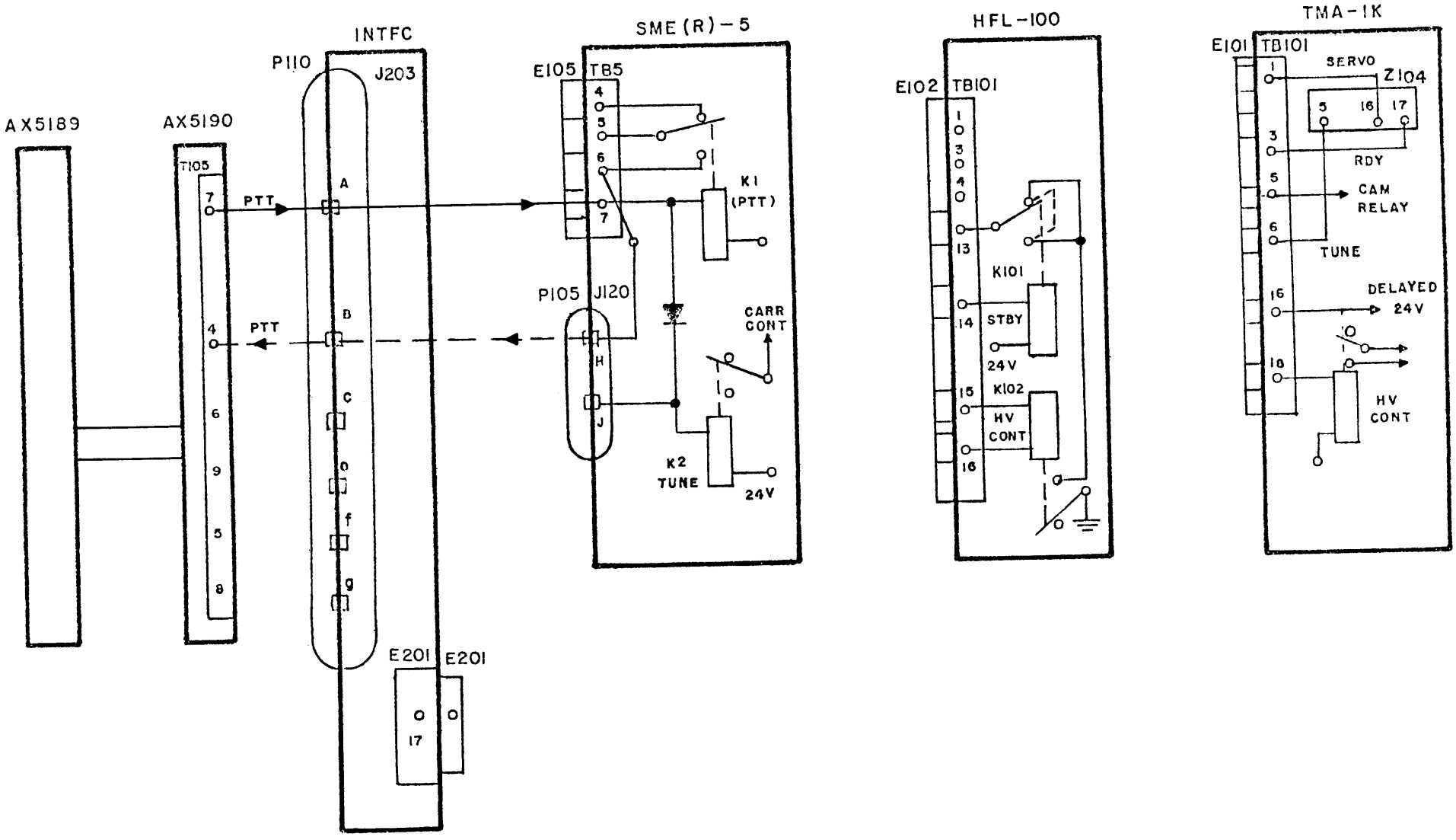


Figure 4-2C. Control and Readback Signals - Push-to-talk

totally cognizant of transmitter operation.

When the TUNE pushbutton at the remote station is pressed, the AX5189 remote programmer transmits tone signals indicating this fact to the decoder in the GPTR transmitter. In the decoder the tone signals are interpreted and a ground signal is directed from terminal 9 of TB105 to pin e of J203 through the internal cable and P110. The transmitter wiring harness carries this signal to pin 6 of TB101 on the TMA-1K amplifier.

