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TECHNICAL MANUAL
for
GENERAL PURPOSE TRANSMITTER
MODEL GPT-350D
———
SYSTEM



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

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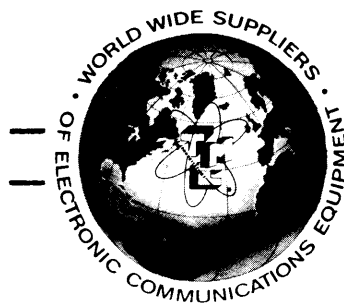
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THE TECHNICAL MATERIEL CORPORATION

COMMUNICATIONS ENGINEERS

700 FENIMORE ROAD

MAMARONECK, N. Y.

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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.
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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.

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*Electron tubes also include semi-conductor devices.

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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.

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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.

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

FOREWORD

TMC's General Purpose Transmitter, Model GPT-350D, consists of four major components as follows:

ATS-2 Antenna Tuning System

PAL-350A Linear Power Amplifier

GPE-1A General Purpose Exciter

VOX-5 Variable Frequency Oscillator

These four basic units are also included in various TMC transmitter systems as well as in the GPT-350D. To satisfy this condition most practically, individual manuals on each unit are written, then combined, as required, to cover any of the GPT-350's multi-model transmitters. The GPT-350D manual is made up of individual manuals as described in Table of Contents of General Purpose Transmitter, Model GPT-350D.

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MODEL GPT-350D

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3	Technical Manual for Linear Power Amplifier, PAL-350A
4	Technical Manual for General Purpose Exciter, Model GPE-1A
5	Technical Manual for Variable Frequency Oscillator, Model VOX-5
6	Appendix - Rack Wiring (includes information on APP-5 Panel)

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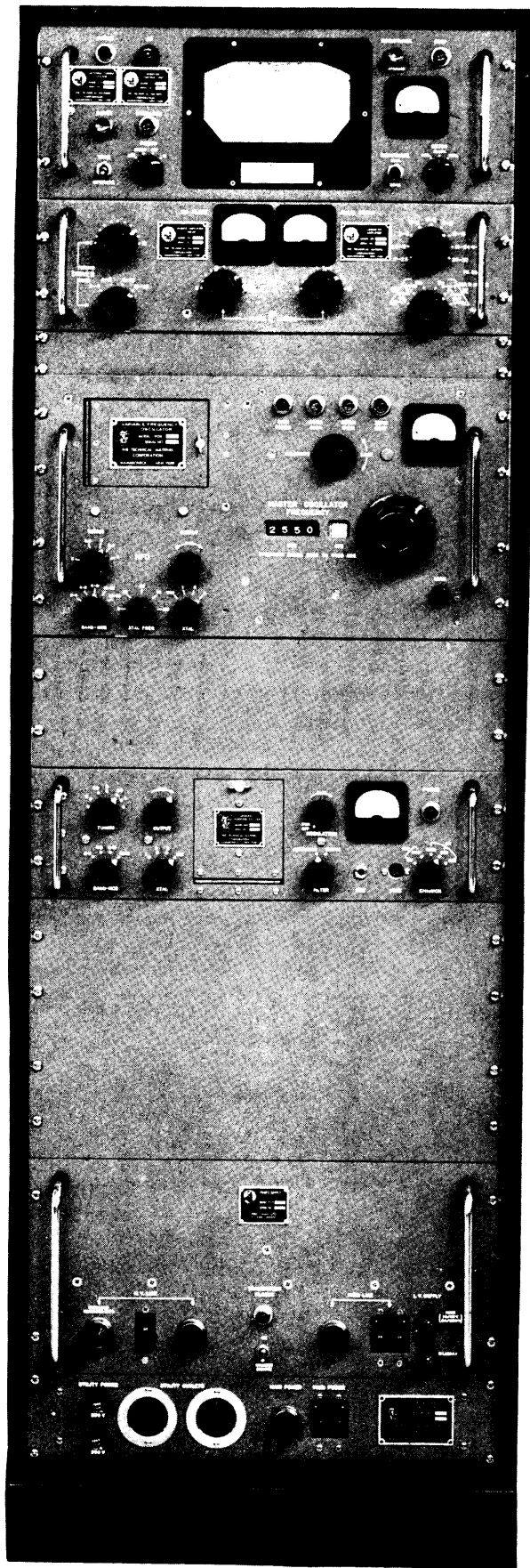


Figure 1-1. Front View, Model GPT-350D General Purpose Transmitter

SECTION 1

GENERAL DESCRIPTION

1-1 FUNCTION

a. OVERALL FUNCTION - Model GPT-350D General Purpose Transmitter transmits CW, MCW and AM in a frequency range of 2 to 32 megacycles. Its output is conservatively rated at 350 watts PEP (Peak Envelope Power). Carrier frequency is continuously adjustable through the range by front panel knob controls and stability is rated as 1 part in 1×10^6 per day. An antenna tuning circuit provides a high degree of match for transmitter output to any unbalanced load from 50 to 600 ohms.

b. COMPONENT FUNCTIONS - GPT-350D is made up of five main components: Model GPE-1A General Purpose Exciter, Model VOX-5 Variable Frequency Oscillator, Model PAL-350A Linear Power Amplifier, Model ATS-2 Antenna Tuning System, and Model APP-5 Auxiliary Power Panel.

Model GPE-1A General Purpose Exciter generates a 2-32 mc AM signal from mike or 600-ohm audio input with a push-to-talk feature available. The Exciter carrier may be keyed for CW transmission. MCW is produced by modulation of the carrier by a built-in 1-kc oscillator; keying of the modulated carrier is the same as that for CW.

Model VOX-5 Variable Frequency Oscillator generates the highly stable continuously adjustable 2-4 mc carrier frequency for GPE-1A Exciter. Frequency multipliers in the GPE-1A translate the carrier up to 2-32 mc before modulation. The VOX-5 oscillator circuit is contained in an oven; its output is read on a precise counter dial

on the front panel, with a zero beat light for calibration.

Model PAL-350A Linear Power Amplifier amplifies the 2-32 mc output of GPE-1A Exciter up to 350 watts (PEP). A relay system controls the sequence of voltages applied to the amplifier as the transmitter is turned on in order to preserve the power amplifier tubes. A safety interlock system turns off the power if doors or covers are opened around high voltage areas or if an overload condition develops.

Model ATS-2 Antenna Tuning System provides the impedance matching of the transmitter to a wide variety of antenna loads. A triple-reading indicator registers forward power, reflected power and VSWR (voltage standing wave ratio) simultaneously. Resistance and reactance settings are monitored on a multimeter which may also be switched to register ambient humidity. A tripping relay turns off the transmitter power if forward or reflected power to the antenna becomes excessive during the loading procedure.

Model APP-5 Auxiliary Power Panel functions as a distributor for line voltage to the components and also contains wiring connections and terminal blocks on the rear of the unit for a tie in of the GPT-350D transmitter safety interlock system with the interlock of a larger system, if required.

c. ADDITIONAL FUNCTIONS - An additional capability of the GPT-350D is found in its individual modular units - ATS-2, PAL-350A, GPE-1, and VOX-5. These units may be used by themselves, without removing them from the rack. Their many capabilities are described in their individual manuals.

1-2 PHYSICAL DESCRIPTION

The GPT-350D, shown in figure 1-1, is contained in a single

rack. Two types are available, varying only in rack installation method and overall height as follows:

<u>Model</u>	<u>Installation</u>	<u>Overall Height</u>
GPT-350D-B	Base mounted	62-1/2 inches
GPT-350D-S	Shock mounted	61-1/2 inches

The base mounted model (shown in figure 1-1) comes equipped with its own separate mounting base, 3-1/4 inches high. The shock mounted model is the same as the base mounted model with a set of 4 shock mounts replacing the mounting base at the bottom and 2 shock mounts installed at the top of the rear rack wall. Both models measure 20-5/8 inches wide x 22-1/2 inches deep. All major components are mounted on tilt-type drawer slides, except the PSP-350 which is mounted on non-tilt slides. Of the three components of ATS-2 Antenna Tuning System, the Monitor Control Unit, Model MCU-2 is mounted at the top of the rack, with Model CU-2 Directional Coupler mounted behind it inside the rack; Model TU-2 Tuner comes separately in the shipment to be mounted adjacent to the antenna and is weatherproof for outdoor installation. The GPT-350D contains its own internal forced-air cooling system, consisting of an intake blower and air filter on the rear rack door, a blower and baffle for the power amplifier tubes in the PAL-350A, and a filtered air exhaust at the top of the rack. The entire unit weighs approximately 474 pounds.

The transmitter is manufactured in accordance with JAN/MIL specifications wherever practicable. All parts meet or exceed the highest quality standards.

TABLE 1-1. ELECTRICAL CHARACTERISTICS, GPT-350D

Output power:	AM: 350 watts (PEP), CW and MCW (key down): 200 watts
Frequency range:	2 to 32 megacycles continuous, bandswitched.
Operating modes:	CW, MCW, and AM
Tuning:	All tuning and bandswitching controls on front panel (no plug-in components).
Output impedance:	Will match any unbalanced load from 70 to 150 ohms at + 20 de- grees in the range of 2 to 4 mc. Will match any unbalanced load from 50 to 600 ohms at + 45 de- grees in the range 4 to 32 mc.
Frequency stability:	Crystal controlled. 1 part in 1×10^6 per day.
Audio response:	350 - 3300 cps, flat within 3 db
Audio input:	1. 600 ohm balanced line, -20 dbm will produce full output. 2. High impedance mike, -50 dbm will produce full output. 3. Carbon mike
ALDC:	ALDC (automatic load and drive control) is furnished to improve linearity and limit distortion during high drive peaks or load changes.
Cooling:	Filtered forced-air system
Safety features:	1. Full interlock protection 2. Full overload and fuse protection
Environmental conditions:	Designed to operate in any ambient temperature between 0° and 50°C and any value of humidity up to 90%.

