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OPERATOR'S MANUAL

for

SYNTHESIZED

GPT-200K TRANSMITTER



THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y.

OTTAWA, CANADA

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4. Nature of defect or cause of failure.
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When ordering replacement parts, the following information must be included in the order as applicable:

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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

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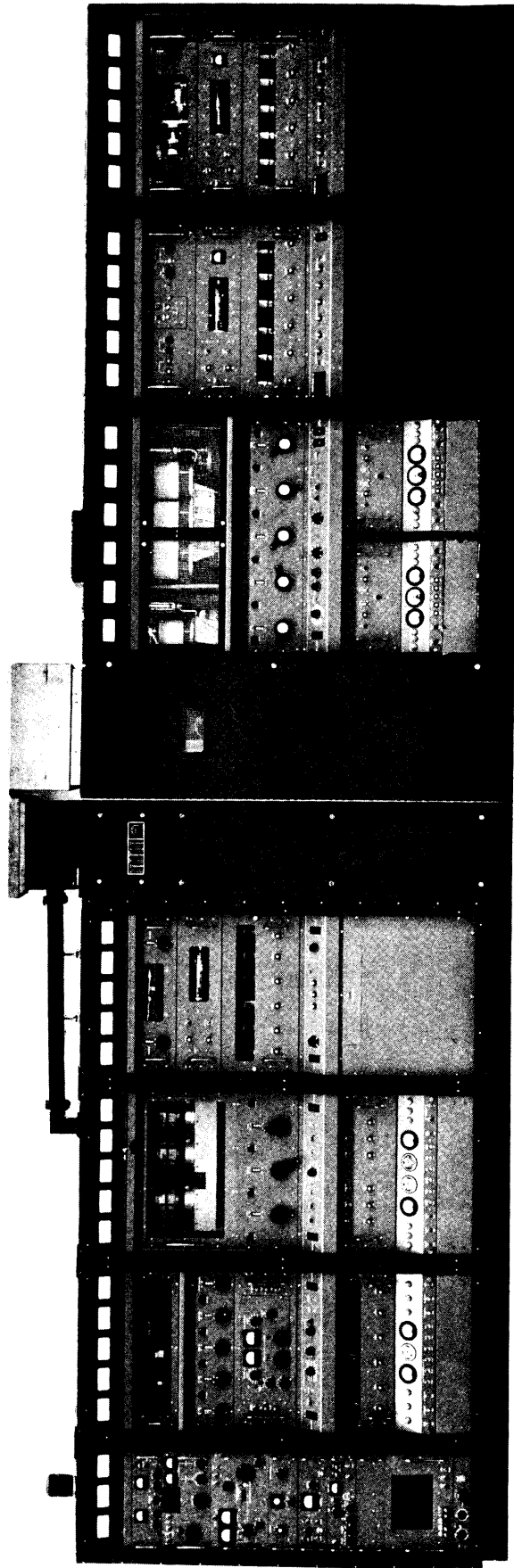
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Figure 1-1. General Purpose Transmitter, Model GPT-200K

SECTION 1

GENERAL INFORMATION

1-1. PURPOSE OF EQUIPMENT.

The GPT-200K transmitter (figure 1-1) is a conservatively rated general purpose transmitter that delivers 200 kw PEP (peak envelope power), or 100 kw average power, throughout the 2- to 28-mc range. The operating modes of the transmitter are:

- a. SSB (single sideband) with suppressed or any degree of carrier (this mode includes AME (AM equivalent) operation).
- b. DSB (double sideband) with suppressed or any degree of carrier (this mode includes AM (amplitude modulation) operation).
- c. ISB (independent sideband) (separate intelligence on each sideband) with suppressed or any degree of carrier.
- d. FSK (frequency-shift telegraphy).
- e. FAX (facsimile).
- f. CW (carrier on-off telegraphy).

1-2. BLOCK DIAGRAM ANALYSIS. (See figure 1-2.)

a. GENERAL. - The transmitter consists of a synthesized exciter, 1-kw IPA (intermediate power amplifier), 10-kw PA (power amplifier), 40-kw PA, a 200-kw power amplifier and associated power supply and power control circuits. The transmitter delivers 200,000 watts PEP throughout its operating range. The exciter generates 1 watt (PEP) r-f in the range of 1.75 to 33.75 mc, with the signal frequency-locked to an accuracy of 1 part in 10^8 (10^9 when using CSS-2) when operating at any 100-cycle increment within this range. The 1-kw IPA, 10-kw PA, 40-kw PA and 200-kw power amplifier stages are tunable through the 2- to 28-mc range, fixing the transmitter output frequencies to this range.

The exciter circuits provide a large variety of operating modes and types of sideband intelligence. The circuits can be set up for single sideband, double sideband, independent sideband, or keyed CW. Operating with proper terminal equipment, either or both sidebands may carry FSK, FAX, or audio line intelligence.

b. AUXILIARY FRAME CIRCUITS. - The auxiliary frame contains the exciter circuits (Sideband Generator SBG), Tone Intelligence Unit TIS* or Keyer Monitor Control Unit KMCU*, Standing Wave Control Unit SWCU, an auxiliary power panel, and a power transformer for the exciter units.

*Optional equipment; TIS may be housed in remote location when both units are employed.

(1) PRIMARY STANDARD CSS. - The CSS generates the 1-mc signal which is the heart of the sideband generator. The CSS-1B provides the signal at a frequency stability of 1 part in 10^8 per day; the CSS-2 provides increased stability of 1 part in 10^9 per day. In either case, the 1-mc signal is applied to Frequency Amplifier CHG.

The CHG also contains a 1-mc oscillator, frequency stable to one part in 10^6 per day which is included only for emergency use. During normal operation, the 1-mc standard signal from Frequency Standard CSS is amplified, then routed through an internal switch in the CHG to Divider Chain CHL.

(2) DIVIDER CHAIN CHL. - In the CHL, the standard 1-mc signal is counted down to provide outputs at 500 kc, 10 kc, 1 kc, and 100 cps. These signals, locked to the standard, are applied to Controlled Oscillator CLL.

(3) CONTROLLED OSCILLATOR CLL. - Equipped with three frequency synthesizer loops, the CLL uses the four counted-down outputs of Divider Chain CHL to produce a synthesized output which is variable from 510.0 to 519.9 kc, in 100-cycle increments. Each of the possible 100 discrete synthesized frequencies provided by the CLL is frequency-locked to the 1-mc standard, maintaining the required frequency stability. The 510.0- to 519.9-kc output of the CLL is applied to Controlled Master Oscillator CMO.

(4) CONTROLLED MASTER OSCILLATOR CMO. - The CMO receives the selected 510.0- to 519.9-kc output of Controlled Oscillator CLL and the 10-kc output of Divider Chain CHL. The CMO contains a precision-designed variable frequency oscillator (VFO) which is operable through the 2- to 4-mc range. A 100-kc crystal oscillator in the CMO is used to calibrate the VFO at any desired 100 kc increment in the 2- to 4-mc range, after which the synthesizer loop is closed. This causes the selected 510.0- to 519.9-kc input signal and the 10-kc input signal to phase-lock the VFO at the selected 100-cycle increment within the 2- to 4-mc range.

(5) TONE INTELLIGENCE UNIT TIS. - The TIS (optional equipment) controls the passage of audio channels 1 and 2 to Sideband Exciter CBE. The TIS may pass audio line 1 and/or 2 to the audio channel inputs of the CBE-1, depending on the position of its front panel EXCITER switches. When connected to the proper terminal equipment, it converts pulsed FSK signals into frequency-shifted audio mark and space tones, or varying dc FAX input signals to varying audio frequency signals. When CW keying

signals are applied, the TIS provides a keyed 1000-cycle tone for keyed carrier operation.

(6) **SIDEBAND EXCITER CBE-1 (OR CBE-2).** - Sideband Exciter CBE accepts two channels of intelligence from Tone Intelligence Unit TIS, and frequency translates these audio inputs into lower and upper sidebands at a nominal frequency of 250 kc. The CBE-1 and CBE-2 are physically identical units that differ only in audio bandpass. The CBE-1 provides a wide bandpass of ± 7.5 kc; the CBE-2 narrow bandpass is 3.3 kc. The difference in bandpass is accomplished by two plug-in bandpass filters that are different in each model. To simplify presentation, all subsequent references in this manual are made to the CBE and are applicable to both, unless otherwise specified.

Controls on the front panel of the CBE permit independent level control of upper and lower sideband audio inputs. The relative power in each sideband is monitored by front panel meters. Either audio input may be switched to either sideband, and carrier level is adjustable from -55 db to 0 db.

(7) **FREQUENCY AMPLIFIER CHG.** - The CHG frequency-translates the 2- to 4-mc synthesized input from Controlled Master Oscillator CMO with the 250 kc signal received from Sideband Exciter CBE, providing a sideband output in the range of 1.75 to 33.75 mc, synthesized in 100-cycle steps. This r-f output signal, conservatively rated at 1 watt PEP is applied to rf amplifier RFC in the main frame.

(8) **POWER SUPPLIES.** - Power Supply CPP-5 provides all the necessary ac and dc power required by Frequency Amplifier CHG. Power Supply CPP-2 provides a-c and d-c power for the Divider Chain CHL, Controlled Master Oscillator CMO, and Controlled Oscillator CLL. The remaining exciter units contain their own power supplies. Primary power is supplied to the exciter units by an auto-transformer in the auxiliary frame.

(9) **STANDING WAVE CONTROL UNIT SWCU.** - The SWCU, rack-mounted at the rear of the auxiliary frame, contains an SWR overload relay, a dc amplifier, and a power supply. This unit monitors SWR at the output of the 10-kw IPA. When excessive SWR is detected, the overload relay automatically removes high voltage from the transmitter.

(10) **KEYER-MONITOR CONTROL UNIT KMCU.** - The KMCU (optional equipment) monitors various phases of transmitter operation such as presence of plate voltage, r-f output, and input keying signals, and provides signals for indication at a remote location for these conditions. The KMCU also sequentially keys Controlled Master Oscillator CMO, Frequency Amplifier CHG, and RF Amplifier RFC, and controls the TUNE/OPERATE condition of the 1-kw IPA and 10-kw PA stages of the transmitter.

c. **MAIN FRAME CIRCUITS.** - The main frame circuits raise the 1-watt (PEP) rf output signal from the exciter to a level sufficiently high (up to 10-kw PEP) to drive the 40-kw PA. These circuits include

the 10-kw high voltage power supply, power controls, and protective relays.

(1) **RF AMPLIFIER RFC (1KW IPA).** - The RFC consists of two voltage amplifier stages operating class A and a 1-kw IPA that operates class AB1. The linear stages of the RFC raise the nominal 1-watt (PEP) rf output of the exciter to 1-kw (PEP). This signal is applied to the 10-kw PA.

(2) **10-KW PA.** - This section contains the 10-kw power amplifier, a linear power amplifier that operates class AB1 to raise the rf level to as high as 10-kw PEP. A sample of 10-kw PA output is routed to the auxiliary power panel where it may be conveniently monitored. A dummy load is provided in this section to permit tuning of the 10-kw PA independently of the following stages.

A portion of the 10-kw PA r-f output is rectified to obtain a control voltage that is applied to an ALDC (automatic load and drive control) circuit. When the front panel ALDC switch is set at ADJ, the ALDC control voltage is applied to frequency amplifier CHG in the exciter. The ALDC control voltage limits high drive peaks which can be developed during multiple signal transmission and subsequently suppresses unwanted transmission products. The ALDC circuit is functionally similar to an AGC circuit in a receiver.

(3) **MAIN POWER SUPPLY, 10-KW HIGH VOLTAGE RECTIFIER, AND MAIN POWER PANEL.** - The 10-kw high voltage rectifier functions together with the main power panel and main power supply to produce the high d-c voltages required by the 1-kw IPA and 10-kw PA.

(4) **MAIN FRAME RELAY PANEL.** - The main frame relay panel contains protective circuits that automatically cut off high voltages to the 1-kw IPA and 10-kw PA when preset overload levels are exceeded in these stages. The protective circuits sample the 1-kw IPA and 10-kw PA plate and screen currents, bias supply voltages and the current in a voltage regulating diode assembly in the main power supply. When any of these currents is excessive, or if a d-c voltage is low, the associated protective relay operates and removes high voltage.

d. **PA AND PS FRAME CIRCUITS.** - The PA and PS frame circuits raise the r-f output power of the 10-kw PA to 40-kw PEP. These circuits include the 40-kw high-voltage power supply, power controls and protective relays.

The 40-kw PA is a linear class AB2 power amplifier. The output of the 40-kw PA is routed to the Buffer Frame. A sample of the 40-kw PA output is routed to the auxiliary power panel where it may be conveniently monitored.

High voltage for the 40-kw PA is supplied by the 40-kw high-voltage rectifier. The B+ and B- outputs of the 40-kw high-voltage rectifier are also connected across circuits in the crowbar drawer. The crowbar drawer, a protective device for the 40-kw PA, detects surges in PA grid current. If a sharp rise in

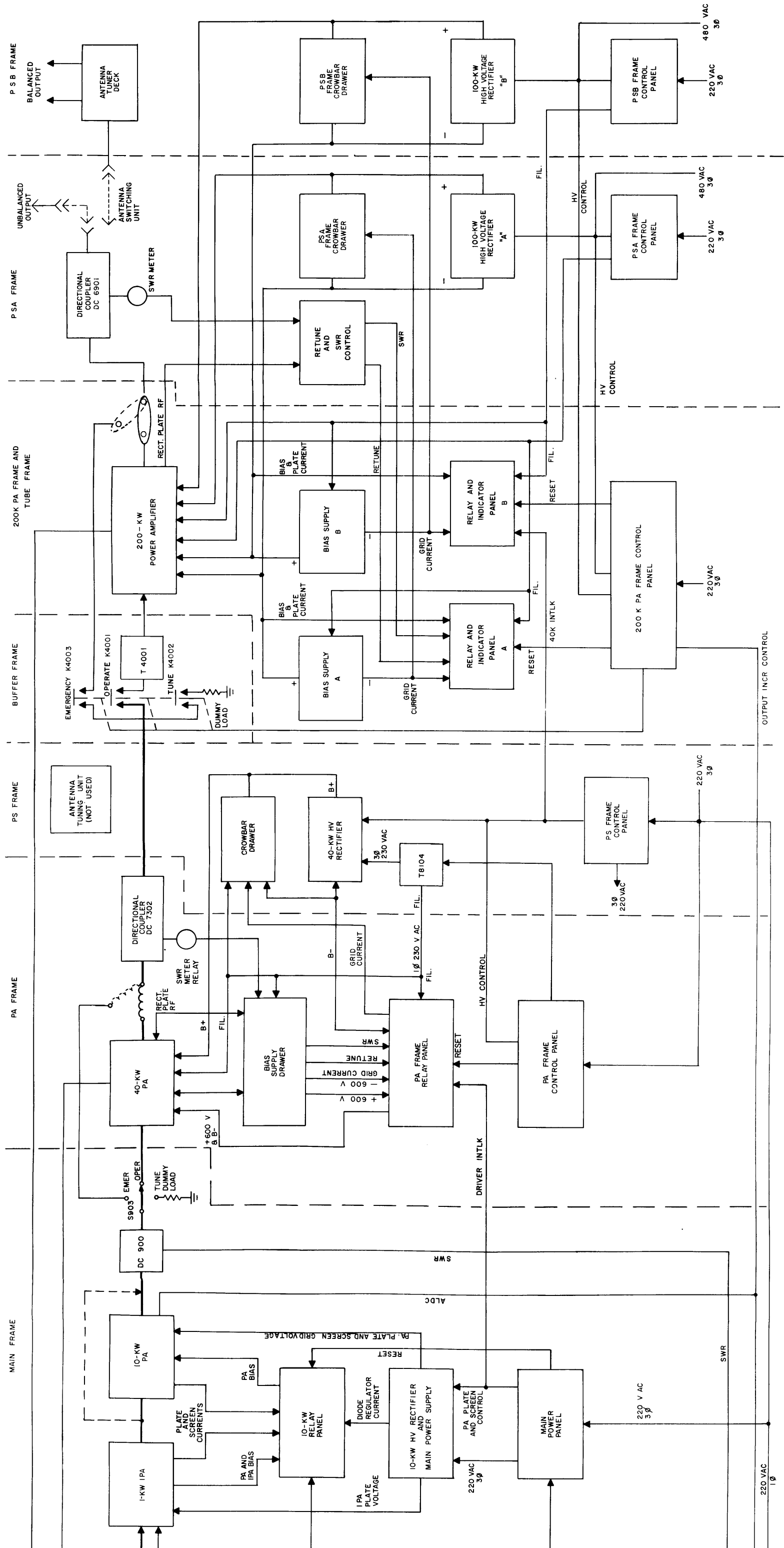
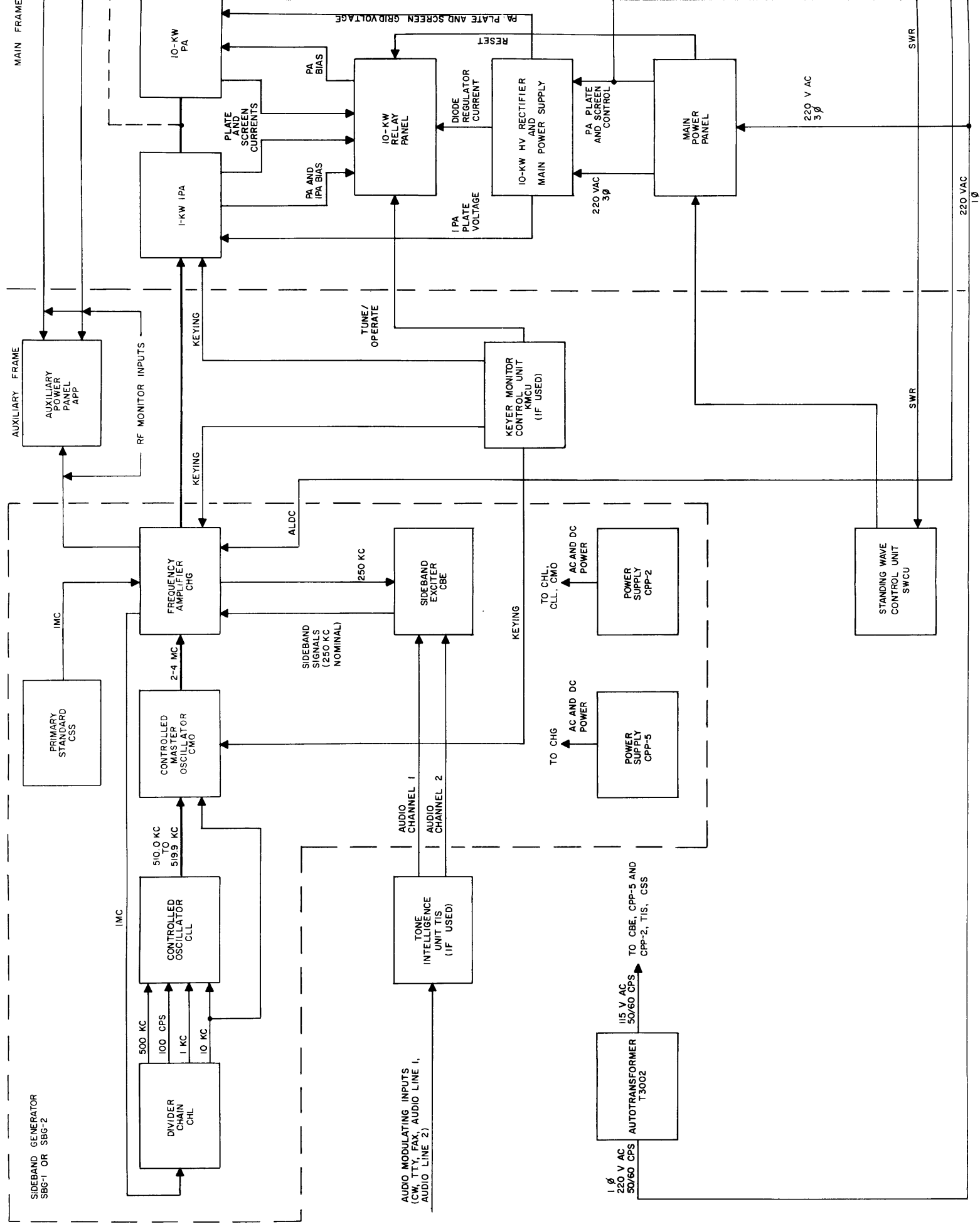


Figure 1-2. Block Diagram, GPT-200K



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grid current occurs (as a result of arcing), the crowbar drawer shorts B+ of the 40-kw high-voltage rectifier to B-, causing MAIN BREAKER CB8101 to trip. This action removes power from the 40-kw high-voltage rectifier.

The 40-kw PA receives a +600-volt regulated bias voltage from the bias supply drawer via the PA frame relay panel. The bias supply drawer contains an unregulated +350-volt supply and electronic circuits associated with the SWR (standing wave ratio) and retune protective circuits. A d-c voltage proportional to the r-f plate voltage in the 40-kw PA is applied to the retune circuit. A d-c voltage is connected through contacts of the SWR meter relay to the SWR circuits in the bias supply drawer when the VSWR is excessive at the output of the 40-kw PA.

Protective relay circuits are used to remove high voltage from the 40-kw PA when a malfunction occurs in an associated circuit. These protective circuits, contained in the PA frame relay panel, sample bias (+600-volts), SWR signals, retune signals, final filament and crowbar filament voltages, and plate and grid currents. If one of these currents is excessive, if a dc voltage is low, or if the 40-kw PA is mistuned, an associated relay operates and removes power from the 40-kw high-voltage rectifier.

Transformer T8104 is an autotransformer that receives 220-volt 3-phase power from the PA frame control panel and supplies 230-volts ac (single phase) to the primary windings of filament transformers in the bias supply drawer, crowbar drawer, and the 40-kw PA. The autotransformer also supplies 3-phase 230 volts ac to the filament transformers in the 40-kw high-voltage rectifier. The 3-phase, 220 volts ac from the PS frame control panel is used for operation of the blowers in the PA frame.

e. BUFFER FRAME CIRCUITS. - The Buffer Frame contains r-f switching circuitry, a dummy load that permits tuning of the 40-kw PA independently of the following stage, and an impedance matching network (T4001) for the input of the final power amplifier of the transmitter.

f. 200K PA, PSA, AND PSB FRAME CIRCUITS. - The 200K PA, PSA, and PSB frames contain the final power-amplifier circuits of the transmitter with associated power supplies and protective circuitry. The final power amplifier receives the r-f output of the 40-kw PA and raises the power level as high as 200-kw PEP.

The final power amplifier of the transmitter consists of a class AB2 power amplifier with two tubes operating in parallel and coupled to a common output tuning circuit. Each tube is supplied from separate bias, plate, and control circuits, and therefore may be operated independently. The power output is then proportionally lower. In normal operation, the combined outputs of the power tubes are applied to a tuned

double pi network and then coupled through antenna switching and matching circuits to the antenna.

High voltage for the two power amplifier tubes is supplied by two 100-kw High Voltage Rectifiers (A and B). Each rectifier is turned on by an associated HV circuit breaker in the 200K PA frame control panel. The B+ and B- outputs of the 100-kw high voltage rectifiers A and B are connected directly across circuits in the PSA and PSB crowbar drawers respectively. The crowbar drawers, protective devices for the 200-kw power amplifier tubes, detect sharp changes in the corresponding PA grid currents. If a sharp rise in grid current occurs (as a result of arcing), the associated crowbar drawer shorts the output of the corresponding high-voltage rectifier in power supply A or B, causing HIGH VOLTAGE A circuit breaker or HIGH VOLTAGE B circuit breaker, respectively, to trip. This action removes the power input to the high-voltage power supplies.

Bias voltages for the two power amplifier tubes in the 200-kw power amplifier are supplied by two +450 volt, regulated Bias Supplies (A and B). Each bias supply is turned on by a circuit breaker in the PSA frame control panel or PSB frame control panel.

The SWR and retune circuits, located on a chassis which is part of the Antenna Switching Unit, contains the power supply and d-c amplifiers associated with the protective circuits. A portion of the self-contained power supply provides negative d-c voltage to the OUTPUT INCR control. The dc amplifiers are used to provide retune and SWR voltages to Relay and Indicator Panel A when insufficient r-f plate voltage or excessive transmission line SWR is detected.

Protective relay circuits are used to remove high voltage from the 200-kw power amplifier when a malfunction occurs in the circuit. The protective circuits, contained in Relay and Indicator Panels (A and B) sample the bias, SWR and retune signals, filament voltage for the crowbar and power amplifier tubes, and plate and grid currents of each power amplifier tube. If one of these currents is excessive or if a voltage is deficient, the associated relay operates and removes power from the corresponding 100-kw high-voltage rectifier.

Switching of the unbalanced transmitter output to 100-kw load is provided by circuits in Antenna Switching Unit and coaxial switches S1 and S2. (The switches are optional equipment specifically designed for the transmitter.)

The transmitter also contains interlock circuits which are provided for personnel and equipment safety. Whenever one of these interlocks opens, high voltage is removed from the transmitter. Interlock circuits are provided for drawers in which voltages greater than 500 volts are present. Important cooling air ducts are also interlocked for equipment safety.

SECTION 2

OPERATING CONTROLS

Tables 2-1 through 2-7 present the component designations and functions of the front-panel controls and indicators for the major equipment frames that make up the GPT-200K transmitter. For simplification, controls and indicators are numbered in series:

<u>FRAME</u>	<u>NUMERICAL INDEX</u>
Auxiliary	0-100
Main	100-200
PA and PS	201-300
Buffer	300
200K PA	301-372
PSA and PSB	373-413

TABLE 2-1. AUXILIARY FRAME OPERATING CONTROLS AND INDICATORS

ITEM NO. (FIGURE 2-1)	PANEL DESIGNATION	FUNCTION
1	PA SCREEN meter	Indicates amplitude of 10-kw PA screen grid voltage.
2	PA BIAS meter	Indicates amplitude of 10-kw PA bias voltage.
3	PA PLATE meter	Indicates amplitude of 10-kw PA plate (dc) voltage.
4	LSB meter	Indicates peak amplitude of lower sideband signal.
5	USB meter	Indicates peak amplitude of upper sideband signal.
6	LSB selector switch	Selects audio channel to be applied to lower sideband.
7	LSB GAIN control	Sets level of lower sideband audio signal.
8	CARRIER LEVEL control	Sets degree of carrier insertion.
9	USB GAIN control	Sets level of upper sideband audio signal.
10	USB selector switch	Selects audio channel to be applied to upper sideband.
11	POWER lamp	When lit, indicates that ac power is applied to CBE.
12	ON-OFF switch	In ON position, applies ac power to CBE.
13	OVEN lamp	When lit, indicates that power is applied to oven of CHG. After warm-up period, it cycles on and off.
14	POWER switch	In STANDBY position, applies power to oven circuit. In ON position, applies full ac and dc power to CHG through B+ switch.

TABLE 2-1. AUXILIARY FRAME OPERATING CONTROLS AND INDICATORS (CONT)

ITEM NO. (FIGURE 2-1)	PANEL DESIGNATION	FUNCTION
15	STANDBY lamp	When lit, indicates that CHG is in standby.
16	B+ switch	In ON position, applies B+ to r-f amplifier portion of CHG.
17	SYNC lamp	When lit, indicates high frequency lock-on in CHG.
18	MCS tuning dial	Indicates rf output frequency of CHG.
19	MF TUNING meter	Indicates relative amplitude of mid-frequency signal tuned by MF TUNING control.
20	OUTPUT meter	Indicates amplitude of rf output of CHG. At full deflection, indicates output of 1 watt PEP.
21	MCS band switch dial	Indicates frequency range, dial designation, and dial numeric of selected rf band.
22	BAND switch	Selects r-f operating band of CHG.
23	OUTPUT TUNING control	Tunes output stages of CHG.
24	MF TUNING control	Tunes mid-frequency circuits of CHG.
25	OUTPUT control	Controls amplitude of CHG r-f output signal.
26	SYNC IND lamp	When lit, indicates that master oscillator is phase-locked to CLL output signal.
27	OVEN lamp	When lit, indicates that power is applied to oven of CMO. After warm-up period, it cycles on and off.
28	CAL BEAT lamp	Used to indicate zero beat during calibration of master oscillator.
29	OPERATE-CAL switch	In OPERATE position, closes synthesizer loop of master oscillator and disables crystal oscillator used for calibration. In CAL position, applies power to crystal oscillator for calibration purposes, and disables master oscillator synthesizer loop.
30	TUNE FOR MAX meter	Indicates relative amplitude of CMO output.
31	ADJ FOR ZERO meter	Indicates relative amplitude and direction of correction voltage generated during low frequency lock-on operation.
32a	LOCK knob	In clockwise position, locks red calibrate control.
32b	Calibrate control	Varies frequency of master oscillator in small increments.
33	TUNING KCS control	Tunes output amplifiers of CMO.
34	MASTER OSCILLATOR FREQUENCY counter dials	Indicates frequency of master oscillator.
35	MASTER OSCILLATOR FREQUENCY control	Varies frequency of master oscillator.
36	OUTPUT control	Controls amplitude of CMO output.

