

TU-28319-5-1-0-2

UNCLASSIFIED

★

TECHNICAL MANUAL

for

TRANSMITTING MODE
SELECTOR, SBE-8,-9,-10



THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N.Y.

OTTAWA, ONTARIO



NOTICE

THE CONTENTS AND INFORMATION CONTAINED IN THIS INSTRUCTION MANUAL IS PROPRIETARY TO THE TECHNICAL MATERIEL CORPORATION TO BE USED AS A GUIDE TO THE OPERATION AND MAINTENANCE OF THE EQUIPMENT FOR WHICH THE MANUAL IS ISSUED AND MAY NOT BE DUPLICATED EITHER IN WHOLE OR IN PART BY ANY MEANS WHATSOEVER WITHOUT THE WRITTEN CONSENT OF THE TECHNICAL MATERIEL CORPORATION.



THE TECHNICAL MATERIEL CORPORATION

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

700 FENIMORE ROAD

MAMARONECK, N. Y.

W a r r a n t y

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,*fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes*furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

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

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

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

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

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

CHANGE NO. 1 **SBE** 8/9/10



INSTRUCTION BOOK CHANGE NOTICE

Date 12-15-66

Manual affected: Transmitting Mode Selector SBE 8/9/10 IN -2008A
 Issue Date: 31 August 1966

1. Page 6-3. Parts List

Change DESCRIPTION for C141 to read as follows:

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C141	CAPACITOR, VARIABLE, CERAMIC: 4-30 uuf, 500 WVDC.	CV11C300

2. Page 6-10. Parts List

Add C310, C311 to read as follows:

Change TMC Part Number of CR113 to read as follows:

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C310	Same as C116.	
C311	Same as C116.	
CR113	SEMICONDUCTOR DEVICE, DIODE: Silicon.	1N252

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

Attn.: Director of Eng. Services.

CHANGE NO. 1 SBE 8/9/10



INSTRUCTION BOOK CHANGE NOTICE

Date 12-15-66

Manual affected: Transmitting Mode Selector SBE 8/9/10 IN -2008A
 Issue Date: 31 August 1966

3. Page 6-15. Parts List

Change DESCRIPTION of L151 to read as follows:

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L151	COIL, RADIO FREQUENCY: fixed; 3.3 uh +10%; DC current rating 1560 ma; molded case.	CL270-3.3

4. Page 6-16. Parts List

Change DESCRIPTION of R101, R102 to read as follows:

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R101	RESISTOR: FIXED, COMPOSITION: 2.2 megohms, +5%; 1/2 watt.	RC20GF225J
R102	Same as R101.	

5. Page 6-19. Parts List

Change DESCRIPTION of R168, R169 to read as follows:

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R168	RESISTOR: VARIABLE, COMPOSITION: 250K, +10%; 2 watts.	RV4NAYSA254AYY
R169	Same as R168.	

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THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

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CHANGE NO. 1 SBE 8/9/10



INSTRUCTION BOOK CHANGE NOTICE

Date 12-16-66

Manual affected: Transmitting Mode Selector SBE8/9/10 IN -2008A
 Issue Date: 31 August 1966

6. Page 6-25. Parts List

Add R289, R290, R291, and R292 to read as follows:

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R289	Same as R247.	
R290	Same as R247.	
R291	Same as R228.	
R292	Same as R228.	

7. Page 7-1/7-2, 7-3/7-4, Schematic Diagram, Sheets 1 and 2.

Remove and replace with following schematics:

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Attn.: Director of Eng. Services.



INSTRUCTION BOOK CHANGE NOTICE

Date May 1, 1967

Manual affected: Transmitting Model Selector, SBE-8, 9, 10 IN 2008A

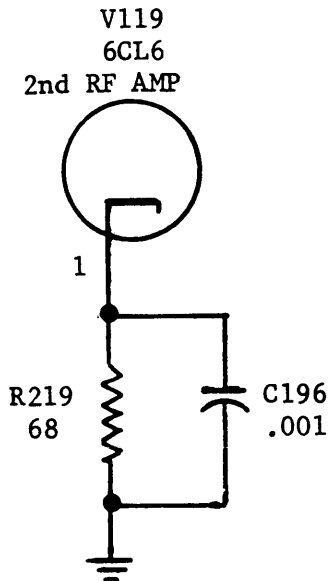
Issue Date: 31 August 1966

NOTE

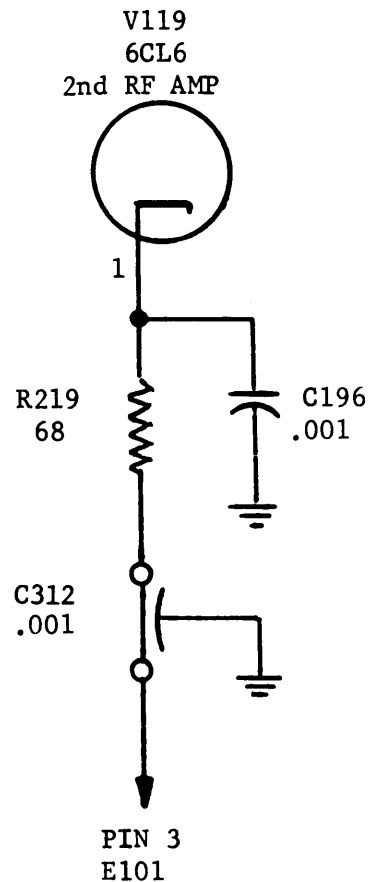
This change is not required when the SBE is used in Sideband Transmitter Model SBT-1KA6.

a. Figure 7-1, Schematic Diagram, Exciter Unit, Page 7-3/7-4.

CHANGE FROM



CHANGE TO



b. Add to PARTS LIST, Page 6-10:
C312 Same as C184

110672008A

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Attn.: Director of Eng. Services

CHANGE NO. 3 SBE-8,9,10

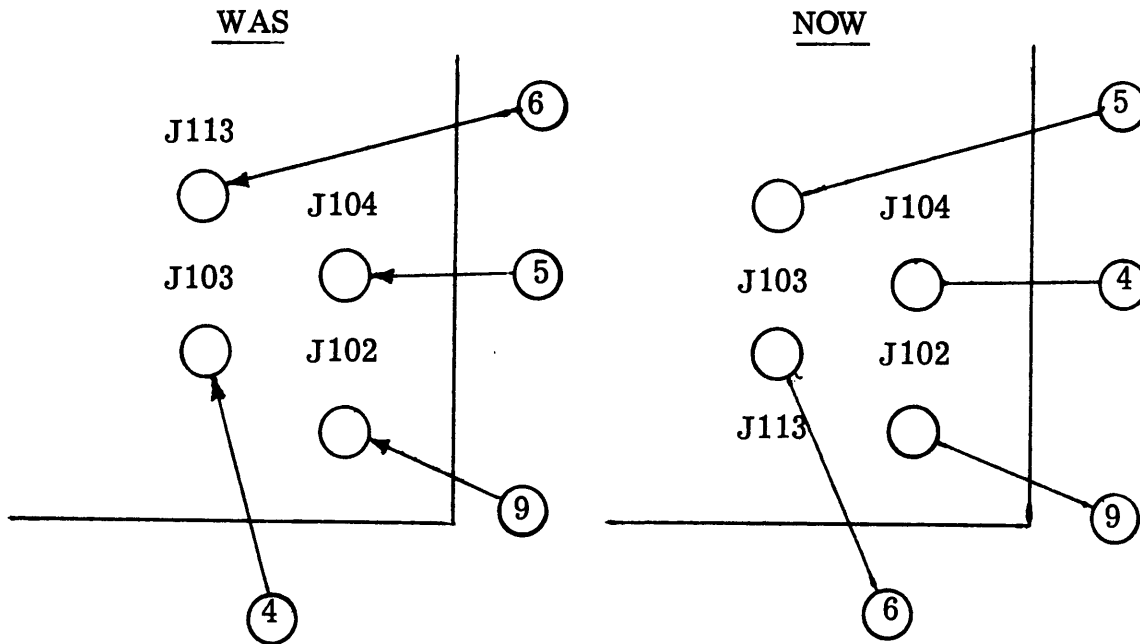


INSTRUCTION BOOK CHANGE NOTICE

Date July 24, 1967

Manual affected: Transmitting Mode Selector, SBE-8,9,10 IN 2008A

1. Figure 2-3. on page 2-3. should be modified as follows:



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Attn.: Director of Eng. Services.

CHANGE NO. 4



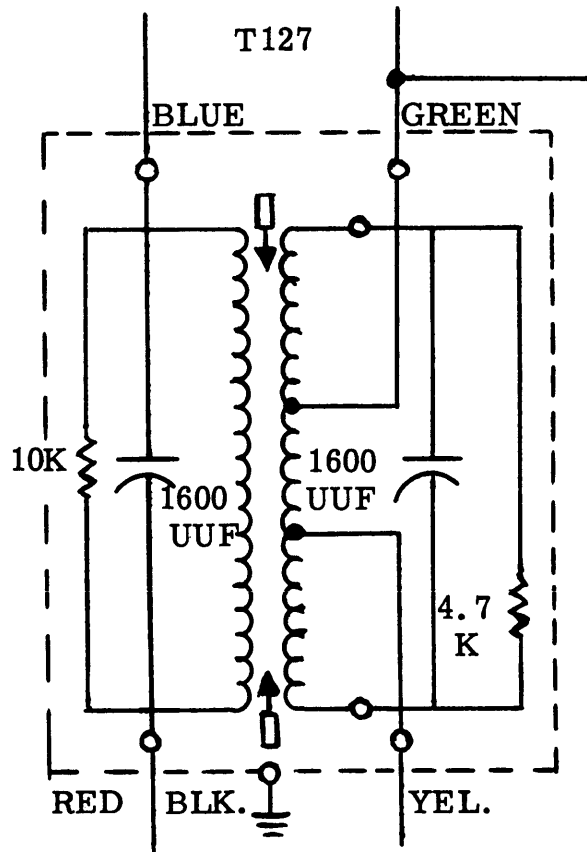
INSTRUCTION BOOK CHANGE NOTICE

Date October 20, 1967

Manual affected: Transmitting Mode Selector, SBE-8, 9, 10 IN 2008A
Issue Date: August 31, 1966

1. Page 7-17-2, Schematic Diagram Sheet 1 of 2. Change T127

Resistor Value as shown below:

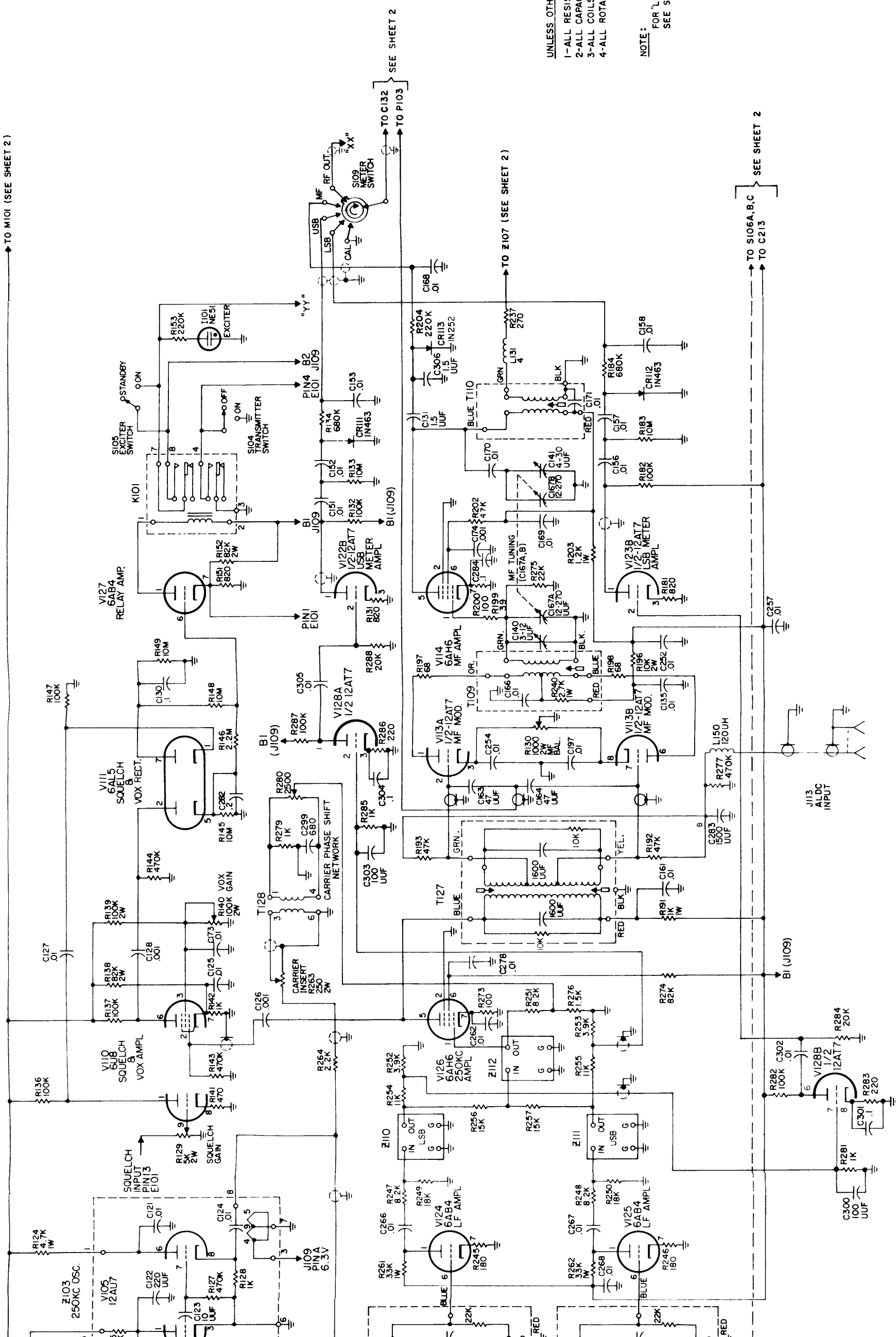


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Attn.: Director of Eng. Services