TABLE 1-1. ELECTRICAL CHARACTERISTICS, GPT-350D

Power requirements:	115/230 volts, 50-60 cps, single phase. Approximately 1090 watts consumption.
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SECTION 2
INSTALLATION

2-1 INTRODUCTION

Each GPT-350D Transmitter has been tested and calibrated as a complete system before shipment. Upon shipment it is disassembled and packed into crates. It is only necessary to unpack and reassemble the equipment as outlined in the following paragraphs. Recalibration of the individual rack mounted units is not necessary.

2-2 INITIAL INSPECTION

The complete GPT-350D will arrive in 4 crates containing Model Rak-23D rack with interconnecting cables and major components. Inspect each crate and its contents immediately for possible damage. Unpack the equipment carefully. Inspect all packing material for parts which may have been shipped as "loose items". With respect to damage to the equipment for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

2-3 RACK INSTALLATION

a. LOCATION - Adequate ventilation must be provided; operation of the transmitter in a poorly ventilated room will cause the surrounding temperature to become too high. The room (or van), in which the GPT-350D is located, should have a ceiling height of at least 7 feet. A clearance of about two feet at the rear of the rack is needed for opening the door. In selecting the transmitter location, refer to the Appendix for reference drawings of rack dimensions. Proximity of the transmitter to the antenna is not critical; however, the TU-2 Tuner (part of ATS-2 Antenna Tuning

System) is mounted separately and close to the antenna. TU-2 is a weatherproof unit and may be mounted outside, if necessary (see paragraph 2-7e).

b. INSTALLATION - The four threaded holes on the top side of the rack and the four eyebolts included in the shipment are for lifting the rack with a crane hoist. The base-mounted rack is bolted to its own base. In the shock-mounted model, the four threaded holes in the two channels in the bottom of the rack are for the 4 shock mounts at the bottom. The two holes in the rear rack wall near the top edge are for the two top shock mounts. To install the shock-mounted model, use the base shock-mount pattern in figure A (Appendix) for drilling in the floor or mounting surface. Hoist the completely assembled transmitter onto the 4 base mounts and allow the transmitter to settle with its own weight. Then install the two top shock mounts, using the two top holes in the rack as a template for drilling holes in the structure.

2-4 230V LINE VOLTAGE MODIFICATION

a. GENERAL - The GPT-350D is factory wired for 115 VAC 50/60 cycle, single phase line voltage unless specified as otherwise on order. If line voltage is 230 VAC 50/60 cycle, single phase, refer to paragraphs 2-4b through 2-4g for modification of GPT-350D wired for 115 VAC.

b. ATS-2 - Relocate jumpers at E101 terminal block in MCU-2 Monitor Control Unit as shown in overall schematic of MCU-2 in ATS-2 Manual. Replace 2-amp fuse (F101) cartridge with 1-amp fuse cartridge, TMC part number FU-100-1.

c. PAL-350A - Relocate wiring connections at T210 transformer in RFA-1 Amplifier and at CB101 MAIN LINE circuit breaker, R104 resistor, and T101 and T102 transformers in PSP-350 Power Supply as shown on overall schematics in PAL-350 manual. Replace 1-amp fuse (F201) cartridge with a 1/2-amp fuse cartridge (TMC part number FU-100-.5) in RFA-1. Replace 1-amp L.V. SUPPLY fuse (F101) cartridge with a 1/2-amp fuse cartridge (TMC part number FU-102-.5) in PSP-350.

d. GPE-1A - Relocate wiring connections at T1 transformer and E3 terminal block as shown in figure 2-1 in GPE-1A manual. Replace 1.5-amp fuse (F1) cartridge with 0.75-amp fuse cartridge, TMC part number FU-102-.75.

e. VOX-5 - Relocate wiring jumpers at T101 transformer and oven heater circuitry as shown on overall schematic in VOX-5 manual. Replace 3-amp OVENS fuse (F101) cartridge with a 1-1/2-amp fuse cartridge (TMC part number FU-100-1.5). Replace 2-amp POWER fuse (F102) cartridge with a 1-amp fuse cartridge (TMC part number FU-100-1).

f. APP-5 - Change bus straps at CB501 as shown in figure 2-1.

g. RACK BLOWERS - Relocate wiring jumpers at blower terminal block on rack door as shown in figure 2-2.

2-5 ASSEMBLY OF TRANSMITTER

Install components as shown in figure 1-1 and make cable connections as shown in figure C (Appendix). In some

cases some of the smaller parts may arrive partially assembled in shipment. All components are slide-mounted except the MCU-2 Monitor Control Unit and the APP-5 Auxiliary Power Panel. Follow this general procedure for installing the slide-mounted units (see figure 2-3):

- (1) Set the component in position on the tracks.
- (2) Slide the component on the tracks until the release button catches.
- (3) Press the release buttons and push the component into the rack until the release buttons engage in the holes in the equipment.
- (4) When all the components have been installed and cabled, press the release buttons and push the component into the rack. To prevent the cables extending from the GPE-1A unit from snagging, utilize the take-up reel cable located inside the rack near the door frame.

Install ATS-CU-2 Directional Coupler inside rack on back wall of rack opposite ATS-MCU-2 Monitor Control Unit. Four mounting holes are provided in the rack to match the four threaded holes located in the ATS-CU-2 enclosure. ATS-TU-2 Tuner is mounted outside the rack and adjacent to the antenna (see paragraph 2-7e, antenna connection).

2-6 INITIAL ADJUSTMENTS

The GPT-350D has been factory tested and adjusted before disassembly for crating. No initial adjustments of chassis mounted variable components are necessary before operation.

2-7 CONNECTION OF EXTERNAL EQUIPMENT

a. INTRODUCTION - External wiring may be brought into the transmitter rack through one of the four holes (with cover plates)

at the bottom of the rack or any of the knockout holes at the top.

b. AUDIO INPUT - Connect 600-ohm audio source at terminals 2 through 5 of terminal block E1 on the rear of the GPE-1A General Purpose Exciter. For unbalanced input wiring, refer to figure 2-6 in GPE-1A manual; for balanced input, refer to figure 2-7. If on/off control is not contained in the audio source, install a "talk" switch across terminals 8 and 9 of E1 as shown in figure 2-6 or 2-7. If on/off control is contained in the audio source, install "talk" switch, in the same manner, to enable turning off carrier when not transmitting.

c. MICROPHONE - Either a carbon mike or a high impedance mike may be connected to the GPE-1A at J5 MIKE receptacle at its front panel. Refer to figures 2-3 and 2-4 in GPE-1A manual for wiring information. Two mating plugs (TMC #PL-208) are provided for making up a carbon mike and a high impedance mike cable. Or, if preferred, a carbon mike may be connected at terminals 9 and 10 of GPE-1A E1 terminal block as shown in figure 2-3 of GPE-1A manual.

If the mike comes with built-in push-to-talk provisions, pin #2 of PL-208 plug may be wired as shown in figure 2-3 or 2-4. If no such provision exists in the mike, a push-to-talk button may be connected at terminals 8 and 9 of E1 as shown in figure 2-3 or 2-4.

If the mike comes with built-in earpiece for a receiver output, connections may be made to a 600-ohm receiver output and the PL-208 plug as shown in figure 2-3 or 2-4.

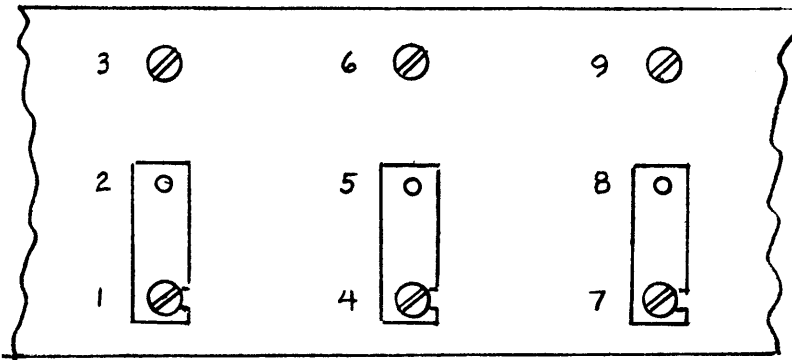
d. HAND KEYER - For CW and MCW modes a KEY jack (J2) is provided on the GPE-1A control panel. The jack is JAN type

JJ-034. However, if it is preferred to connect an external keying device permanently to the GPT-350D, connections may be made as shown in figure 2-5 of the GPE-1A manual.

e. ANTENNA - Refer to figure C in Appendix for interconnecting cable connections between the ATS-2 components and the antenna. Install ATS-TU-2 Tuner in such a position that the cable running between E202 bowl connector on the tuner and the antenna will not exceed 27 inches. The Tuner (see figure E in Appendix for dimensions) is designed for outdoor installation and has watertight terminal tubes for cable connections. Refer to ATS-2 Manual for identification of items shipped with the ATS-TU-2 and their functions. The cables running out of the rack to the tuner may be passed out through any two of the four knockout holes in the top and upper sides of the rack. After the tuner has been installed, manufacture and install a cable running from J302 on the CU-2 Directional Coupler to E203 in the Tuner. Use UG-212C/U adapter, UG-59B/U plug (supplied) and RG-8/U cable (not supplied). If either CA-541 or CA-729 cable assembly has been supplied (on special order) install this cable between J101 on MCU-2 Monitor Control Unit and E201 terminal block in the Tuner. If this cable is not supplied, use the parts supplied as described in table D to make up a cable per diagram in figure C in Appendix. Use the watertight tubes MP201 and MP202, (supplied) to bring the cables into the Tuner. Detailed directions for making these connections at the tuner are included in Section 2 of the ATS-2 manual. CA-484 cable assembly is supplied for connection of the Tuner to the antenna. This cable must not be over 27 inches long.

f. LINE VOLTAGE - Connect the 115 or 230 VAC 50/60 cycle, single phase line voltage source at the a-c input receptacle located at the bottom of the rack on the back wall. TMC #PL-134-NG connector is the mating plug supplied in shipment.

g. EXTERNAL INTERLOCKS - Terminals 7 and 8 of E501 on APP-5 are available for connection of additional safety interlock/s external to the GPT-350D transmitter. Such additional interlock/s will be in series with the GPT-350D interlocks and form another link in the interlock circuit. To make the external interlock connection, remove jumper wire across terminals 7 and 8 and replace with interlock link.