TABLE 2-1. AUXILIARY FRAME OPERATING CONTROLS AND INDICATORS (CONT)

ITEM NO. (FIGURE 2-1)	PANEL DESIGNATION	FUNCTION
37	LOCK knob	Locks MASTER OSCILLATOR FREQUENCY control when turned clockwise.
38	KILOCYCLES switch	Sets kilocycles (third) digit of output frequency generated by CLL.
39	SYNC oscilloscope	In positions L-1, L-2, and L-3, presents visual display (stationary rectangle) to indicate operational status of three synthesizer loops.
40	SYNC switch	Selects synthesizer loop for visual display on SYNC oscilloscope.
41	HUNDREDS OF CYCLES switch	Selects hundreds of cycles (fourth) digit of output frequency generated by CLL.
42	POWER lamp	When lit, indicates that ac and dc power are applied to CSS.
43	PHASE COMPARATOR meter	When external 1-mc signal is applied to PRI STD IN jack, indicates frequency difference between external signal and 1-mc standard. Frequency of meter pointer movement represents difference in frequency.
44	SENSITIVITY control	Controls amplitude of swing on PHASE COMPARATOR meter when frequency comparison is being made.
45	ON-STANDBY switch	In ON position, applies all ac and dc voltages to CSS. In STANDBY position, applies power only to oven circuits.
46	1 MC MONITOR connector	Provides sample of 1-mc primary standard signal.
47	STANDBY lamp	When lit, indicates that CSS is in standby condition.
48	PRI STD IN connector	Provides means for applying external 1-mc signal for frequency comparison.
49	OVEN lamp	When lit, indicates that power is applied to oven of TIS. After warm-up period, it cycles on and off.
50	SHIFT CPS control	Sets the total amount of frequency shift when TIS is set up for FSK operation.
51	LEVEL ADJ control	Controls amplitude of audio output signal of TIS.
52	OUTPUT LEVEL meter	Indicates amplitude of audio output signal of TIS.
53	FUNCTION switch	Sets up TIS for FSK, FAX, or CW operation.
54	CENTER FREQ CPS switch	Determines center frequency when operating FSK or FAX.
55	TEST switch	Simulates mark or space condition in MARK or SPACE position, respectively. Bypassed in LINE position.
56	KEY MODE switch	Matches keying input impedance for voltage or current keying.

TABLE 2-1. AUXILIARY FRAME OPERATING CONTROLS AND INDICATORS (CONT)

ITEM NO. (FIGURE 2-1)	PANEL DESIGNATION	FUNCTION
57	EXCITER CH 1 switch	In LINE position, connects audio line 1 input to TIS to channel 1 audio output of TIS. In FSK-FAX-CW position, connects FSK, FAX, or CW output of TIS (as selected by FUNCTION switch) to channel 1 audio output of TIS.
58	EXCITER CH 2 switch	Same as EXCITER CH 1 switch, but applies to channel 2 audio output of TIS.
59	B+ lamp	When lit, indicates that B+ is applied to TIS.
60	B+ switch	In B+ position, applies all a-c and d-c voltage to TIS; in STANDBY position, applies power to oven only.
61	STANDBY lamp	When lit, indicates that CPP-2 is in standby; i. e., it is applying oven power to CMO and CLL.
62	POWER lamp	When lit, indicates that CPP-2 is applying ac and dc power to CHL, CLL, and CMO.
63	POWER-STANDBY switch	In POWER position, applies all ac and dc voltages to CHL, CLL, and CMO. In STANDBY position, applies oven power to CMO and CLL.
64	MONITOR switch	In EXCITER position, connects rf output sample from CHG to MONITOR OUTPUT connector. In IPA position, connects rf output sample from 40-kw PA to MONITOR OUTPUT connector. In PA position, connects rf output sample from 200-kw PA to MONITOR OUTPUT connector.
65	MONITOR OUTPUT connector	Provides sample of r-f output from CHG (exciter), 40-kw PA, or 200-kw PA, as determined by setting of MONITOR switch.
66	CHANNEL 1 AUDIO INPUT jack	Receives external audio input. Audio applied to this jack is connected by auxiliary frame wiring to line 1 input of TIS.
67	AUX POWER circuit breaker	Applies power to utility receptacles of Auxiliary Power Panel.
68	ON AIR lamp	Lights when keying or modulating signals are applied to transmitter, and transmitter is radiating.
69	READY lamp	Lights when plate voltage is applied to transmitter, but transmitter is not radiating.
70	FAILURE lamp	Lights when keying or modulating signals are applied, but transmitter does not radiate; flashes on and off when transmitter is radiating, but no keying or modulating signals are applied.
71	POWER lamp	Lights when power is applied to KMCU.
72	POWER switch	When set at ON, applies power to KMCU.
73	KEYING CONTROL switch	When set at REMOTE, permits remote keying of transmitter; when set at LOCAL, permits transmitter keying with TEST KEY (74).
74	TEST KEY	Permits local keying of transmitter when KEYING CONTROL switch (73) is set at LOCAL.

TABLE 2-2. MAIN FRAME OPERATING CONTROLS AND INDICATORS

ITEM NO. (FIGURE 2-2)	PANEL DESIGNATION	FUNCTION								
101	FILAMENT PRIMARY meter	Indicates voltage at 230 v tap of filament transformer of 10-kw PA.								
102	PA SCREEN CURRENT meter	Indicates screen current of 10-kw power amplifier tube.								
103	PA PLATE CURRENT meter	Indicates plate current of 10-kw power amplifier tube.								
104	PA PLATE RF meter	Indicates rf voltage at plate of 10-kw power amplifier tube.								
105	PA OUTPUT meter	Indicates output power of 10-kw PA or VSWR at output of 10-kw PA as determined by setting of SWR switch (138).								
106	AC POWER lamp	When lit, indicates that power is applied to main power supply.								
107	TUNE lamp	When lit, indicates that TUNE-OPERATE switch (139) on main power panel is in TUNE position.								
108	OPERATE lamp	When lit, indicates that TUNE-OPERATE switch (139) on main power panel is in OPERATE position.								
109	PLATE ON lamp	When lit, indicates that ac voltage is applied to 10-kw High Voltage Rectifier.								
110	PA TUNE dial	Indicates setting of PA TUNE control (115).								
111	PA LOAD dial	Indicates setting of PA LOAD control (116).								
112	BAND SW dial	Indicates setting of BAND SW switch (117).								
113	OUTPUT BAL dial	Indicates setting of OUTPUT BAL control (118).								
114	OUTPUT LOADING dial	Indicates setting of OUTPUT LOADING control (119).								
115	PA TUNE control	Tunes output of 10-kw PA to desired frequency.								
116	PA LOAD control	Matches output impedance of 10-kw PA to load, antenna, or 40-kw PA input.								
117	BAND SW switch	Sets operating frequency range of 10-kw PA.								
118	OUTPUT BAL control	Operates in conjunction with OUTPUT LOADING control (119) to match impedance of 10-kw PA to input of 40-kw PA.								
119	OUTPUT LOADING Switch	<table border="0"> <thead> <tr> <th data-bbox="822 1705 1020 1734"><u>Switch Position</u></th> <th data-bbox="1202 1705 1308 1734"><u>Function</u></th> </tr> </thead> <tbody> <tr> <td data-bbox="872 1705 954 1734">TUNE</td> <td data-bbox="1103 1705 1417 1768">Connects 10-kw PA output to dummy load.</td> </tr> <tr> <td data-bbox="872 1789 954 1818">OPER</td> <td data-bbox="1103 1789 1417 1852">Connects 10-kw PA output to input of 40-kw PA.</td> </tr> <tr> <td data-bbox="872 1873 954 1902">EMER</td> <td data-bbox="1103 1873 1417 1936">Connects 10-kw PA output to antenna circuits.</td> </tr> </tbody> </table>	<u>Switch Position</u>	<u>Function</u>	TUNE	Connects 10-kw PA output to dummy load.	OPER	Connects 10-kw PA output to input of 40-kw PA.	EMER	Connects 10-kw PA output to antenna circuits.
		<u>Switch Position</u>	<u>Function</u>							
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TUNE	Connects 10-kw PA output to dummy load.									
OPER	Connects 10-kw PA output to input of 40-kw PA.									
EMER	Connects 10-kw PA output to antenna circuits.									

TABLE 2-2. MAIN FRAME OPERATING CONTROLS AND INDICATORS (CONT)

ITEM NO. (FIGURE 2-2)	PANEL DESIGNATION	FUNCTION																		
120	MULTIMETER	Indicates rf voltage, dc voltage, or dc current as selected by MULTIMETER switch (122).																		
121	IPA PLATE CURRENT meter	Indicates plate current of 1-kw IPA.																		
122	MULTIMETER switch	<p>8-position rotary switch:</p> <table border="1" data-bbox="938 470 1533 1052"> <thead> <tr> <th data-bbox="938 470 1235 499"><u>Position</u></th> <th data-bbox="1235 470 1533 499"><u>Measures</u></th> </tr> </thead> <tbody> <tr> <td data-bbox="938 520 1235 550">DC IPA BIAS</td> <td data-bbox="1235 520 1533 550">Bias on 1-kw IPA.</td> </tr> <tr> <td data-bbox="938 562 1235 592">DC IPA ESG</td> <td data-bbox="1235 562 1533 613">Screen voltage of 1-kw IPA.</td> </tr> <tr> <td data-bbox="938 625 1235 655">DC IPA EP</td> <td data-bbox="1235 625 1533 676">Plate voltage of 1-kw IPA.</td> </tr> <tr> <td data-bbox="938 688 1235 718">DC IPA ISG</td> <td data-bbox="1235 688 1533 739">Screen current of 1-kw IPA.</td> </tr> <tr> <td data-bbox="938 751 1235 781">RF 1ST AMPL EP</td> <td data-bbox="1235 751 1533 802">Rf voltage at plate of first rf amplifier in 1-kw IPA.</td> </tr> <tr> <td data-bbox="938 814 1235 844">RF IPA EG</td> <td data-bbox="1235 814 1533 865">Rf voltage at grid of 1-kw IPA.</td> </tr> <tr> <td data-bbox="938 877 1235 907">RF IPA EP</td> <td data-bbox="1235 877 1533 928">Rf voltage at plate of 1-kw IPA.</td> </tr> <tr> <td data-bbox="938 940 1235 970">RF PA EG</td> <td data-bbox="1235 940 1533 991">Rf voltage at input to 10-kw PA.</td> </tr> </tbody> </table>	<u>Position</u>	<u>Measures</u>	DC IPA BIAS	Bias on 1-kw IPA.	DC IPA ESG	Screen voltage of 1-kw IPA.	DC IPA EP	Plate voltage of 1-kw IPA.	DC IPA ISG	Screen current of 1-kw IPA.	RF 1ST AMPL EP	Rf voltage at plate of first rf amplifier in 1-kw IPA.	RF IPA EG	Rf voltage at grid of 1-kw IPA.	RF IPA EP	Rf voltage at plate of 1-kw IPA.	RF PA EG	Rf voltage at input to 10-kw PA.
<u>Position</u>	<u>Measures</u>																			
DC IPA BIAS	Bias on 1-kw IPA.																			
DC IPA ESG	Screen voltage of 1-kw IPA.																			
DC IPA EP	Plate voltage of 1-kw IPA.																			
DC IPA ISG	Screen current of 1-kw IPA.																			
RF 1ST AMPL EP	Rf voltage at plate of first rf amplifier in 1-kw IPA.																			
RF IPA EG	Rf voltage at grid of 1-kw IPA.																			
RF IPA EP	Rf voltage at plate of 1-kw IPA.																			
RF PA EG	Rf voltage at input to 10-kw PA.																			
123	IPA GRID TUNING control	Tunes rf input circuit of 1-kw IPA.																		
124	1ST AMPL TUNING control	Tunes rf output circuit of first rf amplifier in 1-kw IPA.																		
125	DRIVER BAND switch	Sets operating frequency range of first two rf amplifiers in 1-kw IPA.																		
126	IPA BAND switch	Sets operating frequency range of 1-kw IPA.																		
127	IPA LOADING switch	Operates in conjunction with IPA LOADING control (130) to vary impedance at output of 1-kw IPA.																		
128	IPA TUNING control	Tunes output circuit of 1-kw IPA.																		
129	IPA TUNING dial	Indicates setting of IPA TUNING control (128).																		
130	IPA LOADING control	Operates in conjunction with IPA LOADING switch (127) to vary impedance at output of 1-kw IPA.																		
131	IPA LOADING dial	Indicates setting of IPA LOADING control (130).																		
132	MAIN POWER circuit breaker	In ON position, applies primary power to main frame circuits.																		
133	OVERLOAD RESET push-button	When depressed after an overload occurs, resets relays in relay panel.																		
134	INTERLOCK INDICATOR	When lit, indicates interlock circuit selected by INTERLOCK switch (135) is closed.																		

TABLE 2-2. MAIN FRAME OPERATING CONTROLS AND INDICATORS (CONT)

ITEM NO. (FIGURE 2-2)	PANEL DESIGNATION	FUNCTION																										
135	INTERLOCK switch	<p>Selects interlock switch circuit to be checked by INTERLOCK INDICATOR lamp (134) as follows:</p> <table border="1"> <thead> <tr> <th data-bbox="773 348 987 380"><u>Position</u></th> <th data-bbox="1004 348 1389 380"><u>Circuit or Condition Checked</u></th> </tr> </thead> <tbody> <tr> <td data-bbox="773 401 987 432">NORMAL</td> <td data-bbox="1004 401 1389 453">Closure of all main frame interlocks.</td> </tr> <tr> <td data-bbox="773 474 987 506">BAND SW</td> <td data-bbox="1004 474 1389 527">In-detent status of IPA BAND switch (126).</td> </tr> <tr> <td data-bbox="773 548 987 579">IPA AIR SW</td> <td data-bbox="1004 548 1389 600">Normal operation of blower in 1-kw IPA.</td> </tr> <tr> <td data-bbox="773 621 987 653">EXTERNAL</td> <td data-bbox="1004 621 1389 716">Continuity of external interlock (terminals 8 and 10 of E3000 in auxiliary frame).</td> </tr> <tr> <td data-bbox="773 737 987 768">REAR DOOR</td> <td data-bbox="1004 737 1389 768">Closure of rear door.</td> </tr> <tr> <td data-bbox="773 789 987 821">PA AIR SW</td> <td data-bbox="1004 789 1389 842">Normal operation of blower in 10-kw PA.</td> </tr> <tr> <td data-bbox="773 863 987 894">PA DECK</td> <td data-bbox="1004 863 1389 915">Closure of panel on power amplifier section.</td> </tr> <tr> <td data-bbox="773 936 987 968">PA BAND SW</td> <td data-bbox="1004 936 1389 989">In-detent status of BAND SW switch (117)</td> </tr> <tr> <td data-bbox="773 1010 987 1041">RIGHT SIDE</td> <td data-bbox="1004 1010 1389 1041">Closure of right side panel.</td> </tr> <tr> <td data-bbox="773 1062 987 1094">HV DECK</td> <td data-bbox="1004 1062 1389 1115">Closure of high voltage rectifier in main frame.</td> </tr> <tr> <td data-bbox="773 1136 987 1167">RELAY DECK</td> <td data-bbox="1004 1136 1389 1188">Closure of relay panel in main frame.</td> </tr> <tr> <td data-bbox="773 1209 987 1241">TIMER</td> <td data-bbox="1004 1209 1389 1262">Activation of timer after time interval elapses.</td> </tr> </tbody> </table>	<u>Position</u>	<u>Circuit or Condition Checked</u>	NORMAL	Closure of all main frame interlocks.	BAND SW	In-detent status of IPA BAND switch (126).	IPA AIR SW	Normal operation of blower in 1-kw IPA.	EXTERNAL	Continuity of external interlock (terminals 8 and 10 of E3000 in auxiliary frame).	REAR DOOR	Closure of rear door.	PA AIR SW	Normal operation of blower in 10-kw PA.	PA DECK	Closure of panel on power amplifier section.	PA BAND SW	In-detent status of BAND SW switch (117)	RIGHT SIDE	Closure of right side panel.	HV DECK	Closure of high voltage rectifier in main frame.	RELAY DECK	Closure of relay panel in main frame.	TIMER	Activation of timer after time interval elapses.
<u>Position</u>	<u>Circuit or Condition Checked</u>																											
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RIGHT SIDE	Closure of right side panel.																											
HV DECK	Closure of high voltage rectifier in main frame.																											
RELAY DECK	Closure of relay panel in main frame.																											
TIMER	Activation of timer after time interval elapses.																											
136	FIL ADJ switch	Selects primary tap of 10-kw filament transformer to correspond with primary input voltage.																										
137	ALDC switch and control	Switch connects ALDC circuit in system. Control sets ALDC attack level.																										
138	SWR switch	In SWR position, permits direct reading of VSWR at output of 10-kw PA.																										
139	TUNE/OPERATE switch	In TUNE position, causes reduced dc voltage to be applied to screen grids of 1-kw and 10-kw power amplifier tubes. In OPERATE position, it causes full screen voltage to be applied to tubes.																										
140	PA SCREEN switch	In ON position, applies screen voltage to 10-kw PA.																										
141	HIGH VOLTAGE circuit breaker	In ON position, turns on 10-kw high voltage rectifier, applying high voltage dc to 10-kw power amplifier plate circuit.																										
142	FILAMENT TIME meter	Indicates total operating time of filament circuit of 10-kw PA.																										

TABLE 2-2. MAIN FRAME OPERATING CONTROLS AND INDICATORS (CONT)

ITEM NO. (FIGURE 2-2)	PANEL DESIGNATION	FUNCTION
143	TIME DELAY timer	Delays application of high ac voltage to high voltage rectifier so filaments may heat.
144	PLATE TIME meter	Indicates total operating time of high voltage rectifier.
145	PA BIAS lamp	When lit, indicates that no bias voltage is applied to 10-kw PA.
146	PA PLATE OVLD lamp	When lit, indicates that overload has occurred in plate circuit of 10-kw PA.
147	PA SCREEN OVLD lamp	When lit, indicates that overload has occurred in screen circuit of 10-kw PA.
148	IPA SCREEN OVLD lamp	When lit, indicates that overload has occurred in screen circuit of 1-kw IPA.
149	IPA PLATE OVLD lamp	When lit, indicates that overload has occurred in plate circuit of 1-kw IPA.
150	SWR OVLD lamp	When lit, indicates that overload has occurred as a result of excessive VSWR.
151	PA BIAS ADJ control	Sets amplitude of bias voltage applied to 10-kw power amplifier tube.
152	PA PLATE OVLD ADJ control	Controls dc level at which 10-kw PA plate overload relay is energized.
153	PA SCREEN OVLD ADJ control	Controls dc level at which 10-kw PA screen overload relay is energized.
154	IPA SCREEN OVLD ADJ control	Controls dc level at which 1-kw IPA screen overload relay is energized.
155	IPA PLATE OVLD ADJ control	Controls dc level at which 1-kw IPA plate overload relay is energized.
156	ALARM switch	When set at ON, energizes an audible alarm when high voltage is not applied to the 10-kw PA.
157	DRAWER INTERLOCK lamp	When lit, indicates that r-f amplifier drawer interlock is open.
158	IPA BIAS ADJ control	Adjusts amplitude of bias voltage applied 1-kw IPA.

TABLE 2-3. PA FRAME CONTROLS AND INDICATORS

ITEM NO. (FIGURE 2-3)	PANEL DESIGNATION	FUNCTION
201	FILAMENT PRIMARY meter	Indicates ac voltage applied to filament transformer.
202	DRIVE meter	Indicates rf input applied to 40-kw PA.
203	PLATE CURRENT meter	Indicates dc plate current of 40-kw power amplifier tube.

TABLE 2-3. PA FRAME CONTROLS AND INDICATORS (CONT)

ITEM NO. (FIGURE 2-3)	PANEL DESIGNATION	FUNCTION										
204	PLATE RF meter	Indicates rf voltage at plate of 40-kw power amplifier tube.										
205	OUTPUT meter	Indicates output power of 40-kw PA.										
206	AC POWER lamp	When lit, indicates that MAIN POWER circuit breaker (219) is on.										
207	TUNE lamp	When lit, indicates that OUTPUT LOADING switch (119) on 10-kw PA is set at TUNE.										
208	OPERATE lamp	When lit, indicates that OUTPUT LOADING switch (119) is set at OPERATE.										
209	PLATE ON lamp	When lit, indicates that full ac voltage is applied to 40-kw high voltage rectifier.										
210	TUNE control	Tunes output of 40-kw PA to desired frequency.										
211	BAND SW switch	Sets operating frequency range of 40-kw PA.										
212	LOAD control	Varies output impedance of 40-kw PA.										
213	BANDSWITCH RELEASE switch	When depressed, permits BAND SW switch (211) to be turned. When released, BAND SW is locked in position.										
214	OVERLOAD RESET switch pushbutton	When depressed after an overload occurs, resets relays in PA frame relay panel.										
215	INTERLOCK INDICATOR lamp	When lit, indicates that interlock circuit selected by INTERLOCK switch (221) is closed.										
216	HV BREAKER INDICATOR lamp	When lit, indicates that main breaker CB8101 is closed.										
217	HV BREAKER RESET switch	When depressed, actuates breaker motor B8101, closing main breaker CB8101.										
218	PA LIGHT switch	When set at ON, turns on light in 40-kw PA.										
219	MAIN POWER circuit breaker	Applies ac power to PA frame and PS frame.										
220	HIGH VOLTAGE circuit	Causes ac voltage to be applied to 40-kw high voltage relay.										
221	INTERLOCK switch	<p>Selects interlock switch circuit to be checked by INTERLOCK INDICATOR lamp (215) as follows:</p> <table border="1" data-bbox="778 1591 1422 1942"> <thead> <tr> <th data-bbox="778 1591 926 1623"><u>Position</u></th> <th data-bbox="926 1591 1422 1623"><u>Circuit or Condition Checked</u></th> </tr> </thead> <tbody> <tr> <td data-bbox="778 1644 926 1675">EXTERNAL</td> <td data-bbox="926 1644 1422 1759">OUTPUT LOADING switch (119) is set at OPERATE. HV DECK door and REAR DOOR in position on 10K main frame.</td> </tr> <tr> <td data-bbox="778 1780 926 1812">PA DECK</td> <td data-bbox="926 1780 1422 1812">Shield on 40-kw PA is in position.</td> </tr> <tr> <td data-bbox="778 1833 926 1864">BIAS DRAWER</td> <td data-bbox="926 1833 1422 1864">Bias supply drawer secured.</td> </tr> <tr> <td data-bbox="778 1885 926 1942">REAR DOOR (PA FRAME)</td> <td data-bbox="926 1885 1422 1942">Rear door on PA frame secured.</td> </tr> </tbody> </table>	<u>Position</u>	<u>Circuit or Condition Checked</u>	EXTERNAL	OUTPUT LOADING switch (119) is set at OPERATE. HV DECK door and REAR DOOR in position on 10K main frame.	PA DECK	Shield on 40-kw PA is in position.	BIAS DRAWER	Bias supply drawer secured.	REAR DOOR (PA FRAME)	Rear door on PA frame secured.
<u>Position</u>	<u>Circuit or Condition Checked</u>											
EXTERNAL	OUTPUT LOADING switch (119) is set at OPERATE. HV DECK door and REAR DOOR in position on 10K main frame.											
PA DECK	Shield on 40-kw PA is in position.											
BIAS DRAWER	Bias supply drawer secured.											
REAR DOOR (PA FRAME)	Rear door on PA frame secured.											

TABLE 2-3. PA FRAME CONTROLS AND INDICATORS (CONT)

ITEM NO. (FIGURE 2-3)	PANEL DESIGNATION	FUNCTION	
221 (cont)		<u>Position</u>	<u>Circuit or Condition Checked</u>
		AIR SW	40K PA blower operating.
		BAND SW	BAND SW (211) properly set in detent.
		HV RECT	40-kw high voltage rectifier secured.
		CROWBAR	Crowbar drawer secured.
		ANT. TUNING	BAND MCS switch (249) properly set in detent.
		REAR DOOR (PS FRAME)	Rear Door on PS frame secured.
		TIMER	Contacts on TIME DELAY timer (232) closed. Front bottom shield on PS frame in position.
222	BIAS ADJ control	Adjusts output of 600-volt regulated power supply in bias supply.	
223	SWR OVLD ADJ control	Sets operating point of SWR OVLD relay on PA frame relay panel.	
224	RETUNE OVLD ADJ control	Sets operating point of RETUNE OVLD relay on PA frame relay panel.	
225	AC POWER lamp	When lit, indicates that ac power applied to bias supply drawer.	
226	BIAS lamp	When lit, indicates +600 volts dc present in bias supply drawer.	
227	LV lamp	When lit, indicates that 350 volts dc is present in bias supply drawer.	
228	BIAS lamp	When lit, indicates that bias voltage is not applied to 40-kw PA.	
229	PLATE OVLD lamp	When lit, indicates that overload has occurred in plate circuit of 40-kw PA.	
230	GRID OVLD lamp	When lit, indicates that overload has occurred in grid circuit of 40-kw PA.	
231	FILAMENT TIME meter	Indicates operating time of 40-kw PA filament circuit.	
232	TIME DELAY meter	Prevents application of high voltage to 40-kw PA before preset time interval has expired.	
233	BLOWER DELAY timer	Allows blower to operate for 5 minutes after the 40-kw PA MAIN POWER breaker is set at OFF.	
234	PLATE TIME meter	Indicates operating time of 40-kw PA plate circuit.	

TABLE 2-3. PA FRAME CONTROLS AND INDICATORS (CONT)

ITEM NO. (FIGURE 2-3)	PANEL DESIGNATION	FUNCTION
235	RETUNE lamp	When lit, indicates that level of PA rf plate voltage is too low with respect to level of dc plate current in 40-kw PA.
236	SWR lamp	When lit, indicates that overload has occurred due to excessive VSWR at output of 40-kw PA.
237	FINAL FILAMENT lamp	When lit, indicates defect in 40-kw PA filament circuit.
238	BIAS RELAY ADJ control	Sets operating point of BIAS relay in PA frame relay panel.
239	PLATE OVLD ADJ control	Sets operating point of PLATE OVLD relay in PA frame relay panel.
240	GRID OVLD ADJ control	Sets operating point of GRID OVLD relay in PA frame relay panel.
241	TUBE PROTECT ADJ control	Sets operating point of TUBE PROTECT relay in PA frame relay panel.
242	DRIVER INTERLOCKS IND lamp	When lit, indicates high voltage is not applied to 10-kw PA.
243	DRIVER INTERLOCKS switch	In ON position, permits high voltage to be applied to 40-kw PA.

NOTE

After the main frame is powered and high voltage is applied to 10-kw PA, DRIVER INTERLOCKS switch should be set at OFF position to insure full interlock protection.

TABLE 2-4. PS FRAME CONTROLS AND INDICATORS

ITEM NO. (FIGURE 2-4)	PANEL DESIGNATION	FUNCTION
244	GRID CURRENT meter	Indicates grid current of 40-kw PA tube.
245	GRID VOLTS meter	Indicates bias voltage applied to 40-kw PA.
246	PLATE VOLTS meter	Indicates dc plate voltage of 40-kw PA.
247	CROWBAR FILAMENT meter	Indicates ac voltage applied to filament or reservoir of thyratron in crowbar drawer. (Refer to control 252.)
248	SWR meter	Indicates VSWR at output of 40-kw PA.
249	BAND MCS switch	Not used.
250	BALANCE control	Not used.
251	RESERVOIR ADJ control	Adjusts ac voltage applied to reservoir filament of thyratron in crowbar drawer.

TABLE 2-4. PS FRAME CONTROLS AND INDICATORS (CONT)

ITEM NO. (FIGURE 2-4)	PANEL DESIGNATION	FUNCTION
252	RESERVOIR-FILAMENT switch	In RESERVOIR position, applies reservoir voltage of thyatron to CROWBAR FILAMENT meter (247). In FILAMENT position, applies filament voltage of thyatron to CROWBAR FILAMENT meter (247).
253	BLOWER circuit breaker	Applies power to main blower in 40-kw PA.
254	FIL ADJ selector switch	Selects proper primary voltage for application to 40-kw PA filament transformer, 40-kw high voltage rectifier, crowbar drawer, and bias supply.
255	CAL-SWR switch	In CAL position, permits calibration of SWR meter circuit. In SWR position, permits SWR meter (248) to measure VSWR.
256	CAL control	Calibrates SWR meter (248).
257	FINAL FIL circuit breaker	Applies ac power to filament circuit of 40-kw PA.

