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3
OPERATOR'S MANUAL

for

4
TECHNMATIC TRANSMITTER

5
MODEL TSTE-10K



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

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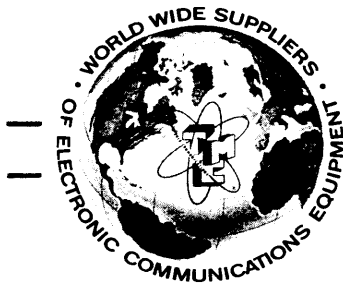
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NOTICE

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THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S E N G I N E E R S

700 FENIMORE ROAD

MAMARONECK, N. Y.

W a r r a n t y

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2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

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2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

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

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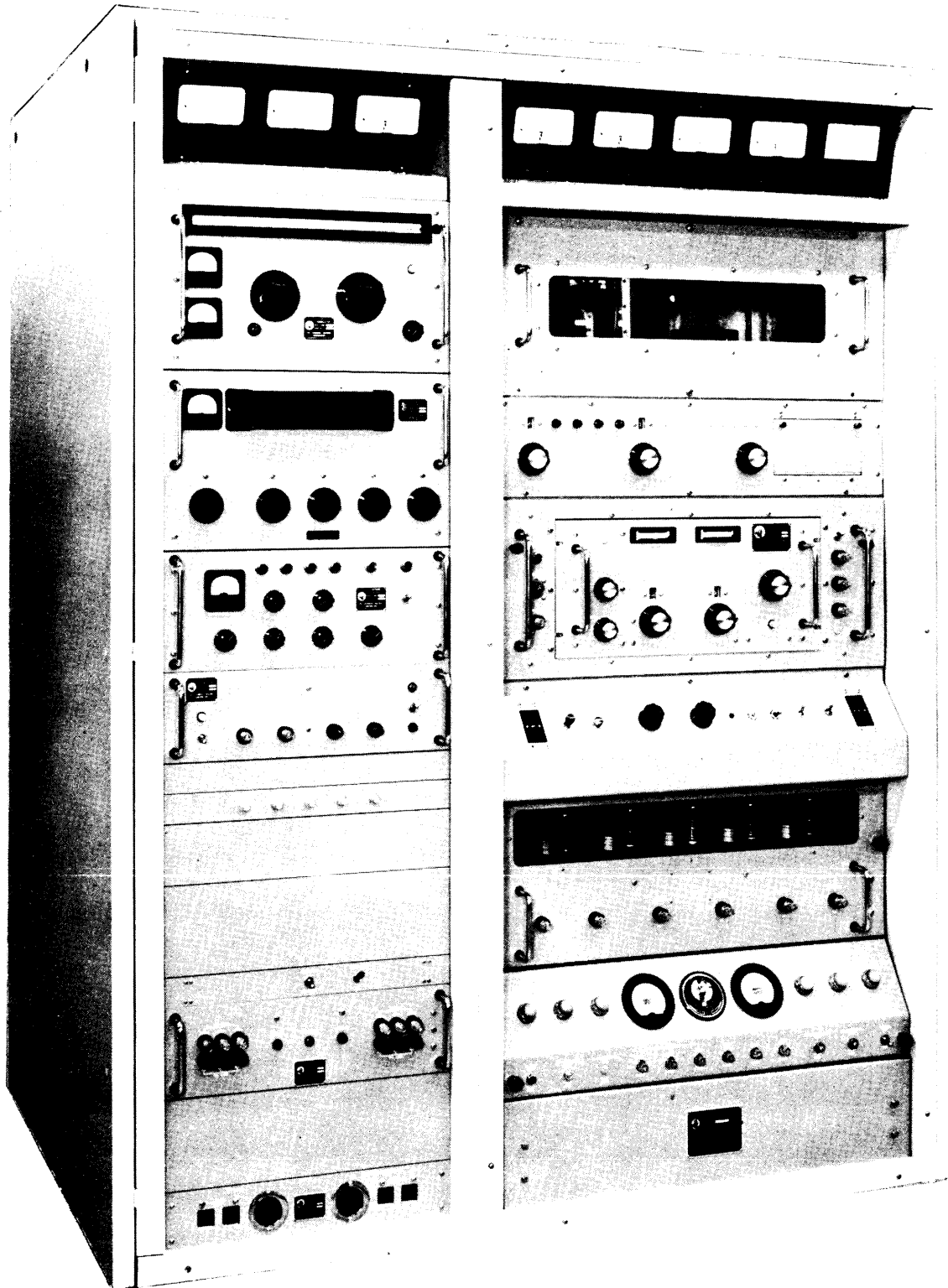


Figure 1-1. Technimatic Transmitter, Model TSTE-10K

SECTION 1 GENERAL INFORMATION

1-1. PURPOSE OF EQUIPMENT.

TechniMatic* Transmitter, Model TSTE-10K (figure 1-1) is a remotely controlled general purpose transmitter that delivers 10,000 watts peak envelope power (PEP), or 5,000 watts average power throughout the 2- to 30-mc range. The transmitter provides many types of operating modes, as follows:

(1) Four-channel independent sideband (ISB) (separate intelligence on each sideband) with suppressed or any degree of carrier.

(2) Single sideband (SSB) with suppressed or any degree of carrier.

(3) AM operation (3 kc per sideband maximum).

(4) Frequency-shift telegraphy (FSK).*

(5) CW keying (telegraphy).

(6) Facsimile (FAX).*

1-2. DESCRIPTION OF EQUIPMENT.

a. GENERAL. - As shown in Figure 1-1, the transmitter consists of two frames, the auxiliary frame and the main frame. The auxiliary frame primarily contains a remote-controlled synthesized exciter. The main frame primarily contains a linear power amplifier.

b. AUXILIARY FRAME: - The auxiliary frame houses the remote-

* An external keyer such as Tone Intelligence Unit TIS is required for FSK, FAX, tone-CW operation.

controlled synthesized exciter portion of the transmitter, two auxiliary power panels (front and rear), an adapter panel assembly, a control panel assembly, a standing wave control unit, a meter panel, and relay control circuitry associated with the transmitter power output metering, control circuitry for the main frame high voltage power supply, and exciter keying and channel enable circuitry.

(1) AUXILIARY FRAME METER PANEL. - The auxiliary frame meter panel, mounted at the top front portion of the auxiliary frame, contains three meters. These meters indicate bias, screen voltage, and plate voltage of the 10-kw PA stage of the transmitter.

(2) RF TRANSLATOR CHGR. - RF Translator CHGR contains the final r-f amplification stages and final frequency translating stage of the exciter. The CHGR contains a high frequency oscillator (hfo) that may be controlled by a d-c correction voltage supplied by Control Synthesizer HFSA. This correction voltage is used to maintain a high degree of stability in the hfo signals.

(3) CONTROL SYNTHESIZER HFSA. - Control Synthesizer HFSA contains a stable 1-mc oscillator that is the frequency reference for the synthesized exciter. The HFSA accepts a sample of the hfo signal (from the r-f translator), compares it with an internally synthesized signal, and generates a control voltage that can stabilize the CHGR hfo to 1 part in 10^8 . The HFSA is tuned by five switches; these switches may be either locally or remotely controlled.

(4) SIDEBAND EXCITER CMRA. - Sideband Exciter CMRA utilizes audio frequency input signals to produce a maximum of four sideband channels centered about a carrier frequency of 1.75 megacycles. Carrier may be suppressed or may be reinserted by a front panel control. The composite sideband channel output signal is applied to the r-f translator.

(5) CONTROL TERMINATOR LRCD. - Control Terminator LRCD is used together with the remote control equipment and controls the automatic bandswitching and RF Translator tuning operations. In addition, the LRCD provides the d-c power required to operate the remote control equipment.

(6) ADAPTER PANEL ASSEMBLY AX-570. - Adapter Panel Assembly AX-570 contains five front-panel mounted jacks. The jacks are test points for monitoring the servo amplifier signals in the associated transmitter equipment.

(7) CONTROL PANEL ASSEMBLY AX-560. - Control Panel Assembly AX560 contains a switch and a test key. Operating the switch energizes Power Supply HFP. Operating the test key controls the level of carrier reinsertion at the sideband exciter.

(8) POWER SUPPLY HFP. - Power Supply HFP provides the plate, bias, and filament voltages for the CHGR and HFSA units and routes 115 volts ac to the CMRA unit. The HFP requires 115 volts, 50 to 60 cycles, single-phase power for operation, and is activated by a switch on the control panel assembly.

(9) AUXILIARY POWER PANEL APP. - The two auxiliary panels contain circuit breakers and receptacles. The receptacles can be used to connect test equipment to the 115 volt ac power line.

(10) STANDING WAVE CONTROL UNIT SWCU. - Standing wave Control Unit SWCU is rack-mounted at the rear of the auxiliary frame. This unit contains an SWR overload relay, a d-c amplifier and a power supply. During unbalanced output operation of the transmitter, SWR on the transmission line is monitored. When the SWCU detects excessive SWR, the overload relay operates, removing high voltage from the transmitter.

c. MAIN FRAME. - The main frame houses five servo amplifiers, a two-stage r-f voltage amplifier, the 1-kw IPA and 10-kw PA, and associated power supply and power control circuits. The r-f components are distributed through the upper portion of the frame; heavy power supply components are bolted to the base channels of the frame.