In the TMA-1K this ground activates the servo assembly circuit Z104. At this point, the "ready" signal emanating from terminal 17 of the servo assembly is lost. While the servo system is operating to control the tuning of the transmitter, both the "tune" relay (K2) and the "PTT" relay (K1) in the SME(R)-5 exciter are actuated.

The "tune" relay (K2) is actuated by a ground signal from terminal 16 of the servo (Z104) routed through TB101-1 to pin J of J120 on the SME(R)-5 exciter. This same signal also actuates the "PTT" relay through diode CR18. With the "PTT" relay actuated the HV readback signal is removed from the transmission lines.

Should the transmitter fail to tune within the allotted time (approximately 55 seconds), the FAULT indicator at the remote station will light. This fault indication at the remote station is controlled by a programmer timing circuit described in the following paragraph.

(5) FAULT Indication Control A portion of the schematic diagram for the AX5189 programmer showing the fault indication circuit is reproduced as figure 4-3.

Under normal operating conditions the fault indication circuit is held in a quiescent state by the "ready" signal being received at the remote station from the transmitter (refer to paragraph 4-2g(2) or by the PTT auxiliary ground circuit (refer to paragraph 4-2g(3)).

When the servo circuit of the TMA-1K amplifier is activated by pressing the TUNE pushbutton, this signal is lost. With the loss of the ground circuit the 24 vdc supply immediately begins to positively charge capacitor C16 through resistor R23 of the fault timing circuit. If circuit conditions are not changed by the return of a ground circuit this will result in the unijunction switch Q11 conducting after 50 to 60 seconds have elapsed.

Under normal conditions Q11 does not conduct, for, at the completion of the tuning cycle the "ready" readback ground signal will provide a path to ground for the charging voltage.