TABLE 2-5. BUFFER AND 200K PA FRAME OPERATING CONTROLS AND INDICATORS

Buffer Frame		
ITEM NO.	PANEL DESIGNATION	FUNCTION
300	INPUT SWR control	Tunes input circuit of 200-kw power amplifier.
200K PA Frame		
ITEM NO. (FIGURE 2-5)	PANEL DESIGNATION	FUNCTION
301	DRIVE meter	Indicates level of r-f input voltage to 200-kw power amplifier.
302	PLATE CURRENT A meter	Indicates amplitude of power amplifier tube A plate current.
303	PLATE CURRENT B meter	Indicates plate current of power amplifier tube B.
304	PLATE RF meter	Indicates amplitude of 200-kw PA rf plate voltage.
305	LOAD RF meter	Indicates amplitude of 200-kw PA rf load voltage.
306	KW OUTPUT meter	Indicates power output of transmitter.
307	AC ON lamp	When lit, indicates that MAIN BLOWER circuit breaker (323) is set at ON.
308	TUNE dial	Indicates setting of TUNE control.
309	TUNE control	Tunes plate circuit of 200-kw power amplifier.
310	EMERGENCY lamp	When lit, indicates that EMERGENCY/TUNE/OPERATE switch (326) is set at EMERGENCY and that output of 40-kw PA is connected to antenna.
311	LOAD dial	Indicates setting of LOAD control.

TABLE 2-5. BUFFER AND 200K PA FRAME OPERATING CONTROLS AND INDICATORS (CONT)

200K PA Frame														
ITEM NO. (FIGURE 2-5)	PANEL DESIGNATION	FUNCTION												
312	LOAD control	Tunes load circuit of 200-kw power amplifier.												
313	TUNE lamp	When lit, indicates that EMERGENCY/TUNE/OPERATE switch (326) is set at TUNE and output of 40-kw PA is connected to dummy load.												
314	BAND SW dial	Indicates setting of BAND SW control.												
315	BAND SW control	Sets operating frequency range of 200-kw power amplifier plate circuit.												
316	OPERATE lamp	When lit, indicates that EMERGENCY/TUNE/OPERATE switch (326) is set at OPERATE and that output of 40-kw PA is connected to 200-kw power amplifier.												
317	OUTPUT BAND SW dial	Indicates the setting of OUTPUT BAND SW control (318).												
318	OUTPUT BAND SW control	Sets operating frequency range of 200-kw power amplifier load circuit.												
319	PLATE A ON lamp	When lit, indicates that high voltage is applied to power amplifier tube A plate circuit.												
320	OUTPUT LOAD dial	Indicates setting of OUTPUT LOAD control (321).												
321	OUTPUT LOAD control	Tunes output load circuit of 200-kw power amplifier.												
322	PLATE B ON lamp	When lit, indicates that high voltage is applied to power amplifier tube B plate circuit.												
323	MAIN BLOWER circuit breaker	When set at ON, applies primary power to main blower of 200-kw power amplifier and to the SWR and RETUNE circuits.												
324	INTERLOCK switch	<p>Selects interlock switch circuit to be checked by INTERLOCK INDICATOR lamp (325) as follows:</p> <table border="1"> <thead> <tr> <th><u>Position</u></th> <th><u>Circuit or Condition Checked</u></th> </tr> </thead> <tbody> <tr> <td>DOORS (PS FRAME)</td> <td>Closure of rear doors in PSA and PSB frames.</td> </tr> <tr> <td>HVR DRAWER</td> <td>100-kw High-voltage rectifier drawers secured and panels attached.</td> </tr> <tr> <td>CROWBAR DRAWERS</td> <td>Crowbar drawers secured.</td> </tr> <tr> <td>ANTENNA DRAWERS</td> <td>Panels of antenna switching unit and antenna tuner deck are secured.</td> </tr> <tr> <td>RELAY PANELS</td> <td>Closure of relay panels in 200K PA frame.</td> </tr> </tbody> </table>	<u>Position</u>	<u>Circuit or Condition Checked</u>	DOORS (PS FRAME)	Closure of rear doors in PSA and PSB frames.	HVR DRAWER	100-kw High-voltage rectifier drawers secured and panels attached.	CROWBAR DRAWERS	Crowbar drawers secured.	ANTENNA DRAWERS	Panels of antenna switching unit and antenna tuner deck are secured.	RELAY PANELS	Closure of relay panels in 200K PA frame.
<u>Position</u>	<u>Circuit or Condition Checked</u>													
DOORS (PS FRAME)	Closure of rear doors in PSA and PSB frames.													
HVR DRAWER	100-kw High-voltage rectifier drawers secured and panels attached.													
CROWBAR DRAWERS	Crowbar drawers secured.													
ANTENNA DRAWERS	Panels of antenna switching unit and antenna tuner deck are secured.													
RELAY PANELS	Closure of relay panels in 200K PA frame.													

TABLE 2-5. BUFFER AND 200K PA FRAME OPERATING CONTROLS AND INDICATORS (CONT)

200K PA Frame		
ITEM NO. (FIGURE 2-5)	PANEL DESIGNATION	FUNCTION
324 (cont)		<u>Position</u> <u>Circuit or Condition Checked</u>
		BIAS DRAWERS Bias supply drawers secured in 200K PA frame.
		PA COM-PARTMENT Closure of front doors of 200-kw PA.
		REAR DOORS (PA) FRAME Closure of rear doors in 200K PA frame.
		BANDSWITCH BAND SW (314) properly set in detent.
		OUTPUT BANDSWITCH In-detent status of OUTPUT BAND SW switch (317)
		FRONT DOOR (FINAL TUBE) Closure of front door in tube frame.
		REAR DOOR (FINAL TUBE) Closure of rear door in tube frame.
325	INTERLOCK INDICATOR lamp	When lit, indicates that interlock circuit selected by INTERLOCK switch (324) is closed.
326	EMERGENCY/TUNE/OPERATE switch	In EMERGENCY position, routes output of 40-kw PA to antenna. In TUNE position applies output of 40-kw PA to dummy load. In OPERATE position, connects output of 40-kw PA to input of 200-kw PA.
327	OUTPUT INCR control	Adjusts exciter output in conjunction with OUTPUT control (25).
328	PRIMARY ADJUST A switch	Adjusts filament voltage of power amplifier tube A.
329	PRIMARY ADJUST B switch	Adjusts filament voltage of power amplifier tube B.
330	RELEASE BANDSWITCH pushbutton	When depressed, permits BAND SW switch (314) to be operated.
331	RELEASE OUTPUT BAND-SWITCH pushbutton	When depressed, permits OUTPUT BAND SW switch (318) to be operated.
332	RESET A switch	When depressed, resets relays in relay and indicator panel A and simultaneously resets HV MAIN POWER BREAKER in PSA frame.
333	RESET B switch	When depressed, resets relays in relay and indicator panel B and simultaneously resets HV MAIN POWER BREAKER in PSB frame.
334	PA FANS INDICATOR lamp	When lit, indicates that one or more fans in 200-kw PA are not operating.
335	HIGH VOLTAGE A circuit breaker	In ON position, applies power to 100-kw high voltage rectifier A which applies high voltage to power-amplifier tube A.

TABLE 2-5. BUFFER AND 200K PA FRAME OPERATING CONTROLS AND INDICATORS (CONT)

200K PA Frame		
ITEM NO. (FIGURE 2-5)	PANEL DESIGNATION	FUNCTION
336	HIGH VOLTAGE B circuit breaker	When set at ON, applies power to 100-kw high voltage rectifier B which applies high voltage to power-amplifier tube B.
337	AC ON lamp	When lit, indicates that primary power is supplied to filament transformer of bias supply A.
338	AC switch	When set at ON, applies primary power to filament transformer of bias supply A.
339	BIAS ON lamp	When lit, indicates that bias voltage is applied to power-amplifier tube A.
340	BIAS ADJUST control	Sets level of bias applied to power-amplifier tube A.
341	AC ON lamp	When lit, indicates that primary power is supplied to filament transformer of bias supply B.
342	AC switch	When set at ON, applies primary power to filament transformer of bias supply B.
343	BIAS ON lamp	When lit, indicates that bias voltage is applied to power-amplifier tube B.
344	BIAS ADJUST control	Sets level of bias applied to power-amplifier tube B.
345	PLATE OVLD lamp	When lit, indicates that overload has occurred in plate circuit of power amplifier tube A.
346	GRID OVLD lamp	When lit, indicates that overload has occurred in grid circuit of power-amplifier tube A.
347	RETUNE lamp	When lit, indicates that overload has occurred due to insufficient r-f plate voltage with respect to power-amplifier tube (A or B) plate current.
348	FILAMENT TIME meter	Indicates total operating time of filament circuit of power amplifier tube A.
349	TIME DELAY meter	Delays application of power to 100-kw high voltage rectifier A so that filaments may heat up.
350	PLATE TIME meter	Indicates total operating time of 100-kw high voltage rectifier A.
351	SWR lamp	When lit, indicates that overload has occurred due to excessive SWR on transmission line.
352	BIAS lamp	When lit, indicates that no bias voltage is applied to power-amplifier tube A.
353	FINAL FILAMENT lamp	When lit, indicates absence of primary power at filament transformer of power-amplifier tube A.
354	PLATE OVLD ADJ. control	Controls d-c level at which power-amplifier tube A plate overload relay is energized.

TABLE 2-5. BUFFER AND 200K PA FRAME OPERATING CONTROLS AND INDICATORS (CONT)

200K PA Frame		
ITEM NO. (FIGURE 2-5)	PANEL DESIGNATION	FUNCTION
355	GRID OVLD ADJ. control	Controls d-c level at which power-amplifier tube A grid overload relay is energized.
356	BIAS RELAY ADJ. control	Controls d-c level at which bias relay A is energized.
357	ALARM switch	When set at ON, energizes a buzzer if primary power to 100-kw high voltage rectifier A or B is interrupted.
358	TUBE PROTECT ADJ. control	Controls d-c level at which tube-protect relay A becomes energized.
359	PLATE OVLD lamp	When lit, indicates that overload has occurred in plate circuit of power-amplifier tube B.
360	GRID OVLD lamp	When lit, indicates that overload has occurred in grid circuit of power-amplifier tube B.
361	HEAT OVLD lamp	When lit, indicates that excessive temperature has developed in the tube frame.
362	FILAMENT TUBE meter	Indicates total operating time of filament circuit of power-amplifier tube B.
363	TIME DELAY meter	Delays application of power to 100-kw high voltage rectifier B so that filaments may heat up.
364	PLATE TIME meter	Indicates total operating time of 100-kw high voltage rectifier B.
365	40K INTERLOCK lamp	When lit, indicates that interlock circuit in frames 2 through 4 is closed.
366	BIAS lamp	When lit, indicates that no bias voltage is applied to power-amplifier tube B.
367	FINAL FILAMENT lamp	When lit, indicates absence of primary power at filament of power amplifier tube B.
368	PLATE OVLD ADJ. control	Controls level at which power-amplifier tube B plate overload relay is energized.
369	GRID OVLD ADJ. control	Controls d-c level at which power-amplifier tube B grid overload relay is energized.
370	BIAS RELAY ADJ. control	Controls d-c level at which bias relay B is energized.
371	40K INTERLOCK switch	When set at ON, bypasses 40K interlock relay circuit.
372	TUBE PROTECT ADJ. control	Controls d-c level at which tube-protect relay B is energized.

TABLE 2-6. PSA FRAME OPERATING CONTROLS AND INDICATORS

ITEM NO. (FIGURE 2-6)	PANEL DESIGNATION	FUNCTION
373	GRID CURRENT meter	Indicates grid current of power-amplifier tube A.
374	BIAS VOLTS meter	Indicates bias voltage of power-amplifier tube A.
375	PLATE VOLTS meter	Indicates plate voltage of power-amplifier tube A.
376	FILAMENT PRIMARY meter	Indicates primary filament voltage of power-amplifier tube A.
377	SWR meter relay	Indicates VSWR on transmission line; sets VSWR at which SWR overload relay is energized.
378	POWER lamp	When lit, indicates primary power is applied to power supply in SWR and retune circuits.
379	B+ lamp	When lit, indicates B+ voltage is applied to d-c amplifiers in SWR and retune circuits.
380	SWR OVLD SET control	Sets operating point of SWR d-c amplifier.
381	RETUNE OVLD SET control	Sets level at which RETUNE OVLD relay operates.
382	ADJ control	Sets level of rectified r-f plate voltage applied to retune d-c amplifier.
383	SWR switch	In SWR position of switch, KW OUTPUT meter (306) measures output power to antenna, and SWR meter (377) indicates VSWR on transmission line. CAL position of switch permits calibration of SWR meter (377).
384	SWR CAL control	Calibrates SWR meter when SWR switch (383) is held in CAL position.
*385	OUTPUT LOAD lamp	When lit, indicates that the transmitter output is routed to dummy load.
*386	OUTPUT ANTENNA lamp	When lit, indicates that the transmitter output is routed to unbalanced antenna.
*387	OUTPUT switch	When set at LOAD, output of transmitter is routed to dummy load. When set at ANTENNA, output of transmitter is routed to antenna.
388	FAN lamp	When lit, indicates that fan in Antenna Switching Unit is not operating.
389	POWER lamp	When lit, indicates that primary power is applied to filament transformer of PSA crowbar drawer.
390	RESERVOIR ADJ control	Sets level of voltage applied to thyratron reservoir filament in PSA crowbar drawer.
391	TRIGGER ADJ control	Sets level of voltage applied to grid of thyratron in PSA crowbar drawer.
392	RESERVOIR meter	Indicates voltage applied to reservoir filament of thyratron in PSA crowbar drawer.

*Associated coaxial switch is optional equipment.

TABLE 2-6. PSA FRAME OPERATING CONTROLS AND INDICATORS (CONT)

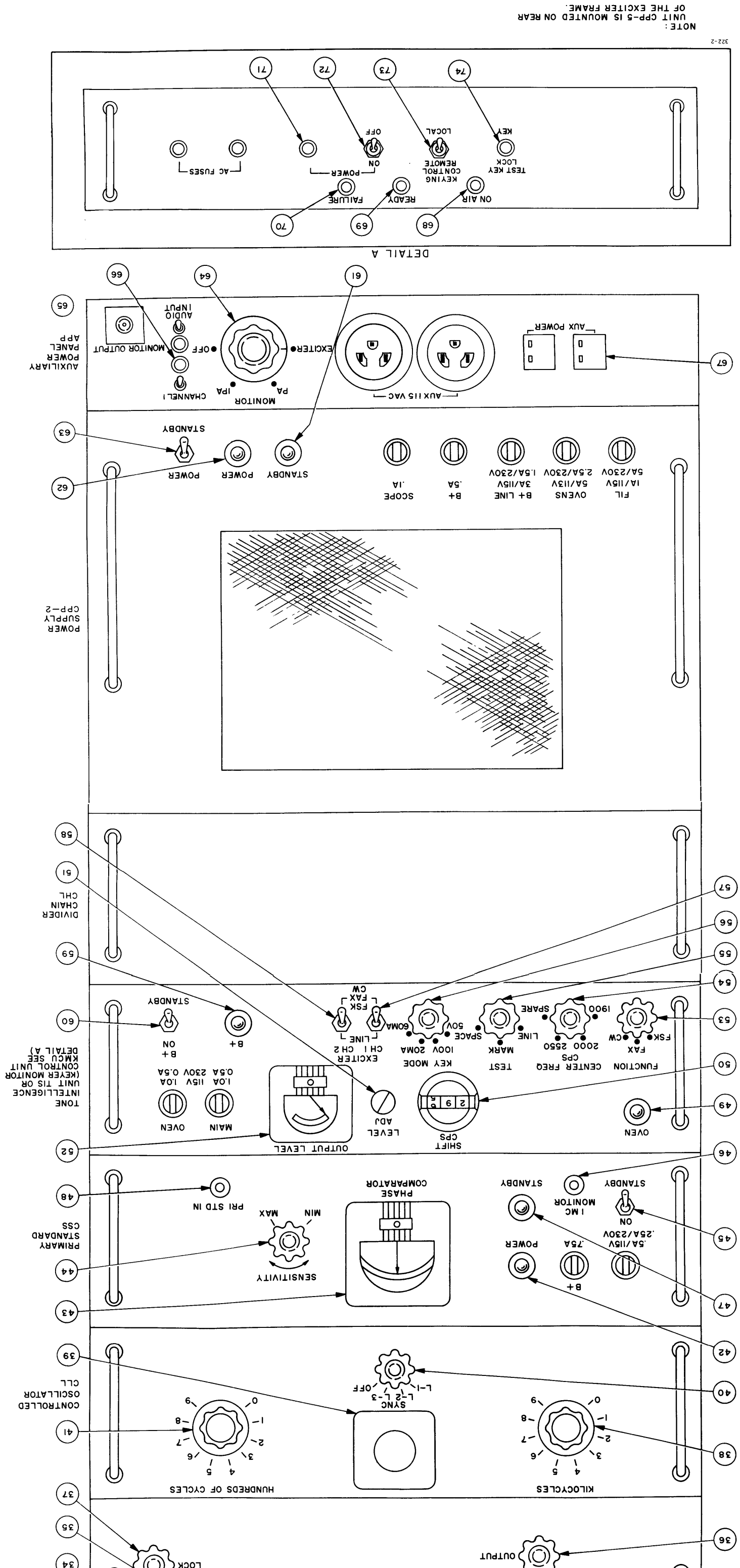
ITEM NO. (FIGURE 2-6)	PANEL DESIGNATION	FUNCTION
393	PRIMARY POWER circuit breaker.	When set at ON, applies primary power to circuits associated with power-amplifier tube A.
394	HVR BLOWER INDICATOR lamp	When lit, indicates that blower for 100-kw high voltage rectifier A is not functioning.
395	TOP FAN INDICATOR lamp	When lit, indicates top fan in PSA frame is not functioning.
396	PA FIL circuit breaker	When set at ON, applies primary power to circuits associated with filament of power-amplifier tube A.

TABLE 2-7. PSB FRAME OPERATING CONTROLS AND INDICATORS

ITEM NO. (FIGURE 2-7)	PANEL DESIGNATION	FUNCTION
397	GRID CURRENT meter	Indicates grid current of power-amplifier tube B.
398	BIAS VOLTS meter	Indicates bias voltage of power-amplifier tube B.
399	PLATE VOLTS meter	Indicates plate voltage of power-amplifier tube B.
400	FILAMENT PRIMARY meter	Indicates primary filament voltage of power-amplifier tube B.
401	BALANCE OUTPUT meter	Indicates degree of balance in two legs of antenna.
402	ANTENNA MATCHING dial	Indicates setting of ANTENNA MATCHING control (403).
403	ANTENNA MATCHING control	Matches transmitter output to antenna for operation with balanced output.
404	BALANCE dial	Indicates setting of BALANCE control (405).
405	BALANCE control	Balanced impedances of two output legs during balanced operation.
406	POWER lamp	When lit, indicates primary power is applied to filament transformer of PSB crowbar drawer.
407	RESERVOIR ADJ control	Sets level of voltage applied to thyatron reservoir filament in PSB crowbar drawer.
408	TRIGGER ADJ control	Sets level of voltage to grid of thyatron in PSB crowbar drawer.
409	RESERVOIR meter	Indicates voltage applied to thyatron reservoir filament in PSB crowbar.
410	PRIMARY POWER circuit breaker	When set at ON, applies primary power to circuits associated with power-amplifier tube B

TABLE 2-7. PSB FRAME OPERATING CONTROLS AND INDICATORS (CONT)

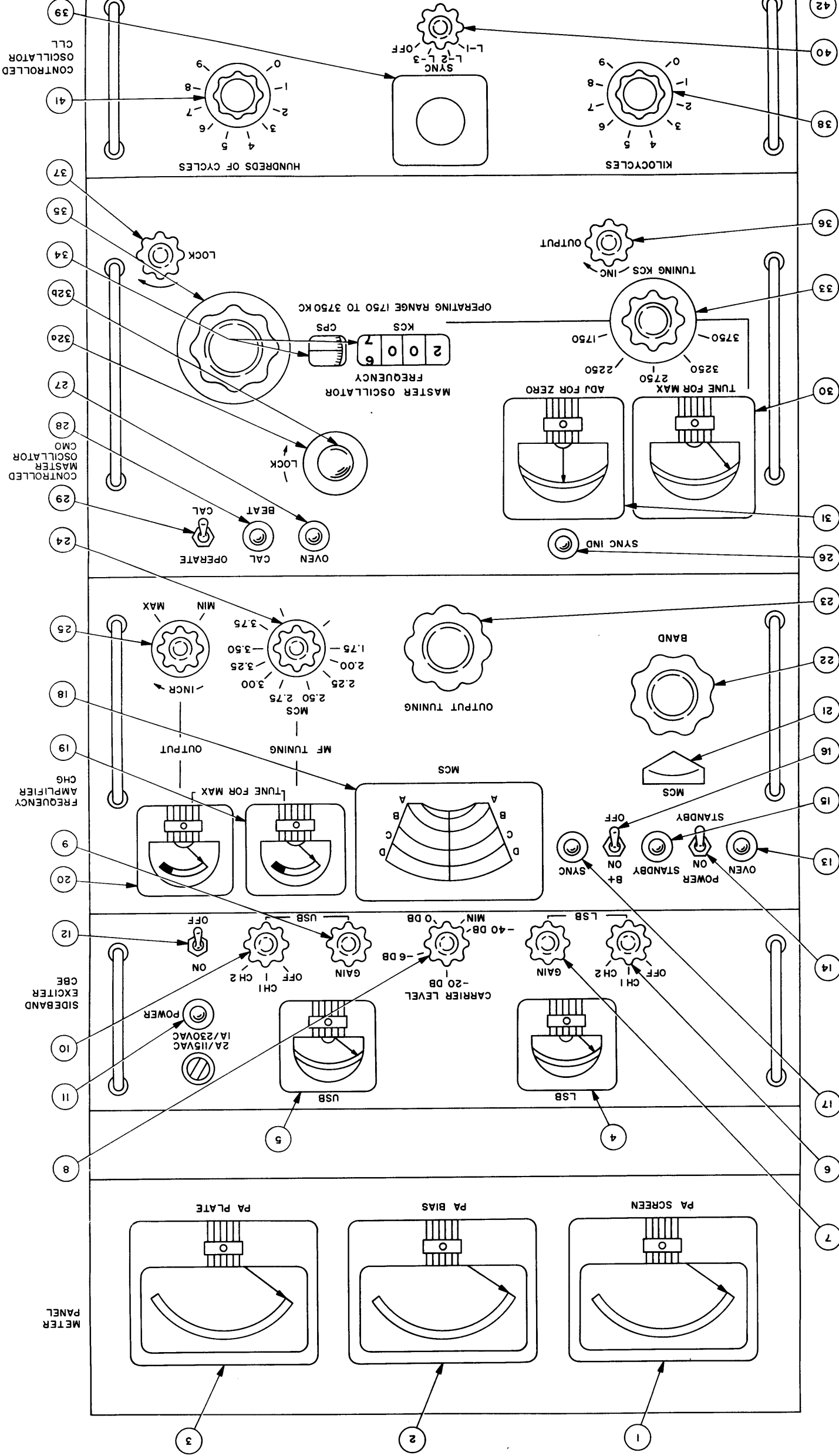
ITEM NO. (FIGURE 2-7)	PANEL DESIGNATION	FUNCTION
411	HVR BLOWER INDICATOR lamp	When lit, indicates that blower for 100-kw high voltage rectifier B is not functioning.
412	TOP FAN INDICATOR lamp	When lit, indicates top fan of PSB frame is not functioning.
413	PA FIL circuit breaker	When set at ON, applies primary power to circuits associated with filament of power-amplifier tube B.



NOTE:
UNIT CP-5 IS MOUNTED ON REAR OF THE EXCITER FRAME.

Figure 2-1. Auxiliary Frame, Operating Controls and Indicators

2-19/2-20



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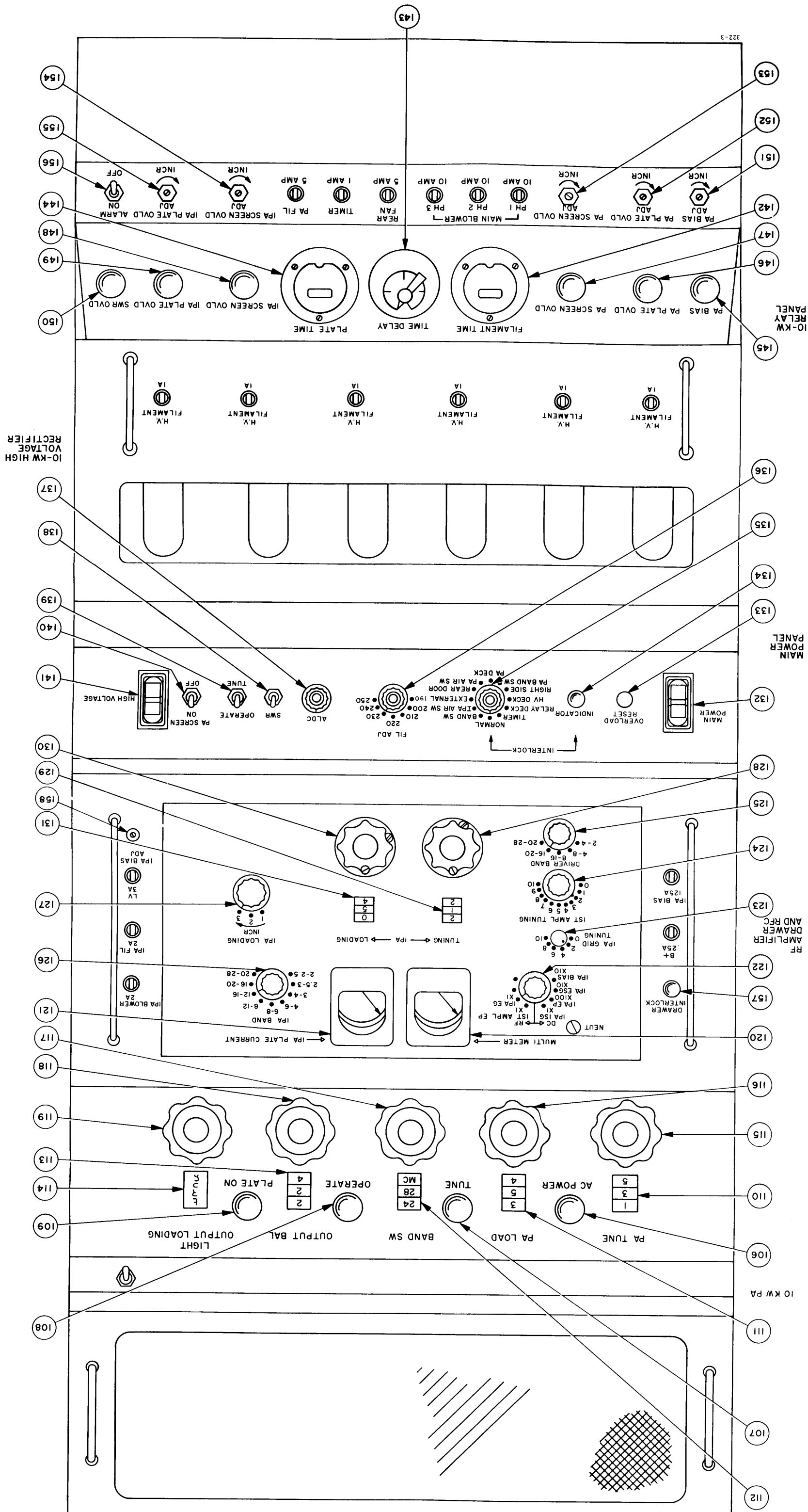
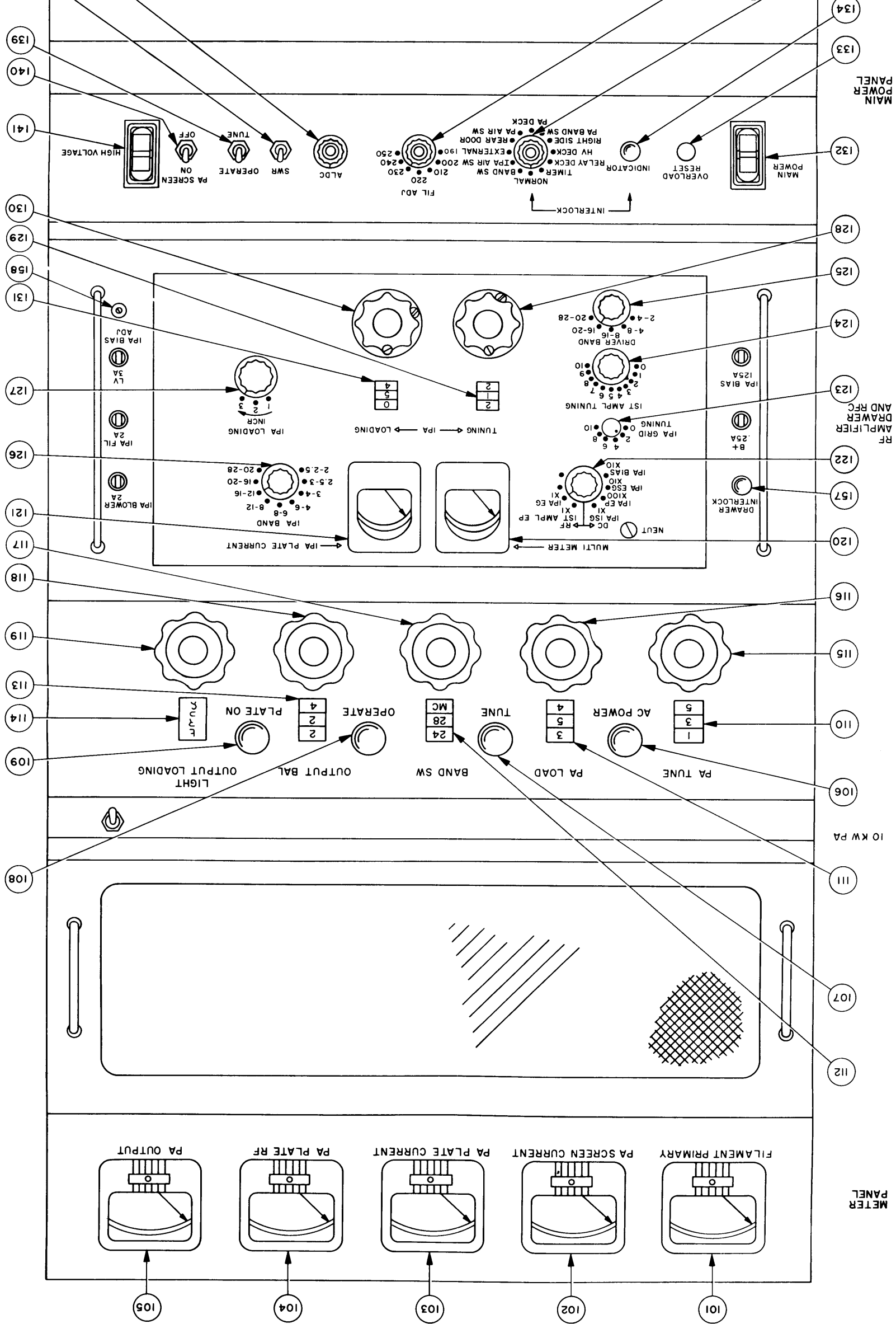