(1) MAIN METER PANEL AM-126. - The main meter panel, mounted at the top of the main frame, contains five meters. These monitor the PA filament primary voltage, PA screen grid current, PA plate current, r-f plate voltage, and power output. The power output meter is calibrated in kilowatts and contains a second scale for measuring SWR.

(2) 10-KW POWER AMPLIFIER AX-580. - 10 KW power amplifier is mounted below the main meter panel. It contains the PA tube and its automatic tune, loading, bandswitching and power drive-up circuits. A blower motor, which provides forced-air cooling of the 10-kw power amplifier tube, is mounted directly under the power amplifier tube. The front panel of the power amplifier contains a plexiglass window, the power amplifier tuning and loading and band switching controls and their associated counter-type dials, and indicator lamps.

(3) RF AMPLIFIER RFTA and POWER SUPPLY, AP-126. - The r-f amplifier and power supply is slide-mounted below the 10-kw power am-

plifier and serves as the intermediate (1-kw) power amplifier between the exciter and the power amplifier. The inner section of the unit contains automatic tune, loading and band-switching circuits and all r-f amplifier parts; the outer section houses the power supply components. The final tube (1-kw amplifier) of the 3-stage amplifier is air-cooled by a self-contained blower in the r-f section. The front panel of the inner r-f section contains tuning and loading controls for the 1-kw amplifier, band-switches to cover the 2- to 30-mc r-f range, and a monitoring meter and associated meter switch. All major d-c and r-f voltages in the r-f amplifier may be conveniently monitored with this arrangement.

(4) MAIN POWER PANEL AX-610. - The main power panel, a factory-mounted unit, controls the application of plate, screen grid, and filament voltages to the 10-kw power amplifier and monitors all interlock circuits contained in the main frame. This panel also controls the primary ac power input to the main frame. Other front panel controls include a reset pushbutton associated with the protective relays in the main frame, an automatic load and drive control switch and level adjustment, and an SWR switch associated with the dual purpose output and SWR meter.

(5) 10-KW HIGH VOLTAGE RECTIFIER. - The 10-KW high voltage rectifier, slide-mounted below the power panel, contains the high-voltage rectifier tubes and their corresponding filament transformers. Operating as the high-voltage rectifier deck associated with the main power supply, this unit generates 7500 volts dc for the plate of the 10-kw power amplifier tube. A plexiglass window on the front panel of the high voltage rectifier permits observation of the rectifier tubes. Button connectors at the rear of the unit provide connection for the 3-phase input voltage and the dc output voltage.

(These provide a quick disconnection for high voltage rectifier removal).

(6) 10-KW RELAY PANEL. - The 10-kw relay panel is rack-mounted at the bottom of the main frame. This panel contains nine relays which protect the TSTE 10K transmitter circuits against overloads. The relays and their associated terminal boards are mounted under a front panel cover plate for quick accessibility. The upper portion of the relay panel contains filament and plate time meters, an automatic reset timer, and overload indicator lamps. All 1-kw and 10-kw amplifier overload adjustments are also brought out on the relay panel for ease of adjustment.

1-3. BLOCK DIAGRAM ANALYSIS. (see figure 1-2.)

The transmitter essentially consists of a remote-controlled, synthesized exciter, and an automatically tuned linear power amplifier. Audio input signals to the transmitter are applied to Sideband Exciter CMRA. The CMRA will accept up to four separate channel inputs (A1, A2, B1, B2), and translate these signals into multiplexed sidebands centered about a 1.75 mc carrier. The 1.75 mc carrier, which may be suppressed, reduced, or fully injected, dependent on the type of transmission desired, is derived from a stable 1-mc signal from Control Synthesizer HFSA. The multiplexing carriers, used to generate the two outboard sidebands (channels A2 and B2) are also derived from the stable 1-mc signal.

The 1.75 mc signal from Sideband Exciter CMRA, which may contain any type of audio intelligence, is applied to R-F Translator CHGR. The CHGR heterodynes the 1.75 megacycle signal to the 2- to 30-mc range. The high frequency oscillator (hfo) that generates the heterodyning signal in the CHGR may be stabilized with a synchronizing voltage from Control

Synthesizer HFSA.

Control Synthesizer HFSA is tunable from 2- to 30-megacycles in 100-cycle steps. The HFSA accepts the hfo output from the CHGR, and compares this signal (in the 3.75- to 31.75-mc range) to an internally synthesized signal. The synthesized signal being derived from the HFSA stable 1-mc oscillator is also stable to 1 part in 10 per day. Any frequency error in the CHGR hfo signal results in a correction voltage that is used to stabilize the hfo.

All operating potentials for the CHGR and HFSA are supplied by Power Supply HFP. Primary power for the sideband exciter's self-contained power supply is routed through a control circuit in the HFP. Control Terminator LRCD also has a self-contained power supply, and receives its power directly from the auxiliary frame primary power circuitry.

The r-f output of R-f Translator CHGR (in the 2- to 30-mc range) is applied to R-F Amplifier RFTA in the main frame. The RFTA contains three amplifier stages. All operating potentials, except plate voltage for the third stage, (IPA) are supplied by the transmitter low voltage power supply (Power Supply AP-126). The output of the IPA is applied to the 10-kw PA. This stage raises the r-f signal level to 10-kw PEP (peak-envelope-power). The output of the 10-kw PA is routed through two low-pass filters to the coaxial output connector. These filters reduce the harmonic content of the output signal.

All operating potentials for the 10-kw PA, except bias, is provided by the main power supply. Bias for this stage is provided by the low voltage power supply.

The transmitter contains metering circuits for monitoring all important operating voltages and currents. Eight of these meters are mounted in the auxiliary frame meter panel and main frame meter panel.

The remaining meters are mounted in RF Translator CHGR and RF Amplifier RFTA.

The transmitter contains electrical and mechanical interlocks that protect against equipment damaging conditions and provide personnel safety. Mechanical interlocks are provided on doors, on panels, on all drawers in which potentials of more than 500 volts exist, and in important cooling ducts. Overload relays are provided for the bias, screen grid, and plate circuits of the power amplifier stages, and for the main power supply screen regulator. When a door, panel, or drawer is opened, or a potential or current is out of tolerance, the transmitter high voltage circuits are disabled.

Frequency selection, carrier suppression, keying, and high voltage control may be accomplished either locally or remotely.

For remote frequency selection, control signals are applied to Control Synthesizer HFSA and Control Terminator LRCD. Five frequency increment selectors in the HFSA then automatically position themselves in accordance with the control signals. Control Terminator LRCD then supplies a band switch control signal to RF Translator CHGR in accordance with the frequency to which the HFSA is tuned. After band switching is accomplished in the CHGR, the LRCD supplies tuning control signals to the r-f translator. Upon reaching synchronization between the r-f translator and control synthesizer, r-f translator tuning stops.

Control Terminator LRCD and Control Synthesizer HFSA supply control signals to the IPA and PA band switch circuits. These band switches are then positioned in accordance with the frequency to which the HFSA is tuned. The tuning and loading capacitors in the IPA and PA are also pre-positioned

in accordance with the HFSA frequency.

Upon completion of band switching, pre-positioning and exciter tuning, IPA and PA tuning is accomplished. The tuning and loading functions are accomplished with servo-amplifier driven motors. These servo amplifiers are controlled by resonance sensing and impedance-match sensing circuits in the IPA and PA stages.

Remote controlled carrier suppression is accomplished with a stepping switch in Sideband Exciter CMRA. This stepping switch automatically positions itself in accordance with the applied control signal.