TO M101 (SEE SHEET 2)

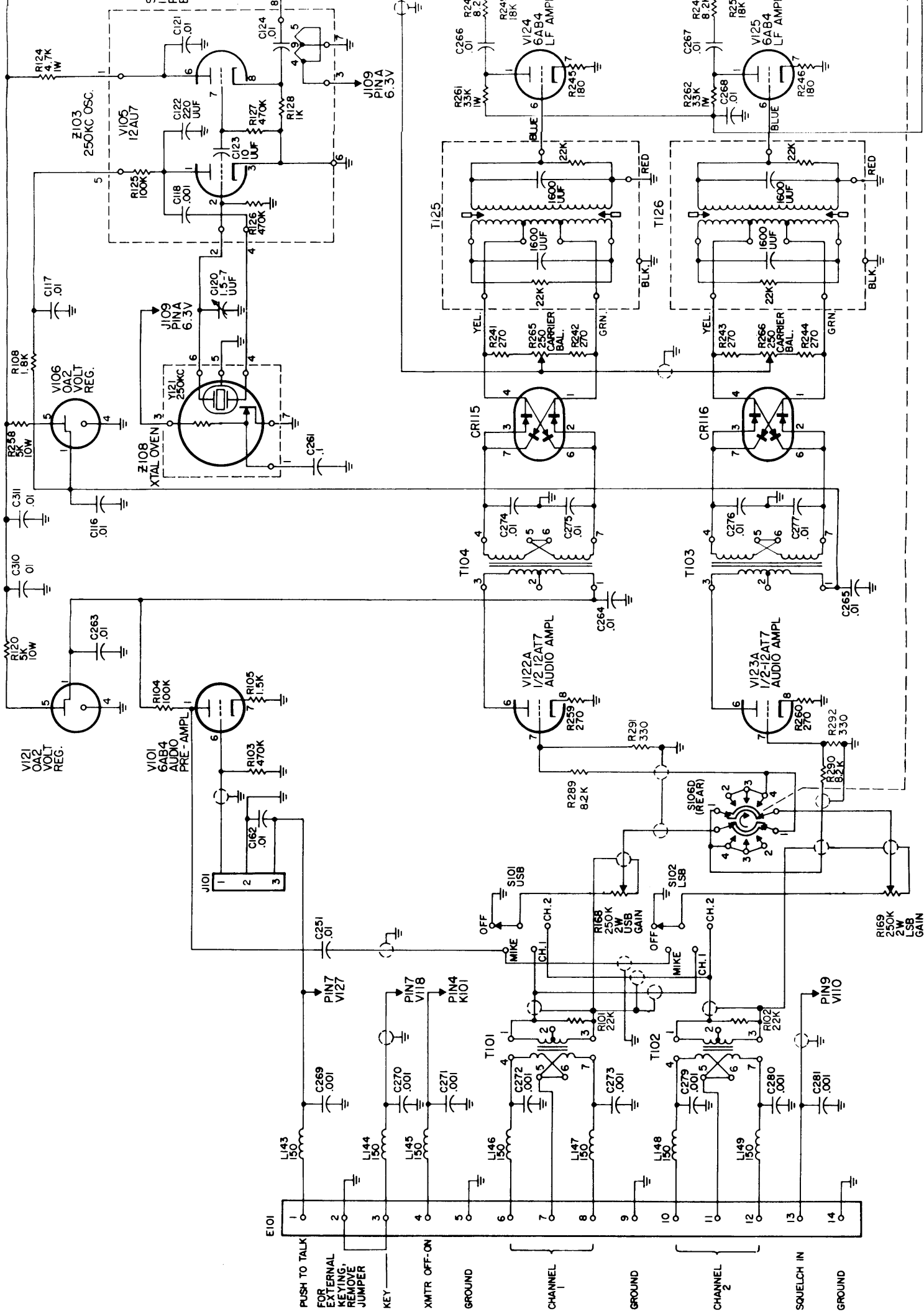


UNLESS OTHERWISE SPECIFIED

- 1- ALL RESISTORS ARE 1/2 WATT. K=1000 M=MILLION
- 2- ALL CAPACITORS ARE IN MICROFARADS.
- 3- ALL COILS ARE IN MICROHENRIES. MH=MILLIHENRIES
- 4- ALL ROTARY SWITCHES ARE SHOWN IN POSITION 1.

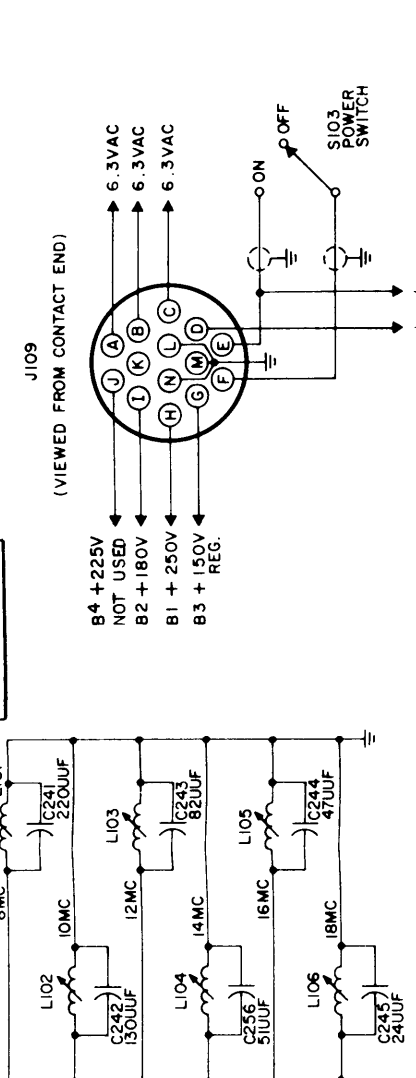
NOTE: FOR "LAST" & "MISSING" SYMBOLS, SEE SHEET 2.

Figure 7-1. Schematic Diagram, Exciter Unit (Sheet 1 of 2)



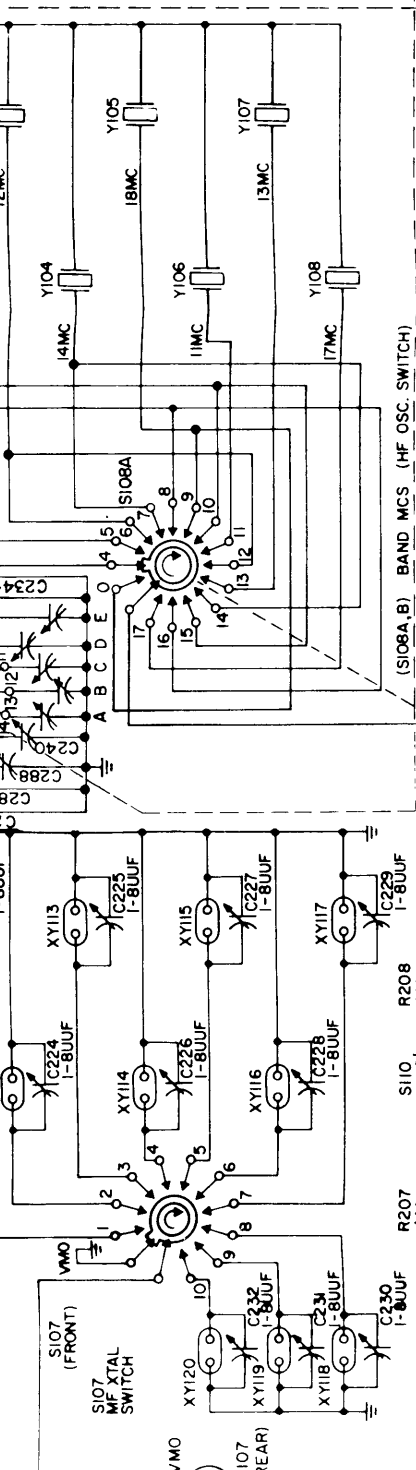
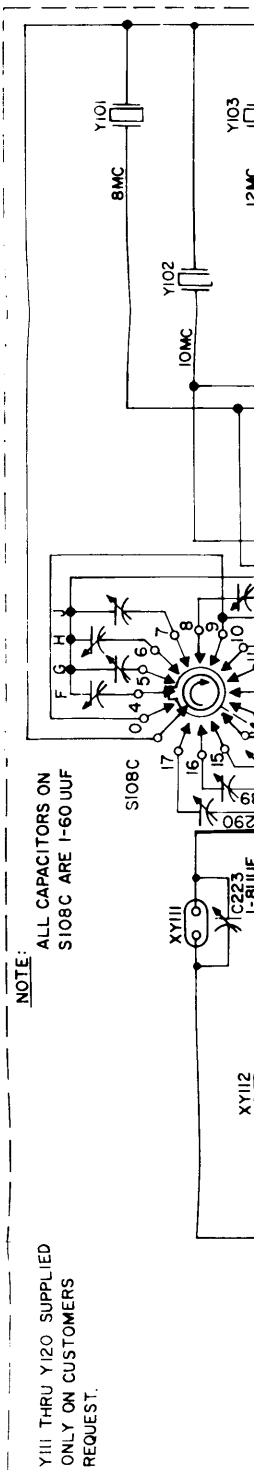
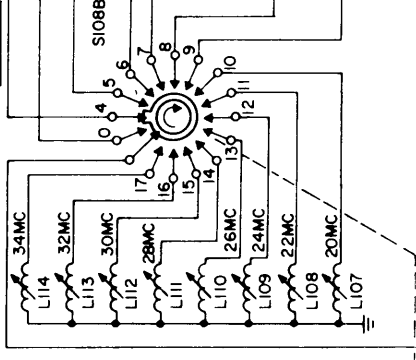
C300
100
UUF

LAST SYMBOLS		MISSING SYMBOLS	
C-311	PS103	C101 THRU C115	C119, C129, C142
CR116	R292	THRU C150	C154, C155, C159,
E102	S110	C160, C165, C172	C195, C255,
J103	T128	C258, C259, C260,	C307, C308
J113	TB101	CR101, THRU CR106,	CR109, CR110
K101	Y128	CR107, CR108	
L154	XY121		
M101	Y121		
PI08	Z112		
	WI01		



- UNLESS OTHERWISE SPECIFIED
- 1 - ALL RESISTORS ARE 1/2 WATT. K = 1000 M = MILLION
 - 2 - ALL CAPACITORS ARE IN MICROFARADS.
 - 3 - ALL COILS ARE IN MICRORHENRIES. MH = MILLIHENRIES
 - 4 - ALL ROTARY SWITCHES ARE SHOWN IN POSITION 1.

SIO8C CAPACITOR CODE	
A = C239	F = C285
B = C238	G = C286
C = C237	H = C287
D = C236	I = C233
E = C235	J = C233



SIO6E CAPACITOR CODE	
K = C298	.62 UUF
L = C296	.130 UUF
M = C294	.270 UUF
N = C292	.510 UUF
O = C291	.510 UUF
P = C293	.270 UUF
R = C295	.130 UUF
S = C297	.62 UUF

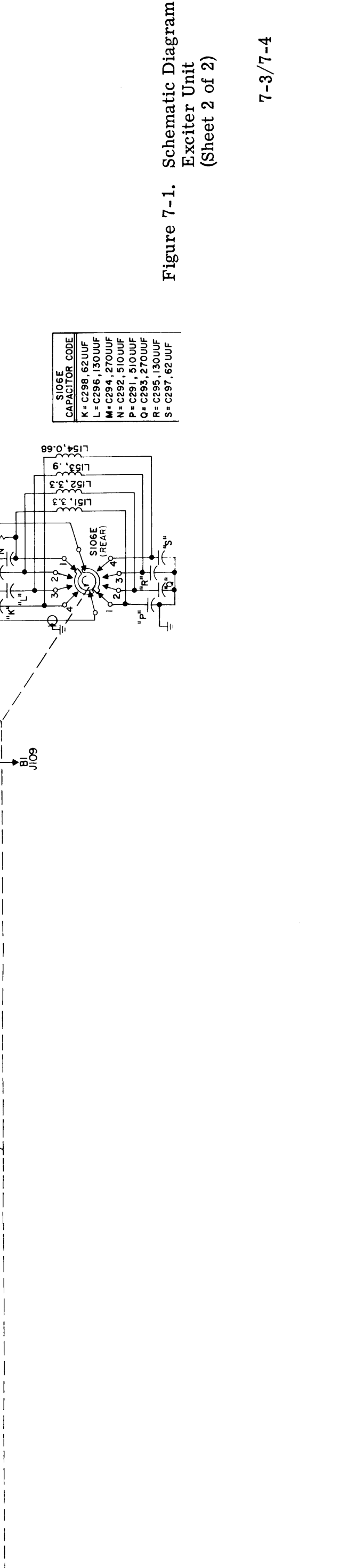
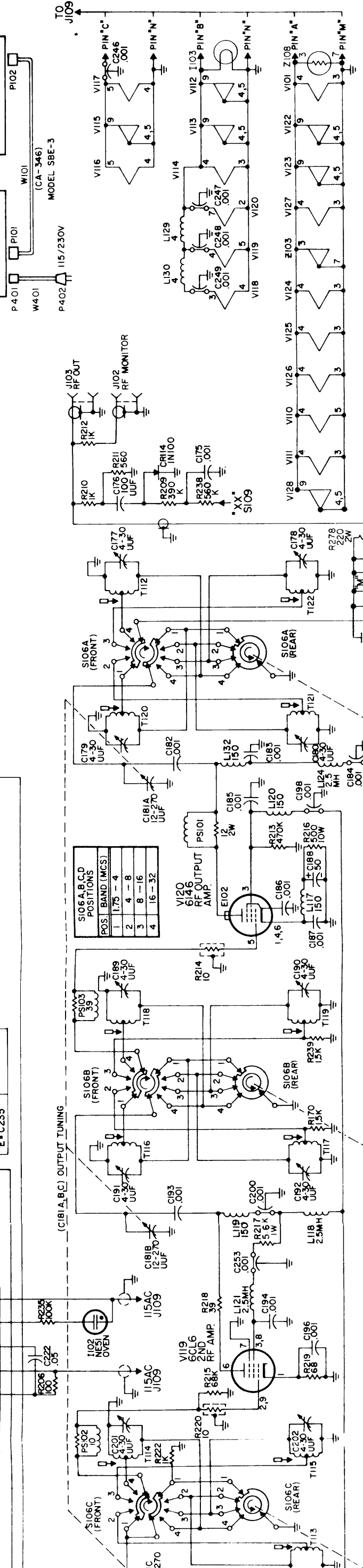
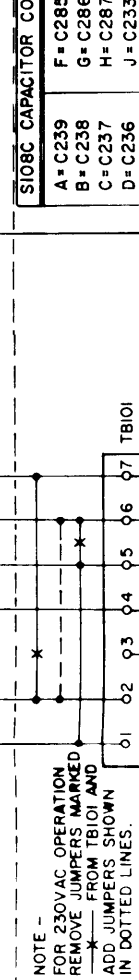