Figure 2-2. Main Frame, Operating Controls and Indicators



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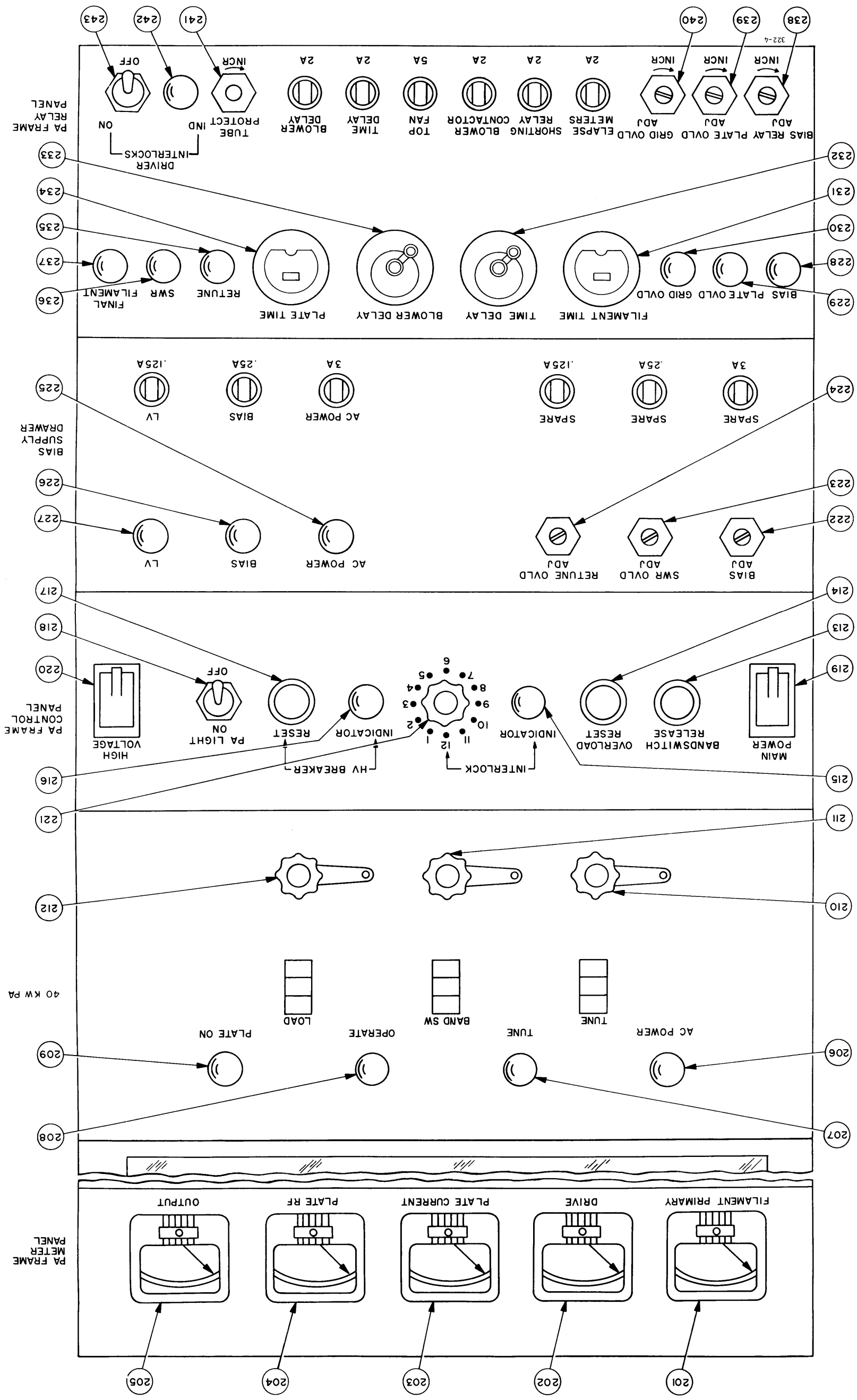
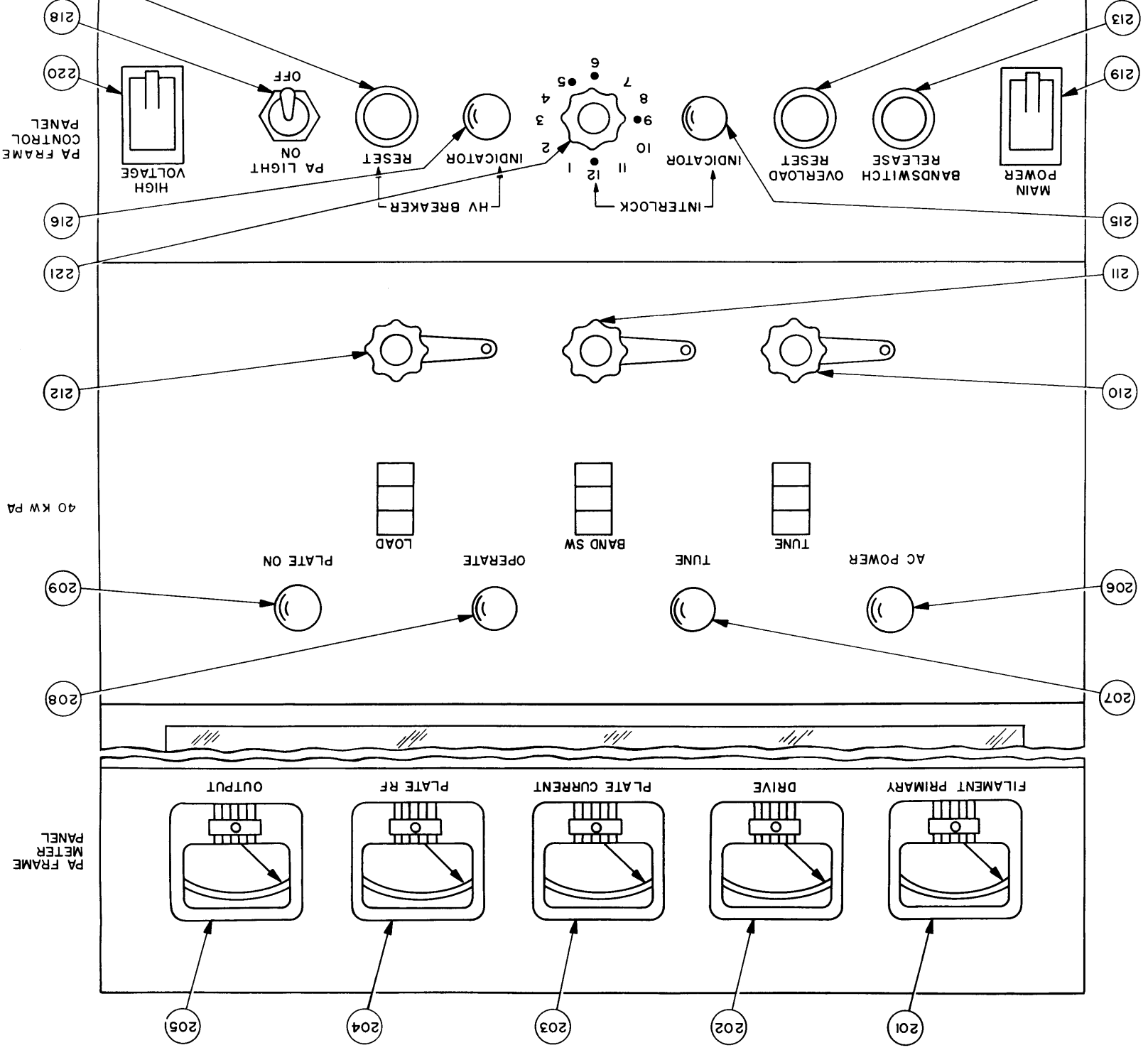


Figure 2-3. PA Frame, Operating Controls and Indicators



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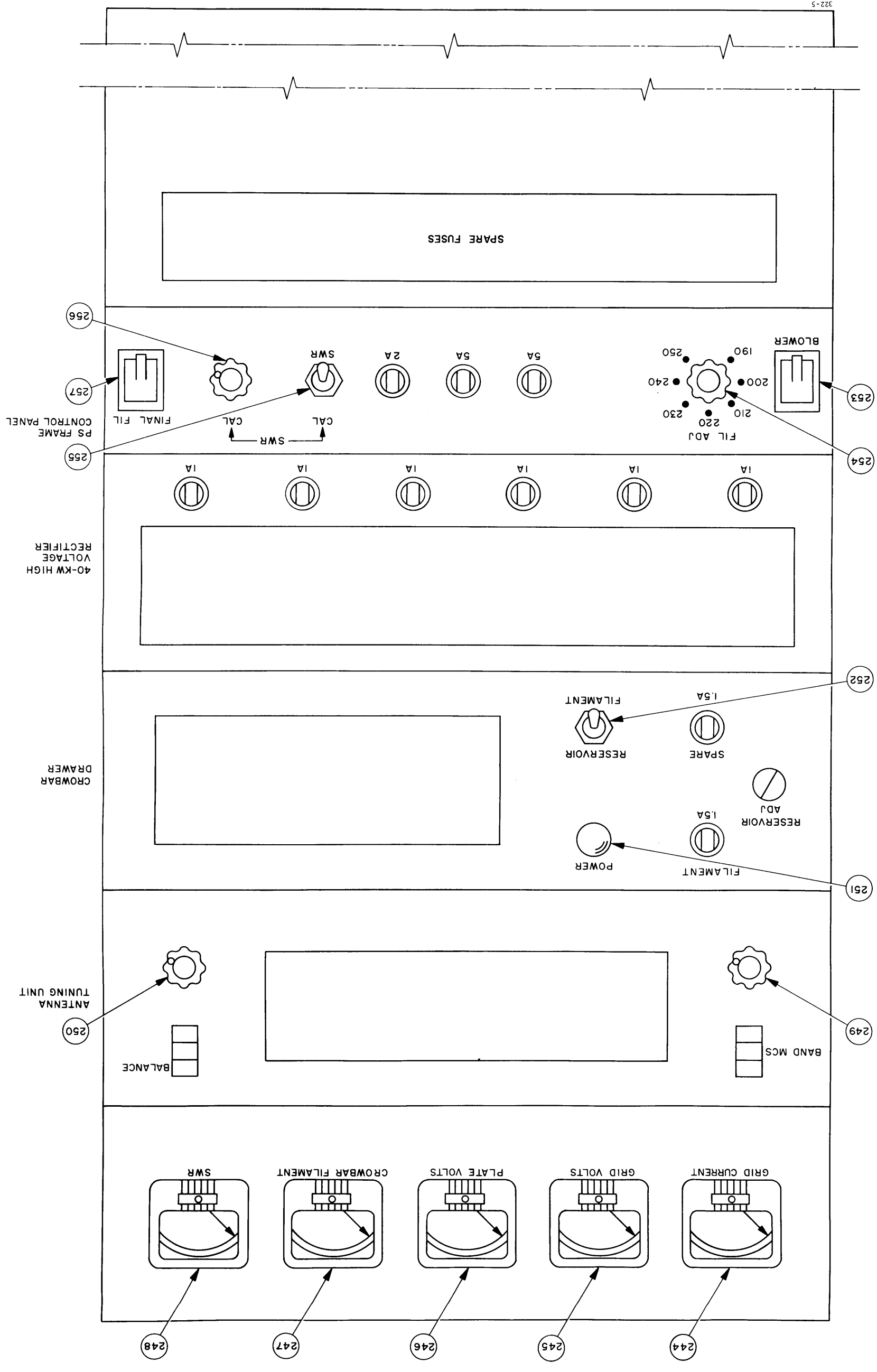
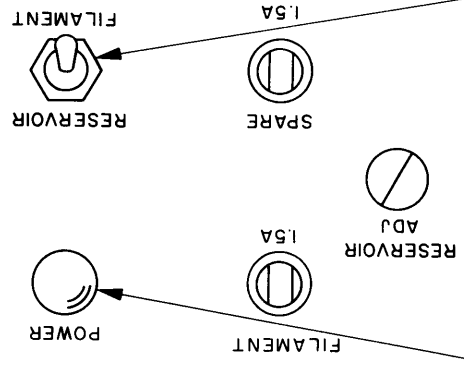
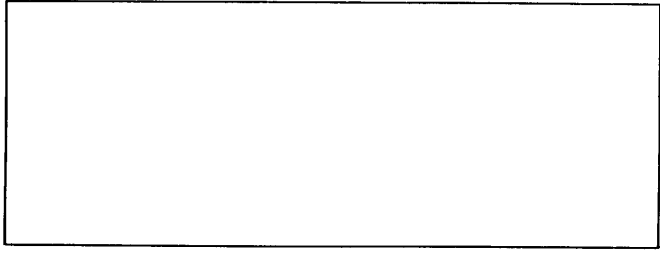


Figure 2-4. PS Frame, Operating Controls and Indicators

2-25/2-26

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CROWBAR
DRAWER



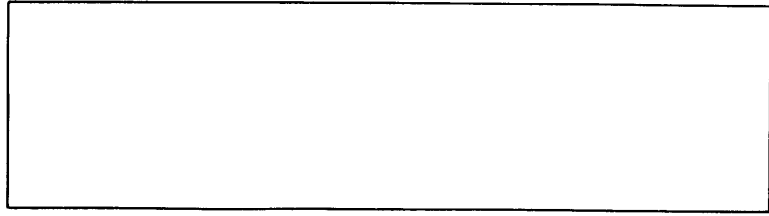
252

251

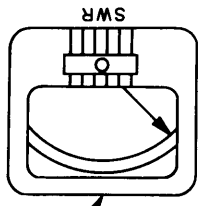
ANTENNA
TUNING UNIT

250

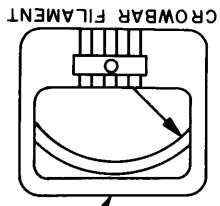
BALANCE



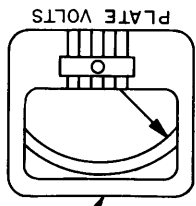
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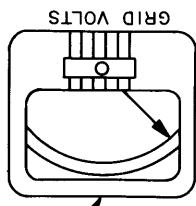
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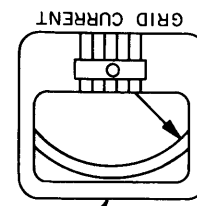
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246



245



244

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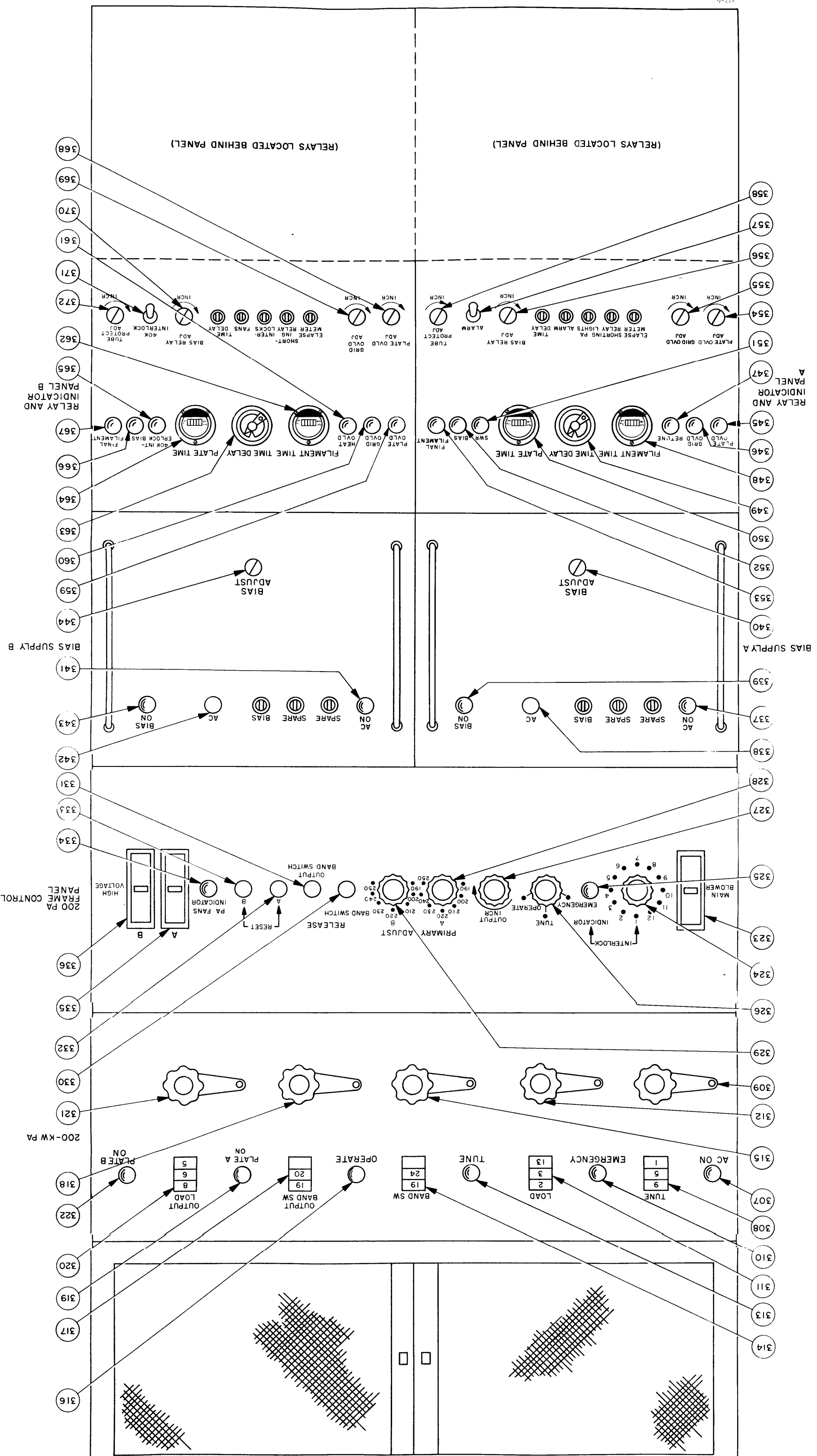
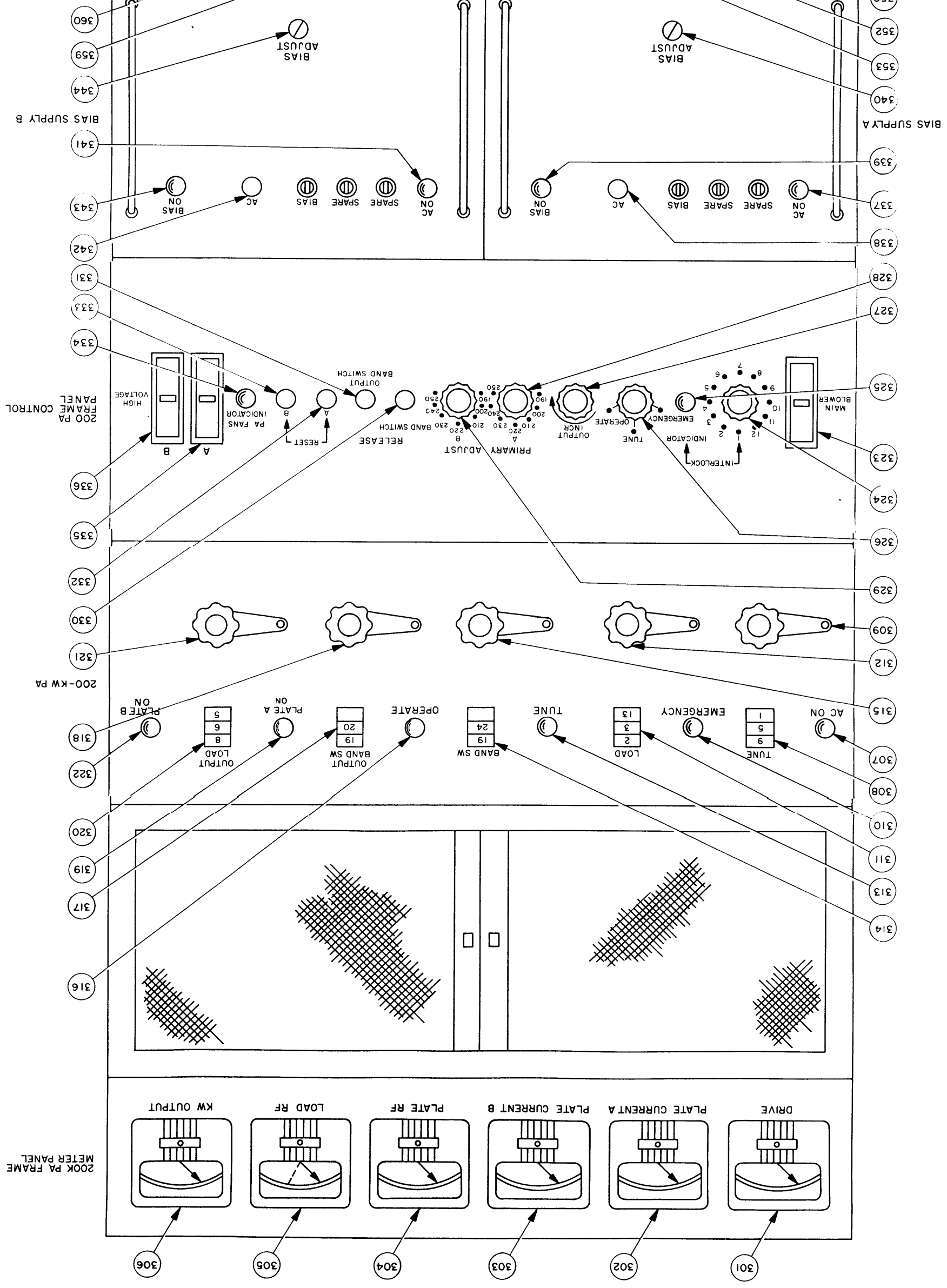


Figure 2-5. 200K PA Frame, Operating Controls and Indicators



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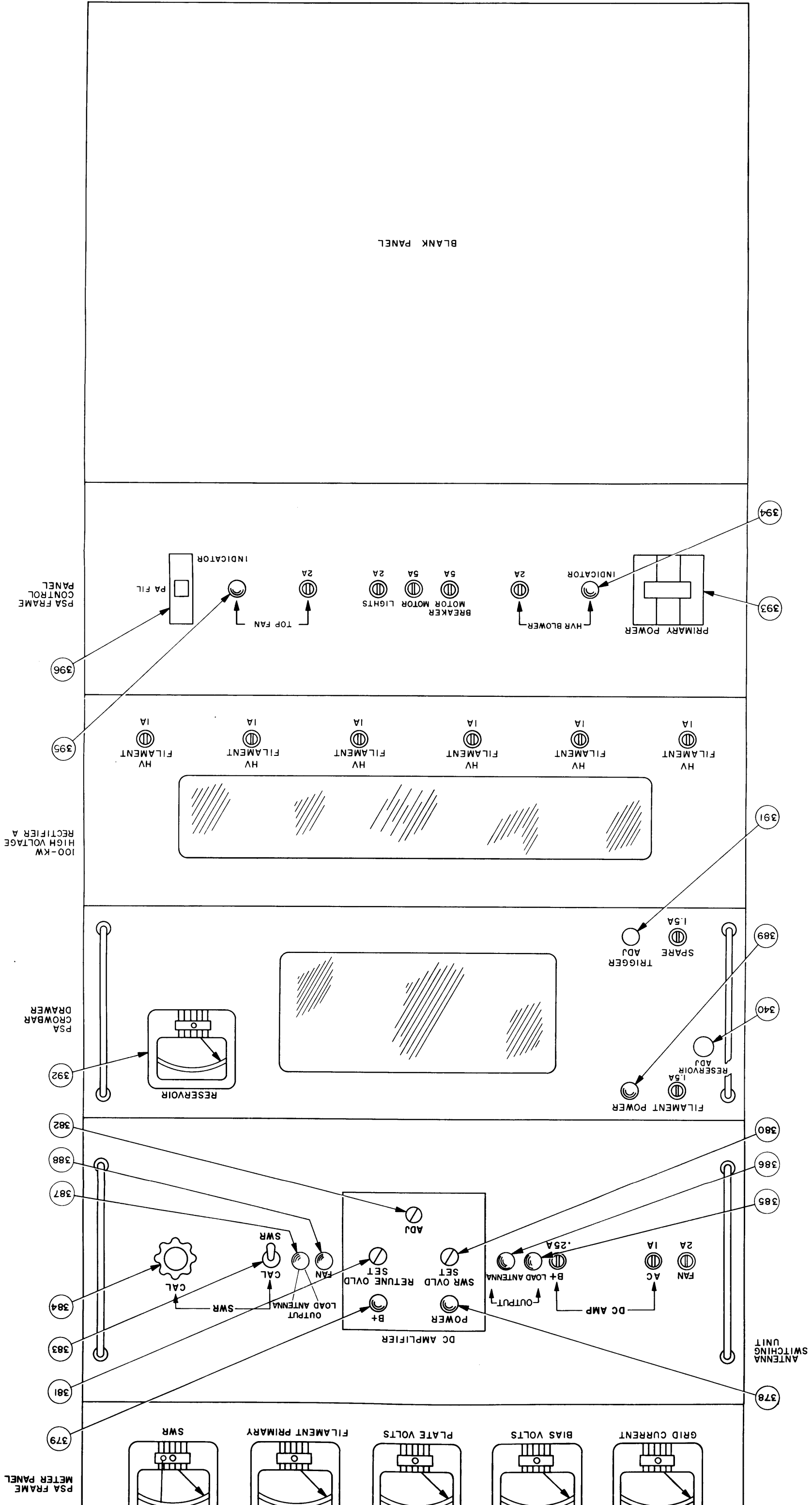
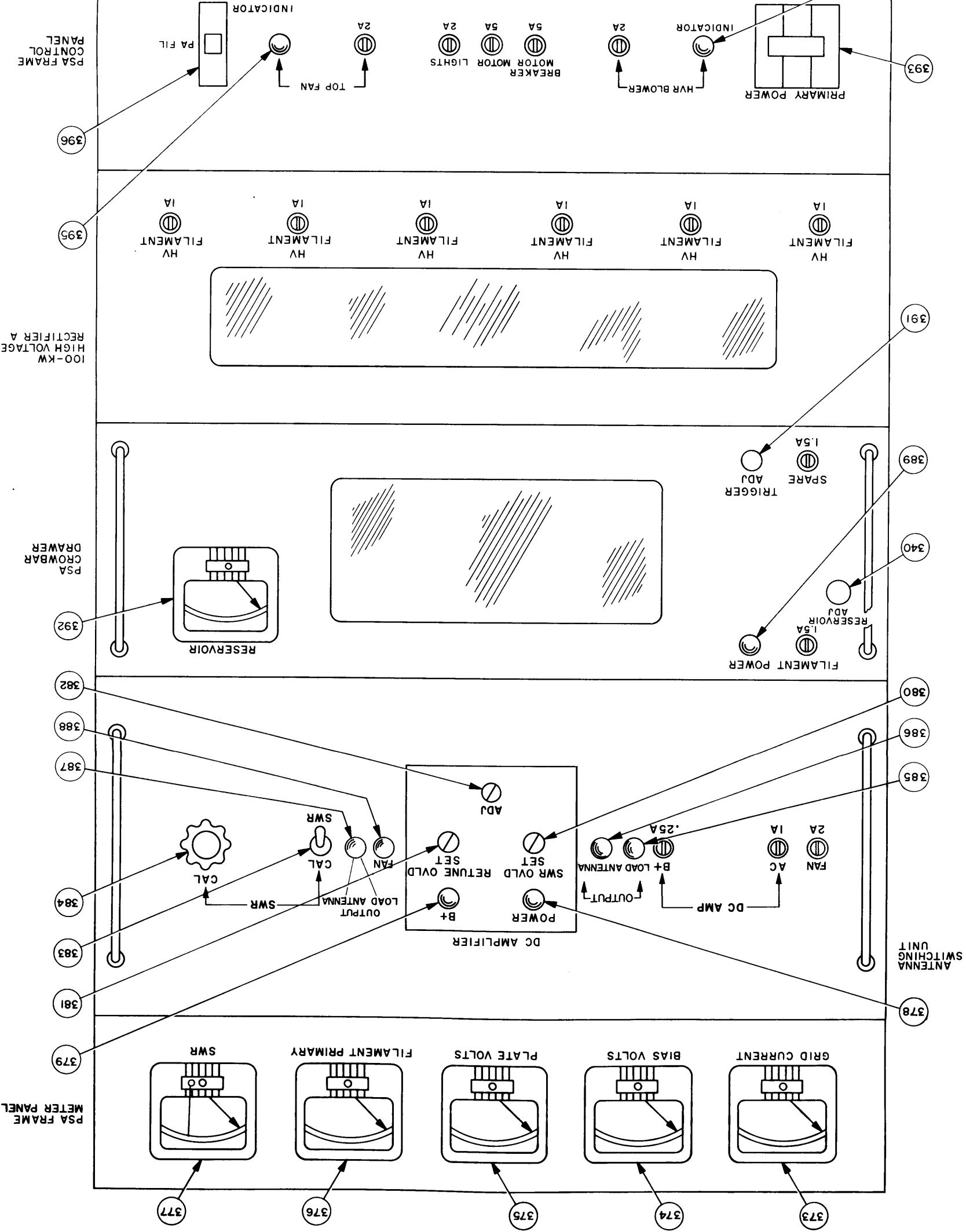