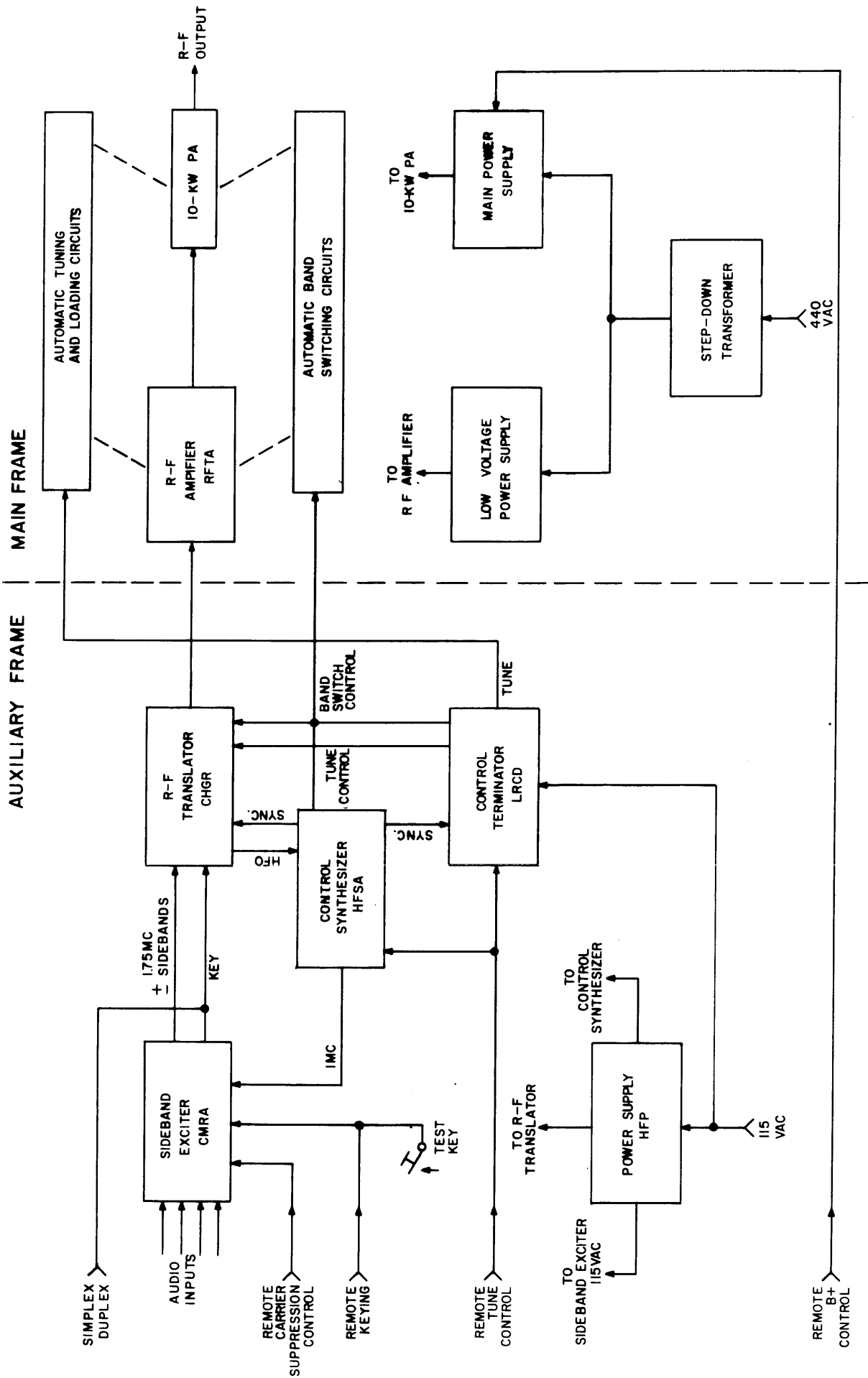


Figure 1-2. Block Diagram TSTE-10K Transmitter

SECTION 2

OPERATING CONTROLS

Tables 2-1 and 2-2 indicate the component designations and functions of the front panel controls and indicators of the TSTE transmitter. See figures 2-1 and 2-2 for the location of each control and indicator. For purposes of simplification, controls and indicators on the auxiliary frame are numbered between 0 and 100; those on the main frame are numbered between 101 and 200.

Table 2-1

Auxiliary Frame Operating Controls and Indicators

| ITEM NO. (See Figure 3-1) | DESIGNATION | FUNCTION |
|------------------------------|----------------------|---|
| 1 | PA SCREEN meter | Indicates d-c voltage applied to control grid of 10-kw power amplifier tube. |
| 2 | PA BIAS meter | Indicates d-c voltage applied to control grid of 10-kw power amplifier tube. |
| 3 | PA PLATE meter | Indicates d-c voltage applied to plate of 10-kw power amplifier tube. |
| 4 | MEGACYCLES dial | Indicates frequency to which R-F Translator CHGR is tuned as selected by TUNE control (7) and BAND switch (8) |
| 5 | SYNCHRONIZE meter | Indicates polarity and relative amplitude of d-c correction voltage used for high frequency oscillator stabilization. |
| 6 | SYNC IND lamp | Light when high frequency oscillator is phase-locked to Control Synthesizer HFSA. |
| 7 | TUNE control | Selects frequency of transmission in conjunction with BAND switch (8). Selected frequency is indicated on MEGACYCLES dial (4) |
| 8 | BAND switch | Selects one of eight operating ranges (frequency bands) of R-F Translator. Selected band is displayed on MEGACYCLES dial (4). |
| 9 | RF LEVEL meter | Indicates relative amplitude of R-F Translator output signal. |
| 10 | LOCK knob | Locks TUNE control (7) to prevent inadvertent rotation. |
| 11 | RF GAIN control | Controls level of RF Translator output signal. |

Table 2-1 (cont)

Auxiliary Frame Operating Controls and Indicators

| ITEM NO. (See Figure 2-1) | DESIGNATION | FUNCTION |
|------------------------------|--|---|
| 12 | 1 MC COMPARATOR meter | Indicates frequency difference between internal frequency standard of Control Synthesizer and external frequency standard; used to calibrate internal or external standard. |
| 13 | No designation (Self-illuminated six-digit indicator) | Indicates frequency to which Control Synthesizer is tuned as selected by MC switch (14), 100KC switch (15), 10KC switch (16), 1 KC switch (17), and .1KC switch (18). |
| 14 | 1MC switch | Tunes Control Synthesizer in one-megacycle steps. |
| 15 | 100KC switch | Tunes Control Synthesizer in hundred-kilocycle steps. |
| 16 | 10KC switch | Tunes Control Synthesizer in ten-kilocycle steps. |
| 17 | 1KC switch | Tunes Control Synthesizer in one-kilocycle steps. |
| 18 | .1KC switch | Tunes Control Synthesizer in hundred-cycle steps. |
| 20 | CHANNEL ACTIVITY LAMPS | Each lamp is lit when corresponding channel is being modulated. |
| 21 | STANDBY lamp | Lights when Sideband Exciter is energized, but no modulating signals are applied. |
| 22 | POWER lamp | Lights when Sideband Exciter is energized as controlled by POWER switch (25) |

Table 2-1 (cont)

Auxiliary Frame Operating Controls and Indicators

| ITEM NO. (See Figure 2-1) | DESIGNATION | FUNCTION |
|------------------------------|----------------------------------|---|
| 23 | INPUT LEVEL meter | Indicates input level of channel B2, B1, A1, or A2 as selected by METER FUNCTION switch (26). |
| 24 | CHANNEL PRIORITY controls | Consisting of B2, B1, A1, and A2 channel controls. Each control adjusts level of corresponding channel modulation. |
| 25 | POWER switch | When set at ON, connects Sideband Exciter power supply to primary power. |
| 26 | METER FUNCTION switch | Connects INPUT LEVEL meter (23) to channel B2, B1, or A1, or A2 circuit. |
| 27 | CARRIER SUPPRESSION switch | Selects degree of carrier suppression of Sideband Exciter output signal. |
| 28 | POWER lamp | Lights when primary power is applied to Extended Local Control Unit as controlled by POWER switch (31). |
| 29 | REMOTE lamp | Lights when LOCAL-REMOTE switch (30) is set at REMOTE. |
| 30 | REMOTE-LOCAL switch | When set at REMOTE, permits Local Control Panel to Control transmitter; when set at LOCAL, permits trans- mitter to be operated with front panel controls. |
| 31 | POWER switch | When set at ON, applies primary power to Extended Local Control Unit. |

Table 2-1 (cont)

Auxiliary Frame Operating Controls and Indicators

| ITEM NO. (See Figure 2-1) | DESIGNATION | FUNCTION |
|------------------------------|--|--|
| 32 | AC POWER MAIN indicator fuse | Protects LRCD main power transformer primary cir- cuit. |
| 33 | AC POWER INTERNAL indi- cator fuse | Protects band switching motor and AC solenoid in associated r-f translator. |
| 34 | DC POWER EXTERNAL indi- cator fuse | Protects associated r-f translator 30-volt power supply. |
| 35 | DC POWER INTERNAL indi- cator fuse | Protects LRCD +28 volt d-c power supply. |
| 36 | LOCAL lamp | Lights when REMOTE-LOCAL switch (30) is set at LOCAL. |
| 37 | OPERATE- STANDBY switch | When set at OPERATE, ener- gizes Power Supply HFP thus supplying operating power to r-f Translator and Control Synthesizer. |
| 38 | TEST KEY | When operated, bypasses carrier suppression circuit of Sideband Exciter, and keys r-f Translator permit- ting local tune-up of trans- mitter. |
| 39 | B+ LINE .375A indi- cator fuse | Protects 200 VDC section A line at J8005 of HFP. |
| 40 | B+ LINE .375A indi- cator fuse | Protects 200 VDC section A line at J8007 of HFP. |
| 41 | B+ LINE .125A indi- cator fuse | Protects -105 VDC section B line at J8006 of HFP. |

Table 2-1 (cont)

Auxiliary Frame Operating Controls and Indicators

| ITEM NO. (See Figure 2-1) | DESIGNATION | FUNCTION |
|------------------------------|------------------------------------|---|
| 42 | FIL LINE 4A indicator fuse | Protects 6.3 vac filament line at J8006 of HFP. |
| 43 | FIL LINE 5A indicator fuse | Protects 6.8 vac filament line at J8009 of HFP. |
| 44 | FIL LINE 15A indicator fuse | Protects 6.8 vac filament line at J8007 of HFP. |
| 45 | STANDBY lamp | Lights when Power Supply HFP is in standby condition; i.e., R-F Translator and Control Synthesizer are de-energized except for oven heater and frequency standard circuits. |
| 46 | TIME DELAY lamp | Lights when Power Supply is between standby and operating conditions; filament voltages are supplied to R-F Transla- tor and Control Synthe- sizer. |
| 47 | OPERATE lamp | Lights when Power Supply HFP is supplying full operating power to R-F Translator and Control Synthesizer. |
| 48 | B+ LINE .250A indicator fuse | Protects 200 vdc section B line at J8005 and J8008 of HFP. |
| 49 | B+ LINE .125A indicator fuse | Protects -105 vdc section B line at J8008 of HFP. |
| 50 | B+ LINE .250A indicator fuse | Protects -105 vdc section B line at J8010 of HFP. |

Table 2-1 (cont)