Figure 7-1. Schematic Diagram, Exciter Unit (Sheet 2 of 2)

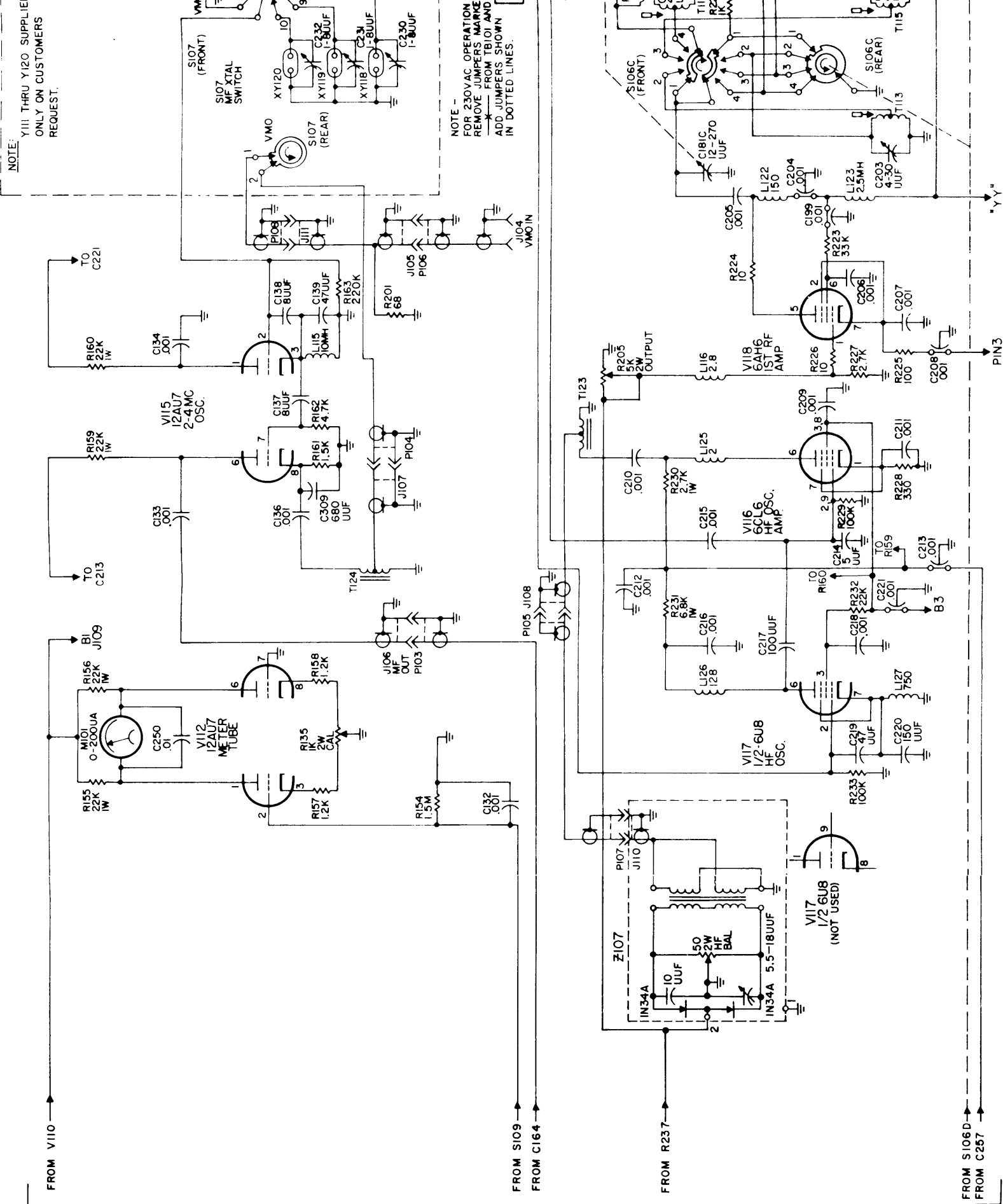


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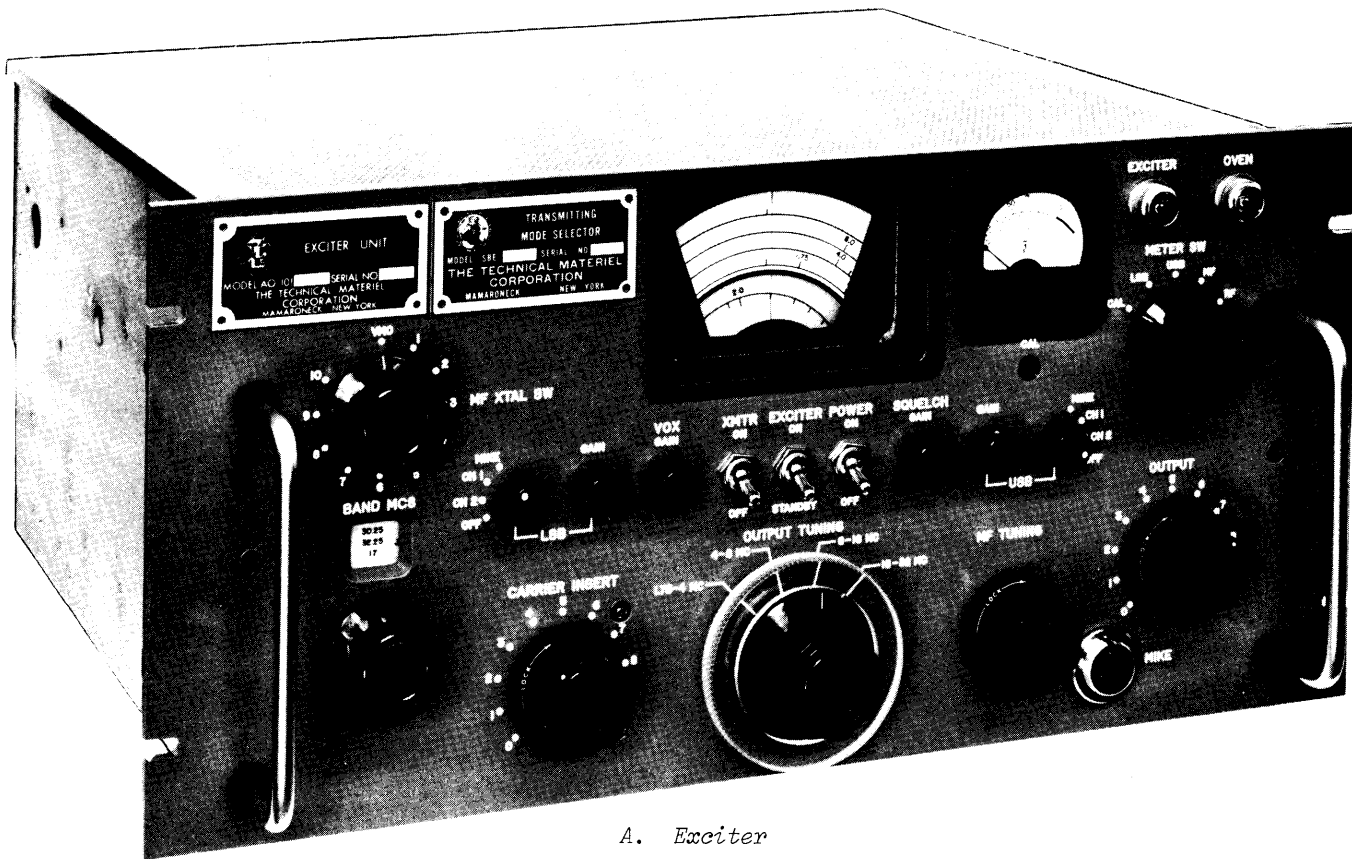
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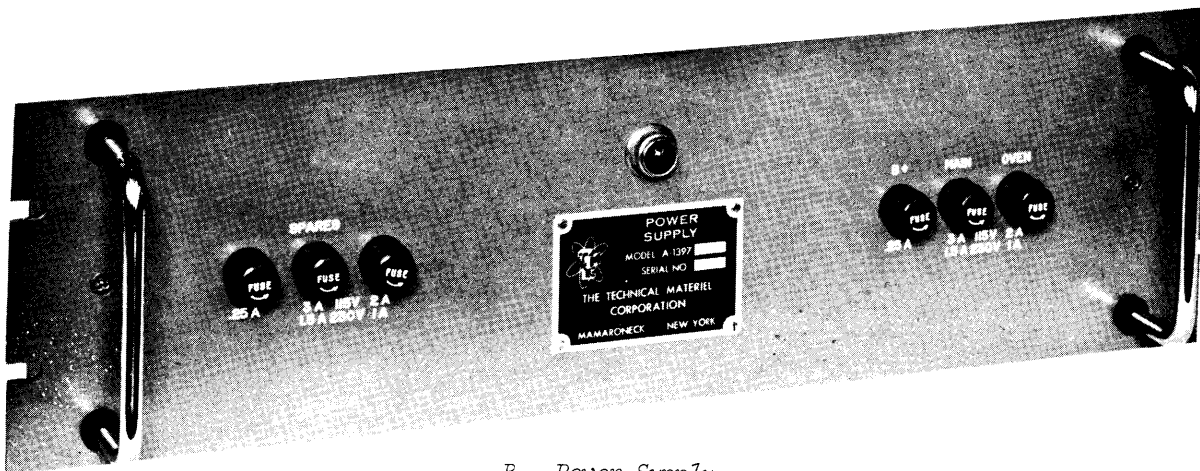
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A. Exciter



B. Power Supply

Figure 1-1. Transmitting Mode Selectors, Models SBE-8, SBE-9, SBE-10

SECTION 1

GENERAL INFORMATION

1-1. PURPOSE AND DESCRIPTION.

Transmitting Mode Selectors, Models SBE-8, SBE-9, SBE-10 and Power Supply (figures 1-1 and 1-2), are filter-type sideband exciters that can be used with any linear amplifier that accepts up to 250 milliwatts PEP of drive to provide ISB, SSB, AM, AME, and CW modes of operation. The SBE models are identical except for the bandwidth of the audio bandpass filters.

The SBE develops single, double, or independent sideband transmissions with various degrees

of carrier insertion with up to 250 milliwatts (PEP) at 72-ohm input impedance.

A voice-operated (VOX) control circuit and an associated squelch circuit allows for proper VOX operation under varying ambient noise conditions. Both circuits are front-panel controlled and may be easily adjusted for best performance over a wide range of operating conditions. Manual push-to-talk control may be used instead of VOX, if desired. The SBE accepts ALDC voltages from associated linear power amplifiers to minimize distortion and limit drive during high modulation peaks or load changes.

1-2. TECHNICAL SPECIFICATIONS.

The SBE technical specifications are listed below.

Frequency range	1.75 to 32 mcs (mHz) continuous, bandswitched.
Modes of operation	The following modes of operation may be selected and used with continuously adjustable amounts of carrier insertions. <ol style="list-style-type: none"> 1. AM with full carrier (same intelligence on both sidebands) (A3). 2. AM Equivalent. 3. Single Sideband (SSB) with any degree of carrier suppression from -55db to 0db. (A3A, A3J, A7A). *4. MCW (Telegraphy) (A2). (With appropriate tone keyer.) 5. Independent Sideband (ISB, separate intelligence on each sideband with any degree of carrier suppression from -55db to 0db). (A3B, A9B). **6. Frequency-Shift Keying (FSK) (F1). **7. CW Telegraphy (A1). **8. Facsimile (FAX) (F4).
Power output	0 to 250 mw PEP, continuously adjustable.
Output impedance	72 ohms unbalanced, nominal.
Frequency stability	<ol style="list-style-type: none"> 1. Crystal controlled, at least 1 part in 10^6 per day for 15°C change in temperature with the range of 0 to 50°C. 2. VFO controlled by external input. Stability that of external VFO.
Frequency control	10 crystals, front panel selected, plus external VMO input. All crystals contained in temperature controlled oven.

*With appropriate tone generator, such as TMC Model RCR, TMC Model TIS.

**With appropriate keyer, such as TMC Model XFK or TMC Model TIS.

1-2. TECHNICAL SPECIFICATIONS (CONT).