Figure 2-6. PSA Frame, Operating Controls and Indicators



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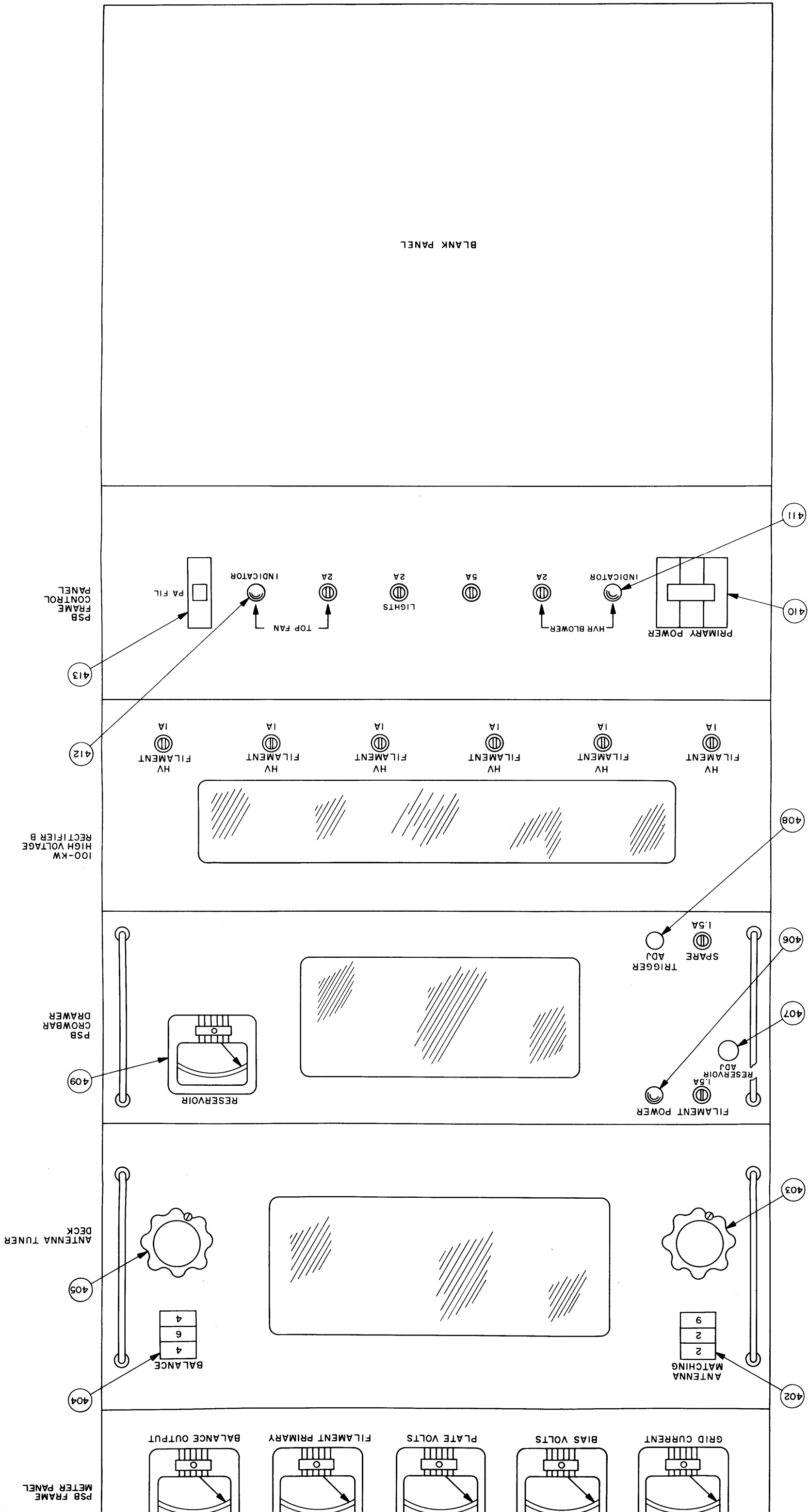
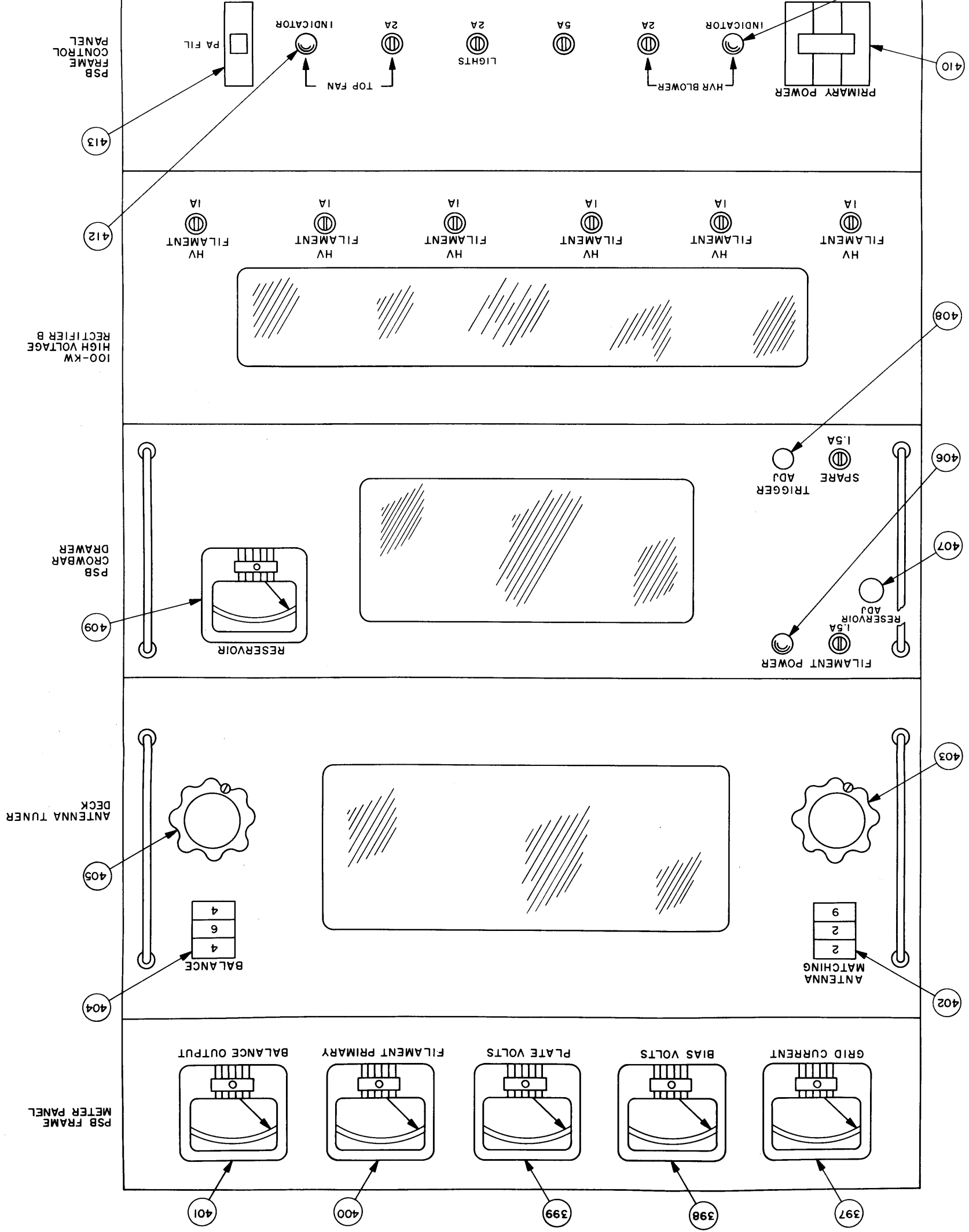


Figure 2-7. PSB Frame, Operating Controls and Indicators



SECTION 3 OPERATING PROCEDURES

3-1. INTRODUCTION.

This section presents the starting procedures, tune-up of exciter on carrier, tune-up of 1-kw IPA and 10-kw PA on carrier, tune-up of 40-kw PA on carrier, tune-up of 200-kw PA on carrier, exciter set-up for different modes of operation, single-sideband operation, double-sideband operation, independent-sideband operation, CW (telegraphy) operation, FSK (frequency shift telegraphy), FAX (facsimile), and emergency operating procedures and techniques. Supplementary operating information such as general tuning techniques, distortion measurements, and power output measurements for multi-tone modulation are described in Section 4. All referenced controls and indicators are shown in figures 2-1 through 2-7, and functionally described in tables 2-1 through 2-7.

3-2. PRELIMINARY PROCEDURE.

Before applying power to the transmitter, check that the following inputs are connected (as required for the modes of operation to be used):

<u>INPUT</u>	<u>CONNECTION</u>
FAX	E3000, terminals 3 (hot) and 4 (gnd)
FSK	E3002, terminals 15(-) and 16(+)
Audio line 1	E3002, terminals 20, 21 (gnd), and 22
Audio line 2	E3002, terminals 24, 25 (gnd), and 26
CW keying	E3002, terminals 15(-) and 16(+)

Also make sure that the antenna is properly connected. Link connections for balanced and unbalanced operation are made in the PSA frame. For unbalanced output operation, the r-f output of the transmitter is routed to the antenna through an L-shaped high-power coaxial connector which is installed at the top of the PSA frame. For balanced output operation, the r-f output of the transmitter is coupled through a straight coaxial section to the PSB frame. The antenna leads are then connected to the bowl insulators on the roof of the PSB frame.

3-3. STARTING PROCEDURE.

a. **APPLYING STANDBY POWER TO EXCITER.** - The temperature-controlled oven circuits should be energized for at least 24 hours before the exciter is operated to assure optimum frequency stability. If

the transmitter is to be operated on a fairly constant basis, its exciter should be left in standby during idle periods. Proceed as follows:

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are callouts located on figures 2-1 through 2-7.

(1) Set the switches listed below at the positions indicated:

<u>UNIT</u>	<u>SWITCH</u>	<u>POSITION</u>
CBE	ON/OFF (12)	OFF
CHG	POWER (14)	STANDBY
	B+ (16)	OFF
CLL	SYNC (40)	OFF
CSS	ON/STANDBY (45)	STANDBY
TIS	B+ (60)	STANDBY
KMCU	POWER (72)	OFF
CPP-2	POWER/STANDBY (63)	STANDBY

(2) Set the AUXILIARY FRAME MAIN POWER circuit breaker, on the inner rear partition of the auxiliary frame at ON. Set SWCU front panel 2:1/3:1 switch at 3:1. The following actions should occur:

- (a) Top front fan in auxiliary frame rotates.
- (b) STANDBY lamp (61) on CPP-2 lights.
- (c) STANDBY lamp (47) on CSS lights.
- (d) STANDBY lamp (15) on CHG lights.
- (e) Power lamp on CPP-5 (rear of auxiliary frame) lights.
- (f) When OVEN lamps (13, 27, and 49) on CHG, CMO and TIS start cycling on and off, these oven circuits have attained proper temperature. However, the CSS must be in standby for 24 hours before operating the transmitter to insure that frequency stability is maintained.

b. **APPLYING OPERATING POWER TO EXCITER.** - Apply plate power to exciter as shown in table 3-1.

TABLE 3-1. CONTROL POSITIONS FOR APPLYING OPERATING POWER TO EXCITER

UNIT	CONTROL	POSITION	ACTION
CBE	ON/OFF (12)	ON	POWER lamp (11) lights.
	LSB (6)	OFF	
	USB (10)	OFF	
	LSB GAIN (7)	Max ccw	
	USB GAIN (9)	Max ccw	
	CARRIER LEVEL (8)	0 DB (max cw)	
CHG	POWER (14)	ON	STANDBY lamp (15) goes off.
CSS	ON/STANDBY (45)	ON	STANDBY lamp (47) goes off. POWER lamp (42) lights.
TIS	B+ (60)	ON	B+ lamp (59) lights.
KMCU	POWER (72)	ON	POWER lamp (71) lights.
CPP-2	POWER/STANDBY (63)	POWER	STANDBY lamp (61) goes off. POWER lamp (62) lights. After 60 seconds, dc power is applied to CHL, CMO, and CLL.

3-4. CONSIDERATIONS IN TUNING TRANSMITTER.

a. GENERAL. - Before the transmitter is tuned for any other mode of operation, it should be initially tuned and loaded on carrier. This procedure should be followed even if suppressed carrier operation is desired. After the transmitter is tuned on carrier, either or both sidebands are generated by applying the proper modulating signals (FAX, FSK, audio line, CW) required by the particular mode of operation. The carrier level may then be re-inserted or suppressed, as desired.

b. CARRIER FREQUENCY VS ASSIGNED FREQUENCY. - A brief description of "carrier" versus "assigned" frequency is presented at this point since these may be significantly different when operating in certain modes and will affect the choice of frequency to be synthesized in the exciter.

"Carrier" frequency is the frequency of the unmodulated carrier wave (if sinusoidal), or the center frequency of the unmodulated carrier when a recurring series of pulses are used. The "assigned" frequency is a reference frequency to a given portion of the r-f spectrum. Most government agencies define the "assigned" frequency as the "center of a frequency band assigned to a station". The "assigned" frequency and the "carrier" frequency may or may not be the same. In practice, the assigned frequency is frequently suffixed by the carrier frequency in parenthesis for clarification.

EXAMPLE 1

For upper sideband transmission with carrier completely suppressed and with total audio bandpass

extending to 3000 cycles, the assigned frequency is 1500 cycles above the non-existent carrier frequency.

EXAMPLE 2

For independent sideband transmission with audio intelligence covering 350 to 7500 cycles per sideband, with or without carrier suppression, the assigned frequency and the carrier frequency are one and the same, since both occupy the center of the transmitted spectrum.

c. DETERMINATION OF PROPER SYNTHESIZED FREQUENCY.

(1) DRY CONTACT KEYING. - When dry contact keying is used for nominal carrier on-off CW transmission, carrier frequency and assigned frequency are the same. Tune up on carrier as described in paragraph 3-5.

(2) DOUBLE SIDEBAND OR AM OPERATION. - For either DSB or AM, carrier and assigned frequency are the same, regardless of the type of modulation. Tune up on carrier as described in paragraph 3-5.

(3) INDEPENDENT SIDEBAND OPERATION. - For ISB operation, carrier and assigned frequency may or may not be the same. The carrier frequency will always be centered between the two independent sidebands. If either sideband is greater in bandwidth than the other, the carrier frequency will be offset from the center frequency accordingly. For example:

Assigned frequency = 15,500 kc
USB bandwidth = 6 kc

LSB bandwidth = 3 kc
Carrier frequency = 15498.5 kc

(4) **CW TONE KEYING.** - When the transmitter is keyed through Tone Intelligence Unit TIS, the TIS delivers a keyed 1-kc tone to the selected input channel of Sideband Exciter CBE. If the exciter is initially tuned to the desired output frequency in normal fashion, injection of the keyed tone will cause the output frequency to be in error by 1-kc; i. e., the assigned frequency and carrier frequency will be 1-kc apart. To compensate for this effect, the carrier frequency must be offset by 1-kc. This places the final keyed r-f output signal on the desired frequency.

Modify the tune-up procedure in paragraph 3-5 as follows:

After the dial numeric is subtracted from the desired output frequency, reduce the resulting figure by 1 kc; then follow the normal procedure outlined in paragraph 3-5. Thus, if a keyed output frequency of 15.5 mc is desired, set BAND switch (22) on Frequency Amplifier CHG to 11.75 - 15.75. Note that the dial numeric for that band is 12.

Output frequency	=	15.5 mc
-Dial numeric	=	<u>12.0 mc</u>
Difference	=	3.5 mc
Now subtract 1 kc	=	<u>.001 mc</u>
Result	=	3.499 mc

If the mid-frequency circuits are now tuned to 3.449 mc, the keyed transmitter output will be 15.5 mc.

(5) **FAX OPERATION.** - When the transmitter is to be used for FAX transmission, Tone Intelligence Unit TIS will deliver a 2000-cycle center frequency to the USB channel. The instantaneous output frequency will shift about this point, so that the assigned frequency and carrier frequency will be 2000 cycles apart. To compensate for this effect, the carrier frequency must be offset by 2000 cycles. Modify the normal carrier tune-up procedure described in paragraph 3-5 by reducing the difference between the output frequency and the dial numeric by an additional 2000 cycles. As an example, for nominal output frequency of 15.5 mc, the mid-frequency becomes 3.498 mc.

(6) **FSK OPERATION.** - When the transmitter is to be used for FSK transmission, Tone Intelligence Unit TIS provides a choice of a 2000- or 2550-cycle center frequency to the USB channel. Mark and space frequencies will shift about the center frequency selected, so that the assigned frequency and carrier frequency will be separated by an amount equal to the selected center frequency. The 2000-cycle center frequency should be used with the synthesized exciter since the system is not capable of precision frequency control in less than 100-cycle increments. (The 2550-cycle center frequency may cause off-frequency violation if the circuit is not cleared for SSB.) Modify

the normal carrier tune-up procedure described in paragraph 3-5 by reducing the difference between the output frequency and the dial numeric by an additional 2000 cycles. (For a nominal output frequency of 15.5 mc, the mid-frequency becomes 3.498 mc.

3-5. EXCITER TUNE-UP ON CARRIER.

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are callouts located on figures 2-1 through 2-7.

a. Start the transmitter as outlined in paragraph 3-3.

b. If Keyer-Monitor Control Unit KMCU is used in the transmitter, set KEYING CONTROL switch (73) at LOCAL; set TEST KEY (74) at LOCK.

NOTE

For purposes of illustration, the following tune-up is made at a carrier frequency of 11.0015 mc.

c. At Frequency Amplifier CHG:

(1) Set BAND switch (22) to the band which includes the desired frequency. The frequency range, frequency band, and dial numeric will appear in MCS window (21). The dial numeric, the bottom number in the MCS window (21) is used to quickly determine the mid-frequency.

EXAMPLE

For 11.0015 mc, BAND switch (22) is set at 9.75-11.75 mc (band C) with dial numeric 8 displayed in window.

(2) Subtract dial numeric from desired output frequency. This is mid-frequency which is used to set up several of the exciter units. Note this mid-frequency figure.

EXAMPLE

For 11.0015 mc carrier, mid-frequency is 11.0015-8 = 3.0015 mc.

(3) Set OUTPUT control (25) at MIN (fully ccw).

d. At Controlled Oscillator CLL:

(1) Rotate SYNC switch (40) through positions L-1, L-2, and L-3. Check that stationary rectangle appears on SYNC monitor scope (39) in each position. Return SYNC switch (40) to OFF position.

(2) Set KILOCYCLES switch (38) and HUNDREDS OF CYCLES switch (41) at positions corresponding to 4th and 5th digits, respectively, of mid-frequency calculated in c above.

EXAMPLE

For mid-frequency of 3.0015 mc (3001.5 kc), set KILOCYCLES switch (38) at 1, and set HUNDREDS OF CYCLES switch (41) at 5.

e. At Controlled Master Oscillator CMO:

(1) Set OPERATE-CAL switch (29) at CAL.

(2) Unlock MASTER OSCILLATOR FREQUENCY control (35) by rotating LOCK knob (37) counterclockwise.

NOTE

When performing step (3) below, note that 100-kc checkpoints occur on 50-kc points of MASTER OSCILLATOR FREQUENCY dial; i.e., 2250.000 kc, 2350.000 kc, 2450.000 kc, etc.

(3) Rotate MASTER OSCILLATOR FREQUENCY control (35) to closest 100-kc checkpoint to calculated mid-frequency. Approach this setting from a lower frequency.

EXAMPLE

The closest 100-kc checkpoint to mid-frequency 3.0015 mc (3001.5 kc) is 3050.000 kc. For this example, rotate counter control (35) to a counter reading lower than 3050.000 kc, then increase the counter readings to precisely 3050.000 (3050 on KCS counter and 000 on CPS counter (34)).

CAUTION

Rotating MASTER OSCILLATOR FREQUENCY control (35) past either of its marked frequency limits (1750 and 3750 kc) may upset resetability of counter.

(4) Unlock red calibration control (32b) with outer black LOCK knob (32a), then adjust red knob for zero-beat indication on CAL BEAT indicator (28). Lock red calibration control in place.

(5) Carefully rotate MASTER OSCILLATOR FREQUENCY control (35) until precise calculated mid-frequency appears on counter dials (34); approach this setting from lower frequency. Lock MASTER OSCILLATOR FREQUENCY control (35) in place with LOCK knob (37).

(6) Set OUTPUT control (36) at mid-position.

(7) Adjust TUNING KCS control (33) to obtain peak on TUNE FOR MAX meter (30). This peak should occur with control (33) set at calculated mid-frequency.

(8) Reset OUTPUT control (36) so that TUNE FOR MAX meter indication is mid-scale.

(9) Set OPERATE/CAL switch (29) at OPERATE. The SYNC IND lamp (26) should light and the ADJ FOR ZERO meter (31) should read in center of green area. If necessary, unlock MASTER OSCILLATOR control (35) and readjust for a center-scale indication. Be sure to lock control after readjustment.

f. At Frequency Amplifier CHG:

(1) Adjust MF TUNING control (24) for maximum indication on MF TUNING meter (19). If the meter reads in the red portion of the scale, reduce the setting of OUTPUT control (36) on the CMO.

(2) Set B+ switch (16) at ON. SYNC indicator (17) should light to indicate high-frequency oscillator lock-in.

(3) Advance OUTPUT control (25) to its mid-position.

(4) Rotate OUTPUT TUNING control (23) for maximum indication on OUTPUT meter (20). Reduce setting of OUTPUT control (25) if OUTPUT meter indication tends to move off scale.

NOTE

Be sure that peak indication obtained on MF TUNING meter (19) is obtained with MF TUNING control set at calculated mid-frequency. It is possible to obtain a false peak by tuning to a harmonic or mixing product. As a simple check, rotate CARRIER LEVEL control (8) on CBE to MIN. The readings on both the MF TUNING METER (19) and OUTPUT meter (20) should return to zero if MF TUNING control is properly set. Return CARRIER LEVEL control (8) on CBE to 0 DB.

(5) This completes tuning of exciter on carrier. Return OUTPUT control (25) to minimum setting.

NOTE

At full scale, OUTPUT meter (20) indicates 1 watt PEP.

3-6. APPLYING LOW VOLTAGE POWER TO TRANSMITTER.

a. PRELIMINARY PROCEDURE. - Before applying power to the remaining transmitter frames, set the tuning controls on these frames for the selected carrier frequency in accordance with the appropriate factory tuning charts prepared for the transmitter. In the absence of such charts (one for unbalanced and balanced output operation), set up the controls in accordance with the sample tuning charts (tables 3-2 and 3-3). These charts were prepared from a typical transmitter at the factory, with the transmitter operating into a dummy load. If control settings are set up as shown, the charts should provide a good starting point for tuning the transmitter. When the transmitter is loaded into an antenna, the tuning will

change somewhat. If necessary, modify the tuning charts so that they reflect actual field conditions. Preset the following controls on the transmitter in accordance with the information given in table 3-2 or 3-3 unless otherwise indicated.

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are callouts located on figures 2-1 through 2-7.

<u>UNIT</u>	<u>CONTROL</u>
1 kw IPA	IPA GRID TUNING (123) 1ST AMPL TUNING (124) DRIVER BAND (125) IPA BAND (126) IPA LOADING (127) IPA TUNING (128) IPA LOADING (130)
10 kw PA	PA TUNE (115) PA LOAD (116) BAND SW (117) OUTPUT BAL (118) OUTPUT LOADING (119) at TUNE
40 kw PA	TUNE (210) BAND SW (211) LOAD (212)
Buffer Frame 200-kw PA	INPUT SWR (300) TUNE (309) LOAD (312) BAND SW (315) OUTPUT BAND SW (318) OUTPUT LOAD (321)
Antenna Tuner Deck	BALANCE (405) ANTENNA MATCHING (403)
200K PA frame Control Panel	EMERGENCY/TUNE/OPERATE (326) at EMERGENCY or OPERATE OUTPUT INCR (327) fully clockwise.

b. APPLYING LOW VOLTAGE POWER TO MAIN FRAME.

(1) On the main power panel (main frame), set controls as follows:

<u>CONTROL</u>	<u>POSITION</u>
PA SCREEN (140)	OFF
TUNE-OPERATE (139)	TUNE
HIGH VOLTAGE (141)	OFF
ALDC (137)	OFF
INTERLOCK (135)	NORMAL

(2) Set TIME DELAY control (143) at 5.

(3) Set MAIN POWER circuit breaker (132) at ON:

(a) Main frame blowers should start.

(b) TUNE lamp (107) should light.

(c) PA BIAS lamp (145) should light, then go off after power supply in 1-kw IPA warms up.

(d) PA BIAS meter (2) should indicate 300 volts.

NOTE

If PA BIAS indication is incorrect, adjust PA BIAS ADJ control (151) on 10-kw relay panel.

(e) FILAMENT PRIMARY meter (101) should indicate 230 volts ac. If necessary, rotate FIL ADJ switch (136) on main power panel for proper meter indication.

(f) After 5-minute delay (see step (2) above), INTERLOCK INDICATOR (134) lamp on main power panel should light.

NOTE

If INTERLOCK INDICATOR lamp (134) does not light, set INTERLOCK switch (135) at IPA BAND SW; then rotate switch clockwise. At first position that INTERLOCK INDICATOR goes off, note switch designation and check interlock at that location. When open interlock has been closed, return INTERLOCK switch to NORMAL. When INTERLOCK INDICATOR is lit with INTERLOCK switch set at a NORMAL, proceed to next step.

c. APPLYING LOW VOLTAGE POWER TO PA AND PS FRAMES.

(1) Set TIME DELAY control (232) at 5, then set MAIN POWER circuit breaker (219) on PA frame control panel at ON.