Auxiliary Frame Operating Controls and Indicators

| ITEM NO. (See Figure 2-1) | DESIGNATION | FUNCTION |
|------------------------------|-------------------------------------|--|
| 51 | FIL LINE 10A indicator fuse | Protects 6.8 vac filament line at J8005 of HFP. |
| 52 | FIL LINE 10A indicator fuse | Protects 6.8 vac filament line at J8008 of HFP. |
| 53 | FIL LINE 8A indicator fuse | Protects 6.8 vac filament line at J8010 of HFP. |
| 54 | UTILITY circuit breakers | Controls power application to utility receptacle of front Auxiliary Power Panel. |
| 55 | INSTRUMENTATION circuit breakers | Controls power application to instrumentation recep- tacle of Front Auxiliary Power Panel. |
| 56 | SWR TRIP OUT switch | When set at 2:1, 540 watts reflected power actuates SWR overload; when set at 3:1, 1200 watts reflected power actuates SWR overload. |
| 57 | OVLD LIGHT indicator fuse | Protects SWR overload lamp circuit (see item 153, table 2-2). |
| 58 | B+ fuse | Protects internal power supply of SWCU. |
| 59 | AC fuse | Protects primary source input power to SWCU. |
| 60 | AC ON lamp | Lights when power supply is Standing Wave Control Unit is operating. |
| 61 | ON/OFF switch | When set at ON, activates power supply in Standing Wave Control Unit. |

Table 2-1 (cont)

Auxiliary Frame Operating Controls and Indicators

| ITEM NO. (See Figure 2-1) | DESIGNATION | FUNCTION |
|------------------------------|---|---|
| 62 | AUXILIARY FRAME MAIN POWER cir- cuit breaker. | Controls power application to Power Supply HFP, Side- band Exciter CMRA, extended Local Control Unit, and Front Fan in Auxiliary Frame. |
| 63 | UTILITY circuit breaker | Same as (54) except applies to rear Auxiliary Power Panel. |
| 64 | INSTRUMENTATION circuit breaker | Same as (55) except applies to rear Auxiliary Power Panel. |

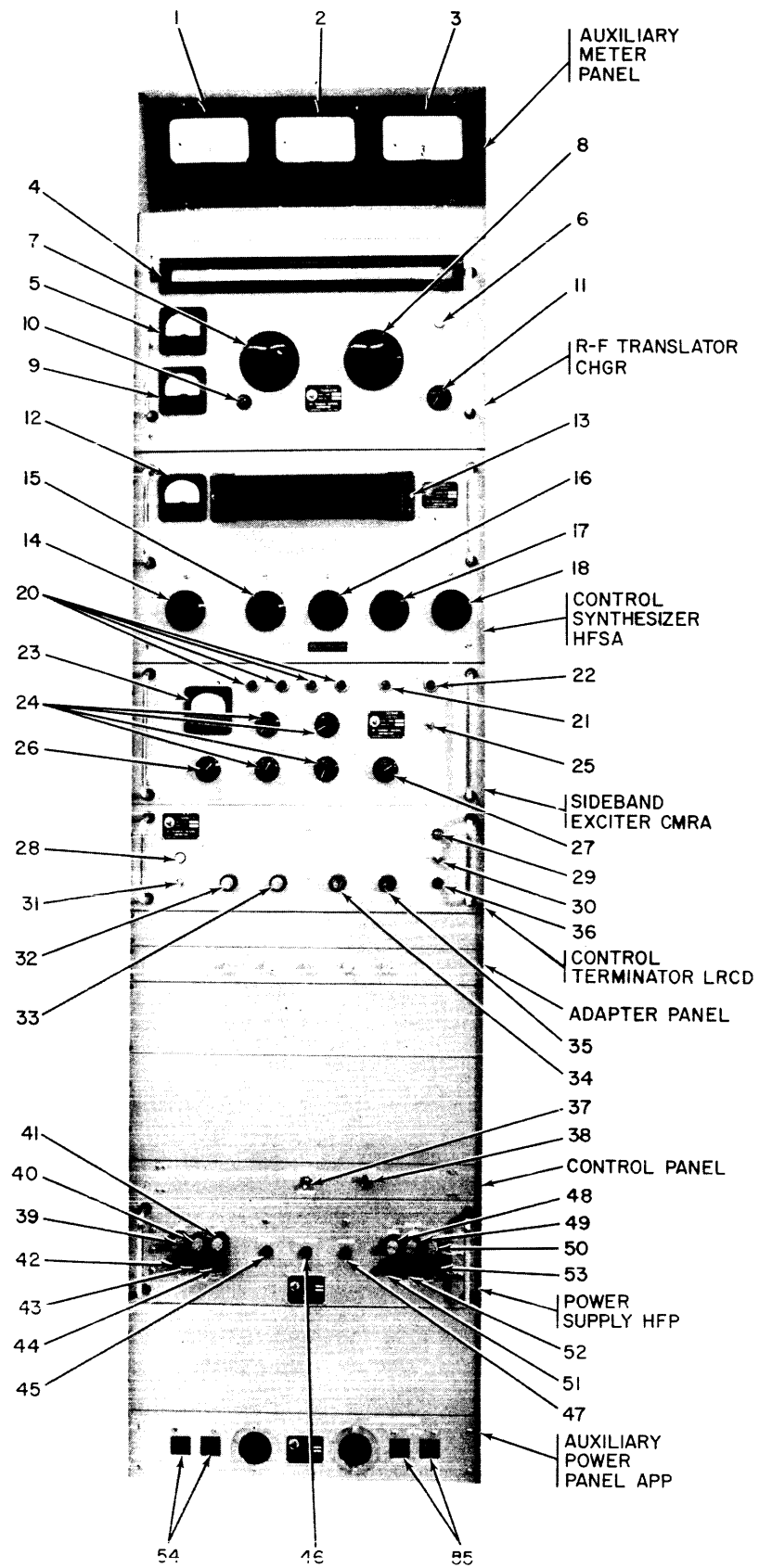


Figure 2-1. Auxiliary Frame, Front View (Sheet 1 of 2)

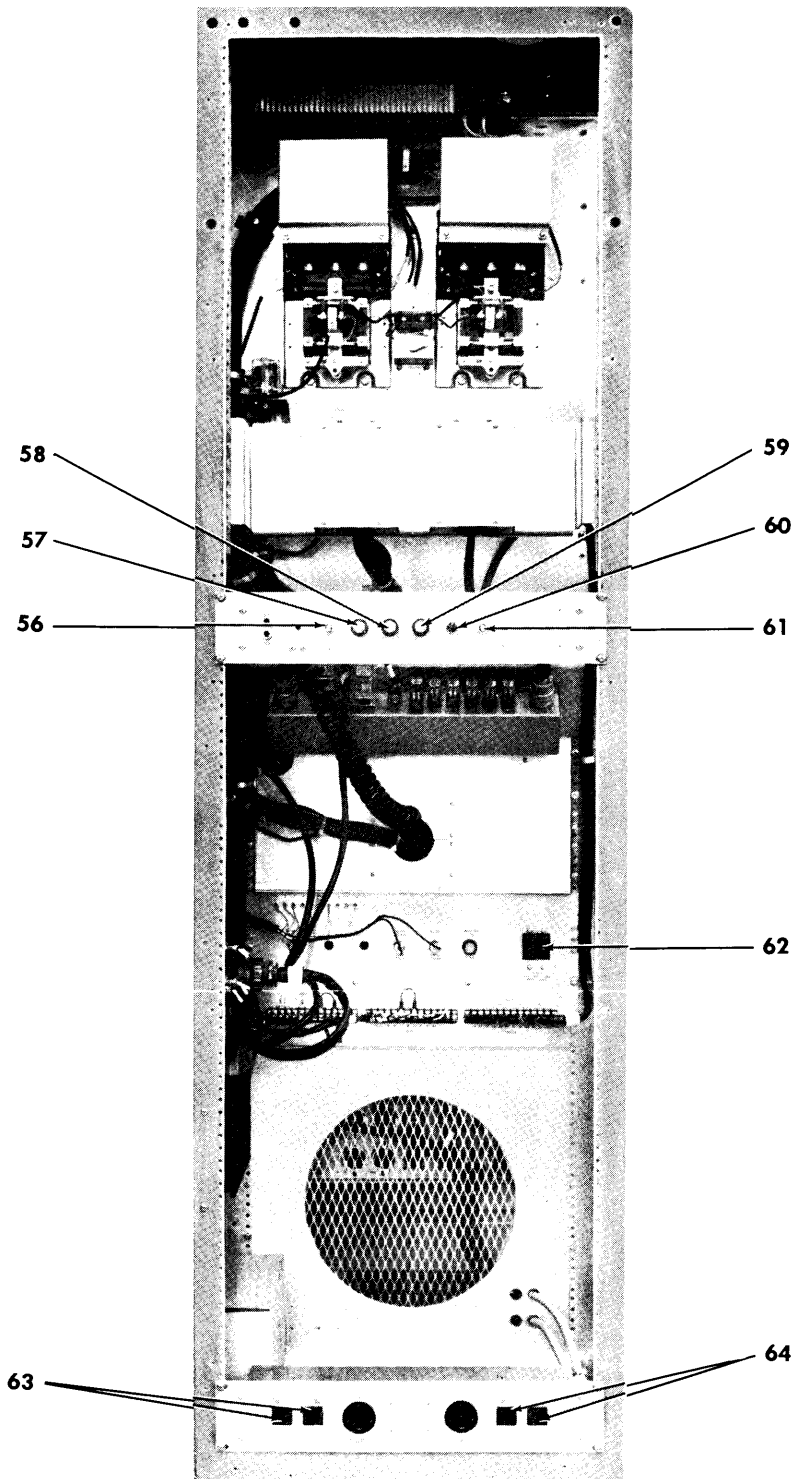


Figure 2-1. Auxiliary Frame, Rear View (Sheet 2 of 2)