APP-5 BUS STRAP ARRANGEMENT

NOTES:

1. FOR 115VAC OPERATION, CONNECT TERMINALS 1 AND 2, 4 AND 5, 7 AND 8.
2. FOR 230VAC OPERATION, CONNECT TERMINALS 2 AND 3, 5 AND 6, 8 AND 9.

FIGURE 2-1. 230V MODIFICATION DIAGRAM, MODEL APP-5

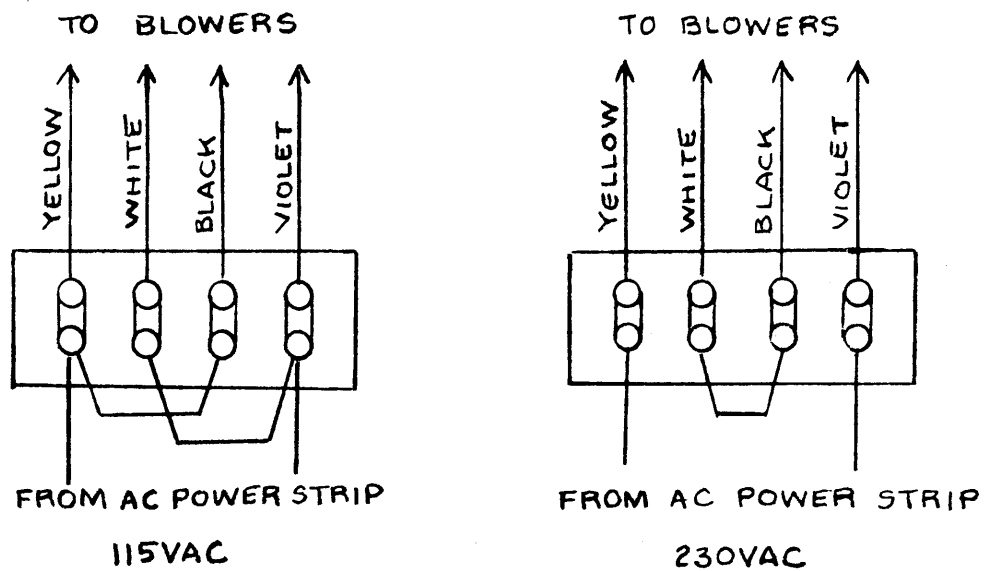
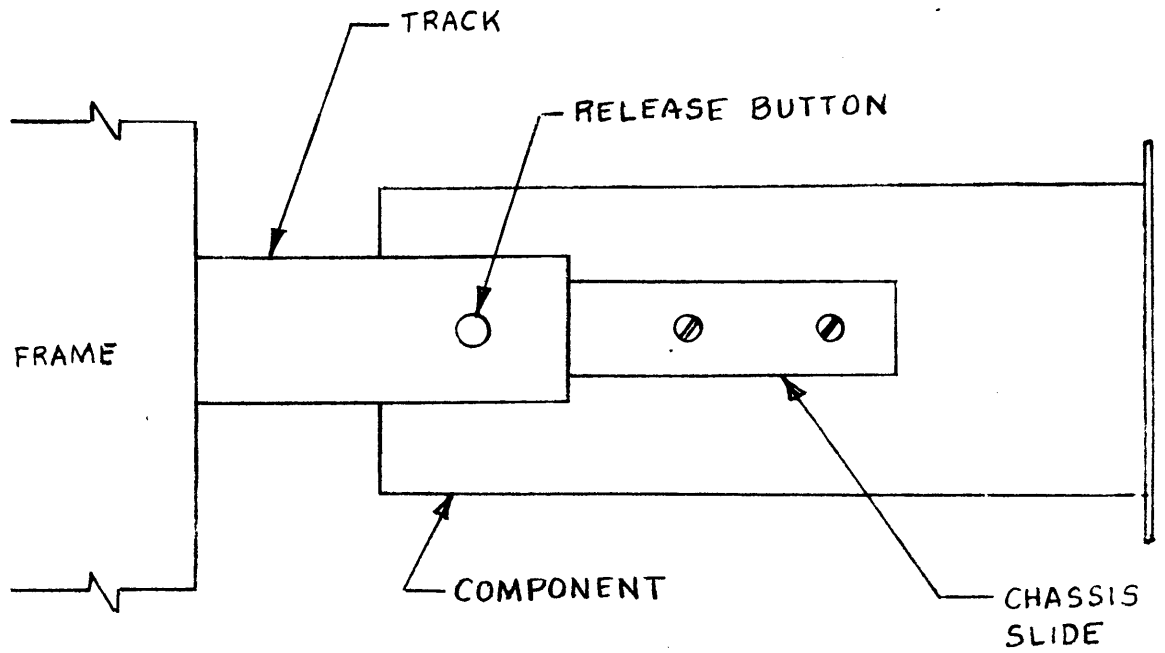
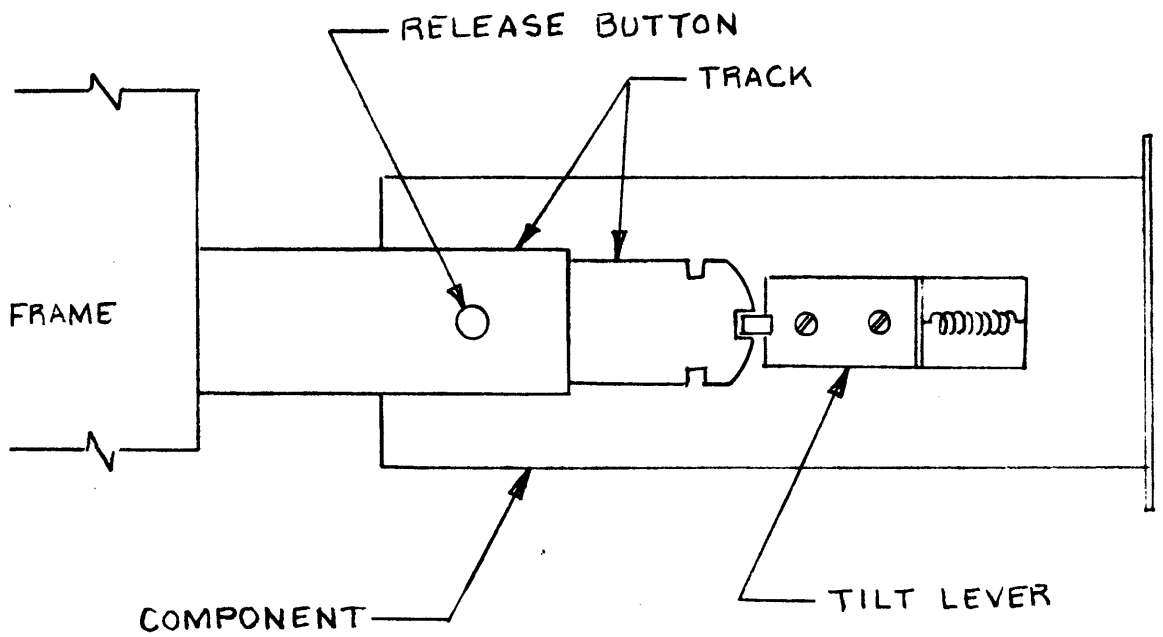


FIGURE 2-2. 230V MODIFICATION DIAGRAM, RACK BLOWERS



A. NON-TILTING SLIDE MECHANISM



B. TILTING SLIDE MECHANISM

FIGURE 2-3. SLIDE MOUNT DETAILS

SECTION 3
OPERATOR'S SECTION

3-1 PRELIMINARY CONSIDERATIONS

a. GENERAL. - Before proceeding to "turn on", tune, or operate the GPT-350D transmitter, certain preliminary considerations should be taken in order to protect equipment and personnel and to save time in tuning. These considerations are:

- 1 - Functions of panel controls
- 2 - Power amplifier tube protection
- 3 - Initial warm-up time for oscillator
- 4 - Mode of transmission
- 5 - Shut-down procedure

b. FUNCTIONS OF PANEL CONTROLS. - Figure 3-1 shows GPT-350D panel controls. Refer to section 3 of individual component manuals for functions of these controls.

c. POWER AMPLIFIER TUBE PROTECTION. - The 2 power amplifier (PA) tubes located in the RFA-1 Amplifier unit should not be tuned and loaded up and down rapidly or inadvertently. This may result in too-rapid heat changes in the tubes with shortened tube-life as a result. A systematic procedure of tuning and loading, operating and "shut-down" should be adhered to in that sequence.

d. OSCILLATOR WARM-UP. - Frequency determining crystals and components for the GPT-350D are located in the VOX-5 master oscillator oven. After tune-up, the transmitted frequency will remain within rated stability only if the oven temperatures have become

stabilized. The necessary initial warm-up time for VOX-5 oven stabilization is 48 hours. If, after operating the transmitter, it is intended to use it again soon, a repetition of the warm-up procedure may be eliminated by leaving certain switches on, as described for STANDBY condition in "shut-down procedure" (paragraph 3-6).

e. MODES OF TRANSMISSION.- The GPT-350D transmits CW, MCW and AM. The CW and MCW is sent from hand keyer or keying device intelligence attached to the GPE-1A Exciter. Input intelligence for AM transmission is microphone or 600-ohm audio input at the GPE-1A.