(a) AC POWER lamp (206) and TUNE lamp (207) on 40-kw PA should light.

(b) The top fan in the PA frame should start.

(c) The AC POWER lamp (225) on the bias supply drawer should light. After a short delay, the BIAS and LV lamps (226 and 227 respectively) should also light.

(d) The filaments of the rectifiers in the 40-kw high voltage rectifier should glow.

(e) POWER lamp (251) on crowbar drawer should light and CROWBAR FILAMENT meter (247) should indicate the proper voltage as determined by the setting of RESERVOIR/FILAMENT switch (252).

(f) DRIVER INTERLOCKS IND lamp (242) on PA frame relay panel should light.

(2) Set BLOWER circuit breaker (253) at ON; main blower in PA frame should start.

(3) Set FINAL FIL circuit breaker (257) at ON. FILAMENT TIME meter (231) should start registering elapsed time. FILAMENT PRIMARY meter (201) should indicate 230 volts; if necessary, adjust FIL ADJ switch (254) until this indication is obtained.

d. APPLYING LOW VOLTAGE POWER TO 200K PA FRAME, PSA FRAME, AND PSB FRAME.

(1) Make certain that EMERGENCY TUNE OPERATE switch (326) is set at EMERGENCY or OPERATE.

(2) Set PRIMARY POWER circuit breakers of PSA and PSB frames (393 and 410 respectively) at ON. Top fans of PSA and PSB frames and blowers for 100-kw high-voltage rectifiers should start. TOP FAN lamps (395 and 412) and HVR BLOWER lamps (394 and 411) should light, and then go off after several seconds.

(3) Set MAIN BLOWER circuit breaker (323) at ON; main blower of 200K PA frame and fans of 200-kw PA should start. PA FANS INDICATOR lamp (334) should light, then go off after several seconds.

NOTE

At this time the following lamps should be lit.

B+ (379)
POWER (378)
AC ON (307)
40 K INTERLOCK (365)

(4) Set PA FIL circuit breakers (396 and 413) on PSA and PSB frames at ON.

(a) Fans in the antenna switching unit of PSA frame should start. FAN lamp (388) should light, then go off.

(b) FILAMENT PRIMARY meters of PSA and PSB frames (376 and 400) should each indicate 230 volts. If necessary, rotate PRIMARY ADJUST A and PRIMARY ADJUST B switches (328 and 329) as required for proper meter indications.

(5) Set AC switches (338 and 341) of Bias Supply A and Bias Supply B at ON.

(a) AC ON lamps (337 and 341) should light.

(b) After 5-minute delay, BIAS ON lamps (339 and 343) should light. Set EMERGENCY/TUNE/OPERATE switch (326) at TUNE; TUNE lamp (313) should light.

3-7. TUNE-UP OF 1-KW IPA AND 10-KW PA ON CARRIER.

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are callouts located on figures 2-1 through 2-7.

Before tuning 1-kw IPA and 10-kw PA, the exciter must be tuned (paragraph 3-5), and low-voltage power should be applied (paragraph 3-6). Proceed as follows:

CAUTION

When tuning and loading the 1-kw IPA and 10-kw PA stages, do not exceed the following meter indications:

PA PLATE CURRENT (103):

At start of loading	0.5 to 1 amp
At end of loading	1.5 amp

PA SCREEN CURRENT (102):	35 ma
PA PLATE RF (104):	6 kv
IPA PLATE CURRENT (121):	400 ma

IPA screen current
(as indicated on MULTIMETER (120) with MULTIMETER switch (122) set at DC IPA ISG): 25 ma

a. Set MULTIMETER switch (122) at RF 1ST AMPL EP.

b. Apply r-f drive from exciter by slowly rotating OUTPUT control (25) on Frequency Amplifier CHG clockwise until some indication is produced on MULTIMETER (120).

c. Carefully adjust 1ST AMPL TUNING control (124) until peak is obtained on MULTIMETER (120). Adjust OUTPUT control (25) as necessary to keep meter indication on scale.

d. Set MULTIMETER switch (122) at RF IPA EG.

e. Adjust IPA GRID TUNING control (123) for maximum indication on MULTIMETER.

f. Readjust 1ST AMPL TUNING control (124), if necessary, to peak indication on MULTIMETER.

g. Set OUTPUT control (25) of CHG at MIN.

CAUTION

If the transmitter has been idle for a long period of time, as after shipment, allow a half hour warm-up period at this point so that the mercury in the 10-kw high voltage rectifier tubes will be vaporized before high voltage is applied.

h. Depress OVERLOAD RESET pushbutton (133).

i. Set HIGH VOLTAGE circuit breaker (141) at ON. PLATE ON lamp (109) on 10 KW PA should light and red indicator on roof of auxiliary frame should glow dimly at first and should brighten after 20 seconds. The mercury vapor tubes in the 10-kw high

TABLE 3-2. TRANSMITTER TUNING CHART, UNBALANCED OUTPUT OPERATION

FREQ	IPA BAND	10 KW AMPL BAND	40 KW AMPL BAND	200K AMPLIFIER		IPA				10KW AMPLIFIER					40 KW AMPLIFIER					200 KW AMPLIFIER																			
				BAND	OUTPUT BAND	TUNING	LOADING	LOAD POS	PLATE CURRENT	TUNE	LOAD	PLATE CURRENT	OUTPUT LOAD	LOAD CURRENT	TUNE	LOAD	DC PLATE CURRENT	PLATE RF	DC GRID CURRENT	KILOWATTS OUT	SWR	INPUT SWR CONTROL	TUNE	LOAD	OUTPUT LOAD	USED FOR BALANCED OUTPUT ONLY		DRIVE	PLATE CURRENT	PLATE CURRENT A	PLATE CURRENT B	PLATE RF	LOAD RF	KW OUTPUT	GRID CURRENT A	GRID CURRENT B	SWR	S/D DB	
																										ANT MATCH	BAL											200 KW	100 KW
2	2-2.5	2-3	2-3	2-5	2-3	020	031	1	230	534	650	.70	490	2.2	518	501	5.1	1.5	0	7.0	1.7	000	648	571	693			.1	6.2	5.9	8.0	2.0	100	10	10	1.7	35	40	
3	3-4	3-4	3-4	2-5	2-3	055	056	2	200	324	294	.60	411	0.7	279	428	2.2	3.0	0	5.0	1.1	000	182	228	477			.82	6.1	6.1	9.2	3.5	100	100	100	1.7	35	40	
3	3-4	3-4	3-4	2-5	3-5	055	056	2	200	324	294	.60	411	0.7	279	428	2.2	3.0	0	5.0	1.1	000	440	215	507			.84	6.3	6.1	9.0	3.2	100	125	100	1.8	35	40	
5	4-6	4-6	5-7	2-5	3-5	090	070	2	200	201	390	.55	349	0.8	250	411	2.6	3.0	0	5.5	1.3	000	474	405	094			.35	5.2	5.2	9.0	2.0	100	50	50	1.8	35	40	
5	4-6	4-6	5-7	5-7	5-7	090	070	2	200	201	390	.55	349	1.0	250	411	2.8	3.0	0	5.5	1.2	000	589	530	390			.35	5.5	5.6	9.5	3.5	100	125	75	1.7	35	40	
7	6-8	6-8	7-13	5-7	5-7	085	051	3	200	178	296	.55	329	0.8	255	372	2.9	2.5	0	3.5	1.1	000	434	282	171			.27	5.9	6.2	9.0	3.0	100	100	75	1.8	35	40	
7	6-8	6-8	7-13	7-13.5	5-7	085	051	3	200	180	299	.55	329	0.8	253	394	2.6	3.0	0	3.5	1.2	000	529	454	134			.28	6.1	6.3	9.5	2.0	100	75	75	1.6	35	40	
7	6-8	6-8	7-13	7-13.5	7-14	085	051	3	200	180	299	.55	329	0.6	253	394	2.4	3.0	0	3.5	1.1	000	500	669	130			.27	5.8	6.3	10.5	1.0	100	150	100	1.6	35	40	
11	8-12	11-15	7-13	7-13.5	7-14	094	063	3	200	179	346	.55	284	0.5	178	231	2.2	2.6	0	4.0	1.1	000	341	166	104			.20	4.6	5.6	8.5	3.0	100	75	100	1.9	35	40	
13.5	12-16	15-19	13-18	7-13.5	7-14	093	042	3	215	140	217	.75	250	1.4	195	265	3.5	2.1	0	8.0	1.5	000	002	093	070			.20	6.8	6.6	5.2	3.0	100	0	0	1.6	35	40	
13.5	12-16	15-19	13-18	13.5-22	14-22																	000	360	240	005			.25	6.6	6.4	5.0	3.0	100	50	50	1.7	35	40	
18	16-20	15-19	18-24	13.5-22	14-22	093	042	3	200	131	180	.55	163	0.9	204	232	2.2	4.0	0	9.0	1.7	160	425	084	430			.25	4.7	5.3	5.0	5.0	100	40	25	1.7	35	40	
22	20-28	19-24	18-24	13.5-22	14-22	088	036	3	210	141	145	.55	306	0.5	174	204	2.0	2.5	0	5.0	1.3	250	005	052	654			.27	4.2	5.2	4.1	4.1	100	100	50	1.2	35	40	
22	20-28	19-24	18-24	22-28	22-28	088	036	3	210	141	145	.55	306	0.5	174	204	2.0	2.5	0	5.0	1.3	250	001	084	630			.27	4.7	4.6	3.5	3.0	100	50	25	1.3	35	40	
24	20-28	24-28	24-28	22-28	22-28	092	027	3	230	191	181	.60	300	0.6	193	211	2.6	2.0	0	4.5	1.3	350	001	061	264			.22	5.4	5.6	3.0	2.8	100	0	0	1.4	35	40	
26	20-28	24-28	24-28	22-28	22-28	096	027	3	210	178	150	.60	293	0.7	185	201	2.7	1.5	0	4.0	1.3	480	001	044	111			.40	4.4	4.6	2.9	4.2	100	100	75	1.5	35	40	
28	20-28	24-28	24-28	22-28	22-28	097	066	3	200	170	123	.55	302	0.4	100	199	2.4	3.5	0	5.0	1.4	550	008	027	177			.42	4.8	6.0	2.0	3.5	100	0	0	1.5	35	40	
19	16-20	19-24	18-24	13.5-22	14-22	095	042	3	240	167	185	.75	131	0.7	194	225	2.0	5.0	0	10.0	1.7	180	396	074	456			.40	5.1	5.8	4.0	4.0	100	0	0	1.1	35	40	
20	20-28	19-24	18-24	13.5-22	14-22	083	026	3	225	156	182	.55	297	0.5	187	218	2.2	3.0	0	4.5	1.2	200	005	086	019			.38	5.1	5.8	4.1	2.8	100	0	0	1.3	35	40	
21	20-28	19-24	18-24	13.5-22	14-22	086	047	3	330	150	159	.65	300	0.8	201	203	2.2	3.2	0	14.0	1.9	225	005	070	032			.50	4.7	5.4	3.5	3.0	100	10	10	1.1	35	40	
23	20-28	19-24	18-24	22-28	22-28	090	036	3	220	135	121	.55	291	0.5	136	201	2.1	2.5	0	4.5	1.2	300	001	072	614			.60	5.2	5.5	3.0	2.5	100	0	0	1.3	35	40	

TEST CONDITIONS:

LOAD



600Ω



50Ω UNBALANCED

REMARKS: _____

DATE _____

MODEL _____

MFGR NO. _____

SERIAL NO. _____

TESTED BY *W. J. ...*

APPROVED BY *W. J. ...*

THE TECHNICAL MATERIEL CORPORATION
 MAMARONECK NEW YORK

TABLE 3-3. TRANSMITTER TUNING CHART, BALANCED OUTPUT OPERATION

FREQ	IPA BAND	10 KW AMPL BAND	40 KW AMPL BAND	200K AMPLIFIER		IPA				10 KW AMPLIFIER					40 KW AMPLIFIER					200 KW AMPLIFIER																		
				BAND	OUTPUT BAND	TUNING	LOADING	LOAD POS	PLATE CURRENT	TUNE	LOAD	PLATE CURRENT	OUTPUT LOAD	LOAD CURRENT	TUNE	LOAD	DC PLATE CURRENT	PLATE RF	DC GRID CURRENT	KILOWATTS OUT	SWR	INPUT SWR CONTROL	TUNE	LOAD	OUTPUT LOAD	USED FOR BALANCED OUTPUT ONLY		DRIVE	PLATE CURRENT A	PLATE CURRENT B	PLATE RF	LOAD RF	KW OUTPUT	GRID CURRENT A	GRID CURRENT B	SWR	S/D DB	
																										ANT MATCH	BAL										200 KW	100 KW
2	2-2.5	2-3	2-3	2-5	2-3	017	125	1	230	567	591	.70	482	2.0	522	523	4.7	2.0	0	6.0	1.8	000	562	134	166	339	180	.9	6.8	6.2	6.5	2.0	100	50	25	1.8	35	40
3	3-4	3-4	3-4	2-5	2-3	054	099	2	210	305	660	.65	395	.8	315	578	2.5	2.2	0	4.0	1.3	000	155	274	477	140	240	.45	7.0	6.6	8.0	2.5	100	25	25	1.8	35	40
3	3-4	3-4	3-4	2-5	3-5	054	099	2	210	305	660	.65	395	.8	315	518	2.5	2.2	0	4.0	1.3	000	457	206	507	140	240	.45	6.0	5.8	9.0	2.0	100	25	25	1.8	35	40
5	4-6	4-6	5-7	2-5	3-5	088	099	2	200	203	538	.60	300	.8	281	458	2.6	2.7	0	4.3	1.2	000	446	458	094	111	297	.37	5.8	5.4	7.5	2.0	100	25	25	1.7	35	40
5	4-6	4-6	5-7	5-7	5-7	088	099	2	200	203	538	.60	300	.8	281	458	2.6	2.7	0	4.3	1.2	000	571	539	366	111	308	.42	5.2	5.8	10.0	3.5	100	200	100	1.7	35	40
7	6-8	6-8	7-13	5-7	5-7	080	081	3	220	183	252	1.5	304	.7	297	369	3.0	2.5	0	3.0	1.2	000	423	296	148	095	332	.35	5.8	5.4	8.5	2.5	100	100	100	2.0	35	40
7	6-8	6-8	7-13	7-13.5	5-7	080	081	3	220	183	252	1.5	304	.7	297	369	3.0	2.5	0	3.0	1.2	000	539	416	148	095	332	.38	6.2	5.8	9.5	3.0	100	200	100	2.0	35	40
7	6-8	6-8	7-13	7-13.5	7-14	080	081	3	220	183	252	1.5	304	.7	297	369	3.0	2.5	0	3.0	1.2	000	496	571	157	095	332	.35	6.2	5.6	9.0	1.5	100	50	50	2.0	35	40
11	8-12	11-15	7-13	7-13.5	7-14	092	081	3	210	183	278	.60	275	.6	217	220	2.4	2.6	0	3.5	1.3	000	415	153	118	042	223	.40	5.2	5.0	1.0	4.0	100	0	0	1.2	35	40
13.5	12-16	15-19	13-18	7-13.5	7-14	091	057	3	270	143	187	.65	285	.8	236	248	2.8	2.5	0	4.0	1.3	000	007	105	071	051	335	.28	6.8	4.4	7.0	3.8	100	100	50	1.2	35	40
13.5	12-16	15-19	13-18	13.5-22	14-22	091	057	3	220	143	187	.65	285	.8	236	048	2.8	2.5	0	4.0	1.3	000	360	239	006	051	335	.54	7.0	6.8	4.0	3.5	100	25	25	1.7	35	40
18	16-20	15-19	18-24	13.5-22	14-22	091	048	3	210	134	146	.60	263	.5	238	221	2.2	3.0	0	5.0	1.5	160	101	102	486	053	337	.54	7.0	6.8	4.0	3.5	100	25	25	1.7	35	40
22	20-28	19-24	18-24	13.5-22	14-22	087	029	3	220	143	121	.55	275	.5	244	184	2.6	2.4	0	3.0	2.0	250	005	064	639	063	000	.45	5.5	5.4	6.0	5.0	100	100	75	1.8	35	40
22	20-28	19-24	18-24	22-28	22-28	087	029	3	220	143	121	.55	275	.5	244	184	2.6	2.4	0	3.0	2.0	250	001	096	630	063	000	.45	5.5	5.6	5.8	5.5	100	100	100	1.9	35	40
24	20-28	24-28	24-28	22-28	22-28	091	029	3	220	193	158	.60	281	.55	241	195	2.5	2.2	0	4.0	1.4	350	002	078	197	003	000	.65	6.8	6.4	4.0	3.5	100	25	0	2.2	35	40
26	20-28	24-28	24-28	22-28	22-28	095	029	3	220	182	119	.65	283	.2	220	189	3.0	2.4	0	4.0	1.2	480	002	056	158	003	002	.40	4.4	5.0	2.0	2.0	100	0	0	2.2	35	40
28	20-28	24-28	24-28	22-28	22-28	097	066	3	220	172	095	.60	284	.2	214	176	3.0	2.6	0	4.5	1.3	550	008	099	253	003	037	.42	3.4	2.4	2.5	3.0	100	0	0	2.3	35	40

TEST CONDITIONS:

LOAD



600Ω



500 UNBALANCED

REMARKS: _____

DATE _____

MODEL _____

MFGR NO. _____

SERIAL NO. _____

TESTED BY *[Signature]*

APPROVED BY *[Signature]*

THE TECHNICAL MATERIEL CORPORATION
 MAMARONECK NEW YORK

voltage rectifier should glow brightly. PA PLATE meter (3) should indicate 7.5 kv.

j. Carefully rotate OUTPUT control (25) on CHG clockwise until some indication is noted on IPA PLATE CURRENT meter (121).

k. Adjust IPA TUNING control (128) to obtain dip on IPA PLATE CURRENT meter.

NOTE

To prevent energizing PA SCREEN overload circuit when performing remainder of tuning procedure, be careful not to set PA SCREEN switch at ON when TUNE/OPERATE switch is set at OPERATE. If any overload relay trips, the HIGH VOLTAGE circuit breaker is automatically set at OFF, and high voltage is removed. If this occurs, set OUTPUT control at MIN, set TUNE/OPERATE switch at TUNE, and set PA SCREEN switch at OFF; start with step (h) above and retune.

l. Set OUTPUT control (25) at MIN; set PA SCREEN switch (140) at ON.

m. Carefully rotate OUTPUT control clockwise until some indication is obtained on PA PLATE CURRENT meter (103).

n. Adjust PA TUNING control (115) to obtain dip on PA PLATE CURRENT meter.

o. Set OUTPUT control (25) at MIN.

p. Set TUNE/OPERATE switch (139) at OPERATE. PA PLATE CURRENT meter (103) should indicate 0.5 amperes. If necessary, adjust PA BIAS control (151) to obtain proper indication.

q. Set MULTIMETER switch at IPA ISG.

r. Rotate OUTPUT control (25) clockwise until IPA PLATE CURRENT meter indicates 250 ma, or until PA PLATE CURRENT meter indicates 1.0 amperes.

s. Adjust IPA TUNING control (128) to obtain dip on IPA PLATE CURRENT meter; adjust PA TUNING control (115) to obtain dip on PA PLATE CURRENT meter.

CAUTION

If unable to obtain desired results when performing step (t) below, IPA LOADING switch (127) must be reset. OUTPUT control (25) must be set at MIN when the IPA LOADING switch is changed to prevent arcing at switch contacts.

t. Rotate OUTPUT control (25) until PA OUTPUT meter (105) indicates 5 kw; when performing this step, pay particular attention to the following:

(1) PA PLATE CURRENT meter (103) should indicate 1.3 to 1.5 amperes; lowest indication is most desirable. If PA PLATE CURRENT meter indicates 1.5 amperes but PA OUTPUT meter indicates less than 5 kw, rotate PA LOADING control (119) counterclockwise and readjust PA TUNING control (115) to obtain dip on PA PLATE CURRENT meter.

(2) PA SCREEN CURRENT meter (102) should indicate 10 to 35 ma; lowest indication is most desirable. If PA SCREEN CURRENT meter indicates 35 ma but PA OUTPUT meter indicates less than 5 kw, rotate PA LOADING control clockwise and readjust PA TUNING control to obtain dip on PA PLATE CURRENT meter.

(3) PA PLATE RF meter (104) should indicate 2.5 to 5 kv; highest indication is most desirable. If PA PLATE RF meter indicates 5 kv but PA OUTPUT meter indicates less than 5 kw, rotate PA LOADING control clockwise and readjust PA TUNING control to obtain dip on PA PLATE CURRENT meter.

(4) IPA PLATE CURRENT meter (121) should indicate 350 ma or less. If IPA PLATE CURRENT meter indicates 350 ma but PA OUTPUT meter indicates less than 5 kw, rotate IPA LOADING control (130) clockwise and readjust IPA TUNING control (128) to obtain dip on IPA PLATE CURRENT meter.

(5) MULTIMETER (120) should indicate 20 ma or less. If MULTIMETER indicates 20 ma but PA OUTPUT meter indicates less than 5 kw, rotate IPA LOADING control counterclockwise and readjust IPA TUNING control to obtain dip on IPA PLATE CURRENT meter.

u. Set OUTPUT control (25) at MIN.

v. Set TUNE/OPERATE switch (139) at TUNE.

w. Set PA SCREEN switch (190) at OFF.

x. Set HIGH VOLTAGE circuit breaker (141) at OFF.

3-8. TUNE-UP OF 40-KW PA ON CARRIER.

Before tuning the 40-kw PA, the exciter, 1-kw IPA, and 10-kw PA must be tuned (paragraphs 3-5 and 3-7), and low voltage power should be applied (paragraph 3-6). Proceed as follows:

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are callouts located on figures 2-1 through 2-7.

CAUTION

When tuning and loading the 40-KW PA do not exceed the following meter indications:

PLATE CURRENT (203):

At start of loading 2 amperes
At end of loading 5 amperes

PLATE RF (204): 7 kv

GRID CURRENT (244): 100 ma

a. Make sure that DRIVER INTERLOCKS switch (243) is set at ON.

b. Set OUTPUT LOADING switch (119) at OPER; TUNE lamp (207) should go off; OPERATE lamp (208) and INTERLOCK INDICATOR lamp (215) should light.

NOTE

If INTERLOCK INDICATOR lamp does not light, set INTERLOCK switch (221) at EXTERNAL, then rotate switch clockwise. Note switch designation of first position at which lamp does not light, and check interlock at that location. When open interlock has been closed, set INTERLOCK switch at TIMER.

c. Observe that GRID VOLTS meter (245) indicates approximately 550 volts. If necessary, adjust BIAS ADJ control (222) to obtain proper meter indication.

d. Set HIGH VOLTAGE circuit breaker (141) at ON.

e. Set HIGH VOLTAGE circuit breaker (220) at ON. PLATE ON lamps (109 and 209) should light. Red indicators on the roof of the auxiliary frame and on roof of PS frame should glow dimly at first and then brighten after 20 seconds. PLATE VOLTS meter (246) should indicate approximately 12 kv, and PLATE CURRENT meter (203) should indicate 1.8 amperes. If necessary, adjust BIAS ADJ control (222) to obtain proper indication on PLATE CURRENT meter.

f. Set PA SCREEN switch (140) at ON.

g. Set TUNE/OPERATE switch (139) at OPERATE.

h. Rotate OUTPUT control (25) on Frequency Amplifier CHG clockwise until PLATE CURRENT meter (203) indicates 2 amperes.

i. Adjust TUNE control (210) to obtain dip on PLATE CURRENT meter (203).

j. Adjust PA TUNE control (115) to obtain dip on PA PLATE CURRENT meter (103). Adjust IPA TUNING control (128) to obtain dip on IPA PLATE CURRENT meter (121).

NOTE

When performing step k below, RETUNE overload relay will trip if plate current exceeds 3 amperes when plate r-f voltage is less than 2 kv.

k. Rotate OUTPUT control (25) clockwise until PLATE CURRENT meter (203) indicates 3 amperes;

when performing this step, pay particular attention to the following:

(1) PLATE RF meter (204) should indicate 2 to 4 kv. If PLATE RF meter indicates 4 kv but PLATE CURRENT meter indicates less than 3 amperes, rotate LOAD control (212) clockwise and readjust TUNE control (210) to obtain dip on PLATE CURRENT meter.

(2) If PLATE CURRENT meter indicates 3 amperes but PLATE RF meter indicates less than 2 kv, rotate LOAD control counterclockwise and readjust TUNE control to obtain dip on PLATE CURRENT meter.

l. Hold SWR switch (138) up, and adjust OUTPUT BAL control (118) for minimum indication on PA OUTPUT meter (105). Release SWR switch.

m. Adjust PA TUNE control (115) to obtain dip on PA PLATE meter (103); adjust IPA TUNING control (128) to obtain dip on IPA PLATE CURRENT meter (121).

n. Rotate OUTPUT control (25) clockwise until OUTPUT meter (205) indicates 20 kw; when performing this step, pay particular attention to the following:

(1) PLATE CURRENT meter (244) should indicate 4.5 to 5 amperes; lowest indication is most desirable. If PLATE CURRENT meter indicates 5 amperes but OUTPUT meter indicates less than 20 kw, rotate LOAD control (212) counterclockwise and readjust TUNE control (210) to obtain dip on PLATE CURRENT meter.

(2) PLATE RF meter (204) should indicate 4.5 to 6 kv. If PLATE RF meter indicates 6 kv but OUTPUT meter indicates less than 20 kw, rotate LOAD control clockwise and readjust TUNE control to obtain dip on PLATE CURRENT meter.

(3) GRID CURRENT meter (249) should indicate less than 80 ma; lowest indication is most desirable. If GRID CURRENT meter indication approaches 80 ma but OUTPUT meter indicates less than 20 kw, rotate LOAD control clockwise and readjust TUNE control to obtain dip on PLATE CURRENT meter.

NOTE

The OUTPUT control (25) on the frequency amplifier CHG is not used in the remainder of the tuning procedure. Its setting should not be changed after completion of step n above.

o. Rotate OUTPUT INCR control (327) fully counterclockwise.

p. Set HIGH VOLTAGE circuit breaker (220) at OFF.

q. Set TUNE/OPERATE switch (139) at TUNE.

r. Set PA SCREEN switch (140) at OFF.

3-9. TUNE-UP OF 200-KW PA ON CARRIER.

Before tuning the 200-kw power amplifier, the exciter, 1-kw IPA, 10-kw PA, and 40-kw PA must be tuned (paragraphs 3-5, 3-7, and 3-8), and low voltage power must be applied (paragraph 3-6).

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are callouts located on figures 2-1 through 2-7.

CAUTION

When tuning and loading the 200-KW PA do not exceed the following meter indications:

PLATE CURRENT A and PLATE CURRENT B (302 and 303):

At start of loading	3 amperes
At end of loading	6 amperes

GRID CURRENT (373 and 397): 500 ma

PLATE RF (304): 10 kv

LOAD RF (305): 8 kv

a. Make sure the 40 K INTERLOCK switch (371) is set at ON.

b. Slowly set EMERGENCY/TUNE/OPERATE and switch (326)* at OPERATE. TUNE lamp (313) should go off; OPERATE lamp (316) and INTERLOCK lamp (325) should light.

NOTE

If INTERLOCK lamp does not light, set INTERLOCK switch (324) at DOORS, then rotate switch clockwise. Note switch designation of first position at which lamp does not light, and check interlock at that location. When open interlock has been closed, proceed to step c.

c. Observe that BIAS lamps (352 and 366) go off. BIAS VOLTS meters (374 and 398) should each indicate approximately 450 volts. If necessary, adjust BIAS ADJUST controls (340 and 344) to obtain proper meter indications.

d. Set HIGH VOLTAGE circuit breaker (220) at ON.

e. Set HIGH VOLTAGE A circuit breaker (335) and HIGH VOLTAGE B circuit breaker (336) at ON. PLATE ON lamps (109 and 209) should light; PLATE ON A lamp (319) and PLATE ON B lamp (322) should light. Red indicators on roof of auxiliary frame, PS frame, and PSA frame should glow dimly at first and then brighten after 20 seconds. PLATE VOLTS meters (375 and 399) should each indicate 20 kv. PLATE CURRENT A meter (302) and PLATE CURRENT B

*This switch must be turned slowly to ensure proper circuit operation.

meter (303) should each indicate 1 ampere. If necessary, adjust BIAS ADJUST controls (340 and 344) to obtain proper meter indications.

f. Set PA SCREEN switch (140) at ON.

g. Set TUNE/OPERATE switch (139) at OPERATE.

h. Rotate OUTPUT INCR control (327) clockwise until PLATE CURRENT A meter (302) and PLATE CURRENT B meter (303) indicate 1.5 amperes.

i. Adjust TUNE control (309) to obtain dip on PLATE CURRENT A and PLATE CURRENT B meters.