Table 2-2. Main Frame Controls and Indicators

| ITEM NO. (See fig. 2-2) | DESIGNATION | FUNCTION |
|----------------------------|-------------------------|--|
| 101 | FILAMENT PRIMARY meter | Indicates potential at 230 v tap of 10-kw PA tube filament transformer. |
| 102 | PA SCREEN CURRENT meter | Indicates current drawn by screen grid of 10-kw PA tube. |
| 103 | PA PLATE CURRENT meter | Indicates current drawn by plate of 10-kw PA tube. |
| 104 | PA PLATE RF meter | Indicates r-f voltage at plate of 10-kw PA tube. |
| 105 | PA OUTPUT meter | Indicates power output of transmitter or VSWR on transmission line, as selected by SWR switch (135). |
| 106 | Harmonic filter switch | Selects cut-off frequency of switchable harmonic filter AF-105. |
| 107 | OPERATE lamp | Lights when TUNE/OPERATE switch (136) is set at OPERATE. |
| 108 | TUNE lamp | Lights when TUNE/OPERATE switch (136) is set at TUNE. |
| 109 | PLATE ON lamp | Lights when high voltage is applied to plates of IPA tube and 10-kw PA tube. |
| 110 | AC ON lamp | Lights when primary power is applied to main frame circuits as controlled by MAIN POWER circuit breaker (129). |
| 111 | Band indicator lamps | Nine lamps; indicates setting of BAND switch (114). |
| 112 | TUNE control | Resonates plate circuit of 10-kw PA. |
| 113 | LOAD control | Matches 10-kw PA to transmission line impedance. |

Table 2-2. Main Frame Controls and Indicators (Cont)

| ITEM NO. (See fig. 2-2) | DESIGNATION | FUNCTION |
|----------------------------|-----------------------------|--|
| 114 | BAND switch | Selects operating range frequency band of 10-kw PA. |
| 115 | MULTIMETER | Indicates plate current of first r-f amplifier tube, plate current of second r-f amplifier tube, r-f voltage at plate of second r-f amplifier, or r-f voltage at plate of IPA tube as selected by MULTIMETER switch (125). |
| 116 | IPA PLATE CURRENT meter | Indicates current drawn by IPA tube. |
| 117 | DRAWER INTER- LOCK lamp | Lights when r-f amplifier drawer interlock switch is not closed. |
| 118 | SERVOS switch | When set at ON, applies primary power to servo amplifiers associated with 2ND AMPL, IPA TUNE, IPA LOAD, PA TUNE, and PA LOAD circuits. |
| 119 | SCREEN indicator fuse | Protects IPA screen power supply circuit. |
| 120 | 2ND AMP TUNING control | Tunes second r-f amplifier. |
| 121 | BAND switch | Selects operating range (frequency band) of first r-f amplifier, second r-f amplifier and IPA. |
| 122 | BLOWER indicator fuse | Protects blower motor in RFTA drawer. |
| 123 | FILAMENTS indicator fuse | Protects the filament transformer circuit in the low voltage power supply AP-126. |
| 124 | BIAS indicator fuse | Protects secondary circuit of bias supply section in low voltage power supply AP-126. |

Table 2-2. Main Frame Controls and Indicators (cont)

| ITEM NO. (See Fig. 2-2) | DESIGNATION | FUNCTION | | | | | | | | |
|--------------------------------|---|---|--------------------------------|---|-----------------|--------------------------------|-------------|---|--------|-----------------------------|
| 125 | MULTIMETER switch | <p>Connects MULTIMETER(115) for the following indications:</p> <table border="0"> <tr> <td data-bbox="1014 449 1306 512">Switch Position 1ST AMPL Ip</td> <td data-bbox="1339 449 1554 604">Value Indicated First r-f amplifier tube plate.</td> </tr> <tr> <td data-bbox="1014 638 1306 680">Switch Position</td> <td data-bbox="1339 638 1554 730">Valve indicated plate current.</td> </tr> <tr> <td data-bbox="1014 764 1229 806">2ND AMPL Ep</td> <td data-bbox="1339 764 1538 890">Second r-f amplifier r-f plate voltage.</td> </tr> <tr> <td data-bbox="1014 924 1136 961">IPA Ep</td> <td data-bbox="1339 924 1521 1016">IPA tube plate r-f voltage.</td> </tr> </table> | Switch Position 1ST AMPL Ip | Value Indicated First r-f amplifier tube plate. | Switch Position | Valve indicated plate current. | 2ND AMPL Ep | Second r-f amplifier r-f plate voltage. | IPA Ep | IPA tube plate r-f voltage. |
| Switch Position 1ST AMPL Ip | Value Indicated First r-f amplifier tube plate. | | | | | | | | | |
| Switch Position | Valve indicated plate current. | | | | | | | | | |
| 2ND AMPL Ep | Second r-f amplifier r-f plate voltage. | | | | | | | | | |
| IPA Ep | IPA tube plate r-f voltage. | | | | | | | | | |
| 126 | TUNE control | Tunes plate circuit of IPA. | | | | | | | | |
| 127 | LOW VOLTAGE indicator fuse | Protects low voltage output circuit in low voltage power supply AP-126. | | | | | | | | |
| 128 | LOAD control | Matches output impedance of IPA to input impedance of 10-kw PA. | | | | | | | | |
| 129 | MAIN POWER circuit breaker | Controls power application to all circuits in second frame of transmitter. | | | | | | | | |
| 130 | OVERLOAD RESET pushbutton | Reset overload relays in 10-kw relay panel after overload has occurred. | | | | | | | | |
| 131 | INTERLOCK INDICATOR lamp | Lights when interlock circuit selected by INTERLOCK switch (132) is closed. | | | | | | | | |

Table 2-2 Main Frame Controls and Indicators (cont)

| ITEM NO. (See Fig. 2-2) | DESIGNATION | FUNCTION |
|----------------------------|------------------|--|
| 132 | INTERLOCK switch | <p>Selects interlock circuit to be monitored by INTERLOCK INDICATOR lamp(131).</p> <p>Switch Position Condition Monitored</p> <p>BAND SW BAND switch (121) set in detent.</p> <p>IPA AIR SW Blower for IPA tube properly operating.</p> <p>EXTERNAL External interlock connected to terminals 8 and 10 of TB3000.</p> <p>REAR DOOR Closure of rear door of second frame.</p> <p>PA AIR SW Blower for 10-kw PA tube properly operating.</p> <p>PA DECK Closure of front door of 10-kw PA compartment.</p> <p>PA BAND SW BAND switch (114) set in detent.</p> <p>RIGHT SIDE Side panel of main frame affixed</p> |

Table 2-2 Main Frame Controls and Indicators (cont)

| ITEM NO. (See Fig. 2.2) | DESIGNATION | FUNCTION |
|----------------------------|-------------------------|--|
| 132 (cont) | | <p>Switch Position Condition monitored</p> <p>HV DECK 10-kw high voltage Rectifier drawer properly positioned.</p> <p>RELAY DECK Front cover of 10-kw Relay Panel properly positioned.</p> <p>TIMER Time delay relay has closed.</p> <p>NORMAL All interlock circuits closed for normal operation.</p> |
| 133 | FIL ADJ switch | <p>Selects taps of filament transformer of 10-kw PA tube to correspond with a-c input line voltage. When properly set, FILAMENT PRIMARY meter (101) indicates 230 v.</p> |
| 134 | ALDC switch and control | <p>Adjusted for the 2.5 to 30 mc frequency range, if desired. Clockwise rotation activates ALDC (automatic load and drive control) circuit; counterclockwise rotation lowers attack poing of ALDC circuit.</p> |
| 135 | SWR switch | <p>When held in its upper position, PA OUTPUT meter (105) indicates VSWR on transmission line (5 kw average power output required for VSWR indication).</p> |

Table 2-2. Main Frame Controls and Indicators (cont)

| ITEM NO. (See Fig. 2-2) | DESIGNATION | FUNCTION |
|----------------------------|---|---|
| 136 | TUNE/OPERATE switch | When set at TUNE, reduces screen grid voltages applied to 10-kw PA and IPA tubes; when set at OPERATE, permits normal voltages to be applied to these screen grids. |
| 137 | PA SCREEN switch | When set at ON, applies d-c voltages to screen grid of 10-kw PA tubes. |
| 138 | HIGH VOLTAGE circuit breaker | When set at ON, applies high d-c potentials to IPA and 10-kw PA tubes. |
| 139 | HV FILAMENT indicator fuse | Protects power tube V600 in high voltage power supply. |
| 140 | HV FILAMENT indicator fuse. | Protects power tube V601 in high voltage power supply. |
| 141 | HV FILAMENT indicator fuse | Protects power tube V602 in high voltage power supply. |
| 142 | HV FILAMENT indicator fuse | Protects power tube V603 in high voltage power supply. |
| 143 | HV FILAMENT indicator fuse | Protects power tube V604 in high voltage power supply. |
| 144 | HV FILAMENT indicator fuse | Protects power tube V605 in high voltage power supply. |
| 145 | PA BIAS lamp | Lights when no bias voltage is applied to grid of 10-kw PA tube. |
| 146 | PA PLATE OVLD lamp | When lit, overload has occurred due to excessive 10-kw tube plate current. |
| 147 | PA SCREEN OVLD lamp | When lit, overload has occurred due to excessive 10-kw screen grid current. |
| 148 | FILAMENT TIME elapsed time indicator. | Indicates total time that filament circuits of transmitter is energized. |