Tuning system	All front panel tuning controls directly calibrated in frequency.
Signal/Distortion ratio	Distortion products are at least 45 db below either tone of a standard two-tone test at 250 mw PEP output.
Unwanted sideband rejection	A signal of 500 cps (Hz) in the desired sideband is at least 60 db down from full PEP in the other sideband.
Spurious emission	All spurious outputs, as a result of internal mixing, are at least 60 db below full PEP output.
Carrier insertion	-55 db to full PEP output.
Harmonic suppression	Second harmonics are at least 40 db below full PEP output. All other harmonics are at least 50 db below full PEP output.
Audio response	SBE-8 ± 1.5 db from 250 to 3040 cps (Hz) SBE-9 ± 1.5 db from 250 to 7500 cps (Hz) SBE-10 ± 1.5 db from 250 to 6080 cps (Hz) (Other audio bandpass filters are available on special order.)
Audio inputs	1. 500,000 ohms for high impedance crystal or dynamic mike. -50 dbm input will provide full RF output. 2. Two independent 600 ohm channels, balanced or unbalanced, -20 dbm to +10 dbm. -20 dbm input will provide full RF output.
ALDC	SBE Models will accept 0 to approximately -11 volts d-c from ALDC circuit of an associated linear amplifier to improve linearity, limit distortion and deliver a relatively constant output level during high modulation peaks or load changes. It is recommended that the ALDC input voltage have an attack time of approximately 2 ms and a decay time of approximately 100 ms in order to give faithful reproduction on voice circuits and multichannel tone telegraph signal operation.
Voice operated relay	Voice operated relay, which includes anti-trip feature, adjustable gain and squelch, is provided.
Metering	Front panel meter with a five position switch provides metering of the following: 1. Calibration. 2. Lower sideband audio level. 3. Upper sideband audio level. 4. Carrier insertion level. 5. RF output level.
Environmental conditions	Designed to operate in any ambient temperature between 0° and 50°C, and any value of humidity up to 90%.
Storage conditions	Equipment will not be materially affected under storage of -20° to +65°C and humidity of 0 to 95%.
Keying information	For CW keying, connections are provided on rear terminal strip that opens the cathode circuit of the first r-f amplifier.

1-2. TECHNICAL SPECIFICATIONS (CONT).

Installation data	Exciter: Weight: Approximately 38 lbs. Size: 19" w x 8-3/4" h x 15" d.
	Power Supply: Weight: Approximately 35 lbs. Size: 19" w x 5-1/4" h x 8-5/8" d.
Primary power	115/230v, 50/60 cycles (Hz) single phase, 120 watts average. 140 watts with oven on.
Shipping data	130 lbs, domestic pack, 6 cu. ft. 140 lbs, level "A" pack, 9 cu. ft.
Components and construction	All equipment manufactured in accordance with JAN/MIL specifications wherever practicable.

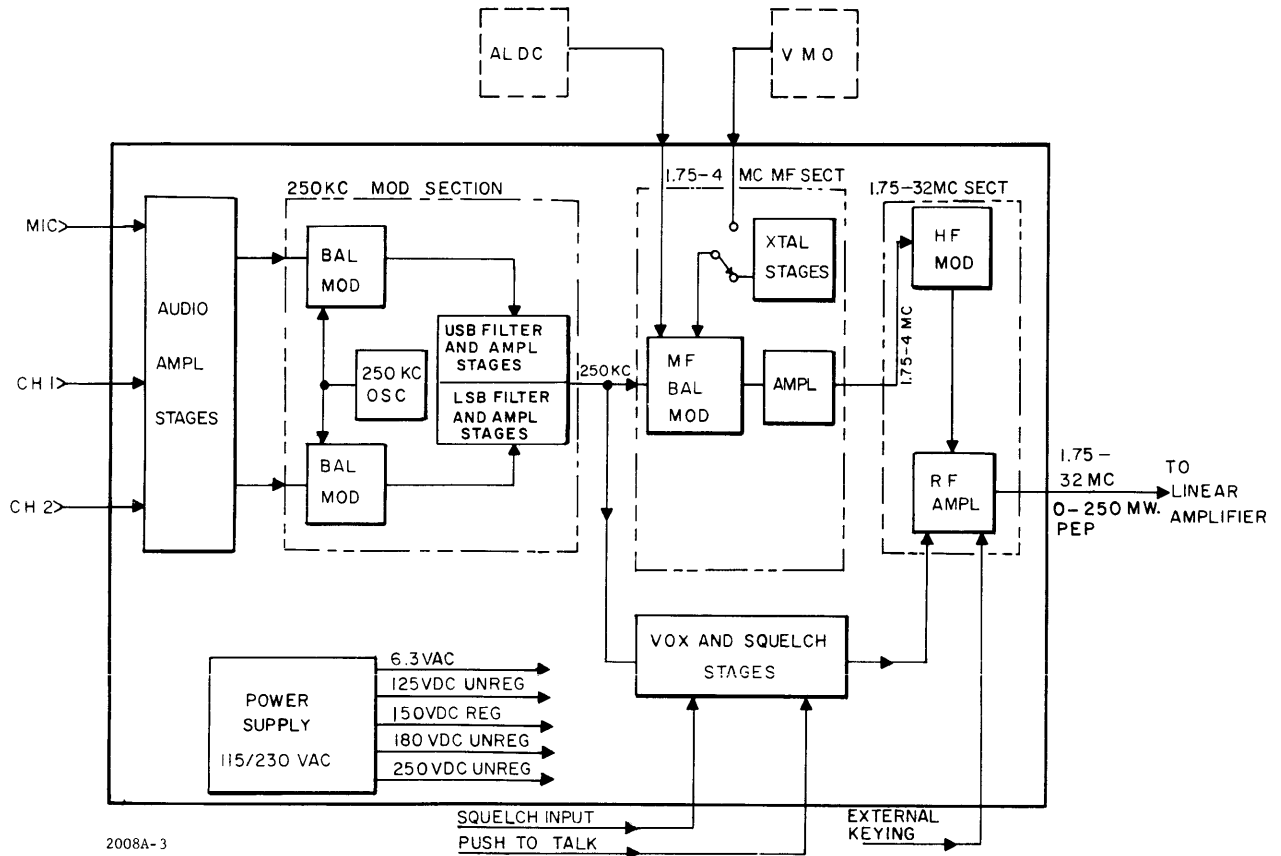


Figure 1-2. Simplified Block Diagram, Model SBE

SECTION 2 INSTALLATION

2-1. INITIAL INSPECTION.

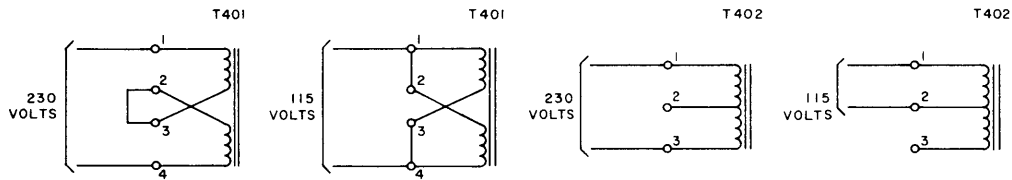
The SBE is calibrated and tested at the factory prior to shipment. When it arrives at the operating site, inspect the packing case and contents for possible damage. Inspect all packing material for parts that may have been shipped as "loose items". With respect to damage to the equipment for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and the furnishing of parts.

The equipment is shipped with all modules

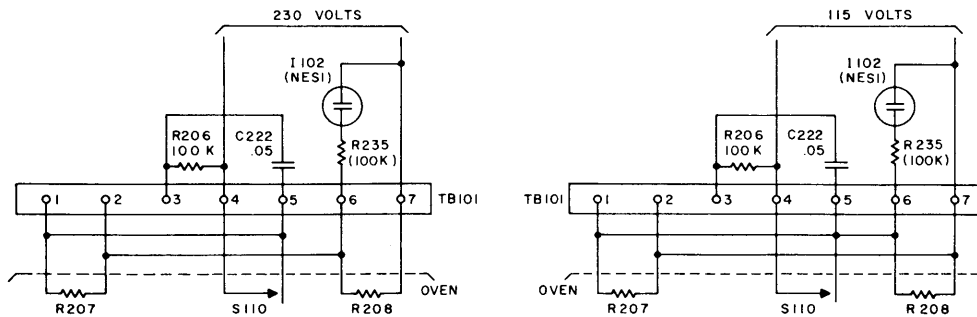
and other components installed. Check that all such components are properly positioned.

2-2. POWER REQUIREMENTS.

Refer to figure 2-1. The SBE is designed for 115/230 volt, 50 to 60 cycles (Hz), single phase power. Unless specifically ordered otherwise, the unit is shipped wired for 115 volt operation. Where 230 volt operation is required, wiring changes must be made to the SBE power supply and to the crystal oven; the power supply fuses (MAIN-3 ampere, and OVEN-2 ampere) must be changed to 1.5 and 1 ampere, respectively.



SKETCH A - POWER SUPPLY



SKETCH B - OVEN

2009A-4

Figure 2-1. Installation Diagram Showing 115-vs 230-Volt Power Supply Connections

2-3. INSTALLATION PROCEDURE.

To install the SBE, proceed as follows:

a. Mount the SBE and its power supply in a standard 19-inch relay rack or other housing desired. Figure 2-2 is an outline dimensional drawing of the SBE and its power supply.

b. Connect cable CA346-3-0 (supplied) from J402 (item 1, figure 2-3) power supply to J109 (item 2, figure 2-3) of the SBE.

c. Set three toggle switches in center of front panel at following positions: XMTR at OFF, EXCITER at STANDBY, POWER at OFF.

d. Connect cable CA-103-72 (supplied) from J401 (item 3) of power supply to a-c source.

e. Connect RF OUT connector J103 (item 4) to associated transmitter. Use one of two connectors (UG-260/U, or RF-59/U) supplied.

f. If an external VMO is to be used, connect it to VMO IN connector J104 (item 5) on rear of SBE and use the MF XTAL SW in the VMO position. Use one of two connectors (UG-260/U, or RF-59/U) supplied.

g. For local voice operation, connect high impedance (1/2-megohm) crystal or dynamic microphone to MIKE jack on front panel of SBE. Use microphone connector (PL132-3) supplied.

h. ALDC INPUT connector J113 (item 6), connected on rear apron of chassis, is furnished for connection of an ALDC (Automatic Load and Drive Control) signal. This ALDC signal may be obtained from any TMC linear amplifier.

i. An r-f monitor connector, RF MON J102 (item 7) is provided on rear apron of chassis. This connector is provided for sampling the r-f output signal with any suitable r-f monitoring device, such as the TMC Model PTE-3.

j. At terminal board E101, proceed as follows:

(1) Connect audio channel 1 to terminals 6, 7, and 8 (600-ohm balanced or unbalanced). Terminal 7 may be grounded for systems balanced to ground. Terminal 8 may be grounded for systems unbalanced to ground.

(2) Connect audio channel 2 to terminals 10, 11, and 12. Terminal 11 may be grounded for systems balanced to ground. Terminal 12 may be grounded for systems unbalanced to ground.

(3) Other inputs on terminal board E101 include the following:

(a) Terminal 1 and ground are intended for push-to-talk keying line when VOX and SQUELCH circuits are not in use.

(b) Terminal 2 (ground) and terminal 3 (key) are CW keying terminals and are normally connected by a jumper when CW is not being used.

(c) Terminal 4 is grounded by K101 (SBE control relay) and can be used to energize an associated r-f amplifier or transmitter.

(d) Terminal 13 is in the SQUELCH input which is normally obtained from the 600-ohm output of a receiver at the operating position.

(e) Terminals 5, 9, and 14 grounded.

2-4. INITIAL ADJUSTMENTS AND INSTALLATION OF MF CRYSTALS.

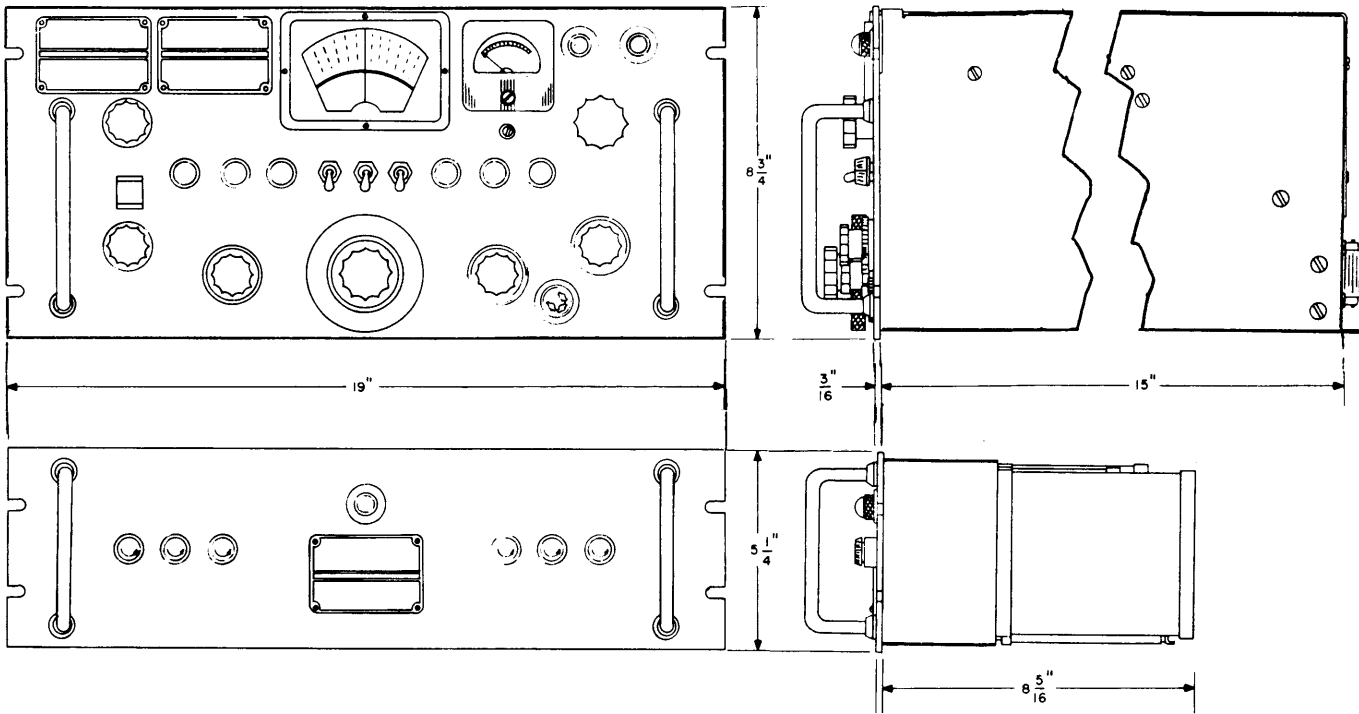
Proceed as follows:

a. Set POWER switch at ON. Allow 1-hour warm-up period to allow crystal ovens to reach operating temperatures ensuring frequency stability.

b. After 1-hour warm-up period, turn METER SW to CAL and zero meter M101 (if necessary) by screwdriver adjustment through the front panel opening located directly beneath the meter.