3-2 TUNING PROCEDURE

a. TUNING TABLES. - Table 3-1 outlines the procedure for tuning the transmitter for the carrier frequency. In all modes of transmission the carrier is tuned up first. Tables 3-2, 3-3 and 3-4 include additional steps for tuning for CW, MCW and AM modes.

b. NOTES ON TUNING. -

(1) For a brief review of theory, the operator may refer to paragraph 4-1, which outlines the functions of the major components in the GPT-350D.

(2) When tuning the GPE-1A, avoid exceeding the "100%" marking on its output meter. Considerable distortion from intermodulation may result otherwise.

(3) When tuning the VOX-5, avoid exceeding the printed "2000 to 4000 KCS" range appearing under the counters; doing so may cause a misalignment in the mechanical calibrations of the master oscillator. The habit of spinning this control too rapidly from one end of the range to the other should also be avoided for the same reason.

Before performing step 8, in table 3-1, adjust MASTER OSCILLATOR FREQUENCY knob so that in step 9, knob may be rotated in the same direction (ie: to increase the frequency reading on the counters). This will prevent error due to gear backlash.

(4) The VOX-5 2-4 mc output frequency into the GPE-1A Exciter is read directly on the VOX-5 counter dial. Multiplication factors of 1, 2, 4 and 8 in the GPE-1A translate the 2-4 mc frequency into the 2-32 mc range. The multiplication factor is selected by the GPE-1A BAND-MCS selector switch as follows:

<u>Multiplication Factor</u>	<u>BAND-MCS switch setting</u>
1 - - - - -	2-4
2 - - - - -	4-8
4 - - - - -	8-16
8 - - - - -	16-32

To determine the VOX-5 output frequency in terms of carrier frequency, use the following formula:

- Where F_c = Carrier frequency
 " F_x = VOX-5 output frequency
 " N = multiplication factor
- $$F_x = \frac{F_c}{N}$$

TABLE 3-1. TUNE-UP OF CARRIER, GPT-350D

Note: Place jumper wire across terminals 1 and 2 of E1 terminal block at rear of GPE-1A Exciter.

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATOR	PURPOSE
1	6,24,48, 61,69	Place all power switches in OFF or STANDBY positions.	Disconnects all line voltage inputs.
2	69,68	Set MAIN POWER switch (69) to ON. MAIN POWER lamp (68) will light and rack blowers will start.	Supplies line voltage to a-c power strip and rack blowers.
3	24,28	Set POWER switch (24) to ON. MAIN POWER lamp (28), INNER OVEN lamp (29) and OUTER OVEN lamp (30) will light.	Supplies voltages to VOX-5 filaments, oven heater and master oscillator.
4		Wait 48 hours for VOX-5 oven temperature to stabilize before proceeding with step 5.	Allows oven temperatures to stabilize in order to stabilize VOX-5 frequency.
5	48,50	Turn MODULATION knob (48) slightly clockwise until POWER lamp (50) lights. Allow 15 minutes warm-up before proceeding with step 6.	Supplies voltages to GPE-1A.
6	37,39	Set HFO BAND-MCS knob (37) to 2-4. Set XTAL knob (39) to VMO. Refer to paragraph 3-2b(4) and determine VOX-5 output frequency (Fx)	Selects proper 2-4 mc frequency from VOX-5 to produce carrier frequency.
7	47	Set XTAL knob (47) to EXT. Set BEAT switch (21) to ON. ZERO BEAT lamp (31) will light.	Connects VOX-5 output to GPE-1A. Turns on 100-kc calibrating oscillator in VOX-5.

TABLE 3-1. TUNE-UP OF CARRIER, GPT-350D (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATOR	PURPOSE
8	42,40,41, 33,31,21	Turn MASTER OSCILLATOR FREQUENCY knob (42) to bring counters (40) and (41) up to the nearest 50-kc increment below F_x . Then adjust CALIBRATE knob (33) to point that causes ZERO BEAT lamp (31) to beat as slowly as possible. Lock with LOCK disc. Set BEAT switch(21) to "off" position (down).	Calibrate VOX-5 frequency to 50-kc increment below F_x . Turns off 100-kc oscillator.
9	42,40,41	Turn MASTER OSCILLATOR FREQUENCY knob (42) to bring counters (40) and (41) up to F_x .	Completes adjustment of VOX-5 output frequency to F_x .
10	46	Turn BAND-MCS knob (46) to select appropriate range for carrier frequency.	Multiplies VOX-5 output frequency up to 2-32 mc range.
11	25,22,51 35,32	Set HFO switch (25) to ON. Set METER knob (22) to HFO. Set METER knob (51) to OUTPUT. Adjust HFO TUNING knob (35) for maximum reading on meter (32).	Supplies VOX-5 amplifier with plate voltage. Connects VOX-5 output meter to sample VOX-5 output. Connects GPE-1A output meter to sample GPE-1A output. Fine-tunes VOX-5 amplifier.
12	45,36,49	Turn OUTPUT knob (45) and HFO knob (36) toward INCR to bring meter (49) needle to middle of dial.	To obtain clear reading for step 13.

TABLE 3-1 TUNE-UP OF CARRIER, GPT-350D (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATOR	PURPOSE
13	44,49	Turn TUNING knob (44) pointer to vicinity of F_x (reading on VOX-5 counters) to obtain peak reading on meter (49)	Fine-tunes GPE-1A amplifiers
14	45	Turn OUTPUT knob (45) to its extreme counter-clockwise position.	Turns down GPE-1A output in preparation for PAL-350 tuning.
15	14,18	Set DRIVER BAND knob (14) and PA BAND knob (18) to appropriate ranges for carrier frequency.	Selects band-pass circuits in driver and PA stages in PAL-350.
16	61,60,20, 17	Set MAIN LINE circuit breaker (61) to ON. MAIN LINE lamp (60) will light and blower in RFA-1 Amplifier will start. Set MULTIMETER switch (20) to FIL-0-10V and observe MULTIMETER (17). Needle should coincide with FIL ADJ mark on dial.	Connects line voltage to PAL-350. Turns on filament supply and PA bias supply. Checks for proper filament voltage to PA tube.
17	59,55,58	Set TRANSMITTER PLATES switch (59) to ON. H.V. LINE OVERLOAD (BREAKER OFF) lamp (55) will light. After a 60-second interval TRANSMITTER PLATES lamp (58) will light.	Sends plate and bias voltages to 1st amplifier and driver stages.

TABLE 3-1. TUNE-UP OF CARRIER, GPT-350D (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATOR	PURPOSE
18	56,55,57, 16	Set H.V. LINE circuit breaker (56) to ON. OVERLOAD (BREAKER OFF) lamp (55) will go out and H.V. LINE lamp (57) will go on. PA PLATE meter (16) should read about 160 ma.	Sends plate voltage to PA stage. Checks static PA plate current.
19	20,17,59, 56	Set MULTIMETER switch (20) to H.V. 0-5 KV. MULTIMETER (17) should read 2000V. Then set TRANSMITTER PLATES switch (59) to STAND-BY and H.V. LINE circuit breaker (56) to OFF.	Checks PA stage plate voltage. Turns off plate and bias voltages.
20	15,19,13, 20	Set PA TUNING and PA LOADING knobs (15 and 19) to 0. Set DRIVER TUNING knob (13) to position indicated for carrier frequency in table 3-7. Set MULTIMETER switch (20) to DR 0-50V.	Coarse-tunes 1st amplifier and driver stages of PAL-350. Connects MULTIMETER to driver stage output.
21	45,59,58, 13,17,45	Turn OUTPUT knob (45) slightly clockwise. Set TRANSMITTER PLATES switch (59) to ON. After TRANSMITTER PLATES lamp (58) lights, re-adjust DRIVER TUNING knob (13) to obtain a peak reading on MULTIMETER (17). Keep peak below "3" (30v) by operation of OUTPUT knob (45).	Turns on plate and bias supply for 1st amplifier and driver stages. Turns up GPE-1A exciter output to a low level and fine-tunes 1st amplifier and driver stages in PAL-350.

TABLE 3-1. TUNE-UP OF CARRIER, GPT-350D (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATOR	PURPOSE
22	45,20,56, 57,16	Set OUTPUT knob (45) to extreme counter-clockwise position. Leave MULTIMETER switch (20) set at RF DR 0-50V. Set H.V. LINE circuit breaker (56) to ON. H. V. LINE lamp (57) will light. Then slowly increase setting on OUTPUT knob (45) and observe PA PLATE meter (16). Increase OUTPUT knob setting until meter indicates current of 200 ma.	Applies plate voltage to PA stage and adjusts input level to proper starting point for subsequent tuning.
23	15,17,19, 45,20,16	Adjust PA TUNING knob (15) to obtain a dip on MULTIMETER (17). Then adjust PA LOADING knob (19) to increase reading on MULTIMETER (17). Adjust OUTPUT knob (45) to obtain "3" (30v) on MULTIMETER. Readjust PA TUNING knob (15) to obtain another dip and then readjust PA LOADING knob (19) to obtain an increase. Readjust OUTPUT knob (45) to obtain a lower reading on MULTIMETER than that in last OUTPUT knob adjustment. Repeat this loading procedure until approximately the values listed below are reached:	To obtain fine tuning of PA TUNING and PA LOADING circuits.