Table 2-2 Main Frame Controls and Indicators (cont)

| ITEM NO. (See Fig. 2-2) | DESIGNATION | FUNCTION |
|----------------------------|-----------------------------------|--|
| 149 | TIME DELAY meter | Delays application of high voltage to transmitter to allow filament heating. |
| 150 | PLATE TIME elapsed time indicator | Indicates total time that high voltage circuit of transmitter is energized. |
| 151 | IPA SCREEN OVLD lamp | When lit, overload has occurred due to excessive IPA tube screen grid current. |
| 152 | IPA PLATE OVLD lamp | When lit, overload has occurred due to excessive IPA tube plate current. |
| 153 | SWR OVLD lamp | When lit, overload has occurred due to excessive reflected power at output of transmitter. |
| 154 | PA BIAS ADJ control | Sets bias applied to 10-kw PA tube. |
| 155 | PA PLATE OVLD ADJ control | Sets trip point of PA PLATE overload relay. |
| 156 | PA SCREEN OVLD ADJ control | Sets trip point of PA SCREEN overload relay. |
| 157 | MAIN BLOWER PH1 indicator fuse | Protects PH1 ac line to main blower B800 in the power supply compartment. |
| 158 | MAIN BLOWER PH2 indicator fuse | Protects PH2 ac line to main blower B800 in the power supply compartment. |
| 159 | MAIN BLOWER PH3 indicator fuse | Protects PH3 ac line to main blower B800 in the power supply compartment. |
| 160 | REAR FAN indicator fuse | Protects rear fans B3000 and B3001 in auxiliary frame. |

Table 2-2 Main Frame Controls and Indicators (cont)

| ITEM NO. (See Fig. 2-2) | DESIGNATION | FUNCTION |
|----------------------------|-----------------------------|--|
| 161 | TIMER indicator fuse | Protects timer M701 in relay panel AR-176. |
| 162 | PA FIL indicator fuse | Protects filament circuit of PA V900. |
| 163 | IPA SCREEN OVLD ADJ control | Sets trip point of IPA SCREEN overload relay. |
| 164 | IPA PLATE OVLD ADJ control | Sets trip point of IPA PLATE overload relay. |
| 165 | ALARM switch | When set at ON, energizes an audible alarm if transmitter high voltage circuit fails (interlock is opened or overload occurs) |
| 166 | Alde control | Adjusted for the 2 to 2.5 mc frequency range. Operates in conjunction with the switch section of ALDC control and switch (134). Clockwise rotation activates ALDC (automatic load and drive control) circuit; counterclockwise rotation lowers attack point of ALDC circuit. |

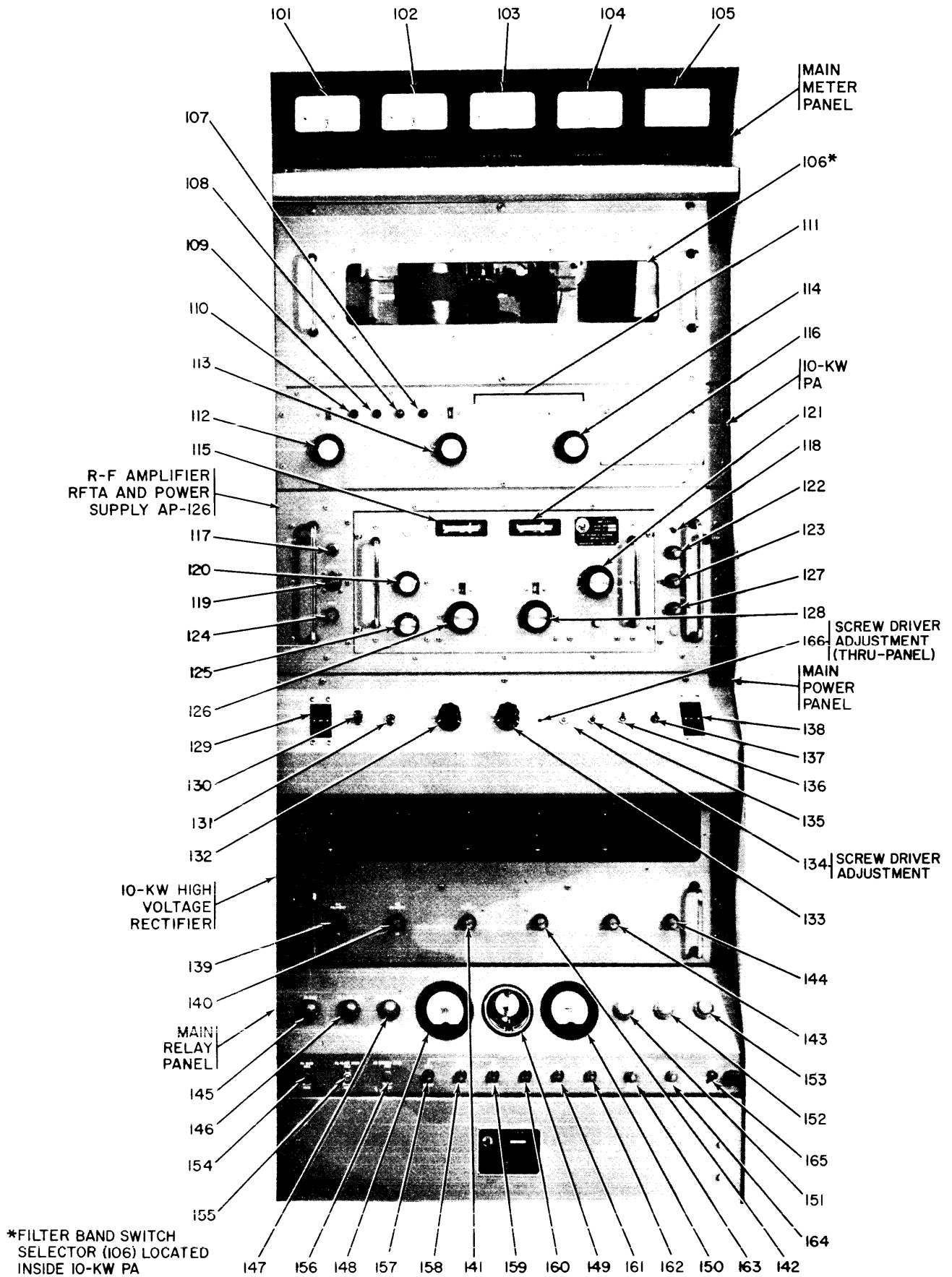


Figure 2-2. Main Frame, Front View

SECTION 3 OPERATING PROCEDURES

3-1. INTRODUCTION

Before operating the TSTE-10K transmitter, the operator should familiarize himself with all front panel controls and indicators. Controls and indicators are functionally described and illustrated in Section 2.

3-2. STARTING PROCEDURE

a. PLACING AUXILIARY FRAME CIRCUITS IN STANDBY.

The auxiliary frame circuits should be in standby condition at least 24 hours before placing the transmitter on-the-air so that the frequency standard in Control Synthesizer HFSA can attain rated stability. The auxiliary frame circuits should not be deenergized completely except in case of emergency or when the transmitter is expected to be out of service for a long period of time. Proceed as follows:

- (1) Set POWER switch (31) on Sideband Exciter
CMRA at OFF.
- (2) Set POWER switch (25) of Control Terminator
LRCD at OFF.
- (3) Set AUXILIARY FRAME MAIN POWER circuit breaker
(62) at ON STANDBY lamp (45) on Power Supply HFP should light.

NOTE

If STANDBY lamp on Power Supply does not light, extend the HFP on its drawer slides, and set STANDBY/OFF switch (on rear of HFP) at STANDBY.

b. APPLYING OPERATING POWER TO AUXILIARY FRAME CIRCUITS.

The auxiliary frame circuits should be in standby at least 24 hours before applying operating power (See paragraph a. above). proceed as follows:

(1) Set POWER switch (25) on Sideband Exciter CMRA at ON; POWER lamp (22) should light.

(2) Set POWER switch (31) on Control Terminator LRCD at ON; POWER lamp (28) should light.

(3) Set OPERATE/STANDBY switch (37) on Control Panel at OPERATE. STANDBY lamp (45) on Power Supply HFP should go out, TIME DELAY lamp (46) should light; after approximately one minute, the TIME DELAY lamp should go out and OPERATE lamp (47) should light.

(4) Set ON/OFF switch (61) on Standing Wave Control Unit SWCU at ON; AC ON lamp (60) should light.

c. STARTING MAIN FRAME CIRCUITS.