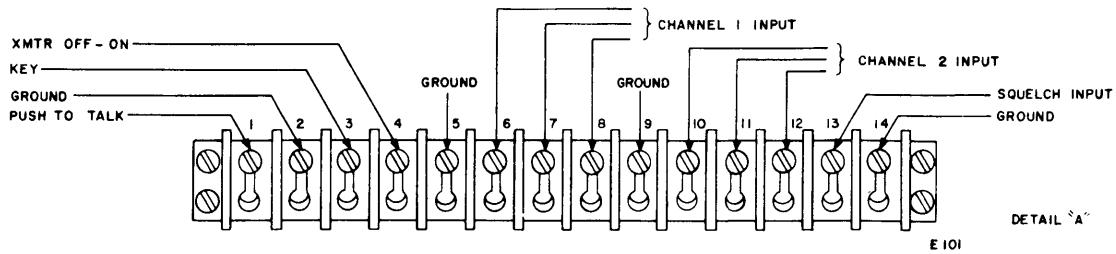
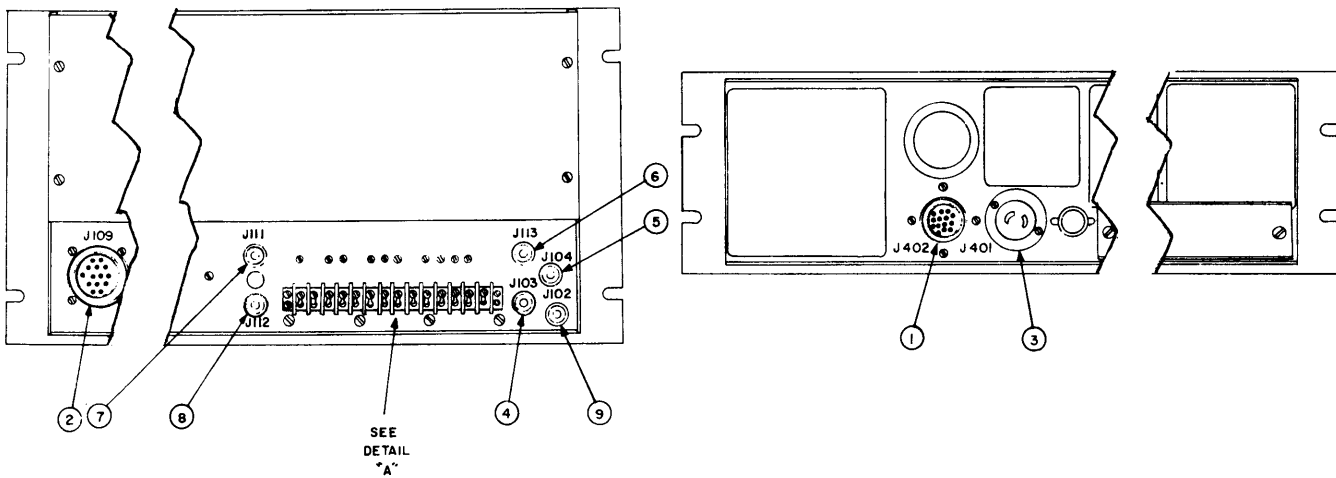
c. The equipment is now ready to be tuned. (Refer to Section 3.)

Refer to paragraph 4-4 for proper crystal selection for desired output frequency. To insert crystals, open oven top by turning snap screws half-turn counterclockwise. Remove cover and celotex insulation and install crystals. Sockets 1, 2, 3, etc., correspond to positions of front panel switch MF XTAL SW. The crystal trimmers are factory adjusted for average crystals, but for more accurate frequency adjustment, beat crystals against any accurate frequency standard. An adjustment tool is provided for trimmer adjustments.



2008A-4

Figure 2-2. Dimensional Outline Diagram, SBE



2008A-5

Figure 2-3. Rear Panel Connections, SBE

SECTION 3 OPERATOR'S SECTION

3-1. OPERATING CONTROLS.

The operating controls for the SBE are located on the front panel of the exciter unit

(see figure 3-1); the protective fuses are located on the front panel of the power supply (see figure 3-2). The operating controls are listed in table 3-1; the protective fuses are listed in table 3-2.

TABLE 3-1. OPERATING CONTROLS

ITEM NUMBER (Figure 3-1)	PANEL DESIGNATION	FUNCTION
1	MF XTAL SW, S107	11-position selector switch. Selects either external VMO (variable master oscillator) or proper internal crystal for medium frequency oscillator.
2	Two Section Dial	Upper dial coordinates with OUTPUT TUNING (disc, vernier) and lower dial with MF TUNING (knob).
3	XMTR switch, S104	ON-activates associated transmitter. Eliminates need for VOX or push-to-talk, through EXCITER (below) by completing the ground circuit of the XMTR final plates relay. OFF-associated transmitter operated by VOX or push-to-talk circuit when EXCITER switch is in STANDBY position.
4	EXCITER switch, S105	ON-activates SBE without need for VOX or push-to-talk input and without associated operating transmitter. STANDBY-allows VOX or push-to-talk operation to activate the SBE and its associated transmitter.
5	POWER switch, S103	ON-applies line voltage to SBE power supply. OFF-turns off entire SBE.
6	Meter, M101	Indicates signal levels in circuits selected by METER SW, S109.
7	EXCITER lamp, I101	Glow during operation when EXCITER switch is in ON-position or SBE is activated by VOX or push-to-talk.
8	OVEN lamp, I102	Glow during operation when thermostats demand crystal-oven heating (automatic).
9	METER SW, S109	Selects point in system to be measured by built-in VTVM circuit. CAL position is used to zero meter.
10	USB switch, S101	Selects audio input source for upper sideband channel.
11	USB GAIN control, R168	Adjusts level of USB audio input.

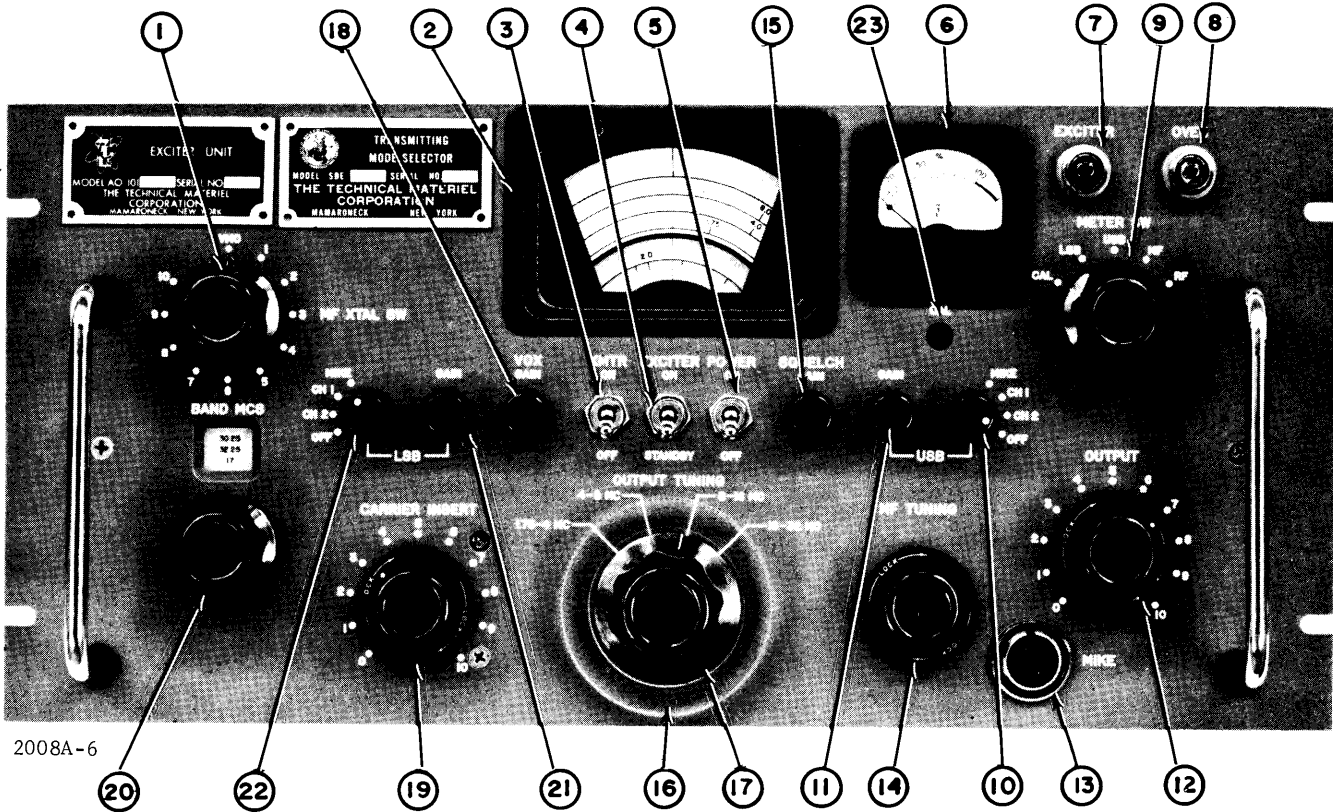


Figure 3-1. Operating Controls, SBE

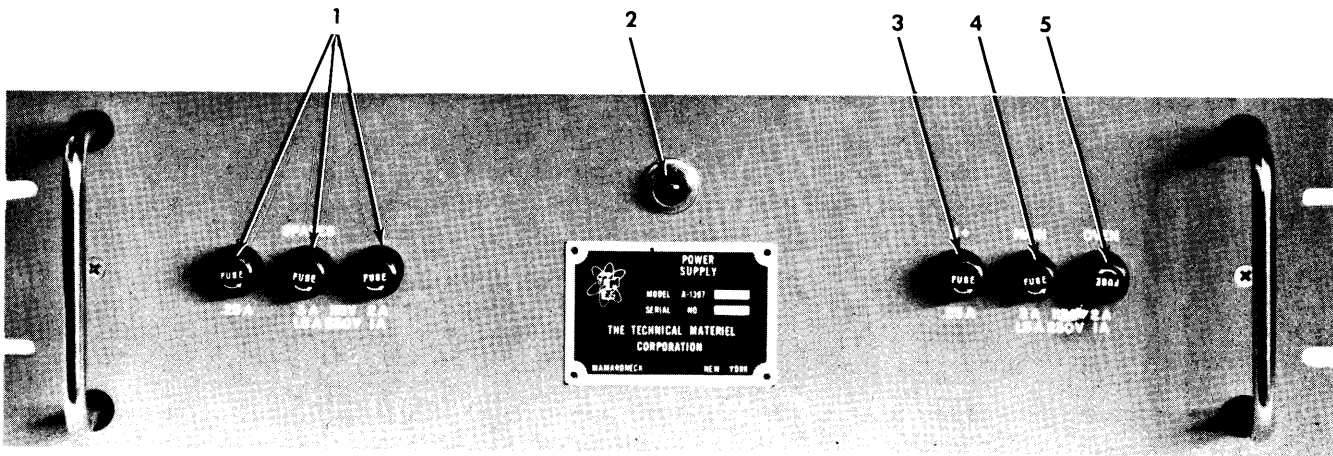


Figure 3-2. Front Panel, Power Supply, SBE

TABLE 3-1. OPERATING CONTROLS (Cont'd)

ITEM NUMBER (Figure 3-1)	PANEL DESIGNATION	FUNCTION
12	OUTPUT control, R205	Adjusts SBE output power level.
13	MIKE jack, J101	Microphone input (substitute for 600-ohms channel input).
14	MF TUNING, C167 A, B	Selects setting of medium frequency as indicated in lower section of main tuning dial.
15	SQUELCH GAIN control, R129	Used in conjunction with VOX GAIN. (Refer to paragraph 4-6).
16	OUTPUT TUNING vernier capacitor, C181 A, B and C	Disc variable capacitor that adjusts setting of main tuning dial centrally located above knob.
17	OUTPUT TUNING switch, S106	4-position switch that selects output frequency band.
18	VOX GAIN control, R140	Voice-operated exciter circuit gain control.
19	CARRIER INSERT control, R263	Controls level of carrier insertion.
20	BAND MCS switch, S108	Indicates injection frequency range of high-frequency modulator in 2 mc increments. It is controlled by the knob beneath the dial.
21	LSB GAIN control, R169	Selects audio input source for lower sideband channel.
22	LSB switch, S102	Adjusts level of LSB audio input.
23	CAL potentiometer, R135	Screwdriver adjustment to zero meter when METER SW is in CAL position. Balances the conduction of both halves of meter tube V112.