TABLE 3-1. TUNE-UP OF CARRIER, GPT-350D (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATOR	PURPOSE
23 (Cont)		MULTIMETER switch (20) <u>position</u>	MULTIMETER meter (17) <u>reading</u>
		RF DR 0-50V - - -	18v (maximum)
		ISG-20, + 30MA- - -	-5ma*
		RF PL 0-2.5KV - - -	500v*
		RF OUT 0-500V - - -	70v
		<u>PA PLATE meter (16) 270 ma*</u>	
		* During the entire load- ing procedure, use OUT- PUT knob (45) to prevent the following readings from exceeding the follow- ing maximum values at any time:	
		MULTIMETER switch (20) <u>position</u>	MULTIMETER meter (17) <u>maximum reading</u>
		ISG-20, + 30MA -	+ 20 ma
		RF PL 0-2.5KV -	800v
		<u>PA PLATE meter (16) 300 ma max.</u>	
24	45	Turn OUTPUT knob (45) fully counterclockwise.	Turns PAL-350 out- put down to minimum to protect ATS-2 unit in next step.

TABLE 3-1. TUNE-UP OF CARRIER, GPT-350D (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATOR	PURPOSE
25	5,6,7, 45,4,3	<p>Set TUNE/OPERATE switch (5) to TUNE. Set POWER switch (6) to X1. Observe meter (7) reading on FORWARD-WATTS scale. If necessary, back off OUTPUT knob (45) to bring reading on meter (7) to 10 (100 watts) or below. If more than 100 watts exist, overload relays may turn transmitter off as indicated by OVERLOAD lamp (4). If this occurs, turn down OUTPUT knob (45) setting and push RESET button (3). After a 60-second interval a new reading will be obtained on meter (7)</p>	<p>Sets ATS-2 overload amplifier for tuning procedure. Sets power meter for 100 watts scale. Adjusts ATS-2 input to 100 watts maximum to prevent damage to power meter while tuning. Overload action disconnects PAL-350 PA plate supply; RESET button re-connects it.</p>
26	12,10,8	<p>Set METER switch (12) to HUMIDITY and observe reading on meter (10). Refer to "35-foot whip antenna measurement" table in ATS-2 manual. Set METER switch (12) to RESISTANCE and observe reading on meter (10). Depress RESISTANCE OPERATE button (8) for 2 seconds, then read meter (10). Repeat until reading is obtained as indicated for carrier frequency and HUMIDITY reading as indicated in ATS-2 manual table.</p>	<p>Adjusts antenna resistance.</p>

TABLE 3-1. TUNE-UP OF CARRIER, GPT-350D (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATION	PURPOSE
27	10,11,3	Set METER switch (10) to REACTANCE. Operate REACTANCE switch (11) towards INCR and DECR to minimize WATTS REFLECTED and VSWR readings on meter (3). (A good VSWR is 2:1 maximum)	Adjusts antenna reactance
	10	CAUTION Observe REACTANCE scale readings on meter (10) while performing step 27 to make certain that reading never exceeds "20" when carrier frequency is higher than 10 mc.	
28	6,5,45 11,7	Set POWER switch (6) to X10 position. Set TUNE/OPERATE switch (5) to OPERATE. Slowly increase setting on OUTPUT knob (45) to bring FORWARD WATTS reading up to desired level for transmitter output power.* Operate REACTANCE switch (11) again to minimize WATTS REFLECTED and VSWR readings on meter (7). Output power is read by subtracting WATTS REFLECTED from FORWARD WATTS.	Increases GPE-1A output level to bring up transmitter power output. Readjusts antenna reactance for power increase.

* The overload relay in ATS-2 has been set at the factory to trip at 400 watts output or 4:1 VSWR in the GPR-350D transmitter, with TUNE/OPERATE switch (5) in OPERATE position.

TABLE 3-1. TUNE-UP OF CARRIER, GPT-350D (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATION	PURPOSE
29	6,7	Set POWER switch (6) to SHORT. Power meter (7) needles will re- turn to zero.	Disconnects power meter (7) from circuit to pre- vent meter damage due to surges in transmitter out- put power.

TABLE 3-2. TUNING PROCEDURE FOR CW MODE

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATION	PURPOSE
1	45	Tune up carrier as described in table 3-1.	Tunes up for carrier.
2	52	Remove jumper from terminals 1 and 2 of GPE-1A terminal strip E1. Replace with hand keyer at these terminals or plug in a keyer at GPE-1A KEY jack (52).	Installs keying device for control of carrier.
3	54	Set EMISSION switch (54) to CW.	Disconnects all audio inputs from GPE-1A and sets it up for CW operation.

TABLE 3-3. TUNING PROCEDURE FOR MCW MODE

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATION	PURPOSE
1	45	Tune up carrier as described in table 3-1.	Tunes up for carrier.
2	52	Remove jumper from terminals 1 and 2 of GPE-1A terminal strip E1. Replace with hand keyer at these terminals or plug in a keyer at GPE-1A KEY jack (52).	Installs keying device for control of carrier.
3	51	Set METER switch (51) to OUTPUT.	Connects output meter (49) to read level of GPE-1A carrier output.

TABLE 3-3. TUNING PROCEDURE FOR MCW MODE (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATOR	PURPOSE
4	54	Set EMISSION switch (54) to CW.	Disconnects all external audio inputs from GPE-1A.
5	6,5,49, 7	Set POWER switch (6) to X10 position. Set TUNE/OPERATE switch (5) to OPERATE. Holding keyer down, note reading on GPE-1A output meter (49) when FORWARD WATTS reading on ATS-2 output meter (7) reaches desired level. Release keyer.	To note level of carrier output at GPE-1A for reference in setting modulation level.
6	51	Set METER switch (51) to MODULATION.	Connects output meter (49) to read level of 1-kc modulating signal at input of GPE-1A modulator.
7	54	Set EMISSION switch (54) to MCW.	Generates modulating signal of 1-kc.
8	48,49	Adjust MODULATION knob (48) to obtain figure on output meter (49) that represents 90% of figure noted on this meter in step 5.	Adjusts modulation percentage to 90%.
9	6	Set POWER switch (6) to SHORT.	Disconnects power meter (7) from circuit to prevent meter damage due to surges in power.

TABLE 3-4. TUNING PROCEDURE FOR AM MODE WITH MIKE

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATION	PURPOSE
1		Tune up carrier as described in table 3-1.	Tunes up for carrier
2		If push-to-talk feature is to be used, remove jumper from terminals 1 and 2 of GPE-1A terminal strip E1; otherwise leave jumper in.	Sets up type of operating control.
3	53	Plug mike cable into MIKE jack (53)	Connects microphone to audio input of GPE-1A.
4	51	Set METER switch (51) to OUTPUT.	Connects output meter (49) to read level of GPE-1A carrier output.
5	54	Set EMISSION switch (54) to CW.	Disconnects audio inputs.
6	6,5,49, 7	Set POWER switch (6) to X10 position. Set TUNE/OPERATE switch (5) to OPERATE. If push-to-talk feature is used, hold down push-to-talk button when performing the rest of this step. Note reading on GPE-1A output meter (49) when FORWARD WATTS reading on ATS-2 output meter (7) reaches desired level.	To note level of carrier output at GPE-1A for reference in setting modulation level.

TABLE 3-4. TUNING PROCEDURE FOR AM MODE WITH MIKE (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATION	PURPOSE
7	54	Set EMISSION switch (54) to CARB or DYN (for carbon or dynamic mike).	Connects mike to appropriate audio amplifier in GPE-1A.
8	51	Set METER switch (51) to MODULATION.	Connects output meter (49) to read level of audio modulating signal from mike at input of GPE-1A modulation.
9	49,48	Observe meter (49) needle while speaking into mike. Adjust MODULATION knob (48) to cause needle to peak at a figure around 100% of figure noted on meter (49) in step 6.	Adjusts modulation percentage to 100% peaks for clear reception.
10		Set POWER switch (6) to SHORT.	Disconnects power meter (7) from circuit to prevent meter damage due to surges of power.

TABLE 3-5. TUNING PROCEDURE FOR AM MODE FROM EXTERNAL AUDIO SOURCE

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATION	PURPOSE
1		Tune up carrier as described in table 3-1	Tunes up for carrier
2		If "talk" switch is installed across terminals 8 and 9 of terminal strip E1 on rear of GPE-1A, remove jumper across terminals 1 and 2 of E1; otherwise leave jumper in.	
3	51	Set METER switch (51) to OUTPUT	Connects output meter (49) to read level of GPE-1A carrier output.
4	54	Set EMISSION switch (54) to CW	Disconnects audio inputs.
5	6,5	Set POWER switch (6) to X10 position. Set TUNE/OPERATE switch (5) to OPERATE. If "talk" switch is installed (see step 2), close switch when performing the rest of this step. Note reading on GPE-1A output meter (49) when FORWARD WATTS reading on ATS-2 output meter (7) reaches desired level.	To note level of carrier output at GPE-1A for reference in setting modulation level.