NOTE

When performing step (j) below, RETUNE overload relay will trip if plate current of power amplifier tube A or B exceeds 3 amperes when plate r-f voltage is less than 2 kv.

j. Rotate OUTPUT INCR control (327) until PLATE CURRENT A meter (302) and PLATE CURRENT B meter (303) indicate 3 amperes. When performing this step, pay particular attention to the following:

(1) PLATE RF meter (304) should indicate 2.5 to 4.5 kv. If PLATE RF meter indicates 4.5 kv but PLATE CURRENT meters (A and B) indicate less than 3 amperes, rotate LOAD control (312) clockwise, and readjust TUNE control (309) to obtain dip on PLATE CURRENT meters (A and B).

(2) If PLATE RF meter indicates less than 2.5 kv and PLATE CURRENT meters indicate 3 amperes, rotate LOAD control counterclockwise and readjust TUNE control to obtain dips on PLATE CURRENT meters.

(3) GRID CURRENT meters (373 and 397) should indicate 0 to 100 ma; lowest indications are desirable. If GRID CURRENT meters indicate 100 ma when PLATE CURRENT meters indicate less than 3 amperes, rotate LOAD control clockwise and readjust TUNE control to obtain dip on PLATE CURRENT meters (A and B).

k. For balanced output operation, adjust ANTENNA MATCHING control (403) to obtain maximum indication on BALANCE OUTPUT meter (401); adjust BALANCE control (405) to obtain minimum indication on BALANCE OUTPUT meter.

l. Adjust CAL control (256) to obtain a readable indication on SWR meter (248); adjust INPUT SWR control (300) to obtain dip on SWR meter.

m. Adjust TUNE control (210) to obtain dip on PLATE CURRENT meter (203).

n. Rotate OUTPUT INCR control (327) until KW OUTPUT meter (306) indicates 100 kw; when performing this step, pay particular attention to the following:

(1) PLATE CURRENT A meter (302) and PLATE CURRENT B meter (303) should each indicate 4 to 6 amperes. If PLATE CURRENT meters (A and B) indicate 6 amperes but KW OUTPUT meter indicates less than 100 kw, rotate LOAD control (312) counterclockwise and readjust TUNE control (309) to obtain dip on PLATE CURRENT meters (A and B).

(2) PLATE RF meter (304) should indicate 5 to 7.5 kv. If PLATE RF meter indicates 7.5 kv but KW OUTPUT meter indicates less than 100 kw, rotate LOAD control clockwise and readjust TUNE control to obtain dip on PLATE CURRENT meters (A and B).

(3) GRID CURRENT meters (373 and 397) should indicate 0-500 ma; lowest indication is desirable. If GRID CURRENT meters indicate 500 ma but KW OUTPUT meter indicates less than 100 kw, rotate LOAD control clockwise and readjust TUNE control to obtain dip on PLATE CURRENT meters (A and B).

(4) LOAD RF meter (305) should indicate 1.25 to 5 kv. If LOAD RF meter indicates less than 1.25 kv, PLATE CURRENT meters (A and B) indicate approximately 6 amperes each, PLATE RF meter indicates approximately 7.5 kv, and KW OUTPUT meter indicates less than 100 kw; rotate OUTPUT LOAD control (321) counterclockwise, rotate LOAD control clockwise, and readjust TUNE control to obtain dips on PLATE CURRENT meters (A and B).

(5) If LOAD RF meter indicates higher than 5 kv, PLATE CURRENT meters (A and B) indicate approximately 6 amperes each, PLATE RF meter indicates approximately 7.5 kv, and KW OUTPUT meter indicates less than 100 kw; rotate OUTPUT LOAD control clockwise, rotate LOAD counterclockwise, and readjust TUNE control to obtain dips on PLATE CURRENT meters (A and B).

o. Set 40K INTERLOCK switch (371) at OFF; set DRIVER INTERLOCK switch (243) at OFF.

p. Rotate OUTPUT INCR control (327) fully counterclockwise.

r. If Keyer-Monitor Control Unit KMCU is used in the transmitter, set KEYING CONTROL switch (73) at REMOTE; set TEST KEY (74) at KEY, and then release.

3-10. PREPARATION FOR AM, MCW, SSB, DSB, OR ISB OPERATION.

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are callouts located on figures 2-1 through 2-7.

a. Set LSB and USB switches (7 and 10) at CH-1.

b. Set CARRIER LEVEL control (8) at MIN.

c. Set FUNCTION switch (53) at CW.

d. Set TEST switch (55) at MARK.

e. Set EXCITER CH 1 switch (57) at FSK/FAX/CW.

f. Adjust LEVEL ADJ control (51) to obtain mid-scale indication on OUTPUT LEVEL meter (52).

g. Adjust USB GAIN control (9) to obtain mid-scale indication on USB meter (5); adjust LSB Gain control (7) to obtain mid-scale indication on LSB meter (4). Indications on USB and LSB meters must be precisely equal.

h. Rotate OUTPUT INCR control (327) clockwise until KW OUTPUT meter (306) indicates 100 kw; when performing this step, pay particular attention to the following:

(1) PLATE CURRENT A and PLATE CURRENT B meters (302 and 303) must indicate no higher than 6 amperes.

(2) PLATE RF meter (304) must indicate no higher than 10 kv; note the specific PLATE RF meter indication.

(3) GRID CURRENT meters (373 and 397) must indicate no higher than 500 ma, each; lowest obtainable indication is most desirable.

(4) LOAD RF meter (305) should indicate no higher than 8 kv.

(5) If necessary, retune the 200-KW PA as outlined in paragraph 3-9 until all these conditions are met.

i. Set ALDC control (137) at its fully clockwise position; then slowly rotate ALDC control counterclockwise until indication on PLATE RF meter (304) starts to decrease.

j. Rotate OUTPUT INCR control (327) fully counterclockwise.

k. Proceed as outlined in paragraph 3-12, 3-15, or 3-16.

3-11. CW OPERATION.

a. DRY KEYING - Remove strap that connects terminals 17 and 18 on terminal board E3002; connect "dry" keying source to these terminals. Tune transmitter on carrier as outlined in paragraphs 3-5 through 3-9; keep key closed during tuning procedure. Adjust OUTPUT INCR control (327) for desired transmitter power output (up to 100 kw) as indicated on KW OUTPUT meter (306).

NOTE

If dry keyed CW operation is employed, it will be necessary to supply a locked key to the transmitter to facilitate all other modes of operation.

b. TONE CW.

- (1) Tune transmitter on carrier as outlined in paragraphs 3-5, 3-6, 3-7, 3-8 and 3-9. Offset carrier as described in paragraph 3-4.
- (2) Set CARRIER LEVEL control (8) at MIN.
- (3) Set FUNCTION switch (53) at CW.
- (4) Set TEST switch (55) at MARK.
- (5) Set KEY MODE switch (56) to correspond with keying source (current or voltage, and level).
- (6) Set EXCITER CH 1 or EXCITER CH 2 switch (57 or 58) at FSK-FAX-CW.
- (7) Set USB switch (10) at CH-1 or CH-2 to correspond with EXCITER switch (CH 1 or CH 2) used in step (6), above.
- (8) Adjust LEVEL ADJ control (51) to obtain mid-scale indication on OUTPUT LEVEL meter (52).
- (9) Adjust USB GAIN control (9) to obtain mid-scale indication on USB meter (5).
- (10) Adjust OUTPUT INCR control (327) for desired transmitter power output (up to 100 KW) as indicated on KW OUTPUT meter (306).
- (11) Set TEST switch (55) at LINE.

3-12. MCW OPERATION.

- a. Tune transmitter on carrier as outlined in paragraphs 3-5 through 3-9; perform preparatory procedure as outlined in paragraph 3-10.
- b. Set CARRIER LEVEL control (8) at -6 DB.
- c. Set FUNCTION switch (53) at CW.
- d. Set TEST switch (55) at MARK.
- e. Set KEY MODE switch (56) to correspond with keying source (current or voltage, and level).
- f. Set EXCITER CH 1 or EXCITER CH 2 switch (57 or 58) at FSK-FAX-CW.
- g. Set USB and LSB switches (6 and 10) at CH-1 or CH-2 to correspond with EXCITER switch (CH 1 or CH 2) used in step f., above.
- h. Adjust LEVEL ADJ control (51) to obtain mid-scale indication on OUTPUT LEVEL meter (52).
- i. Adjust USB GAIN control (9) to obtain mid-scale indication on USB meter (5); adjust LSB GAIN control (7) to obtain mid-scale indication on LSB meter (4).
- j. Adjust OUTPUT INCR control (327) to obtain same indication on PLATE RF meter (309) as was obtained in step h. of paragraph 3-10.
- k. Set TEST switch (55) at LINE.

3-13. FSK OPERATION.

- a. Tune transmitter on carrier as outlined in paragraphs 3-5 through 3-9; offset carrier as outlined in paragraph 3-4.
- b. Set CARRIER LEVEL control (8) at MIN.
- c. Set FUNCTION switch (53) at FSK.
- d. Set TEST switch (55) at LINE.
- e. Set KEY MODE switch (56) to correspond with keying source (current or voltage, and level).
- f. Rotate SHIFT CPS control (50) for indication of desired total frequency shift on counter dial.
- g. Set CENTER FREQ CPS switch (54) at 2000.
- h. Set EXCITER CH 1 or EXCITER CH 2 switch (57 or 58) at FSK/FAX/CW.
- i. Set USB switch (10) at CH-1 or CH-2 to correspond with EXCITER switch (CH 1 or CH 2) used in step (h) above.
- j. Adjust LEVEL ADJ control (51) to obtain mid-scale indication on OUTPUT LEVEL meter (52).
- k. Adjust USB GAIN control (9) to obtain mid-scale indication on USB meter (5).
- l. Adjust OUTPUT INCR control (327) for desired transmitter output power (up to 100 kw) as indicated on KW OUTPUT meter (306).

3-14. FAX OPERATION.

- a. Tune transmitter on carrier as outlined in paragraphs 3-5 through 3-9; offset carrier as outlined in paragraph 3-4.
- b. Set CARRIER LEVEL control (8) at MIN.
- c. Set FUNCTION switch (53) at FAX.
- d. Set CENTER FREQ. CPS switch (54) at 2000.
- e. Set EXCITER CH 1 or EXCITER CH 2 switch (57 or 58) at FSK/FAX/CW.
- f. Set USB switch (10) at CH-1 or CH-2 to correspond with EXCITER switch (CH 1 or CH 2) used in step e., above.
- g. Adjust LEVEL ADJ control (51) to obtain mid-scale indication on OUTPUT LEVEL meter (52).
- h. Adjust USB GAIN control (9) to obtain mid-scale indication on USB meter (5).
- i. Adjust OUTPUT INCR control (327) for desired transmitter output power (up to 100 KW) as indicated on KW OUTPUT meter (306).

3-15. SSB AND AME (AM EQUIVALENT) OPERATION.

a. Tune transmitter on carrier as outlined in paragraphs 3-5 through 3-9; offset carrier as outlined in paragraph 3-4; perform preparatory procedure as outlined in paragraph 3-10.

b. Set CARRIER LEVEL control (8) for desired type of transmission; i. e., at MIN (Fully counter-clockwise) for suppressed carrier operation, at -20 DB or as desired for reduced carrier operation, or at -6DB for AME.

c. Set USB switch (10) or LSB switch (6) at CH-1 or CH-2 to correspond with line to which audio intelligence is applied, and to correspond with desired sideband.

EXAMPLE

If upper sideband operation is desired, and the audio intelligence is applied to line 1; set USB switch at CH 1, and set LSB switch at OFF.

d. Adjust USB GAIN or LSB GAIN control (7 or 9) for indication on USB or LSB meter (4 or 5) as shown in table 3-4.

e. Adjust OUTPUT INCR control (327) to obtain same indication on PLATE RF meter (304) as was obtained in step h. of paragraph 3-10.

3-16. ISB, DSB, AND AM OPERATION.

a. Tune transmitter on carrier as outlined in paragraphs 3-5 through 3-6; offset carrier, if necessary, as outlined in paragraph 3-4; perform preparatory procedure as outlined in paragraph 3-10.

b. Set CARRIER LEVEL control (8) for desired type of transmission; i. e., at MIN (Fully counter-clockwise) for suppressed carrier operation, at -20DB or as desired for reduced carrier operation, or at -6DB for AM operation.

NOTE

If it is desired to transmit an AFSK or AFAX signal in one of the independent sidebands, set controls on Tone Intelligence Unit TIS as outlined in paragraph 3-13 or 3-14. For AFSK transmissions, set CENTER FREQ CPS switch (54) at 2550; for AFAX transmissions, set CENTER FREQ CPS switch at 1900.

c. Set USB switch (10) at CH-1 or CH-2 to correspond with line to which upper sideband audio intelligence is applied. Set LSB switch (6) at CH-1 or CH-2 to correspond line to which lower sideband audio intelligence is applied. For DSB or AM operation, set both switches (USB and LSB) at identically marked positions (CH-1 or CH-2).

d. Adjust USB GAIN control (9) to obtain indication on USB meter (5) as shown in table 3-4; adjust LSB

GAIN control (7) to obtain indication on LSB meter (4) as shown in table 3-4.

e. Adjust OUTPUT INCR control (327) to obtain same indication on PLATE RF meter (304) as was obtained in step h. of paragraph 3-10.

TABLE 3-4. METER INDICATIONS, SIDEBAND EXCITER CBE

TYPE OF AUDIO INTELLIGENCE	METER INDICATION IN DB	
	SSB	ISB/AM
VOICE	-3 (Peaks)	-6
4 CHANNEL VF TELEGRAPHY	-3	-6
6 CHANNEL VF TELEGRAPHY	-5	-8
8 CHANNEL VF TELEGRAPHY	-6	-9
12 CHANNEL VF TELEGRAPHY	-8	-11
16 CHANNEL VF TELEGRAPHY	-9	-12
32 CHANNEL VF TELEGRAPHY	-12	-15

3-17. EMERGENCY OPERATION.

If the 200-kw power amplifier fails to function properly, it is possible to operate the GPT-200K at reduced power as a 40-kw transmitter, using the 40-kw PA as the final amplifier and bypassing the 200-kw stage. It is also possible to bypass both the 40-kw and 200-kw PA, operating at 10-kw PEP from the 10-kw PA. Additionally, the 200-kw and 10-kw stages may be bypassed, permitting operation from the 1-kw IPA. The transmitter may be set up for any of these operating modes by making appropriate connections as shown on decals permanently affixed to the inner side walls of the transmitter frames.

NOTE

If low voltage power cannot be applied to the 200K PA frame, the r-f switching relays (K4001, K4002, and K4003) that normally operate in conjunction with EMERGENCY/TUNE/OPERATE switch may be operated manually. These relays are easily accessible from the front of the Buffer Frame.

a. 40-KW OPERATION.

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are call-outs located on figures 2-1 through 2-7.

(1) CONNECTIONS.

(a) Remove high voltage from all stages of the transmitter.

(b) Set EMERGENCY/TUNE/OPERATE switch (326) at EMERGENCY.

WARNING

Before proceeding, make sure that all capacitors in the 200K PA are discharged.

(c) Refer to figure 3-1:

1. Remove strap No. 1 from transition piece and capacitor C5333.

2. Remove screw from strap No. 2.

3. Swing strap No. 2 over and connect to transition piece.

(2) TUNING TRANSMITTER ON CARRIER.

(a) Turn OUTPUT INCR control (322) fully clockwise; turn OUTPUT control (25) on Frequency Amplifier CHG fully counterclockwise.

(b) Tune exciter, 1-kw IPA, 10-kw PA, and 40-kw PA on carrier as described in paragraphs 3-5 through 3-8. Use OUTPUT control (25) to control the r-f drive.

(3) CW, FSK and FAX OPERATION. - Follow exciter set-up procedures as described in paragraphs 3-11, 3-13, or 3-14; adjust OUTPUT control (25) to obtain 20-kw output as indicated on OUTPUT meter (205).

(4) MCW, AM, SSB, ISB and DSB OPERATION.

(a) Perform preparatory procedure as described in paragraph 3-10; limit power output to 20-kw as indicated on OUTPUT meter (205); note indication on PLATE RF meter (204).

(b) Follow exciter set-up procedures as described in paragraphs 3-12, 3-15, or 3-16; adjust OUTPUT control (25) to obtain same indication on PLATE RF meter (204) as was obtained in preparatory procedure.

b. 10-KW OPERATION.

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are callouts located on figures 2-1 through 2-7.

(1) CONNECTIONS.

(a) Remove high voltage from all stages of the transmitter.

(b) Set EMERGENCY/TUNE/OPERATE switch (326) at EMERGENCY.

(c) Set OUTPUT LOADING switch (119) at EMER.

WARNING

Before proceeding, make sure that all capacitors in the 200K PA and 40K PA are discharged.

(d) Refer to figure 3-1:

1. Remove strap No. 1 from transition piece and capacitor C5333.

2. Remove screw from strap No. 2.

3. Swing strap No. 2 over and connect to transition piece.

(e) Refer to figure 3-2:

1. Disconnect L7318 from the 40K UNBAL terminal.

2. Swing L7318 over and connect to EMERG terminal.

(2) TUNING TRANSMITTER ON CARRIER.

(a) Turn OUTPUT INCR control (327) fully clockwise; turn OUTPUT control (25) on Frequency Amplifier CHG fully counterclockwise.

(b) Tune exciter, 1-kw IPA, and 10-kw PA on carrier as described in paragraphs 3-5 thru 3-7. Use OUTPUT control (25) to control r-f drive.

(3) CW, FSK, AND FAX OPERATION. - Follow exciter set-up procedures as described in paragraphs 3-11, 3-13, or 3-14; adjust OUTPUT control (25) to obtain 5-kw output as indicated on PA OUTPUT meter (105).

(4) MCW, AM, SSB, ISB AND DSB OPERATION.

(a) Perform preparatory procedure as described in paragraph 3-10; limit power output to 5-kw as indicated on PA OUTPUT meter (105); note indication on PA PLATE RF meter (104).

(b) Follow exciter set-up procedure as described in paragraphs 3-12, 3-15, or 3-16; adjust OUTPUT control (25) to obtain same indication on PLATE RF meter (104) as was obtained in preparatory procedure.

c. 1-KW OPERATION.

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are callouts located on figures 2-1 through 2-7.

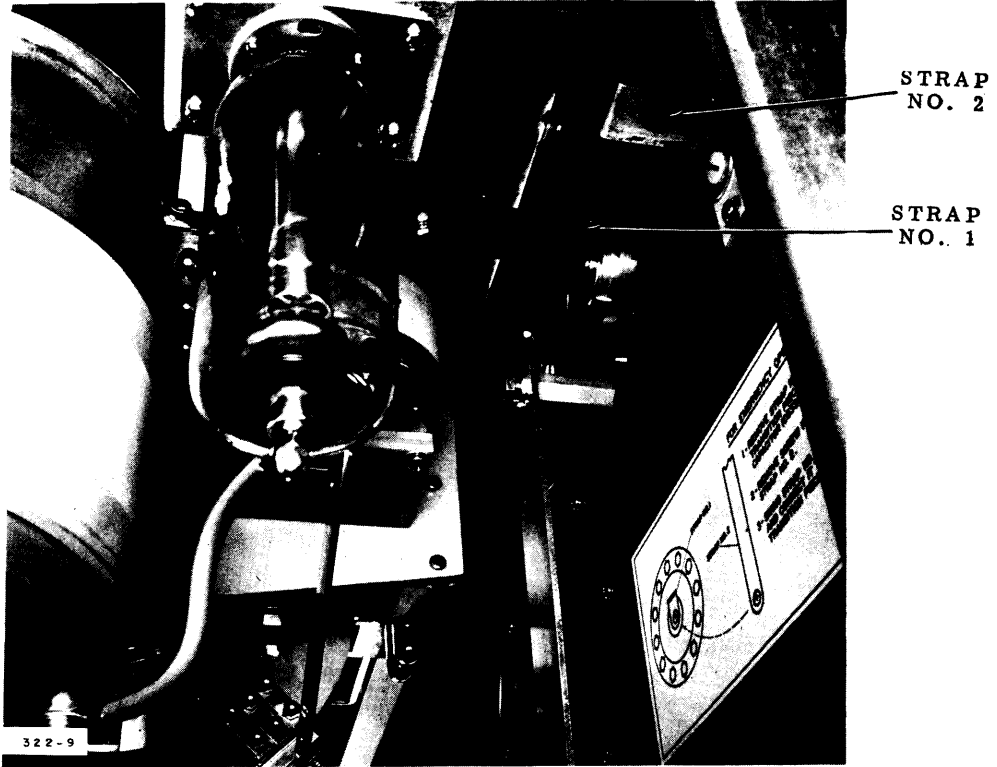


Figure 3-1. Connections for 40-kw Emergency Operation

656.30-1



Figure 3-2. Connections for 10-kw Emergency Operation

645.18-4

(1) CONNECTIONS.

(a) Remove high voltage from all stages of the transmitter.

(b) Set EMERGENCY/TUNE/OPERATE switch (326) at EMERGENCY.

(c) Set OUTPUT LOADING switch (119) at EMER.

(d) Set MAIN POWER circuit breaker (132) at OFF.

WARNING

Before proceeding, make sure that all capacitors in the 200K PA, 40K PA, 10K PA, and main power supply are discharged.

(e) Refer to Figure 3-1, and proceed as follows:

1. Remove strap No. 1 from transistion piece and capacitor C5333.

2. Remove screw from strap No. 2.

3. Swing strap No. 2 over and connect to transistion piece.

(f) Refer to Figure 3-2, and proceed as follows:

1. Disconnect L7318 from 40K UNBAL terminal.

2. Swing L7318 over and connect to EMER terminal.

(g) Refer to figure 3-3, and proceed as follows:

1. Disconnect and remove lead between EMER terminal of OUTPUT LOADING switch S903 and emergency output jack J905.

2. Connect cable W901 (loose item) between J905 and P902.

3. Disconnect cable W1004 from jack J901.

4. Swing W1004 over and connect to feed-thru connector CP902.

(2) TUNING TRANSMITTER ON CARRIER.

(a) Turn OUTPUT INCR control (327) fully clockwise; turn OUTPUT control (25) on Frequency Amplifier fully counterclockwise.

(b) Tune exciter as described in paragraph 3-5. Tune 1-kw IPA as described in steps a through j, paragraph 3-7.

(c) Set TUNE/OPERATE switch (139) at OPERATE (PA SCREEN switch 140 is set at OFF); IPA PLATE CURRENT meter (121) should indicate 200 ma.

(d) Set MULTIMETER switch (122) at IPA ISG.

(e) Rotate OUTPUT control (25) until IPA PLATE CURRENT meter (121) indicates 400-450 ma; when performing this step, pay particular attention to the following:

1. MULTIMETER (120) should indicate 20-30 ma; if MULTIMETER indicates less than 20 ma when IPA PLATE CURRENT meter indicates 450 ma, rotate IPA LOADING control (130) clockwise and readjust IPA TUNING control (128) to obtain dip on IPA PLATE CURRENT meter.

2. If MULTIMETER indicates higher than 30 ma and IPA PLATE CURRENT meter indicates less than 400 ma, rotate IPA LOADING control counterclockwise and readjust IPA TUNING control to obtain dip on IPA PLATE CURRENT meter.

(f) Turn OUTPUT control (25) fully counterclockwise.

(3) CW, FSK, AND FAX OPERATION. - Follow exciter set-up procedures as described in paragraph 3-11, 3-13, or 3-14; adjust OUTPUT control (25) until IPA PLATE CURRENT meter (121) indicates 400-450 ma.

(4) MCW, AM, SSB, ISB, AND DSB OPERATION.

(a) Perform preparatory procedure as described in paragraph 3-10; adjust OUTPUT control to obtain 400-450 in IPA plate current and 25-35 ma IPA screen current; note IPA plate r-f voltage as indicated on MULTIMETER (120) with MULTIMETER switch (122) set at IPA E_p - RF.

(b) Follow exciter set-up procedure as described in paragraphs 3-12, 3-15, or 3-16; adjust OUTPUT control (25) to obtain same value of IPA plate r-f voltage as was obtained in preparatory procedure.

3-18. STOPPING PROCEDURES.

NOTE

Control and indicator reference numbers (numbers enclosed in parenthesis) are call-outs located on figures 2-1 through 2-7.

a. STANDBY. - When the GPT-200K is to be turned off for a limited interval of time, the temperature control oven circuits in the exciter should be left on to maintain maximum frequency stability. To place the transmitter in standby, proceed as follows:

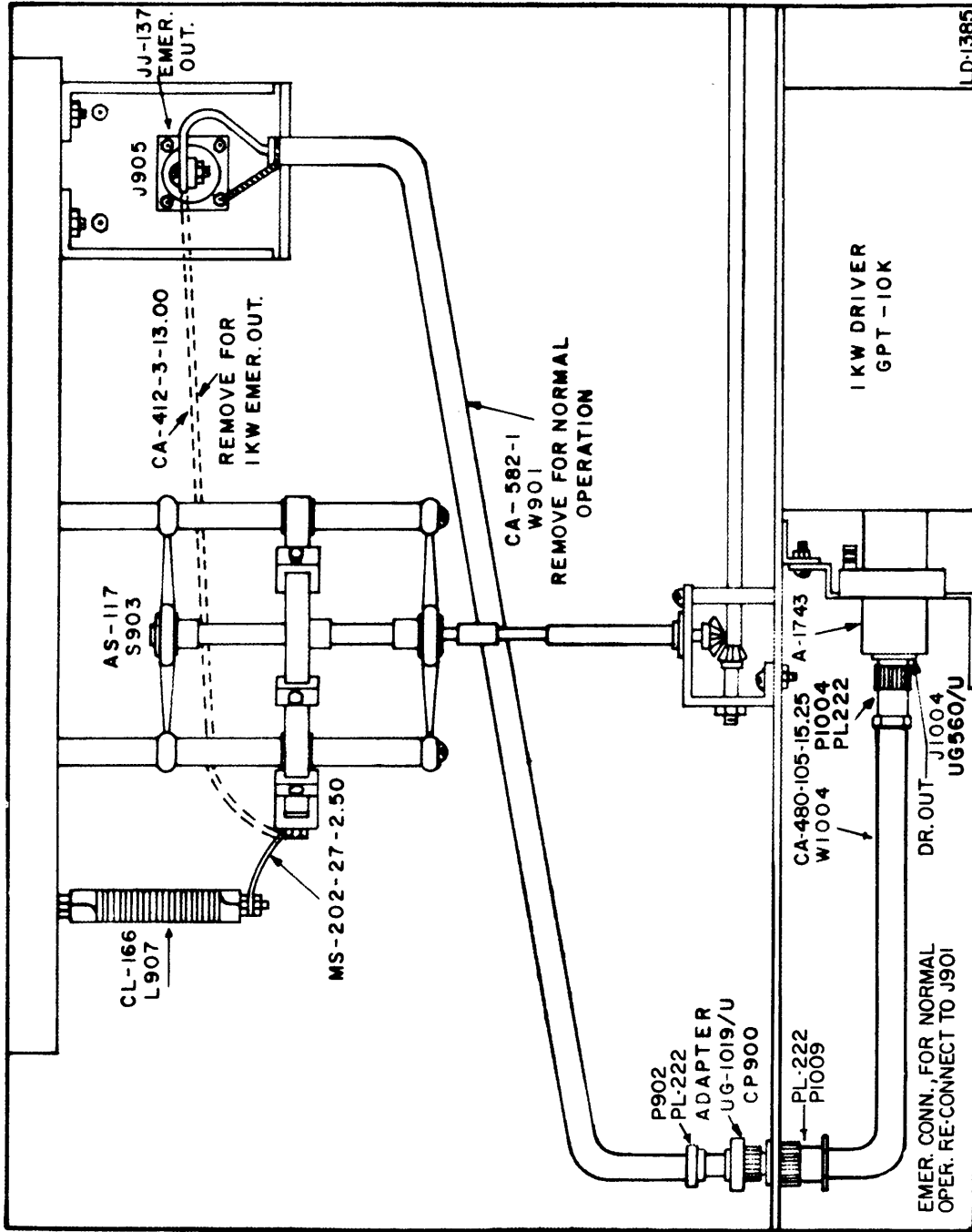


Figure 3-3. Connections for 1-kw Emergency Operation

LD-1385

<u>UNIT</u>	<u>CONTROL</u>	<u>POSITION</u>
200K PA Frame Control Panel	HIGH VOLTAGE A (335) HIGH VOLTAGE B (336)	OFF OFF
Bias Supply Drawer A	AC (338)	OFF
PSA Control Panel	PA FIL (396) PRIMARY POWER (393)	OFF OFF
Bias Supply Drawer B	PA FIL (413) PRIMARY POWER (410)	OFF OFF
200K PA Frame Control Panel	MAIN BLOWER (323)	OFF
PA Frame Control Panel	HIGH VOLTAGE (220) MAIN POWER (219)	OFF OFF
PS Frame Control Panel	BLOWER (253) FINAL FIL (257)	OFF OFF
Main Frame Control Panel	PA SCREEN (140) TUNE/OPERATE (139) HIGH VOLTAGE (141) MAIN POWER (132)	OFF TUNE OFF OFF
CPP-2	POWER/STANDBY (63)	STANDBY
TIS	B+ (60)	STANDBY
KMCU	POWER (72)	OFF
CSS	ON/STANDBY (45)	STANDBY
CHG	POWER (14)	STANDBY
CBE	ON/OFF (12)	OFF

b. COMPLETE STOPPING. - If the transmitter is in standby, simply set AUXILIARY FRAME MAIN POWER circuit breaker on rear of auxiliary frame at OFF. For complete stopping from full on condition, set switches in 100- to 300 series as listed in paragraph a above, then set AUXILIARY FRAME MAIN POWER circuit breaker at OFF.

c. EMERGENCY STOPPING. - For quick stopping during an emergency, set the following circuit breakers at OFF:

PRIMARY POWER (393)
PRIMARY POWER (410)
MAIN BLOWER (323)
MAIN POWER (219)
MAIN POWER (132)

BLOWER (253)
AUXILIARY FRAME MAIN POWER

NOTE

Every attempt should be made to maintain power to the exciter at all times. Indiscriminate interruption of power will result in loss of frequency stability and may require resetting of the 1-mc frequency standard in Primary Standard CSS.