TABLE 3-2. PROTECTIVE FUSES

ITEM NUMBER (Figure 3-2)	PANEL DESIGNATION	FUNCTION
1	SPARE	Spare fuses.
2	Indicator lamp, I401	Glow during operation. Indicates that MAIN fuse is intact and that power is applied.
3	B+ fuse	0.25 ampere protective fuse for B+ circuits.
4	MAIN fuse	3.0 ampere protective fuse for power supply. When 230 volts a-c power is used fuse value is changed to 1.5 ampere.
5	OVEN fuse	2.0 ampere protective fuse for oven. When 230 volts a-c power is used fuse value is changed to 1.0 ampere.

3-2. PRELIMINARY CONSIDERATIONS.

Before attempting to operate the SBE, the following must be considered:

- a. Mode of transmission desired.
- b. Output frequency desired (crystal selection or use of VMO).

Input circuit controls are as follows:

- a. LSB (channels, GAIN). Varies gain of intelligence in LSB.
- b. USB (channels, GAIN). Varies gain of intelligence in USB.
- c. MIKE. Varies microphone gain.

LSB control places audio channel 1, 2, or MIKE in the lower sideband position; USB control places audio channel 1, 2, or MIKE in the upper sideband position. A microphone connection is made to MIKE connector.

Initially, output frequency requirements are concerned with the following front panel controls: MF XTAL SW (1), BAND MCS (20), and OUTPUT TUNING knob (bandswitch element 17). Subsequently, tuning concerns the following front panel controls: OUTPUT TUNING disc (tuning element 16), MF TUNING (14), OUTPUT (level control 12), and METER SW (9) and its associated meter.

The first consideration is whether the medium frequency 1.75-4 MC is to be supplied by an external VMO or an internal crystal. If by a VMO, the MF XTAL SW is placed in the VMO position; if by a crystal, MF XTAL SW is placed in the position that selects the proper crystal. More information on this phase of operation is given in the discussion below of medium frequency circuit controls.

The output frequency (f_o) desired requires the use of the proper medium frequency (f_{mf}) whether supplied by an external VMO or a crystal. If the desired output frequency (f_o) is between 4.25 and 32.25 mc, adjust the BAND MCS switch (20, figure 3-1) to the frequency range containing the output frequency desired. Located below the desired frequency range on the BAND MCS dial is a number hereafter referred to as the Dial Numeric. This Dial Numeric is used to compute the crystal or VMO frequency (f_x).

This frequency is computed by using the following formula:

$$f_x = (2N - f_o) + 0.250 \text{ mc.}$$

where: f_x = Internal crystal or external VMO frequency.

f_o = output frequency.

N = Dial Numeric (see chart below and figure 3-3).

0.250 mc = Internally generated mixing frequency.

BAND MCS DIAL MARKINGS

(f_o) OUTPUT FREQ. RANGE	(N) DIAL NUMERIC	INJECTION FREQ.
1.75 - 4.25 mc	0	(see note)
4.25 - 6.25 mc	4	8 mc
6.25 - 8.25 mc	5	10 mc
8.25 - 10.25 mc	6	12 mc
10.25 - 12.25 mc	7	14 mc
12.25 - 14.25 mc	8	16 mc
14.25 - 16.25 mc	9	18 mc
16.25 - 18.25 mc	10	20 mc
18.25 - 20.25 mc	11	22 mc
20.25 - 22.25 mc	12	24 mc
22.25 - 24.25 mc	13	26 mc
24.25 - 26.25 mc	14	28 mc
26.25 - 28.25 mc	15	30 mc
28.25 - 30.25 mc	16	32 mc
30.25 - 32.25 mc	17	34 mc

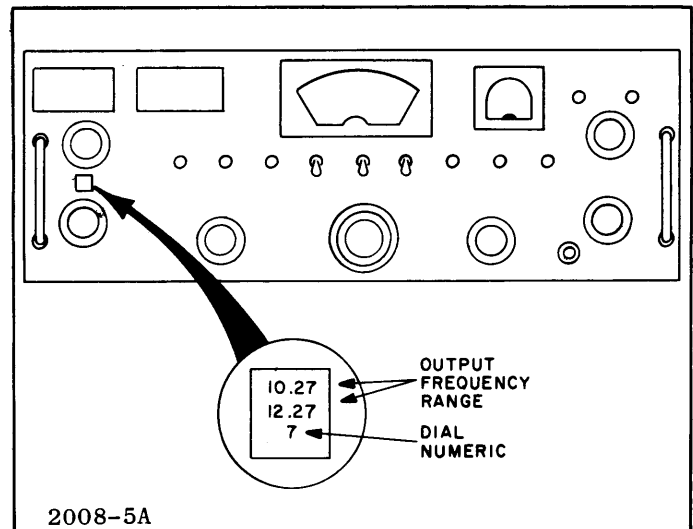


Figure 3-3. Dial Numeric Vs Frequency Range

NOTE

The MF dial, moving in conjunction with the MF TUNING control (item 14, figure 3-1) is calibrated to read 250 mc above the actual MF frequency. Therefore, the MF dial reads the VMO or crystal MF injection frequency resulting in f_x - MF dial reading.

Example:

Suppose an output frequency of 10.5 mc is desired:

$$f_x = 2N - f_o + .250 \text{ mc}$$

$$f_x = 14.0 \text{ mc} - 10.5 \text{ mc} + .250 \text{ mc}$$

$$f_x = 3.750 \text{ mc}$$

NOTE

When the output frequency is in the frequency range of 1.75 to 4.25 mc, there is no dial numeric. Therefore, an 18 mc injection frequency is applied to the HF Balanced Modulator. This is done to maintain bias on the modulator diodes, to prevent intermodulation distortion. Since the RF amplifiers are tuned to the 1.75 to 4.25 mc range, the sum and difference frequencies, produced by the 18 mc injection frequency will be far removed, and thus will have no effect on circuit operation.

The degree of 250 kc carrier insertion is controlled by the front panel CARRIER INSERT (19) control which varies the level of carrier

in relation to sideband intelligence. The magnitude of the carrier relative to sidebands may be determined by use of a spectrum analyzer.

The medium frequency modulator is adjusted by the CARRIER INSERT (19), MF TUNING (14) and METER SW (9) controls. The medium frequency modulator receives 250 kc sideband signals and VMO of MF XTAL frequencies. Its output circuit is tuned to the lower sideband of the VMO or MF XTAL frequency.

The high frequency modulator, together with the RF circuit tuning elements, are adjusted by the front panel BAND MCS (20), OUTPUT TUNING (16) (17), OUTPUT (12) and METER SW (9) controls.

The high frequency modulator receives the lower sideband output of the medium frequency modulator in addition to the output of the high frequency crystal oscillator. The output and RF circuits are tuned to the lower sideband of the high frequency crystal oscillator's frequency, to prevent signal inversion.

Referring to meter circuit and miscellaneous controls, the exciter operated with the front panel controls listed below as shown:

VOX GAIN (18):	Fully ccw
XMTR (3):	ON
EXCITER (4):	ON
POWER (5):	ON
SQUELCH GAIN (15):	Fully ccw

Refer to Section 4, Principles of Operation for further details.

3-3. SINGLE SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION.

STEP	PANEL CALLOUT NO.	OPERATION	PURPOSE
Part I - Tuneup on Carrier:			
1	3	XMTR toggle switch, ON.	Not effective on tuneup on carrier.
2	4	EXCITER toggle switch, ON.	Refer to paragraph 4-6.
3	18	VOX GAIN, fully ccw.	
4	15	SQUELCH GAIN, fully ccw.	
5	21, 22	LSB, OFF/GAIN, fully ccw.	Not in circuit during tuneup on carrier
6	10, 11	USB, OFF/GAIN, fully ccw.	
7	5, 8	POWER toggle switch, ON.	Energizes unit. OVEN indicator 8 should go on.
8	1	MF XTAL SW, use correct MF VMO/XTAL, frequency.	Refer to paragraph 3-2.

3-3. SINGLE SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION (Cont'd).

STEP	PANEL CALLOUT NO.	OPERATION	PURPOSE
Part I - Tuneup on Carrier (Cont'd).			
9	20	BAND MCS, use correct MF frequency.	Refer to Paragraph 3-2.
10	19	CARRIER INSERT, fully cw.	Provides 100% carrier.
11	9	METER SW, MF position.	In preparation for step 13.
12	16, 17, 2	OUTPUT TUNING switch: knob 17 (coarse setting) for proper band, and disc 16 (vernier setting) for a frequency slightly below the desired output frequency on multi-scale dial 2.	In preparation for step 13.
13	14, 6, 19, 2	MF TUNING knob 14, tune MF. Peak SBE's meter 6 reading.	Decrease CARRIER INSERT 19 as necessary to avoid an off-scale reading. The reading on single-scale dial 2 should agree with the frequency of VMO on MF XTAL SW; except when tuning for an operating frequency between 3.75 and 4.25 mc.
14	9	METER SW, RF position.	In preparation for step 15.
15	16, 6	OUTPUT TUNING disc 16, tune RF. Peak SBE's meter 6 reading.	Advance the OUTPUT TUNING vernier switch 17 slightly to peak the reading on the SBE's meter.
<i>NOTE</i>			
<i>Several peaks, due to modulation products, are possible. The correct (lower sideband) peak is the first one encountered as the vernier switch is slightly advanced</i>			
16	12, 19	Adjust OUTPUT knob 12 to control magnitude of the RF output.	Operation of OUTPUT knob 12 controls the magnitude of the RF output. The same is true by operating CARRIER INSERT switch 19.
17		The SBE is now tuned on carrier.	
Part II - Tuneup on SSB with Any Degree of Carrier Insertion:			
18	21, 22	LSB circuit to CH 1, CH 2, or MIKE as required. Set GAIN to mid position.	To place audio channel in lower sideband.
19	10, 11	USB circuit to CH 1, CH 2, or MIKE as required. Set GAIN to mid position.	To place audio channel in upper sideband.

3-3. SINGLE SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION (Cont'd).

STEP	PANEL CALLOUT NO.	OPERATION	PURPOSE
Part II - Tuneup on SSB with Any Degree of Carrier Insertion (Cont'd).			
20	19	Set CARRIER INSERT to 0.	To suppress carrier 100%. (-55 db)
21	6, 9, 10, 11 21, 22	Set METER SW 9 to USB or LSB. Advance or decrease GAIN control 11 or 21 as required until meter shows a maximum reading of 100 on audio peaks. (Lower peak values are frequently compatible with sufficient RF output as determined by the subsequent setting of OUTPUT control 12).	<i>CAUTION</i> <i>With METER SW 9 in USB, LSB, or RF position, meter peaks must never exceed 100 as intermodulation distortion may become excessive beyond this point.</i>
22	9	Set METER SW 9 to RF position.	Preparatory to step 23.
23	12, 19	Adjust OUTPUT control 12 for desired level simultaneously with adjusting CARRIER INSERT control 19 for desired degree of carrier insertion.	
24	6, 9, 12, 19	With METER SW 9 in RF position and CARRIER INSERT 19 in 0 position, set OUTPUT control 12 to give meter 6 reading of 90 with one of the audio channels in operation. Now advance CARRIER INSERT control 19 until meter 6 reading becomes 100.	Steps 24 and 25 illustrate the procedure to inject a carrier 20 db down from PEP. Increasing a meter reading of 90 due to audio with no carrier and to 100 with carrier (audio level unchanged) signifies a carrier level of 10% (-20 db) of the combined audio and carrier level.
<i>NOTE</i>			
<i>As explained more fully in Section 5, the SBE's meter circuit, as is the case with most VTVM's, has a small amount of waveform error. For this reason, carrier and sideband additions may not be precisely linear.</i>			
25	12	Decrease OUTPUT control 12 for desired PEP output. Do not change audio and carrier settings (11, 19, and 21).	Decreases audio and carrier proportionately.

3-4. DOUBLE SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION.

Part I, tuneup on carrier, is the same as part I in paragraph 3-2. After completing part I, proceed as follows: (For convenience, the following steps, 18 through 32, assume that

channel 1 is used on both lower and upper sidebands with either 0- or 10-percent carrier insertion. In case channel 2 is used on both lower and upper sidebands with either 0- or 10-percent carrier insertion, substitute CH 2 for CH 1 in the settings of USB 10 and LSB 22 controls.)

3-4. DOUBLE SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION (Cont'd).