TABLE 3-5. TUNING PROCEDURE FOR AM MODE FROM EXTERNAL AUDIO SOURCE (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATION	PURPOSE
6	54	Set EMISSION switch (54) to EXT.	Connects audio source to GPE-1A audio amplifiers.
7	51	Set METER switch (51) to MODULATION.	Connects output meter (49) to read level of audio modulating signal at input of GPE-1A modulation.
8	49,48	If audio source has on/off control, set control to "on". Observe meter (49) needle. Adjust MODULATION knob (48) to cause needle to peak at a figure around 100% of figure noted on meter (49) in step 5.	Adjusts modulation percentage to 100% peaks for clear reception.
9		Set POWER switch (6) to SHORT.	Disconnects power meter (7) from circuit to prevent meter damage due to surges of power.

3-3 OPERATING PROCEDURE

a. CW MODE. - Depressing keyer sends carrier; releasing keyer cuts off carrier.

b. MCW MODE. - Depressing keyer sends modulated carrier; releasing keyer cuts off modulated carrier and carrier.

c. AM MODE (WITH MIKE). - If push-to-talk button is installed, holding down button will transmit modulated carrier (when speaking) and carrier (when not speaking). Releasing button cuts off modulated carrier or carrier. If push-to-talk button is not installed, modulated carrier is transmitted (when speaking) and carrier is transmitted (when not speaking).

d. AM MODE (FROM EXTERNAL AUDIO SOURCE). - If "talk" switch is installed, closing talk switch will transmit modulated carrier (with audio source turned on) and carrier (with audio source turned off). Opening switch cuts off modulated carrier or carrier. If "talk" switch is not installed, carrier only will be transmitted when audio source is turned off.

3-4 SHUT-DOWN PROCEDURE

a. GENERAL. - The GPT-350D may be placed in standby or completely turned off. Standby is recommended when it is intended to transmit again in the near future. This eliminates repeating the 48-hour crystal oven warm-up procedure as described in table 3-1.

b. STANDBY. - To place GPT-350D in standby condition, set switches as shown in table 3-6.

c. NORMAL STOPPING. - To completely turn off the GPT-350D transmitter, follow the procedure outlined in table 3-6, steps 1 and 2, and then set the following switches in positions as listed:

<u>Switch</u>	<u>Control Number</u> <u>(Figure 3-1)</u>	<u>Position</u>
POWER - - - - -	6 - - - - -	OFF
ON/POWER - - - - -	24 - - - - -	OFF (down)
ON/BEAT - - - - -	21 - - - - -	OFF (down)
MODULATION - - - - -	48 - - - - -	POWER OFF
MAIN POWER - - - - -	69 - - - - -	OFF

d. EMERGENCY STOPPING. - To turn off GPT-350D in an emergency, set MAIN POWER circuit breaker (69) to OFF.

TABLE 3-6. PROCEDURE FOR PLACING GPT-350D IN STANDBY

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATION	PURPOSE
1	59,56,58 57,55	Set TRANSMITTER PLATES switch (59) to STANDBY REMOTE and H.V. LINE circuit breaker (56) to OFF. TRANSMITTER PLATES lamp (58) and H.V. LINE lamp (57) will go out. H.V. LINE OVERLOAD (BREAKER OFF) lamp (55) will go on.	Shuts off all plate and screen supplies and control amplifier and driver stage bias supply in PAL-350.
		<u>CAUTION</u>	
		Wait at least 5 minutes before proceeding to step 2. This delay will gradually cool the PA tubes in PAL-350 and prolong their lives.	
2	61,60,55	Set MAIN LINE circuit breaker (61) to OFF. MAIN LINE lamp (60) and H.V. LINE OVERLOAD (BREAKER OFF) lamp (55) will go out. Blower in PAL-350 will stop.	Cuts off primary line voltage to PAL-350 and subsequent filament supply and PA tube bias supply.
3	6,1	Set POWER switch (6) to OFF. POWER lamp (1) will go out.	Disconnects line voltage from ATS-2.
4	24,28,29, 30,21	Set HFO switch (25) to OFF. Leave ON/POWER switch (24) in ON position. MAIN POWER lamp (28) will remain lighted and INNER and OUTER OVEN lamps (29 and 30) will continue to cycle. ON/BEAT switch (21) should be in OFF (down) position.	Leaves line voltage connected to VOX-5 and subsequently to crystal oven heating circuit, VMO plate supply and all filament supplies.

TABLE 3-6. PROCEDURE FOR PLACING GPT-350D IN STANDBY (Cont)

STEP	CONTROL NUMBER (See Fig 3-1)	OPERATION	PROCEDURE
5	48,50	Turn MODULATION knob (48) completely counterclockwise. POWER lamp (50) will go out.	Disconnects line voltage from GPE-1A.
6	69,68	Leave MAIN POWER circuit breaker (69) in ON position. MAIN POWER lamp (68) will remain ON.	Leaves line voltage connected to GPT-350D system.

TABLE 3-7. DRIVER TUNING KNOB SETTINGS, PAL-350

DRIVER BAND Setting 2 - 4		DRIVER BAND Setting 4 - 8		DRIVER BAND Setting 8 - 16		DRIVER BAND Setting 16 - 32	
fo (mc)	DRIVER TUNING Setting	fo (mc)	DRIVER TUNING Setting	fo (mc)	DRIVER TUNING Setting	fo (mc)	DRIVER TUNING Setting
*	0	*	0	*	0	*	0
2	1	4	1	8	1	16	1
2.25	2	4.5	2	9	2	18	2
2.5	3	5	3	10	3	20	3
2.75	4	5.55	4	11	4	22	4
3	5	6	5	12	5	24	5
3.25	6	6.5	6	13	6	26	6
3.5	7	7	7	14	7	28	7
3.75	8	7.5	8	15	8	30	8
4	9	8	9	16	9	32	9
*	10	*	10	*	10	*	10

* BEYOND TUNING RANGE.

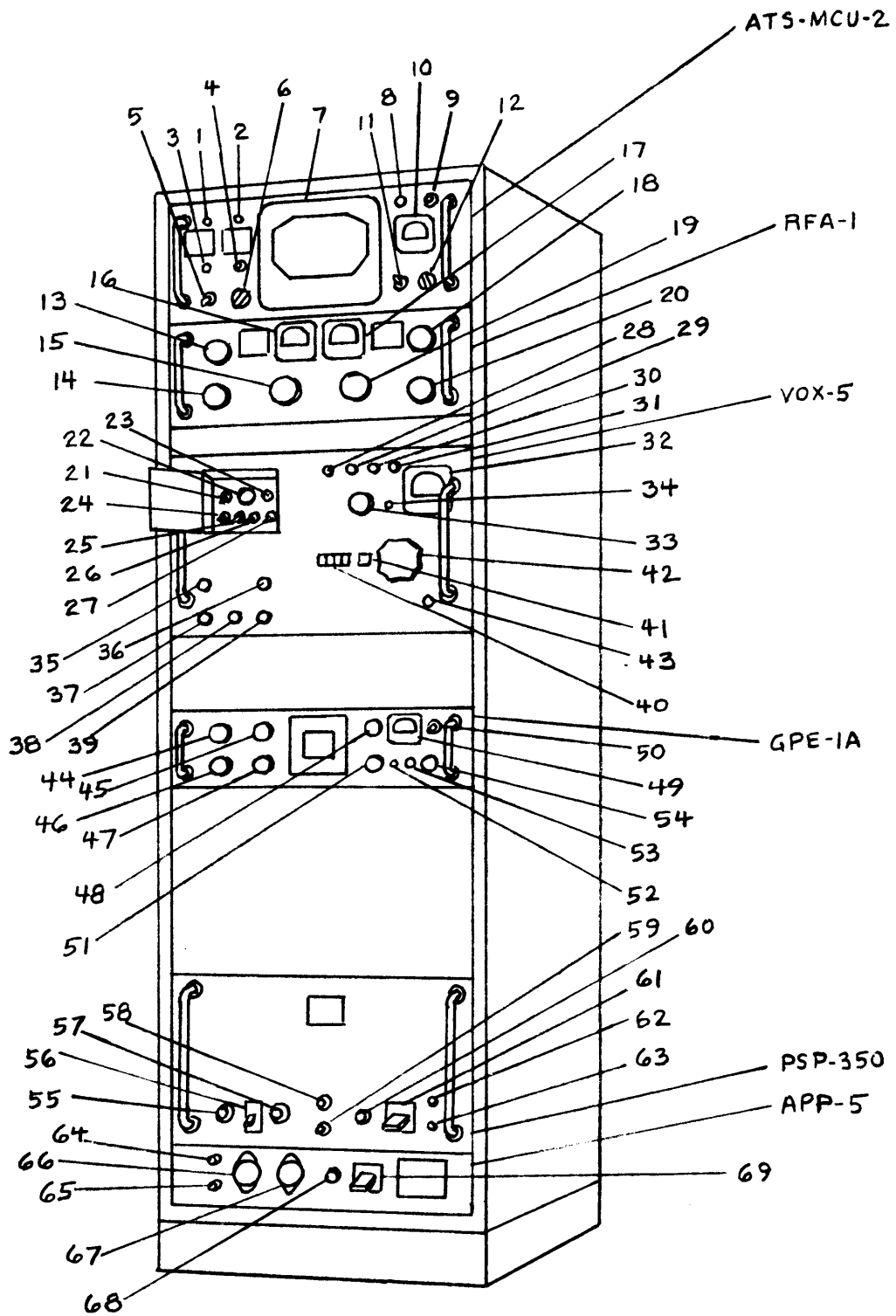


FIGURE 3-1. GPT-350D PANEL CONTROLS

SECTION 4
PRINCIPLES OF OPERATION

4-1 INTRODUCTION

Figure 4-1 is a functional block diagram of the GPT-350D transmitter. For a detailed functional block diagram and schematic diagram of each unit (ATS-2, PAL-350A, VOX-5 and GPE-1A), refer to the individual manual for the unit.