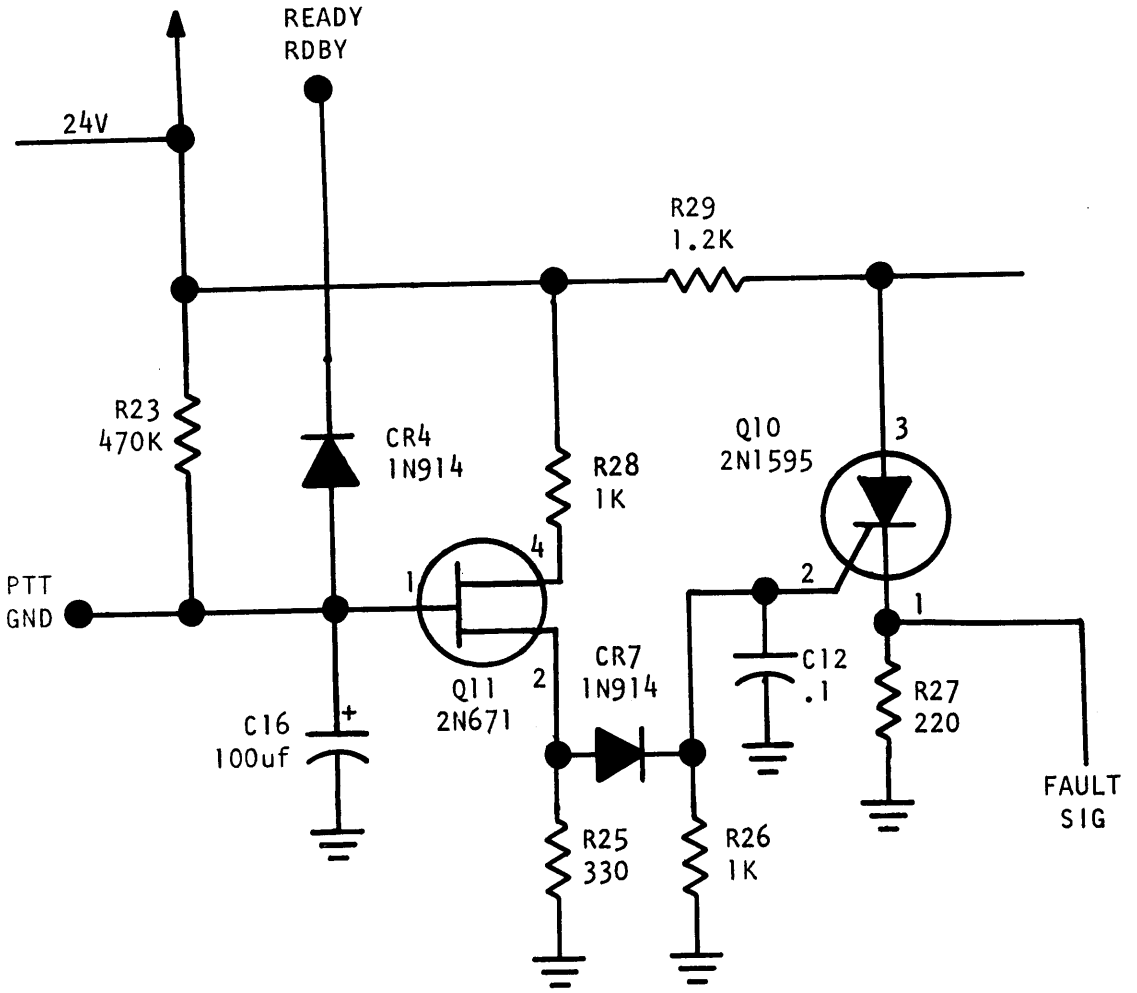


Figure 4-3. Fault Indication Control Portion of AX5189 Programmer

Should a malfunction in the tuning cycle prevent the "ready" signal from being received, the 24 vdc will continue to charge capacitor C16. When this capacitor reaches a positive potential of approximately 16 volts the unijunction switch Q11 will conduct.

When switch Q11 conducts, a triggering voltage is provided to the fault SCR, Q10. When Q10 fires a positive fault signal will be sent to the fault indicator which will then light.

SECTION 5

MAINTENANCE

5-1. INTRODUCTION

During the design phase of the Model GPTR-1KE/( ) transmitters, due consideration was given to elimination of shutdowns caused by equipment failure. Providing that the operating limitations are recognized and adhered to, long-time trouble free operation may be expected when the recommended preventive maintenance schedule is followed. The Technical Materiel Corporation recommends that only technicians familiar with the equipment and knowledgeable of normal solid-state troubleshooting techniques be allowed to adjust or service the equipment. Technical manuals which have been prepared for each of the modular units of the system should be consulted for details about each of these components. Reference to the block diagram (figure 4-1) and to the interconnecting diagram (figure 2-2) will assist the technician in solving any system problem which might arise. Schematic diagrams for each of the system components are furnished in the individual technical manuals.

5-2. TEST EQUIPMENT

TABLE 5-1. TEST EQUIPMENT

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

Additional test equipment which may be necessary is listed in the individual technical manuals for system components.

5-3. PREVENTIVE MAINTENANCE

Preventive maintenance may be defined as those regularly scheduled inspections and minor repairs which are designed to minimize the possibility of major breakdowns. Much of the preventive maintenance program may well fall with the scope of the operator's responsibility. The time spent on a

daily effort to eliminate dust and dirt and a weekly internal inspection to discern deteriorated components is well invested. A program designed to discover potential sources of trouble, and immediate correction of minor flaws will result in the maximum "in service" time for the GPTR-1KE/( ) transmitter.

Each of the units is provided with monitoring instrumentation. The normal indications are given in the individual technical manuals. The reason or cause for abnormal indications should be immediately investigated and any erroneous condition rectified. Daily care assures less major repair.

5-4. CORRECTIVE MAINTENANCE

A good preventive maintenance program performed on schedule will make little corrective maintenance necessary. If in spite of all precautionary measures a failure occurs the cause should be determined so that recurrence may be prevented. It is therefore, suggested that only a trained technician familiar with the equipment perform corrective maintenance.

WARNING

High voltages will be encountered at several locations in the GPTR-1KE/( ) transmitter. Extreme caution is mandatory when servicing the transmitter or its components.

The operator and technicians working with the transmitter must know the locations within the units where high potentials exist. Source power should be removed from the transmitter before any leads or cables are disconnected.

WARNING

When source power is removed, unplug the main power input connector and tag to prevent an inadvertant reconnection.