3-19. OPERATOR'S MAINTENANCE.

a. GENERAL. - The operator should observe that transmitter controls, indicator lamps, and meters are functioning properly. During daily operation

electrical quantities measurable with built-in meters should be observed and compared with established standards. Noticeable irregularities should be immediately referred to maintenance personnel.

b. **REPLACEMENT OF FUSES.** - Tables 3-5 through 3-9 list all fuses in the transmitter, their panel designations, types, and functions.

CAUTION

Never replace a fuse with one of higher rating. If a fuse burns out immediately after replacement, do not replace it a second time until the trouble has been located and corrected.

TABLE 3-5. AUXILIARY AND MAIN FRAMES, FUSE LOCATIONS AND FUNCTIONS

LOCATION	PANEL DESIGNATION	TYPE	CIRCUIT PROTECTED	REFERENCE DESIGNATION
10-kw high voltage rectifier	H. V. FILAMENT	MDL 1	Filaments V600 through V605	F600 through F605
Relay panel	MAIN BLOWER	MDL 10	Main blower B800	F700 through F702
Relay panel	REAR FAN	MDL 5	Rear fan B3001	F703
Relay panel	PA FIL	MDL 5	Filaments of PA V900	F705
Relay panel	TIMER	MDL 1	Timer M701	F704
Rf amplifier drawer	B+	MDL 1/4	Plate circuits of V201 and V202 in RFC	F2000
Rf amplifier drawer	IPA BIAS	MDL 1/8	Bias circuit of PA V900	P2001
Rf amplifier drawer	IPA BLOWER	MDL 2	Blower B201	F2002
Rf amplifier drawer	IPA FIL	MDL 2	Filament of IPA V203	F2003
Rf amplifier drawer	LV	MDL 1.5	Rf amplifier driver	F2004
Auxiliary frame (rear)	FRONT FAN	MDL 5	Front fan B3000	F3000
SWCU	OVLDT LIGHT	MDL 1	Lamp I705	F101
SWCU	B+	MDL 1/8	SWCU power supply	F102
SWCU	AC	MDL 1	SWCU transformer T101	F103

TABLE 3-6. PA AND PS FRAMES, FUSE LOCATIONS AND FUNCTIONS

LOCATION	PANEL DESIGNATION	TYPE	CIRCUIT PROTECTED	REFERENCE DESIGNATION
Bias Supply	LV	AGC 1/8	Low voltage power supply	F7501
	BIAS	MDL 1/2	600-volt power supply	F7502
	AC POWER	MDL 3	Transformer T7501	F7503
Relay Panel	TOP FAN	MDL 5	Top fan B7301	F7601
	BLOWER DELAY	MDL 2	Blower delay meter	F7602
	ELAPSE METERS	MDL 2	Filament time meter	F7603

TABLE 3-6. PA AND PS FRAMES, FUSE LOCATIONS AND FUNCTIONS (CONT)

LOCATION	PANEL DESIGNATION	TYPE	CIRCUIT PROTECTED	REFERENCE DESIGNATION
Relay Panel (cont)	TIME DELAY	MDL 2	Time delay and plate time meters	F7604
	SHORTING RELAY	MDL 2	Time delay relay	F7605
	BLOWER CONTACTOR	MDL 2	Blower relay K7101	F7606
PS Frame	TOP FAN	MDL 3	Top fan B8102	F8101
	40K INTERLOCK RELAY	MDL 5	40K interlock relay K5706	F8102, F8103
12-KV High Voltage Power Supply	H.V. FILAMENT	MDL 1	Filament transformers T8401 through T8406	F8401 through F8406
PS Frame Control Panel	INTERLOCK	MDL 5	Contactors K8101 and K8102	F8501
	BREAKER MOTOR	MDL 5	Breaker motor B8101	F8502
	LIGHTS	MDL 2	Antenna tuning unit light circuit	F8503

TABLE 3-7. 200K PA FRAME, FUSE LOCATIONS AND FUNCTIONS

LOCATION	PANEL DESIGNATION	TYPE	CIRCUIT PROTECTED	REFERENCE DESIGNATION
Bias Supply A	BIAS		Rectifier and load circuit, bias supply A	F5501
	AC		T5501 and T5502, bias supply A	F5502
Bias Supply B	BIAS		Rectifier and load circuit, bias supply B	F5501
	AC		T5501 and T5502, bias supply B	F5502
Relay Panel A	ELAPSE METER		Filament time meter M5603	F5605
	SHORTING RELAY		Shorting relay K6003	F5604
	PA LIGHTS		Fluorescent lamps DS5201-DS5203	F5602
	ALARM		Buzzer DS5101	F5603
	TIME DELAY		Time delay meter M5602	F5601
Relay Panel B	ELAPSE METER		Filament time meter M5701	F5702
	SHORTING RELAY		Shorting relay K6603	F5705

TABLE 3-7. 200K PA FRAME, FUSE LOCATIONS AND FUNCTIONS (CONT)

LOCATION	PANEL DESIGNATION	TYPE	CIRCUIT PROTECTED	REFERENCE DESIGNATION
Relay Panel B (cont)	INTERLOCKS		Interlock relays K5608 and K5708	F5704
	FANS		Fans B5301-B5304	F5703
	TIME DELAY		Time delay meter M5702	F5701
Blower Delay Unit	RELAY A		Relay K5002	F5001
	RELAY A		Relay K5002	F5002
	RELAY B		Relay K5003	F5003
	RELAY B		Relay K5003	F5004
	BLOWER CONTACTOR		Contactors K5001	F5005
	TIME DELAY		Time Delay Meter M5001	F5006

TABLE 3-8. PSA FRAME, FUSE LOCATIONS AND FUNCTIONS

LOCATION	PANEL DESIGNATION	TYPE	CIRCUIT PROTECTED	REFERENCE DESIGNATION
Antenna Switching Deck	FAN		Fan B6901	F6901
	DC AMP AC		Transformer T6201	F6902
	DC AMP B+		Power supply in dc amplifier unit	F6903
			Power supply for optional antenna switching circuit	F6904
Crowbar	FILAMENT		Filament of V6301	F6301
HV Rectifier	HV FILAMENT		Filament circuits of V6401-V6406	F6401-F6406
PSA Control Panel	HVR BREAKER		HV blower B6002	F6502
	BREAKER MOTOR		Breaker motor B6003	F6501
	BREAKER MOTOR		Breaker motor B6003	F6506
	LIGHTS		Fluorescent lamps DS6101 and DS6102	F6505
	TOP FAN		Top fan B6001	F6503
	HV LIGHTS		HV top lamp DS6002, lamps DS6101-DS6102	F6504

TABLE 3-9. PSB FRAME, FUSE LOCATIONS AND FUNCTIONS

LOCATION	PANEL DESIGNATION	TYPE	CIRCUIT PROTECTED	REFERENCE DESIGNATION
Crowbar	FILAMENT		Filament of V6301	F6301
HV Rectifier	HV FILAMENT		Filament circuits of V6401-V6406	F6401-F6406
PSB Control Panel	HVR BLOWER		HVR Blower B6602	F6502
	BREAKER MOTOR		Breaker motor B6603	F6501
	BREAKER MOTOR		Breaker motor B6603	F6506
	LIGHTS		Fluorescent lamps DS6701-DS6702	F6505
	TOP FAN		Top fan B6601	F6503
Frame Proper	HV REAR		HV rear lamp DS6601	F6601
	HV LIGHTS		HV top lamp DS6602, lamps DS6407-DS6408	F6504

SECTION 4

SUPPLEMENTARY INFORMATION

4-1. INTRODUCTION.

This section contains supplementary information useful to the operation of the GPT-200K transmitter. Paragraph 4-2 relates average power to peak envelope power so that the operator can compute maximum average power output for his specific application. Paragraph 4-3 describes two tone test procedures, as used to obtain rated PEP output, and checking distortion.

4-2. CALCULATION OF MAXIMUM AVERAGE POWER.

The GPT-200K is rated at 200-kw PEP, and 100-kw average. When tuning the transmitter to full PEP, always calculate in terms of average power. When only one tone or the carrier is to be transmitted (CW, FSK, FAX), average power and peak envelope power are equal (100,000 watts maximum).

When two or more tones are used to modulate a sideband:

$$\text{Average Power} = \frac{\text{PEP}}{N}$$

Where PEP = Peak Envelope Power:

N = Number of tones (assuming tones are equal in amplitude).

a. For two tone operation:

$$\text{Average Power} = \frac{200 \text{ kw}}{2} = 100 \text{ kw}$$

b. For four tone operation:

$$\text{Average Power} = \frac{200 \text{ kw}}{4} = 50 \text{ kw}$$

c. For sixteen tone operation:

$$\text{Average Power} = \frac{200 \text{ kw}}{16} = 12.5 \text{ kw}$$

Thus, as more tones are added, average power is reduced for any given PEP rating. In practice, r-f excitation must be reduced in order not to exceed the PEP rating, as more tones are added; failure to reduce excitation will result in excessive distortion and may damage the equipment.

4-3. TWO TONE TESTING.

a. GENERAL. - The operating procedures presented in section 3 can be used to quickly bring the GPT-200K to full rated output in the field. This

paragraph describes an alternate method of obtaining full rated power, using two-tone testing techniques, and indicates how signal-to-distortion ratio can be measured at rated output. An rf spectrum analyzer and a two-tone generator (such as a TMC Model PTE-3, or equivalent) must be used to measure signal-to-distortion ratio. In the absence of a spectrum analyzer, rough distortion checks can be made with a good oscilloscope.

If the output signal of a linear amplifier is a replica of the exciting signal, there are no distortion products.

However, when a multiple signal source (such as multiple tones or a voice signal) is applied, an inherent mixing action occurs, producing distortion. Such distortion products are the sum and difference combinations of the original frequencies. The degree of such intermodulation distortion caused by any non-linearity can be measured by the two-tone test. In this test, two known radio frequencies of equal amplitude are applied to the amplifier and the output signal is examined for spurious products. These products fall in the fundamental signal region and in the harmonic regions. The tuned circuits of the amplifier filter out the spurious signals falling in the harmonic regions. Such signals are called even order products. However, the odd-order products (such as third order and fifth order) fall close to the fundamental output frequency of the amplifier. The third-order product frequencies are $2f_1 - f_2$ and $2f_2 - f_1$ where f_1 and f_2 represent any two radio frequencies present in the desired transmission. The fifth-order product frequencies are $3f_1 - 2f_2$ and $3f_2 - 2f_1$. These are shown in figure 4-1. For illustrative purposes, figure 4-1 shows the basic tones and third and fifth order distortion products when a 2-mc carrier is modulated by two audio tones of 935 cps and 2805 cps. Note that the frequency spacing of the distortion products is always equal to the frequency difference between the two original tones, or legitimate sideband frequencies. When a linear amplifier is heavily overloaded, such spurious frequencies can extend beyond the original channel, causing adjacent channel interference.

Using a two-tone test, the distortion (called signal-to-distortion ratio) is defined as the ratio of the amplitude of one test tone to the amplitude of the odd-order products and is expressed in db. Generally, odd-order products such as the fifth, seventh, and so forth, are negligible in amplitude in comparison to the third-order product. In the GPT-200K, the signal-to-distortion ratio for a two-tone input at full rated output is specified as 35 db minimum.

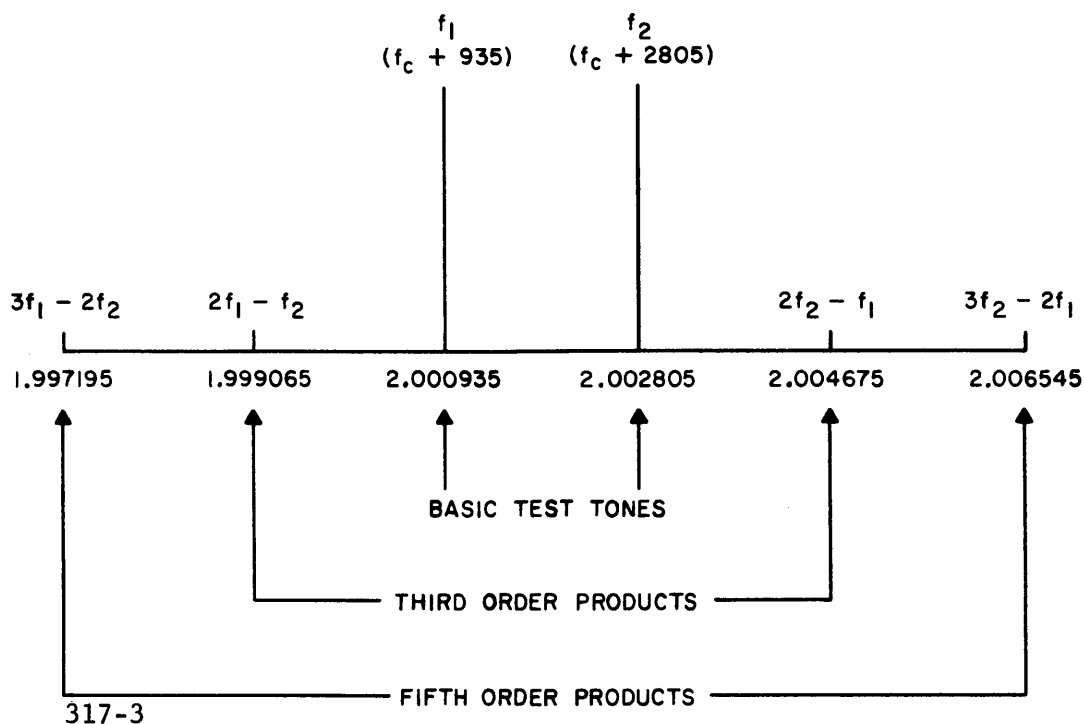


Figure 4-1. Odd Order Distortion Product Distribution

EXAMPLE 1

Figure 4-2 shows output waveforms observed on the spectrum analyzer of the PTE-3 with two-tone input applied to the transmitter and the transmitter tuned and loaded to 40-kw PEP, operating single sideband, upper carrier. In each case, the bandwidth displayed is 10-kc. In pattern A, the carrier (almost fully suppressed) is centered on the display. The two test tones appear 935 cps and 2805 cps above the carrier. The third order modulation product is too small to be discerned. The fifth-order harmonic is not included in the displayed passband. In pattern B, the tones are centered within the 10-kc passband so that both third and fifth order harmonics fall within the display passband. Again the distortion products are not discernible. In pattern C, the vertical scale attenuation of the spectrum analyzer oscilloscope is reduced, so that the two tone peaks rise 20 db. The third and fifth order modulation products can now be seen. They are well below 40 db. In pattern D, the display is centered at the second tone to permit better viewing of the fifth order distortion product.

EXAMPLE 2

Figure 4-3 illustrates the appearance of transmitter output waveforms under varying conditions. In pattern A, a two-tone input signal is applied to an improperly tuned transmitter and the output is monitored on a spectrum analyzer. The fundamental

tones, situated 1-kc on each side of the zero reference, are at a power level of zero db. The third and fifth odd order products are shown for each sideband. The third order product is down 15 db; the fifth order product is down 25 db. This distortion level is a result of improper tuning. The transmitter should be re-tuned until the signal-to-distortion ratio is at least 35 db.

In pattern B, a 16-channel teletype signal is modulating the A1 slot of a transmitter.

The input level shown is approximately zero db. Note that, because of intermodulation distortion effects, much of the modulating information extends into adjacent frequency slots. This represents a case of extreme distortion. If additional voice slots were used under these conditions, they would be highly distorted.

Pattern C shows the effect of reducing the power level of the composite tones 15 db. Some improvement is noted; however, a high degree of distortion is still present and appears in adjacent slots as noise. The carrier appears in this pattern, approximately 17 db down.

Pattern D shows the insertion of two-tones in the upper sideband of a properly tuned transmitter. With the fundamental tone level at zero db, the third and fifth order products are at least 35 db down.

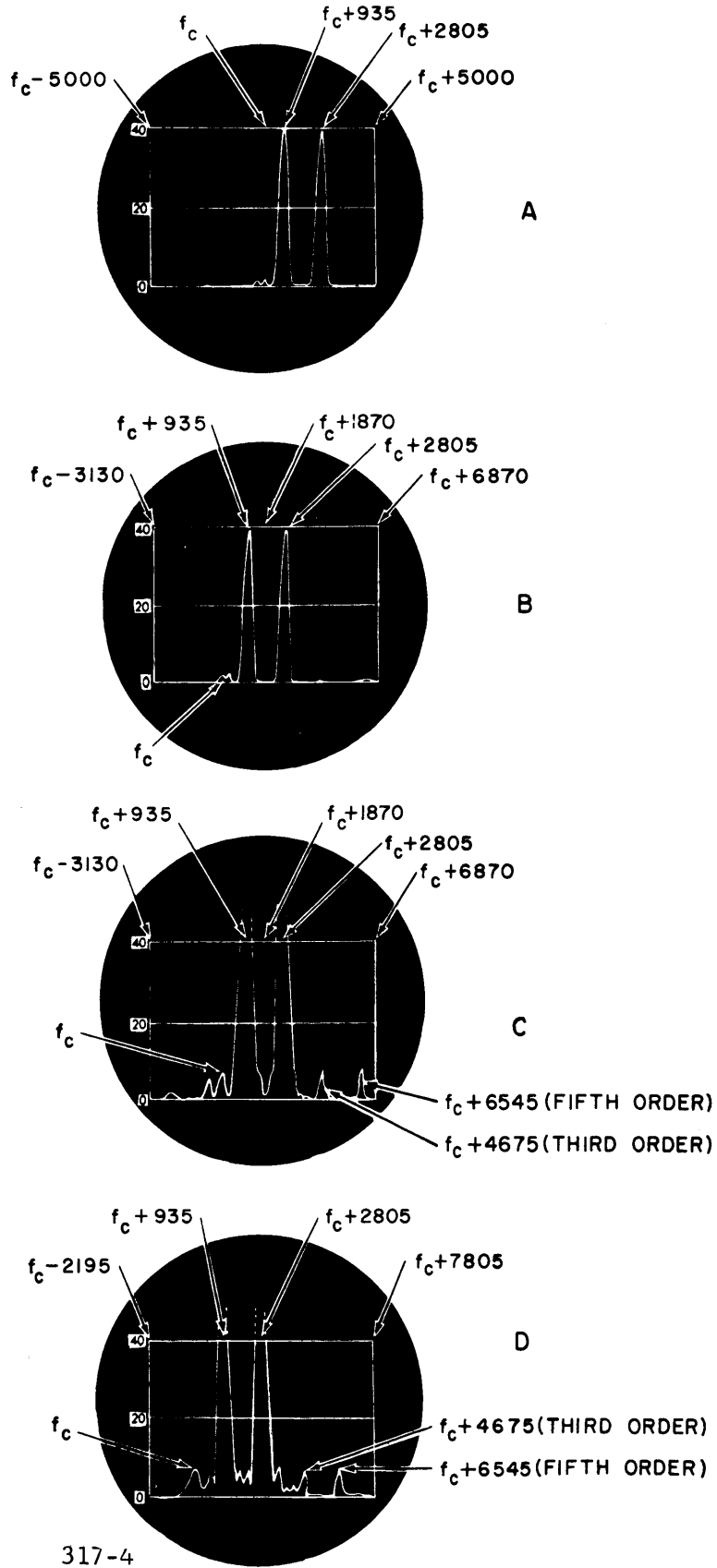
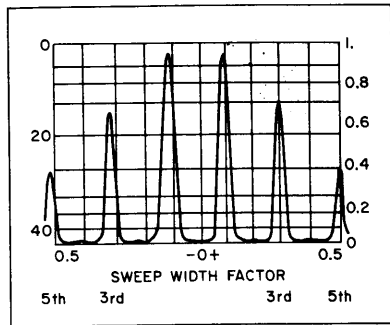
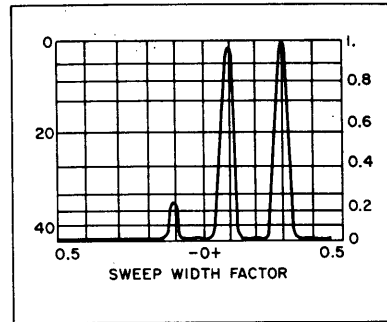


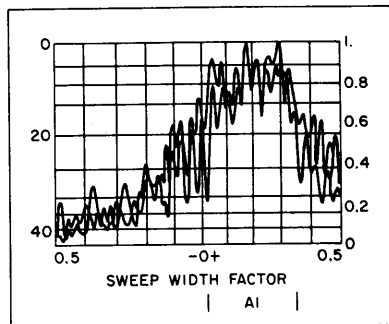
Figure 4-2. Two-tone Spectrum Analyzer Patterns (Example 1)



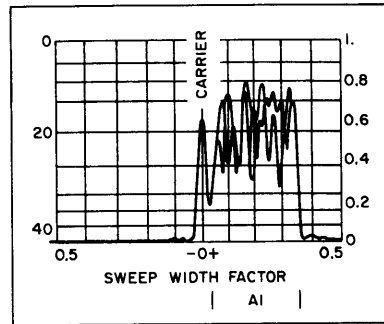
A



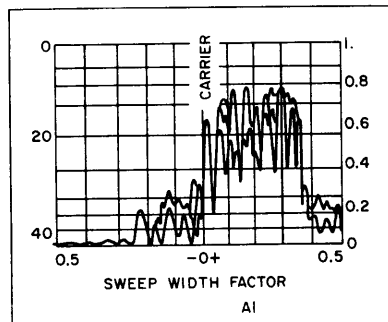
D



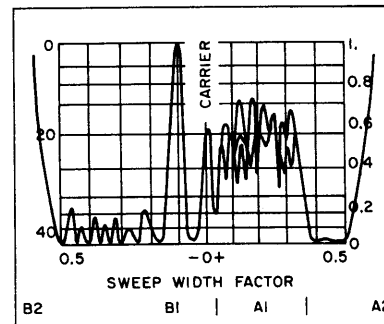
B



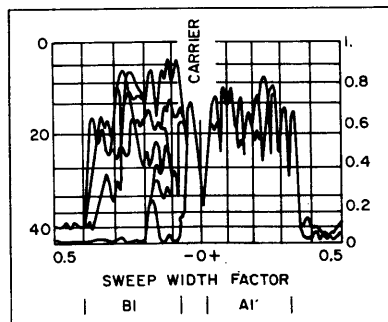
E



C



F



G
317-5

Figure 4-3. Transmitter Output Patterns (Example 2)

With the transmitter tuned in this fashion, intermodulation between slots is reduced to a minimum.

Pattern E shows the result of proper operation. With the composite tones in the A1 slot 15 db down from the zero reference, the distortion in adjacent sideband slots is well below 35 db. The carrier, set 20 db down, is at normal operating amplitude.

Pattern F, taken with a sweep width of 10-kc on the spectrum analyzer, shows portions of all four sideband slots. The composite tones are shown in the A1 slot and line-up tones are shown in the voice slots. The line-up tones are adjusted for zero db level, the composite tones are 15 db down, and the carrier is 20 db down. This pattern represents clean transmission for all four sideband slots, since distortion is at least 35 db down.

Pattern G, taken during a period of normal transmission, shows the A1 and B1 sideband slots of a properly tuned transmitter. The B1 slot is modulated with voice signals, while composite tones are transmitted in the A1 slot. Noise level in the outer slots is at least 35 db down, indicating normal tuning and normal input levels.

b. TWO TONE TESTING WITH SPECTRUM ANALYZER. - If a PTE-3 or equivalent is available for test, proceed as follows:

(1) Connect audio output of two-tone generator to CHANNEL 1 AUDIO INPUT jack (66).

(2) Tune transmitter on carrier as described in Section 3 of this manual at the desired transmission frequency.

(3) Set EXCITER CH 1 switch (57) at LINE.

(4) Set USB or LSB switch (10 or 6) at CH -1.

(5) Adjust USB GAIN or LSB GAIN control (9 or 7) to obtain mid-scale indication on USB or LSB meter (5 or 4).

(6) Adjust OUTPUT INCR control (327) to obtain 100 kw output as indicated on KW OUTPUT meter (306).

(7) Set MONITOR switch (69) at PA; adjust controls on spectrum analyzer to permit observation of the transmitted signal. Odd order distortion products must be at least 35 db below tone level; if necessary readjust tuning and loading of the 1-kw IPA, 10-kw PA, 40-kw PA, and 200-kw PA to obtain rated output without excessive distortion. Note tone level on spectrum analyzer.

(8) Rotate USB GAIN and LSB GAIN controls (5 and 4) fully counterclockwise. Disconnect two-tone generator, and apply normal audio inputs to transmitter. Adjust sideband gain controls as required for the desired type of transmission.

(a) SSB, VOICE TRANSMISSION. - Adjust USB GAIN or LSB GAIN control until peaks of voice signal

approach but do not exceed tone level noted in step (7) above.

(b) SSB, MULTI-CHANNEL TELEGRAPHY. - Adjust appropriate sideband gain control until individual channel tones (16 channels assumed) are approximately 12 db below test tone level noted in step (7) above. For 12 channel telegraphy, individual channel tones should be approximately 10 db below test tone level.

(c) TWO CHANNEL ISB (A1 and B1). - Voice peaks should occur approximately 3 db below test tone level; individual telegraph channel tones (16 channels assumed) should be approximately 15 db below test tone level.

(d) FOUR CHANNEL ISB (A1, A2, B1 and B2). - Voice peaks should occur approximately 6 db below test tone level; individual telegraph channel tones (16 channels assumed) should be approximately 18 db below test tone level.

c. TWO-TONE TESTING WITH OSCILLOSCOPE. - If only a two-tone generator and oscilloscope is available for test, proceed as follows:

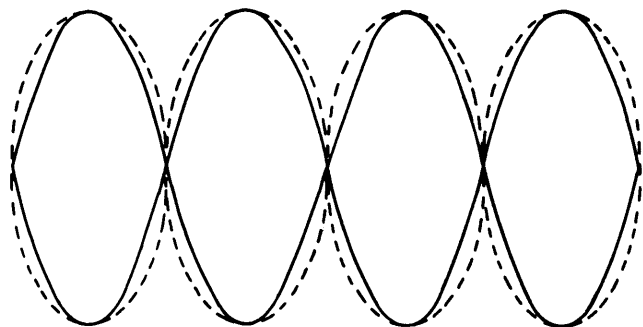
(1) Perform steps (1) through (3) of b above.

(2) Set MONITOR switch (64) on the APP-0 at PA position and connect an rf cable between the MONITOR OUTPUT jack on the APP and the vertical input to the oscilloscope.

(3) With the transmitter set up for full rated output, as indicated by reading on KW OUTPUT meter (306), note the waveform obtained on the oscilloscope. The outline of the two-tone pattern should look like the solid line of figure 4-4. The dashed lines represent distortion. The peaks should not be rounded or flattened - such distortion is caused by too much drive or too little loading. If necessary, adjust tuning and loading of the 10-kw PA, 40-kw PA, and 200-kw power amplifier until the ideal pattern is obtained with full power output. When satisfactory output is obtained, carefully note maximum amplitude of pattern on oscilloscope screen.

(4) Reduce drive to minimum.

(5) Apply normal signal input to transmitter and carefully increase drive until the same amount of maximum deflection is obtained on oscilloscope screen as noted in step (3) above. This corresponds to full PEP and insures that distortion is at reasonable level.



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Figure 4-4. Two-tone Oscilloscope Pattern