(1) Preliminary - Set Controls as follows:

| <u>SWITCH ON CONTROL</u> | <u>POSITION</u> |
|----------------------------------|--|
| SERVOS switch (118) | Down (off) |
| MAIN POWER circuit breaker (129) | OFF |
| INTERLOCK switch (132) | NORMAL |
| FIL. ADJ Switch (133) | To correspond with Primary a-c line voltage. |
| ALDC control (134) | OFF |

| <u>SWITCH ON CONTROL</u> | <u>POSITION</u> |
|------------------------------------|-----------------|
| OPERATE/TUNE switch (136) | OPERATE |
| PA SCREEN switch (137) | ON |
| HIGH VOLTAGE circuit breaker (138) | OFF |
| TIME DELAY timer (149) | 5 |
| ALARM switch (165) | OFF |

(2) Set MAIN Power circuit breaker (129) at ON; AC ON lamp (110) and OPERATE lamp (107) should light. PA BIAS meter (2) should indicate approximately 300V. FILAMENT PRIMARY meter (101) should indicate 230V; if necessary, rotate FIL ADJ switch (133) to obtain proper indication on FILAMENT PRIMARY meter.

After approximately five minutes, INTERLOCK INDICATOR lamp (131) should light. If INTERLOCK INDICATOR lamp does not light, rotate INTERLOCK switch (132) clockwise from its BAND SW position; first position at which lamp goes out corresponds with open interlock switch. Secure drawer, panel, or position band switch to close interlock.

3-3. REMOTE-CONTROLLED OPERATION.

Numerical control designations used in this procedure are callouts shown on figures 2-1 and 2-2.

- a. Start the transmitter as described in paragraph 3-2.
- b. Set controls as shown below:

| <u>CONTROL</u> | <u>POSITION</u> |
|------------------------------------|-----------------------|
| LOCAL/REMOTE switch (30) | REMOTE |
| SERVOS switch (118) | ON |
| HIGH VOLTAGE circuit breaker (138) | ON |
| HARMONIC FILTER switch (106) | AUTO |
| SWR TRIP OUT switch (56) | 2:1 or 3:1 as desired |

NOTE

Lock knob (10) should be rotated clockwise to its stop in order to prevent inadvertent rotation of TUNE control (7) after transmitter tune-up.

c. Set the CHANNEL PRIORITY controls (24) for the desired mode of operation.

EXAMPLE 1: For 1 channel SSB operation with suppressed or reduced carrier, set A1 control or B1 control at 100.

EXAMPLE 2: For 2 channel ISB operation, set A1 and B1 controls at 50.

EXAMPLE 3: For 4 channel ISB operation, set A1, B1, A2 and B2 controls at 25 (assuming that equal power is desired in each channel).

EXAMPLE 4: For AME operation (amplitude modulation equivalent, SSB with full carrier), set A1 or B1 control at 50.

EXAMPLE 5: For AM operation, set A1 and B1 controls at 30.

EXAMPLE 6: For CW operation (keyed carrier telegraphy) set all CHANNEL PRIORITY controls at 0.

EXAMPLE 7: For tone CW, FSK, or FAX operation, set A1 control at 50, and set all other CHANNEL PRIORITY controls at 0. If one channel of an ISB transmission is to be used for FSK or FAX, set the PRIORITY control of the channel containing the single-tone modulation at 25 (for 2-channel ISB), or at 12.5 (for 4-channel ISB).

d. Remaining control settings are performed at the remote control equipment as follows.

(1) Set the applicable POWER OUTPUT control on Remote Gain Control AX-614 at MAX.

(2) Set SIMPLEX or DUPLEX method of transmission with SIMPLEX/DUPLEX switch on Transmitter Control Module AX-568.

(3) Select desired carrier suppression as described in par-

graph 3-4d, step (1) using the CARRIER SUPPRESSION switch on the AX-568.

(4) Depress B+ switch on the AX-568; the pushbutton lamp should light.

(5) Set the CARRIER FREQUENCY switches on the AX-568 to select the desired transmission frequency; for FSK, FAX, or tone CW operation, the carrier frequency must be displaced as described in paragraph 3-4b.

(6) Depress TUNE SYNC pushbutton on the AX-568; the pushbutton lamp should light within one minute.

(7) Depress CHANNEL ENABLE pushbuttons on the AX-568 to activate channels A1, B1, A2, and B2 as desired.

(8) If less than 10-kw PEP output is desired, rotate the POWER OUTPUT control on the AX-614 clockwise to reduce power output.

NOTE

Normally the ALDC controls (166) and (134) are adjusted for the 2 to 2.5 mc and 2.5 to 30 mc frequency ranges, respectively. When performing the aldc adjustment, ALDC control (166) is adjusted at 2 mc and ALDC control (134) is adjusted at 28 mc thereby covering the two frequency spectrum.

(9) If desired, activate the ALDC (automatic load and drive control) circuit as follows:

(a) Rotate ALDC control (134) in a clockwise direction until the aldc switch just activates.

(b) Rotate the desired ALDC control fully clockwise.

(c) Rotate the ALDC control counterclockwise until a slight decrease is noted on PA PLATE RF meter (104) indication.

3-4. LOCAL-CONTROLLED OPERATION.

Numerical control designations used in this procedure are callouts shown on Figures 2-1 and 2-2.

a. PRELIMINARY

(1) Start transmitter as outlined in paragraph 3-2. Make sure that SERVOS switch (118) is at its lower (off) position.

(2) Set LOCAL/REMOTE switch (30) at LOCAL.

(3) Rotate RF GAIN (11) and CHANNEL PRIORITY (24) controls fully counterclockwise:

NOTE

If extreme harmonic suppression is not required, Harmonic Filter switch (106) may be set at its 17-30 position for operation on any Frequency.

(4) Set BAND switch (8), BAND switch (114), Harmonic Filter switch (106), and BAND switch (121) to select operating ranges of RF Translator CHGR, 10-KW PA, and IPA that include desired frequency of transmission.

(5) Set TUNE control (126), LOAD control (128), TUNE control (112) and LOAD control (113) at positions indicated in table 3-1 (sample tuning chart) for desired frequency of transmission: interpolate as necessary for frequencies between those shown in the table.

b. EXCITER TUNE-UP.

NOTE

For tone CW, FSK, or FAX transmission, the carrier Frequency displayed on digital indicator (12) must be lower than the actual transmitted carrier Frequency by an amount equal to the center modulation Frequency supplied by the external tone keyer.

(1) Set MC switch (14), 100 KC switch (15), 10 KC switch (16), 1 KC switch (17), and .1 KC switch (18) so that desired carrier frequency is displayed on digital indicator (13).

(2) Rotate TUNE control (7) until pointer of MEGACYCLES dial (4) indicates desired transmission frequency. Adjust TUNE control slightly until SYNC IND lamp (6) lights, and SYNCHRONIZE meter (5) indicates zero (center-scale). Lock TUNE control with LOCK knob (10).

c. IPA AND 10 KW PA TUNE-UP.

(1) Set TEST KEY (38) at its upper position (TEST KEY is self-locking in this position).

(2) Set MULTIMETER switch (125) at 2ND AMPL Ep.

(3) Rotate RF GAIN control (11) clockwise approximately one-half turn.

(4) Adjust 2ND AMPL TUNING control (120) to obtain peak indication on MULTIMETER (115); adjust RF GAIN control (12) as necessary to keep MULTIMETER indication below half scale.

(5) Rotate RF GAIN control (11) fully counter-clockwise. Set HIGH VOLTAGE circuit breaker (138) at ON; PLATE ON lamp (109) should light, PA SCREEN meter (1) should indicate approximately 1200V, PA PLATE meter (3) should indicate 7.5 kv, and IPA PLATE CURRENT meter (116) should indicate 300 milliamperes.

NOTE

If adjustment of TUNE control (126) does not yield dip on IPA PLATE CURRENT meter, rotate LOAD control (128) counter-clockwise, then repeat adjustment of TUNE control.

(6) Set MULTIMETER switch (125) at IPA Ep. Rotate RF GAIN control (11) clockwise until IPA PLATE CURRENT meter (116) indicates 350 milliamperes. Adjust TUNE control (126) to obtain

dip on IPA PLATE CURRENT meter.

(7) Adjust RF GAIN control (11) until PA PLATE CURRENT meter (103) indicates 1 ampere; adjust TUNE control (112) to obtain dip on PA PLATE CURRENT meter. If adjustment of TUNE control (112) does not yield a dip on PA PLATE CURRENT meter, rotate LOAD control (113) counter-clockwise, then repeat adjustment at TUNE control.

(8) Adjust RF GAIN control (11) until PA OUTPUT meter (105) indicates 5 kilowatts. When performing this step, pay particular attention to the following:

(a) PA PLATE CURRENT meter (103) should not indicate higher than 1.8 amperes. If PA PLATE CURRENT meter indicates 1.8 amperes but PA OUTPUT meter indicates less than 5 kilowatts, rotate LOAD control (113) counter-clockwise, and adjust TUNE control (112) to maintain dip on PA PLATE CURRENT meter.

(b) PA SCREEN CURRENT meter (102) should not indicate higher than 40 miliamperes. If PA SCREEN CURRENT meter indicates 40 miliamperes but PA OUTPUT meter indicates less than 5 kilowatts, rotate LOAD control (113) counter-clockwise, and adjust TUNE control (112) to maintain dip on PA PLATE CURRENT meter.

(c) PA PLATE RF meter (104) should indicate between 4.5 and 6.0 kv. If excessive r-f voltage is indicated, rotate LOAD control (113) clockwise, and adjust TUNE control (112) to maintain dip on PA PLATE CURRENT meter. If deficient r-f voltage is indicated, rotate LOAD control counter-clockwise, and adjust TUNE control to maintain dip on PA PLATE CURRENT meter.