If a failure occurs do not overlook the simple solutions to the problem. Even experienced technicians often miss what might seen to be "obvious"; blown fuses, source power failure, signal input missing, loose connections and the like.

When simple solutions fail, isolate the fault to a specific modular unit. Then troubleshoot that component as directed in the unit technical manual.

The use of the diagrams and drawings furnished, combined with normal troubleshooting techniques, and logical reasoning should enable the technician to locate the defective part and replace it.

NOTE

Only identical or electrically equivalent parts should be used when making replacements.

Parts lists, and identifying drawings when required are furnished in each individual technical manual.

5-5. MODULAR UNIT ISOLATION

Should it be necessary to check-out an individual unit it may be advisable to isolate it from the other components of the transmitter, and test it as an entity. The following paragraphs will assist the technician with such a procedure. Refer to figure 2-2 for system interconnections and reference designations of the connectors.

a. The SME(R)-5 Exciter

(1) Set all switches to an off position and remove P104 from J14.

(2) Disconnect P113 from J127 (ALDC IN).

(3) Remove E103 from TB1, E104 from TB2 and E105 from TB3.

(4) Disconnect P105 from J120.

(5) Disconnect P114 from J128 (RF OUT).

NOTE

The control signals to J119 may be simulated by external ground signals.

b. HFL-100 Amplifier

(1) Set all switches to the OFF position and disconnect P101 from the power source.

(2) Remove P203 from J103 (RF OUT).

(3) Remove P201 from J101 (RF IN)

(4) Connect a 50 ohm resistive dummy load or antenna system to J103.

(5) Connect an rf signal generator to J101.

(6) Provide primary power to P101 independent of the transmitter.

(7) Refer to the HFL-100 technical service manual for power distribution data and the operators manual for normal indications.

(8) The following electrical parameters may be helpful to the technician working with the HFL-100 amplifier.

Gain (db)	-	27.0
Input Power (Pi)	-	0.100 W
Output Power (Pe)	-	50.0 W
Input Voltage (Ei)	-	2.23 vrf
Output Voltage (Eo)	-	50.0 vrf
Load Impedance (Z)	-	50 ohms

c. The TMA-1K Power Amplifier

NOTE

The TMA-1K requires a 50 watt rf input. It is suggested that a properly adjusted HFL-100 amplifier be used as this source.

(1) Place all switches in an off position and remove P101 from J101 (AC IN).

(2) Remove P205 from J105 (RF OUT).

(3) Connect a 1 KW, 50 ohm, noninductive dummy load to J105.

(4) Disconnect P109 from J103 (RF IN).

(5) Remove the connections (E101) from TB101.

(6) Disconnect P102 from J102.

(7) Disconnect P112 from J104 (ALDC OUT).

(8) Connect a 12 inch jumper wire to TB101-17.

NOTE

This jumper may be used during operational tests to provide 24 volt bandswitching signals at TB101 terminals 8 through 15.

(9) Provide primary power to J101 (AC IN) independent of the transmitter.

(10) Connect a 50 watt rf source to J103 (RF IN) independent of the transmitter harness.

(11) Provide a ground connection to terminal 18 of TB101.

NOTE

During operational test a tune sequence may be initiated by pressing the RESET pushbutton on the front panel or by furnishing a ground signal to terminal 6 of TB101.

(12) Refer to the technical service manual prepared for the TMA-1K for maintenance data.

(13) The electrical parameters for the TMA-1K amplifier which may be of interest to a technician working with the unit are as follows:

Gain (db)	-	10.0
Input Power (Pi)	-	50.0 W
Output Power (Po)	-	500.0 W
Input Voltage (Ei)	-	50.0 vrf
Output Voltage (Eo)	-	158.1 vrf
Load Impedance (Z)	-	50 ohms

SECTION 6

PARTS LIST

6-1. GENERAL

The GPTR-1KE/( ) Transmitter consists of an SME(R)-5 exciter, HFL-100 linear amplifier, TMA-1K power amplifier and an ADC-5 digital control system. To these basic units may be added either the ATSA-3 antenna tuning system or the TFP-1K harmonic filter or both. A technical manual has been prepared for each of these equipments. Each contains a parts list for the specific unit to which reference should be made when ordering renewal parts.