STEP	PANEL CALLOUT NO.	OPERATION	PURPOSE								
Part II - Tuneup on DSB with Any Degree of Carrier Insertion (Cont'd).											
<p><i>NOTE</i></p> <p><i>Step numbering begins with 18 since this part II follows part I of paragraph 3-3.</i></p>											
18	21, 22	LSB circuit to CH 1; set GAIN to quarter-scale.	To place desired audio channel in lower sideband.								
19	19	CARRIER INSERT, set to 0.	To suppress carrier 100%.								
20	10, 11	USB circuit to OFF; set GAIN to quarter-scale.	To cut off desired audio channel in upper sideband.								
21	9	Set METER SW to LSB. (On 1.75-4 Mc band set METER SW to USB.)	To measure desired audio channel level in lower sideband.								
22	6, 20	Adjust LSB GAIN until the meter shows the following readings on audio peaks: <table data-bbox="475 877 814 1035"> <tr> <td>Carrier Insertion</td> <td>Audio Peaks</td> </tr> <tr> <td>Eventually Wanted</td> <td></td> </tr> <tr> <td>0</td> <td>50</td> </tr> <tr> <td>10% (-20db)</td> <td>45</td> </tr> </table>	Carrier Insertion	Audio Peaks	Eventually Wanted		0	50	10% (-20db)	45	To obtain proper desired audio channel level in lower sideband with or without 10% carrier insertion.
Carrier Insertion	Audio Peaks										
Eventually Wanted											
0	50										
10% (-20db)	45										
23	22	Set control 22 to OFF.	To cut off desired audio channel in lower sideband.								
24	10, 11	USB circuit to CH 1; set GAIN to quarter-scale.	To place desired audio channel in upper sideband.								
25	19	CARRIER INSERT, leave on 0.	To suppress carrier 100%.								
26	9	Set METER SW to USB. (on 1.75-4 Mc band set METER SW to LSB.)	To measure desired audio channel level in upper sideband.								
27	6, 11	Adjust USB GAIN until the meter shows the following readings on audio peaks: <table data-bbox="475 1455 814 1612"> <tr> <td>Carrier Insertion</td> <td>Audio Peaks</td> </tr> <tr> <td>Eventually Wanted</td> <td></td> </tr> <tr> <td>0</td> <td>50</td> </tr> <tr> <td>10% (-20db)</td> <td>45</td> </tr> </table>	Carrier Insertion	Audio Peaks	Eventually Wanted		0	50	10% (-20db)	45	To obtain proper desired audio channel level in upper sideband with or without 10% carrier insertion.
Carrier Insertion	Audio Peaks										
Eventually Wanted											
0	50										
10% (-20db)	45										
28	9	Set METER SW to RF.	To measure audio levels after RF modulation.								
29	12, 6	Advance OUTPUT control 12 from 0 until meter 6 reads same as in step 27.	Check that LSB switch is OFF and USB switch is in desired channel.								
30	10, 22	Set USB switch to OFF and LSB switch to its desired channel.	Check that METER SW is in RF position.								

3-4. DOUBLE SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION (Cont'd).

STEP	PANEL CALLOUT NO.	OPERATION	PURPOSE
Part II - Tuneup on DSB with Any Degree of Carrier Insertion (Cont'd).			
31	6, 21	Note reading on meter 6. Readjust LSB GAIN control 21 until meter 6 reads same as in step 22.	
32	6, 22, 10	Turn controls 22 and 10 to place CH 1 in both sidebands. Meter 6 should now read as follows on peaks: Carrier Insertion Finally <u>Wanted</u> <u>Audio Peaks</u> 0 100 10% (-20db) 90	
NOTE			
<i>As explained more fully in Section 5, the SBE's meter circuit, as is the case with most VTVM's, has a small amount of waveform error. For this reason, carrier and sideband additions may not be precisely linear.</i>			
33	19	Set CARRIER INSERT to give desired amount of carrier insertion. For 0 insertion: turn control 19 to 0; peak readings on meter 6 should reach 100. For 10% (-20db) insertion: advance control 19 until peak readings on meter 6 rise from 90 to 100.	

3-5. INDEPENDENT SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION.

Part I, tuneup on carrier, is the same as part I in paragraph 3-3. After completing part I, proceed as follows: (For convenience, the following steps, 18 through 32, assume that channel 1 is used on the lower sideband

and channel 2 is used on the upper sideband with either 0- or 10-percent carrier insertion. In case channel 1 is used on the upper sideband and channel 2 is used on the lower sideband with either 0- or 10-percent carrier insertion, substitute CH 2 or CH 1 and vice versa in the settings of USB 10 and LSB 22 controls.)

STEP	PANEL CALLOUT NO.	OPERATION	PURPOSE
Part II - Tuneup on ISB with Any Degree of Carrier Insertion:			
NOTE			
<i>Step numbering begins with 18 since this part II follows part I of paragraph 3-2.</i>			
18	21, 22	LSB circuit to CH 1; set GAIN to quarter-scale.	To place desired audio channel in lower sideband.
19	19	CARRIER INSERT, set to 0.	To suppress carrier 100% (-55db).
20	10, 11	USB circuit to OFF; set GAIN to quarter-scale.	To cut off desired audio channel in upper sideband.

3-5. INDEPENDENT SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION (Cont'd).

STEP	PANEL CALLOUT NO.	OPERATION	PURPOSE
Part II - Tuneup on ISB with Any Degree of Carrier Insertion (Cont'd):			
21	9	Set METER SW to LSB (On 1.75-4 Mc band set METER SW to USB.)	To measure desired audio channel level in lower sideband.
22	6, 20	Adjust LSB GAIN until the meter shows the following readings on audio peaks: Carrier Insertion Eventually <u>Wanted</u> <u>Audio Peaks</u> 0 50 10% (-20db) 45	To obtain proper desired audio channel level in lower sideband with or without 10% carrier insertion.
23	22	Set LSB channel control 22 to OFF.	To cut off desired channel in lower sideband.
24	10, 11	USB circuit to CH 1; set GAIN to quarter-scale.	To place desired audio channel in upper sideband.
25	19	CARRIER INSERT, leave on 0.	To suppress carrier 100% (-55 db).
26	9	Set METER SW 9 to USB. (On 1.75-4 Mc band set METER SW to LSB.)	To measure desired audio channel level in upper sideband.
27	6, 11	Adjust USB GAIN until the meter shows the following readings on audio peaks: Carrier Insertion Eventually <u>Wanted</u> <u>Audio Peaks</u> 0 50 10% (-20db) 45	To obtain proper desired audio channel level in upper sideband with or without 10% carrier insertion.
28	9	Set METER SW 9 to RF.	To measure audio levels after RF modulation.
29	12, 6	Advance OUTPUT control 12 from 0 until meter 6 reads same as in step 27.	Check that LSB switch is OFF and USB switch is in desired position.
30	10, 22	Set USB switch to OFF and LSB switch to its desired channel.	Check that METER SW is in RF position.
31	6, 21	Note reading on meter 6. Re-adjust LSB GAIN control 21 until meter 6 reads same as in step 22.	

3-5. INDEPENDENT SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION (Cont'd).

STEP	PANEL CALLOUT NO.	OPERATION	PURPOSE
Part II - Tuneup on ISB with Any Degree of Carrier Insertion (Cont'd):			
32	6, 22, 10	Turn controls 22 and 10 to place CH 1 or CH 2 in both sidebands. Meter 6 should now read as follows on peaks: Carrier Insertion Finally Wanted 0 10% (-20db)	Audio Peaks 100 90
NOTE <i>As explained more fully in Section 5, the SBE's meter circuit, as is the case with most VTVM's, has a small amount of waveform error. For this reason, carrier and sideband additions may not be precisely linear.</i>			
33	19	Set CARRIER INSERT 19 to give desired amount of carrier insertion. For 0 insertion: turn control 19 to 0; peak readings on meter 6 should reach 100. For 10% (-20db) insertion: advance control 19 until peak readings on meter 6 rise from 90 to 100.	

3-6. CONVENTIONAL AM OPERATION.

Part I, tuneup on carrier, is the same as part I in paragraph 3-3. Part II, conventional AM operation (50-percent carrier insertion) is the same as part II in paragraph 3-4 except for the following modifications:

a. Steps 22 and 27 should be modified as follows:

<u>Carrier Insertion</u> <u>Eventually Wanted</u>	<u>Audio Peaks</u>
50% (-6db)	25

b. Step 32 should be modified as follows:

<u>Carrier Insertion</u> <u>Finally Wanted</u>	<u>Audio Peaks</u>
50% (-6db)	50

c. Step 33 should be modified as follows: Set CARRIER INSERT to give desired amount of carrier insertion. For 50% (-6db) insertion: advance control 19 until peak readings on meter 6 rise from 50 to 100.

3-7. FREQUENCY-SHIFT TELEGRAPH OPERATION.

In frequency-shift telegraph operation, the SBE must obtain a frequency-shift signal from any suitable external source, such as a TMC Model XFK, Frequency Shift Exciter or a TMC Model TIS-3, Tone Intelligence Unit. To obtain frequency-shift telegraph operation, perform the following steps:

- a. Perform the procedure described in paragraph 3-3, step 1 of this manual.
- b. Set the CARRIER INSERT potentiometer (item 19, figure 3-1) to position 10.
- c. Set the MF XTAL SW (item 1, figure 3-1) to the VMO position.
- d. Connect the frequency shift signal to the SBE VMO connector J104.

3-8. CW TELEGRAPH OPERATION.

Part I, tuneup on carrier, is the same as part I in paragraph 3-3. Part II, CW telegraph operation, is as follows:

- a. Remove jumper from pins 2 and 3. (E101 on rear of SBE.)
- b. Attach key from pin 3 to ground.
- c. Turn LSB and USB switches 22 and 10 to OFF position.
- d. Turn CARRIER INSERT 19 to fully cw position.
- e. Turn METER SW 9 to RF position.
- f. Advance OUTPUT 12 control to drive transmitter with proper SBE output.

3-9. VOX AND SQUELCH CIRCUIT OPERATION.

The VOX and SQUELCH circuits may be used when transmitters are actuated by speech into an associated microphone. In this case, the VOX circuit should be adjusted so that only the intermittent voice peaks actuate the VOX relay which turns on the transmitter. The time constant of the VOX circuit is such that the intermittent voice peaks keep the transmitter turned on so long as there is reasonably strong speech coming into the MIKE. Otherwise, a transmitter is turned on manually or by keying. The SQUELCH circuit, on the other hand should be adjusted so that extraneous sounds that reach the MIKE do not turn on the transmitter. Of course, if the extraneous sounds are loud enough, the action of the VOX circuit overpowers that of the SQUELCH circuit; consequently, the transmitter is turned on in this case. General field practice is such that the VOX and SQUELCH circuits are rarely used.

a. VOX ADJUSTMENT. - The VOX circuit functions only in SSB and DSB operation of the unit and not with conventional AM or SSB with carrier. Proceed as follows:

- (1) Set EXCITER ON-STANDBY switch 4 to STANDBY position.
- (2) Talking directly into the mike, adjust VOX GAIN control 19 until EXCITER lamp 7 remains on with normal speech level but extinguishes with no speech input. Further adjustment may be necessary to prevent background noises from actuating the exciter.

b. SQUELCH GAIN ADJUSTMENT. - Proceed as follows:

(1) Make connection from the 600-ohm audio output terminals of the station receiver to terminal 13 and ground on terminal board E101 of the SBE.

(2) Advance SQUELCH GAIN 15 until audio from the station receiver no longer trips the VOX circuit.

3-10. OPERATOR'S MAINTENANCE.

The operator should make minor adjustments of tuning controls to verify proper tuning, note general condition of panel switches, observe whether panel indicator lamps light properly, and check the condition of the three panel fuses as well as that of all tubes. All fuses and a power indicator lamps are located on the front panel of the power supply. The locations of all tubes in the SBE are indicated by the tube location diagram action of figure 5-1.

The SBE has triple fuse protection: oven heater, power supply primary, and high voltage. (Since a partial short across the B+ line may not blow the line fuse, this separate high voltage fuse has been incorporated in the unit.)

If no meter readings can be obtained or the EXCITER lamp (item 7 on figure 3-1) fails to go on when the POWER switch (item 5 on figure 3-1) is in the ON position, check F403 (B+ fuse). If dial lights and tube filaments fail to go on when POWER switch is in the ON position, check F402 (MAIN fuse). If after 1-hour warm-up period, the OVEN lamp (item 8 on figure 3-1) fails to cycle every 4 or 5 minutes, check F401 (OVEN fuse).

CAUTION

Never replace a fuse with one of higher rating unless continued operation is more important than probable damage to the equipment. If a fuse burns out immediately after replacement, do not replace it a second time until the trouble has been located and corrected.

SECTION 4

PRINCIPLES OF OPERATION

4-1. BLOCK DIAGRAM ANALYSIS.

Refer to figure 4-1. The SBE comprises seven major sections: (1) audio input section, (2) 250-kc oscillator and balanced modulator section, (3) 1.75- to 4-mc MF section, (4) 1.75- to 32-mc HF section, (5) squelch and VOX section, (6) M101 meter section, (7) power-supply section.

The Audio Input Section provides input circuits for two 600-ohm line channels (balanced or unbalanced) and one microphone channel. All three input channels are applied to function switches S101 and S102 (600-ohm line channels via transformers T101 and T102; microphone input via pre-amplifier V101) for routing through a section of the bandswitch (which corrects sideband reversal in the 1.75-4.250 mc range) to upper- or lower-sideband amplifiers V123A and V122A. The amplified outputs of V123A and V122A are transformer coupled via T103 and T104 to audio balanced modulator stages contained in the 250-KC Oscillator and Balanced Modulator Section. Two meter amplifiers (V122B and V123B) and associated rectifier circuits (CR111 and CR112) contained in the Audio Input Section provide power-level indications of incoming audio signals.

NOTE

Although the SBE-8,9, and 10 employ different bandpass filters (refer to technical specifications given in section 1), the principles of operation for each is the same. Therefore, only the SBE-10 is discussed in the following paragraphs.

Audio input signals applied to the balanced modulators (CR115 and T125, CR116 and T120) are beat with the 250-KC output of oscillator V105. The resultant output (reduced carrier with upper and lower sideband intelligence) is amplified and applied to upper and lower sideband filters. LSB filter Z110 passes a small amount of 250-kc carrier and signals in the 250 -6.0 kc frequency range whereas USB filter Z111 passes a small amount of 250-kc carrier and signals in the 250 +6.0 frequency range. The outputs of both filters are applied simultaneously to: (1) amplifiers V128A and V128B; (2) notch filter Z112. The notch filter removes the 250-KC carrier component from the two sideband signals which are then applied to amplifier V126. 250-kc carrier re-insertion is accomplished at V126 through a 90-degree phase shift network thus providing a true AM signal. The amplified out-

put (sideband intelligence) of V126 is transformer coupled to the MF balanced modulator stage contained in the 1.75- to 4 mc Section. The amplified outputs of V128A and V128B are applied to upper- and lower-sideband meter amplifiers for monitoring purposes.