4-2 OPERATION

a. CARRIER GENERATION (Figure 4-1). - The r-f carrier, in the 2 to 32 mc range, is generated by the VOX-5 and GPE-1A units. The VOX-5 generates a highly stable 2-4 mc which is stepped up into the 2 to 32 mc range by frequency multipliers in the GPE-1A r-f stage. Since the VOX-5 frequency is continuously adjustable, this gives the continuously adjustable feature to the 2-32 mc carrier. The carrier is amplified up to the 350-watt level by PAL-350A. The ATS-2 contains tuning circuits to match the output of PAL-350A to a wide variety of antennas. It contains a VSWR indicator and tuning controls which enable a very fine degree of match.

b. CW TRANSMISSION (Figure 4-1). - In CW mode, the carrier is keyed at the GPE-1A Exciter r-f stage. Holding down the key grounds the r-f stage cathode circuits and enable the r-f amplifiers to conduct.

c. MCW TRANSMISSION (Figure 4-1). - In MCW mode, the modulated carrier is keyed at the GPE-1A Exciter r-f stage in the same manner as that for CW mode.

d. AM TRANSMISSION (Figure 4-1). - In AM mode, the carrier is modulated at the output of the GPE-1A stage by audio input from a 600-ohm source or mike.

e. INTERLOCK SYSTEM (Figure 4-2) - Figure 4-2 shows the complete GPT-350D safety interlock system. The purpose of the interlock system is to shut off high voltages when any one of a series of undesirable conditions exist, in order to protect personnel and equipment.

Essentially, a +150 VDC voltage, originating in the PAL-350A Power Supply (PSP-350A) completes a circuit through a series of interlocks when PSP-350 TRANSMITTER PLATES switch is closed. The interlock links are listed in table 4-1. Completing the interlock circuit sends current through PSP-350 transmitter plates relay coil, energizing this relay. Closed contacts on the relay send plate voltages to PAL-350 1st amplifier and driver stages. The energized K102 relay also completes the primary line voltage to T102 high voltage transformer when H.V. LINE circuit breaker is closed. In addition, bias voltage is supplied to 1st amplifier and driver stages.

In short, energized K102 transmitter plates relay has the effect of adding sufficient power to the signal to transmit it. When any one of the series interlocks is opened, the relay is de-energized, high voltages are removed from PAL-350 and the transmitted signal is cut off.

TABLE 4-1. INTERLOCK CIRCUIT COMPONENTS, GPT-350D

UNIT	INTERLOCK	WHEN CLOSED
PSP-350A	Bottom cover interlock switch S102.	When bottom cover of PSP-350A is secured in position.
PSP-350A	Top cover interlock switch S101.	When top cover of PSP-350A is secured in position.
ATS-MCU-2	Overload relay K103 (RESET position)	When transmitter power has not exceeded 400 watts and VSWR has not exceeded 4:1
RAK-23D	Rack rear door interlock switch	When rack rear door is closed.
RFA-1	Top cover interlock switch S204	When top cover of RFA-1 is secured in position.
RFA-1	Bottom cover interlock switch S205	When bottom cover of RFA-1 is secured in position.