(d) IPA PLATE CURRENT meter (116) should not indicate higher than 410 miliamperes. If IPA PLATE CURRENT meter indicates 410 miliamperes but PA OUTPUT meter indicates less than 5 kilowatts, rotate LOAD control (128) counter-clockwise, and adjust TUNE control (126) to maintain dip on IPA PLATE CURRENT meter.

(9) Set TEST KEY (38) at its center (off) position.

d. SIDEBAND EXCITER SET-UP.

(1) Set CARRIER SUPPRESSION switch (27) for the desired mode of transmission as follows:

| <u>MODE</u> | <u>CARRIER SUPPRESSION</u> |
|---|----------------------------|
| CW (keyed carrier telegraphy) | 0 DB |
| AME | 3 DB |
| AM | 6 DB |
| SSB or two-channel ISB with reduced carrier | 20 DB |
| Four channel ISB with reduced carrier | 30 DB |
| SSB or ISB with suppressed carrier, Tone CW, FSK, or FAX. | FULL |

(2) Set CHANNEL PRIORITY controls (24) for the desired mode of operation as described in paragraph 3-3, step c.

NOTE

Normally the ALDC controls (166) and (134) are adjusted for the 2 to 2.5 mc and 2.5 to 30 mc frequency ranges, respectively. When performing the aldc adjustment, ALDC control (166) is adjusted at 2 mc and ALDC control (134) is adjusted at 28 mc, thereby covering the two frequency spectrums.

(3) If desired, activate the ALDC (automatic load and drive control) circuit as follows:

(a) Rotate ALDC control (134) in a clockwise direction until the aldc switch just activates.

(b) Rotate the desired ALDC control fully clockwise.

(c) Rotate the ALDC control counterclockwise until a slight decrease is noted on PA PLATE RF meter (104) indication.

(4) If desired, set ALARM switch (165) at ON; an alarm buzzer in the transmitter will sound if a high voltage failure occurs (overload or open interlock).

3-5. STOPPING PROCEDURE.

a. PLACING TRANSMITTER IN STANDBY. - Set controls as shown below:

| Control | Position |
|------------------------------------|------------|
| HIGH VOLTAGE circuit breaker (138) | OFF |
| SERVOS switch (118) | Down (off) |
| MAIN POWER circuit breaker (129) | OFF |
| POWER switch (25) | OFF |
| POWER switch (31) | OFF |
| OPERATE/STANDBY switch (37) | STANDBY |

b. COMPLETE STOPPING. - Place transmitter in standby as indicated in paragraph a. above; then set AUXILIARY FRAME MAIN POWER circuit breaker (62) at OFF.

c. EMERGENCY STOPPING. - Set the following circuit breakers at their OFF positions:

MAIN POWER (129)

AUXILIARY FRAME MAIN POWER (62)

TABLE 3-1. TYPICAL TUNING CHART.

| FREQUENCY | IPA | | | PA | | | IPA Ep (RF) VOLTS | PA PLATE CURRENT AMPS | PA SCREEN CURRENT MA | PA PLATE RF POWER | | EXCITER*** | | | | |
|-----------|------|-------|------|-------|-----|-------|-------------------|-----------------------|----------------------|-------------------|------|------------|--------|-----|---------|-----|
| | TUNE | | LOAD | TUNE | | LOAD | | | | KV | KW | FREQ | CHG RF | | | |
| | PP* | FNL** | PP* | FNL** | PP* | FNL** | | | | | | | | | | |
| 2.0000 | 156 | 147 | 173 | 102 | 331 | 212 | 239 | 187 | 430 | 10 | 2.1 | 4 | 3.5 | 5.8 | 2.0 | 8.5 |
| 2.3050 | 156 | 115 | 173 | 058 | 331 | 178 | 239 | 134 | 420 | 10 | 2.00 | 8 | 4.0 | 6.1 | 2.305 | 6.6 |
| 2.4999 | 156 | 102 | 174 | 044 | 331 | 162 | 234 | 098 | 400 | 10 | 1.8 | 4 | 4.0 | 5.5 | 2.5 | 7.5 |
| 2.5000 | 156 | 107 | 118 | 095 | 331 | 180 | 428 | 332 | 400 | 10 | 1.7 | 4 | 4.5 | 6.0 | 2.9999 | 8.8 |
| 2.9999 | 156 | 087 | 118 | 051 | 331 | 155 | 460 | 433 | 440 | 10 | 2.0 | 14 | 5.0 | 6.0 | 3.0 | 5.1 |
| 3.0000 | 156 | 097 | 173 | 070 | 331 | 182 | 501 | 433 | 440 | 8 | 1.9 | 6 | 3.5 | 5.8 | 3.5 | 6.6 |
| 3.9999 | 156 | 072 | 089 | 018 | 331 | 142 | 501 | 341 | 480 | 10 | 2.0 | 6 | 3.5 | 6.0 | 3.9999 | 8.8 |
| 4.0000 | 125 | 087 | 140 | 108 | 250 | 179 | 589 | 518 | 430 | 9 | 1.8 | 6 | 3.5 | 5.6 | 4.0 | 6.5 |
| 5.9999 | 125 | 065 | 077 | 045 | 247 | 123 | 380 | 170 | 480 | 9 | 1.8 | 4 | 3.5 | 5.9 | 5.0 | 7.0 |
| 6.0000 | 125 | 065 | 068 | 045 | 247 | 224 | 668 | 522 | 480 | 9 | 1.9 | 8 | 3.75 | 6.2 | 5.9999 | 9.0 |
| 6.9999 | 125 | 060 | 068 | 033 | 247 | 204 | 668 | 269 | 480 | 9 | 1.9 | 8 | 3.60 | 6.0 | 6.0 | 5.0 |
| 7.0000 | 125 | 082 | 137 | 076 | 246 | 204 | 329 | 290 | 480 | 9 | 1.8 | 6 | 3.5 | 6.0 | 7.0 | 7.2 |
| 10.2950 | 125 | 065 | 075 | 032 | 246 | 151 | 187 | 119 | 460 | 8 | 1.70 | 8 | 3.4 | 6.0 | 7.9999 | 9.0 |
| 10.9999 | 125 | 064 | 075 | 027 | 246 | 142 | 187 | 104 | 440 | 8 | 1.65 | 6 | 3.2 | 5.5 | 8.0 | 5.6 |
| 11.0000 | 084 | 067 | 063 | 050 | 162 | 162 | 213 | 175 | 420 | 8 | 1.70 | 6 | 3.2 | 5.8 | 10 | 6.0 |
| 12.2050 | 084 | 065 | 063 | 038 | 162 | 148 | 213 | 146 | 440 | 8 | 1.65 | 6 | 3.4 | 5.9 | 10.295 | 6.0 |
| 14.9999 | 084 | 059 | 045 | 024 | 158 | 109 | 118 | 088 | 430 | 8 | 1.55 | 5 | 3.6 | 5.9 | 11.9999 | 7.0 |
| 15.0000 | 084 | 063 | 061 | 049 | 158 | 147 | 172 | 138 | 440 | 8 | 1.70 | 6 | 3.4 | 6.0 | 12.0 | 4.6 |
| 18.9999 | 085 | 057 | 054 | 029 | 158 | 083 | 136 | 090 | 420 | 8 | 1.60 | 6 | 3.5 | 6.0 | 12.205 | 4.5 |
| 19.0000 | 084 | 060 | 070 | 050 | 158 | 143 | 139 | 114 | 390 | 10 | 1.70 | 6 | 3.5 | 6.0 | 14.0 | 3.5 |
| 19.6400 | 084 | 060 | 070 | 045 | 158 | 139 | 139 | 105 | 430 | 8 | 1.65 | 7 | 3.4 | 6.2 | 15.9999 | 5.5 |
| 23.9999 | 084 | 052 | 049 | 030 | 158 | 065 | 105 | 076 | 410 | 8 | 1.65 | 6 | 3.5 | 6.0 | 16.0 | 5.5 |
| 24.0000 | 084 | 060 | 051 | 043 | 158 | 136 | 113 | 103 | 390 | 8 | 1.60 | 7 | 3.4 | 5.5 | 19.640 | 6.5 |
| 25.1300 | 084 | 059 | 051 | 040 | 158 | 132 | 113 | 090 | 390 | 6 | 1.60 | 7 | 3.1 | 5.5 | 20.0 | 7.0 |
| 27.8320 | 083 | 055 | 048 | 032 | 158 | 112 | 101 | 073 | 380 | 4 | 1.70 | 7 | 3.3 | 5.5 | 23.9999 | 7.7 |
| 27.9250 | 084 | 055 | 047 | 033 | 158 | 107 | 101 | 073 | 360 | 4 | 1.60 | 7 | 3.4 | 5.5 | 24.0 | 3.6 |
| 29.9999 | 084 | 051 | 034 | 027 | 158 | 084 | 083 | 063 | 410 | 6 | 2.00 | 8 | 3.3 | 6.1 | 25.130 | 3.5 |
| | | | | | | | | | | | | | | | 27.832 | 3.0 |
| | | | | | | | | | | | | | | | 27.925 | 3.0 |
| | | | | | | | | | | | | | | | 28.0 | 3.0 |
| | | | | | | | | | | | | | | | 30.0 | 3.6 |

NOTES:

The values given above are nominal and may vary from transmitter to transmitter.

*Take PP (Pre-position) readings with exciter gain potentiometer adjusted fully CCW.

**Final settings may be used for manual operation.

***Take CHG readings from RF level meter with 440V off and exciter gain potentiometer adjusted fully CW.

All other readings taken with full power output, 0 carrier suppression, and all channels off.