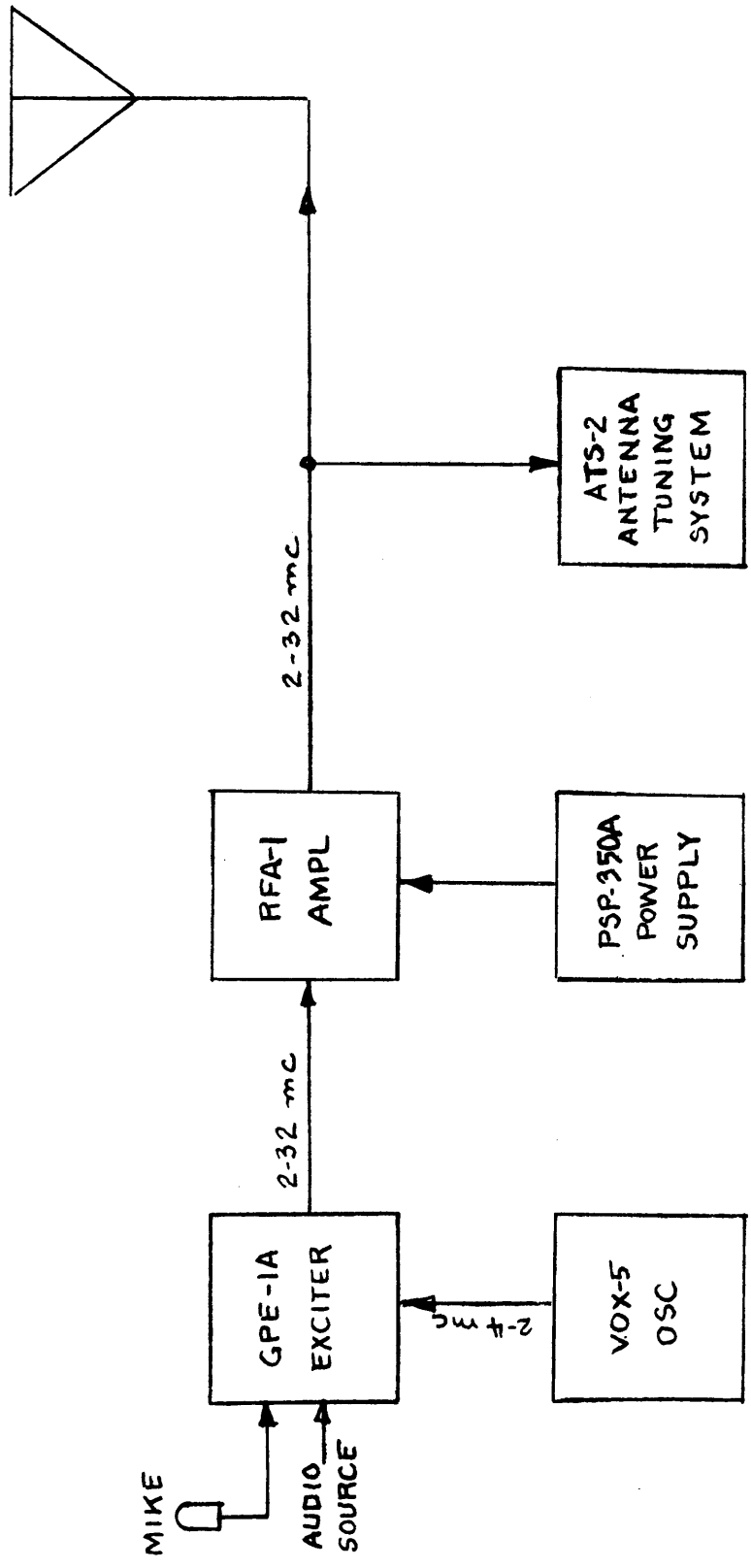


FIGURE 4-1. FUNCTIONAL BLOCK DIAGRAM, GPT-350D

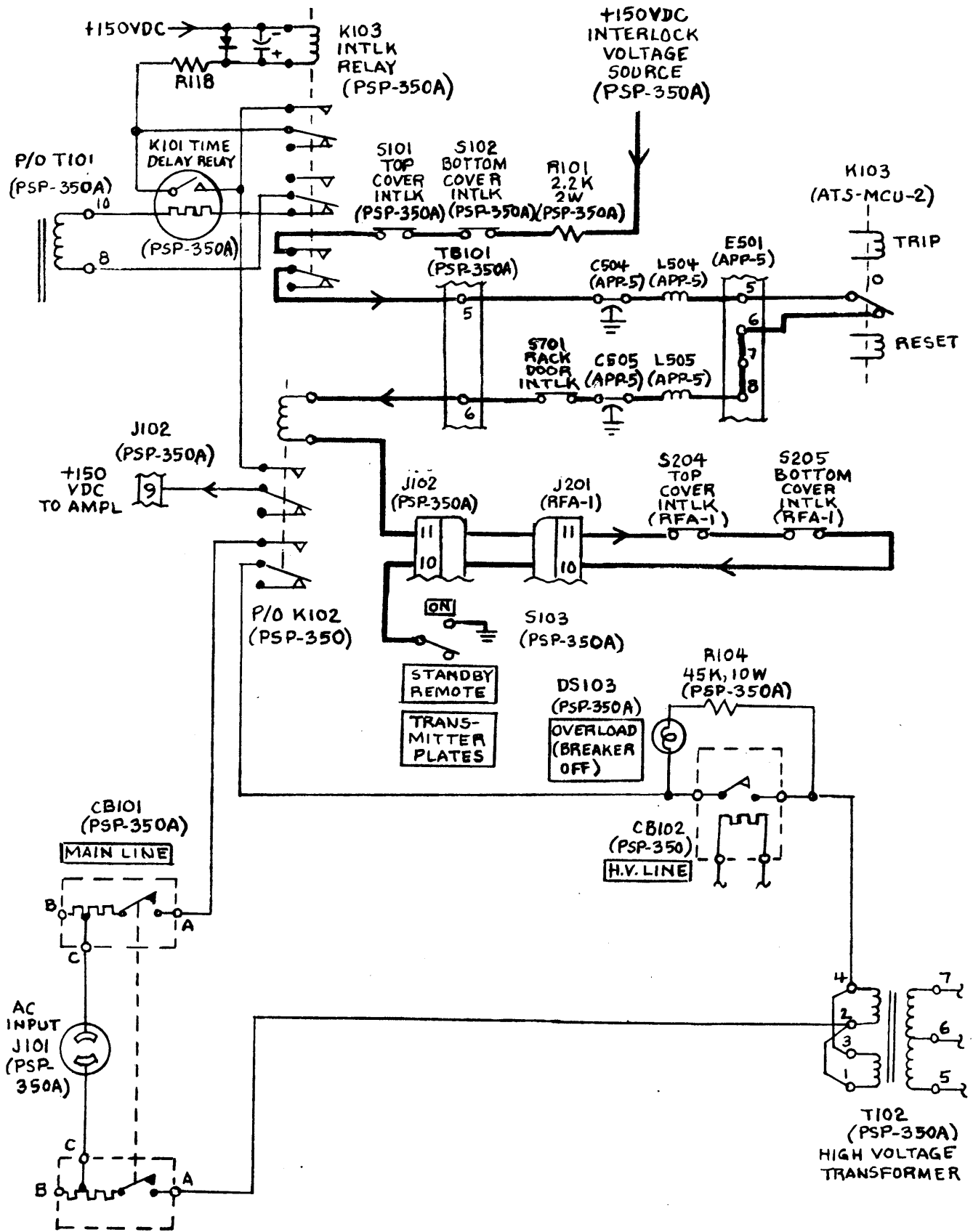


FIGURE 4-2. SAFETY INTERLOCK CIRCUIT, GPT-350D

SECTION 5

TROUBLESHOOTING

5-1. INTRODUCTION

This section describes a procedure of checking the GPT-350D in order to determine which of the four major components (ATS-2, PAL-350A, GPE-1A, and APP-5) is at fault. When this is determined, the individual manual may be referred to for troubleshooting the unit.

Troubleshooting is the art of locating and diagnosing equipment troubles and maladjustments; the information necessary to remedy the equipment troubles is reserved for section 6 (Maintenance Section) of the individual manual for the faulty unit.

5-2. GENERAL TROUBLESHOOTING TECHNIQUES

Often it is unnecessary to follow a lengthy and orderly course of troubleshooting in order to localize and isolate the faulty part. When a piece of equipment has been working satisfactorily and suddenly fails, the cause of failure may be apparent either because of circumstances occurring at the time of failure or because of symptoms analogous to past failures.

Another short cut in troubleshooting is to ascertain that all tubes and fuses are in proper working order; also that equipment receives proper supply voltages. Many times this will eliminate further investigation.

A brief examination of the equipment for burned-out elements, charring, corrosion, arcing, excessive heat, dirt, dampness, etc. is usually in order. Here it is important to recognize that a defective element may have become defective due to its own weakness or to some contributive cause beyond its control.

Sometimes excessive vibration will cause failure; for example, at soldered joints or when components, normally isolated from others, are shaken together. Such failures are more difficult to locate.

5-3. TROUBLESHOOTING THE GPT-350D SYSTEM

a. GENERAL NOTES - If trouble occurs during operation of the GPT-350D, some general rules may be followed that will often give a clue in determining which major unit (ATS-2, PAL-350A, GPE-1A and APP-5) is at fault. Perform a general check along the lines listed in paragraphs under 5-2. If the faulty unit is not revealed in this way, refer to paragraph 5-3b which lists some generalizations as to causes of trouble during operation. If the faulty unit is still not evident, refer to section 5 of the individual component manual and take voltage readings of each unit. Once the faulty unit has been determined, refer to the individual manual for narrowing down the trouble to the section and the defective component in the unit.

b. TROUBLESHOOTING BASED ON OPERATIONAL PROCEDURE - In many cases the faulty unit may become evident by referring to the "purpose" column of tables 3-1 through 3-3 opposite the step in which the trouble occurs. If the various lights and indicators have responded correctly as described in the "operation" column up to a certain step and do not respond in that step, the faulty unit may be pointed out in this way. Besides this, other generalizations may be stated as listed below:

TROUBLE

CHECK

Output frequency is off	VOX-5 master oscillator
Output power cannot be brought up to desired level	PAL-350 (RFA-1 unit) power amplifier or ATS-2 power indicator
Overload condition occurs repeatedly	ATS-2 overload relays or PSP-350 H.V. LINE circuit breaker
Output signal is distorted at receiver	PAL-350 amplifier tubes or GPE-1 output frequency or VOX-5 output frequency
Output frequency is unstable	VOX-5 oven thermostat
Transmitter is inoperative	Interlock system (see table 4-1)

SECTION 6
MAINTENANCE

6-1. INTRODUCTION

Generalized phases of maintenance of the GPT-350D are outlined below. For maintenance of individual components, refer to section 6 of component manuals.

6-2. GENERAL

The GPT-350D contains assemblies of many electrical and mechanical parts which may be maintained adequately by conventional preventive and corrective maintenance techniques as outlined in the following paragraphs. Long life and continual operation of moving parts require especially good maintenance. However, when a component fails in a highly precise frequency-sensitive assembly it is generally more practical to replace the entire assembly rather than to attempt to repair it. Such assemblies may then be returned to the factory for repair and adjustment. The same is true of complex mechanical assemblies. Installation of "parts peculiar" without suitable tools makes the replacement of the entire assembly more practical than disassembly, installation and reassembly. Pieces of the GPT-350D that fall into this category are the master oscillator/oven assembly in the VOX-5, master oscillator counters and gears, and the larger selector switches in GPE-1A and PAL-350A.

6-3. OPERATOR'S MAINTENANCE

Operator's maintenance consists in not only maintaining optimum equipment performance at all times but also keeping a detailed record of the equipment performance as well as a log of events and happenings, including climatic conditions, pertinent to equipment operation.

Such records are useful in spotting gradual equipment degradation and when more general remedial measures are necessary. A periodic cleaning of the outside of the equipment will help to prevent internal damage due to accumulated grime in the control movements.

6-4. PREVENTIVE MAINTENANCE

a. GENERAL - Preventive maintenance is maintenance that detects and corrects trouble producing items before they become serious enough to affect equipment operation adversely. Some trouble producing items are dirt and grime, contact erosion, improper contact pressure, lack of proper lubrication, overheating, unstable power supplies, vacuum tubes with poor emission, loose parts (due to excessive vibration), etc.

It may appear contradictory to state that good preventive maintenance means that one should not constantly poke around and tinker with an equipment that is performing excellently. Over-zealous maintenance can readily cause more, rather than less, potential trouble. Good preventive maintenance requires constant vigilance and good judgment of when, what and how to apply remedial measures.

b. ONCE EACH SHIFT DURING AN "ON THE AIR" PERIOD - Check the operator's GPT-350D performance record for irregularities and possible sources of future trouble. Make minor adjustments of the tuning controls to verify proper tuning. Observe all electrical quantities possible with built-in meters (such as the PAL-350 MULTIMETER and PA PLATE current meters) and compare observations with established standards for irregularities.

c. DAILY DURING AN "OFF THE AIR" PERIOD - If transmitter has been set in STANDBY condition (see table 3-6), the following inspection

should be accomplished quickly in order to minimize the time in which the rack door is open. Leaving the rack door open too long may upset the VOX-5 master oscillator oven temperature stabilization as will be indicated by an irregular cycling of the INNER and OUTER OVEN lights. Briefly inspect all parts of the GPT-350D for overheating and damage. Note deposits of dust and dirt. Check operation of all door and cover interlocks.

d. MONTHLY DURING "OFF THE AIR" PERIODS - Turn transmitter off (see paragraph 3-4c, page 3-19). Inspect all sliding and moving coil contacts and observe all rotating parts for wear. Inspect condition of relay contacts. Recondition rotary switch contacts as necessary. Use crocus cloth and trichloroethylene or ethylenedichloride for cleaning. Remove dirt or grease from non-electrical parts with any good dry-cleaning fluid.

WARNING

When using trichloroethylene or carbon tetrachloride, make sure that adequate ventilation exists. These are toxic substances. Avoid prolonged contact with skin.

Check the conditions of the air filters; replace or clean dirty filters. Inspect GPT-350D for loose solder connections or screws, especially in those cases experiencing appreciable vibration in service. Note the condition of gear trains; those showing signs of becoming dry should be lubricated with a drop or two of any high quality, light machine lubricant. The tube of silicone compound lubricant included in the GPT-350D shipment is a weatherproof lubricant for the ATS-TU-2 Tuner motors. Check condition of all tubes.

6-5. CORRECTIVE MAINTENANCE

a. DEFINITION - Corrective maintenance is an aftermath of troubleshooting as discussed in section 5, or preventive maintenance as discussed in the preceding paragraph (6-4). With the exception of those cases when components suddenly fail for no apparent good reason or under extenuating circumstances, an intelligent program of preventive maintenance should produce minimum equipment outage.

b. REPLACEMENT OF PARTS - After a defective part has been localized and isolated by the troubleshooting techniques presented in various sections 5 of the component manual, replacement generally presents no major problem, particularly in the case of failure of non-complex electrical and mechanical components. Refer to Appendix for guide in ordering parts used in the APP-5 and RAK-23D.

c. ALIGNMENT PROCEDURE - It must be stated here that, as a general practice, re-alignment of the GPT-350D should not be performed indiscriminately. It should be a last course of action to be taken in diagnosis and remedy of trouble. The alignment procedure presented below is essentially that used by TMC for each transmitter before it is shipped. First, each component (ATS-2, PAL-350A, VOX-5 and GPE-1A) is aligned in accordance with alignment procedure presented in section 6 of the component manual. Then, after the transmitter is assembled, R121 forward power trip adjustment potentiometer in the ATS-MCU-2 is adjusted to trip at 400 watts instead of 1200 watts. The same procedure is used as that described in section 6 of the ATS-2 manual for 1200 watts.