Sideband intelligence (centered at 250 kc) applied to balanced modulator V113 is mixed with a 2- to 4.25-mc injection frequency provided by internal crystals or a variable master oscillator (VMO). The resultant, a sideband signal in the 1.75 to 4.0-mc frequency range, is amplified by V114 and then transformer coupled to Z107 in the 1.75- to 32-mc HF Section. An ALDC input to balanced modulator tube V113 increases d-c grid bias on strong modulation bursts from the associated linear amplifier thus reducing the output level of V113.

The 1.75- to 4-mc signal applied to Z107 is: (1) mixed with the output of HF oscillator V117 to produce a 4- to 32-mc signal which is then applied to r-f amplifiers V118, V119, V120; (2) applied directly to the r-f amplifiers. In the 4- to 32-mc output-frequency range, injection signals from 8- to 34-mc in 2-mc steps are applied to HF oscillator V117 via the BAND MCS switch. When the BAND MCS switch is set at the 1.75- to 4.25-mc position, an 18-mc injection signal is applied to Z107 to prevent inter-modulation distortion. The results of this 18-mc injection signal are far removed from the 1.75- to 4.250-mc frequency and are therefore not amplified by the r-f amplifier stages.

The VOX stage employed in the SBE rectifies a portion of the sideband signal from amplifier V126 thus developing a positive d-c voltage that is applied to relay amplifier V127. When audio intelligence is present in the audio channels, relay K101 operates and the SBE is activated.

Squelch (anti-vox) stages allow the SBE to operate within close proximity of an operating receiver. This is accomplished by rectifying a portion of the receiver's output thus developing a negative d-c voltage which is applied to relay amplifier V127. With both VOX and squelch circuits operating, the SBE will be activated only when audio intelligence is applied to the SBE inputs.

Metering stages in the SBE provide monitoring functions for audio input power levels for upper- and lower-sideband channels; for the 1.75- to 4-mc MF power level; and for the 1.75- to 32-mc HF power level.

The SBE power supply provides 6.3 vac, +250 vdc, +125 vdc, +180 vdc, and regulated +150 vdc.

4-2. CIRCUIT ANALYSIS, AUDIO INPUT SECTION.

Refer to figure 7-1. The SBE is provided with three audio inputs (two 600-ohm balanced or unbalanced inputs, and one high-impedance microphone input). The 600-ohm inputs originate from terminal strip E101 and are transformer coupled via T101 and T102 to switches S101 and S102 respectively.

Microphone input signals from J101 are amplified by V101 and are then extended to switches S101 and S102. Depending upon the setting of S101 and S102, the desired input is applied to upper- and lower-sideband gain controls R168 (USB) and R169 (LSB) through a section of the bandswitch (S106) and then to audio amplifiers V122A and V123A of the 250-KC Oscillator and Balanced Modulator Section.

Bandswitch S106 is configured to reverse upper and lower sideband inputs when the SBE is operating in the 1.75- to 4.25-mc range. This reversal compensates for the lack of frequency conversion at high-frequency balanced modulator Z107 (refer to paragraph 4-5).

4-3. CIRCUIT ANALYSIS, 250-KC OSCILLATOR AND MODULATOR SECTION.

Refer to figure 7-1. Audio input signals applied to V122A and V123A are amplified and transformer coupled via T104 and T103 to balanced modulator circuits (CR115 and T125, CR116 and T126). Within the balanced modulators, the audio input frequencies are mixed with a 250-kc signal generated by oscillator Z103. The 250-kc output from Z103 is applied to variable resistors R265 and R266 which are used to balance the input circuits of T125 and T126.

The resultant output of T125 and T126 (double sideband reduced 250-kc carrier) is amplified by V124 and V125 and applied to sideband filter Z110 and Z111. LSB filter Z110 is designed to pass only frequencies from approximately 244 kc to 250 kc; thus, only the sideband below the suppressed 250-kc carrier is passed on to notch filter Z112. USB filter Z111 performs in the same manner as Z110, differing in that it passes frequencies between approximately 250-kc and 256-kc (upper sideband).

The outputs of Z110 and Z111 are applied to: (1) notch filter Z112; (2) meter amplifiers V122B and V123B via V128A and V128B for monitoring purposes.

Notch filter Z112 has considerable loss in the immediate region of 250-kc. However, the upper or lower sidebands pass through the filter; experiencing relatively small loss. The output of notch filter Z112 is amplified by V126 and is transformer coupled by T127 to balanced modulator V113 of the 1.75- to 4-MC MF Section.

Carrier re-insertion is accomplished at V126 by means of a 90-degree phase-shift network (comprising R280 and T128) and a 250-kc CARRIER INSERT control R263. The 250-kc signal level applied to T128 is controlled by R263. The phase-shifted output of T128 is terminated into variable resistor R280 which is adjusted to provide a true 90-degree phase-shifted 250-kc carrier (and consequently a true AM signal) to amplifier V126.

4-4. CIRCUIT ANALYSIS, 1.75- TO 4-mc MF SECTION.

Refer to figure 7-1. Sideband intelligence (centered at 250-kc) applied to balanced modulator V113 is mixed with a 2- to 4.25-mc injection frequency provided by oscillator V115. Oscillator V115 is frequency controlled by either: external variable master oscillator via Jack J104; or internal oven contained crystals. The difference frequency output of balanced modulator V113 is coupled via tuned transformer T109 to MF amplifier V114. The amplified output of V114 is coupled via T110 (tuned transformer) to Z107 of the 1.75- to 32-mc HF Section.

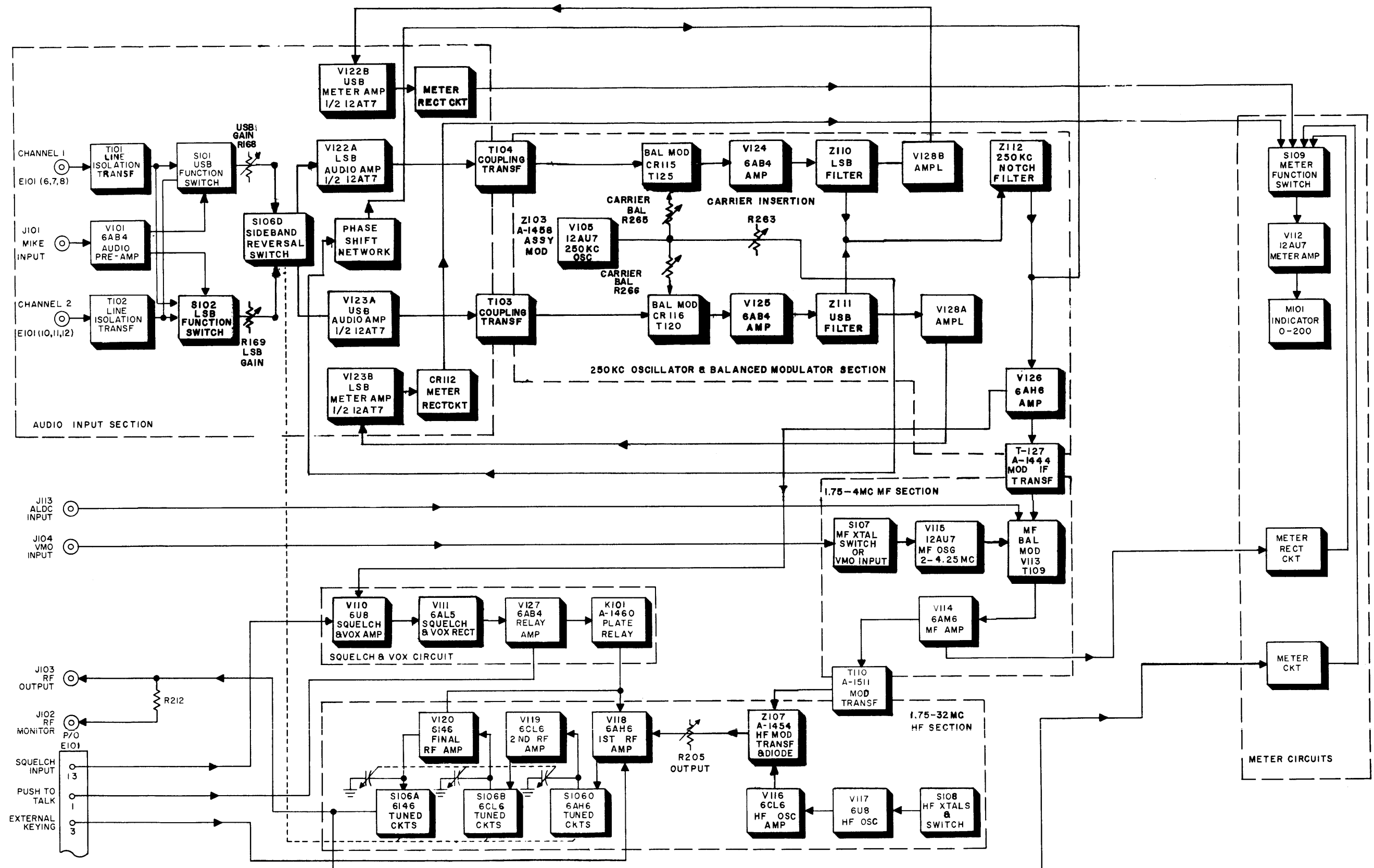
Transformers T109 and T110 are both tuned by ganged capacitor C167. Sections A and B of modulator V113 are balanced by adjusting cathode bias resistor R130.

ALDC input signals applied to modulator tube V113 via Jack J113 increase d-c grid bias on strong modulation bursts from the associated linear amplifier thus reducing the output level of V113. The ALDC input is a varying negative d-c signal with a desirable attack time of 2 milliseconds and a decay time of 100 milliseconds not to exceed -4 vdc.

4-5. CIRCUIT ANALYSIS, 1.75- TO 32-mc HF SECTION.

Refer to figure 7-1. The 1.75- to 4-mc sideband signal from transformer T110 in the MF Section is applied to pin 2 of Z107 and to the control grid of first r-f amplifier V118 via front-panel OUTPUT control R205. A high-frequency injection signal (from 8- to 34-mc in 2-mc steps; selected by front-panel BAND MCS switch) is developed by V117, amplified by V116, and coupled via transformer T123 to J110 of Z107 where it is balanced by a variable resistor and capacitor network. The sideband signal applied to pin 2 of Z107 is rectified thus upsetting the balance of the high-frequency injection signal allowing it to mix with the incoming sideband signal. The resultant difference frequency is then applied to r-f amplifier V118.

When operating in the 1.75- to 4-mc frequency range, an 18-mc injection signal is applied to Z107 in order to maintain proper bias level preventing inter-modulation distortion at amplifier V118. The 18-mc injection and the sidebands produced are not passed by the r-f amplifier stages (V118, V119, and V120) which are tuned to 1.75- to 4.25-mc. A sideband reversal switch (part of OUTPUT TUNING bandswitch S106) compensates for the sideband reversal that does not take place



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Figure 4-1. Block Diagram, SBE

at the output of Z107.

The r-f taken from R205 (front-panel OUTPUT control) is amplified by the V118, V119, and V120 to the rated 250 milliwatt PEP output of the SBE. These stages are gang-tuned by C181A, C181B, C181C, and bandswitched by S106A, S106B, and S106C to cover the frequency range of 1.75- to 32-mc continuously.

4-6. CIRCUIT ANALYSIS, SQUELCH AND VOX SECTION.

Refer to figure 7-1. A sample of the side-band signal from amplifier V126 is capacitively coupled to the input grid of amplifier V110 (pentode section). The amplified output of V110 is capacitively coupled to one half of rectifier V111, which develops a positive d-c voltage. This positive voltage is applied to the control grid of relay amplifier V127. When intelligence is present in the audio channels, the positive voltage developed at V127 causes V127 to conduct, and relay K101 energizes thus activating the SBE.

A signal from a nearby receiver is applied to the triode section of V110. The output of V110 is capacitively coupled to one half of rectifier V111 which develops a negative d-c voltage. This negative voltage is applied to the grid of relay amplifier V127. With both VOX and squelch circuits operating, the SBE will be activated only when audio intelligence is applied to the SBE inputs.

4-7. CIRCUIT ANALYSIS, METER SECTION.

Refer to figure 7-1. The meter circuit comprises METER SW switch S109, meter M101, and

V112 configured as a VTVM circuit. Depending upon the setting of meter switch S109, meter M101 will provide indications as outlined below:

a. USB. - M101 indicates only the USB channel audio level except in the 1.75- to 4-mc band. In this band it indicates the LSB channel audio level.

b. LSB. - M101 indicates only the LSB channel audio level except in the 1.75- to 4-mc band. In this band it indicates the USB channel audio level.

c. MF. - M101 indicates sum total of both sidebands and carrier when used. This meter position is used only to indicate proper tuning of the MF dial; and, therefore, its absolute level has no real meaning.

d. RF. - M101 indicates the sum total of both sidebands and carrier when used.

e. CAL. - Pin 2 of V112 is grounded thus allowing the gain of both triode sections to be equalized by adjustment of R130.

4-8. CIRCUIT ANALYSIS, POWER SUPPLY.

Refer to figure 7-2. The SBE power supply (comprising transformer T401 and T402, rectifier V401, and voltage regulator V402) is a conventional gaseous rectifier with choke-input, pi filter, and a voltage divider network (R401 through R405). Under load conditions, the power supply provides 6.3-volt a-c filament voltage, +250-volt d-c plate voltage, +180-volt d-c plate voltage, +125-volt d-c plate voltage, and +150-volt d-c regulated plate voltage.

SECTION 5 MAINTENANCE

5-1. PREVENTIVE MAINTENANCE.

The SBE has been designed to provide long-term, trouble-free operation under continuous duty conditions. However, in order to prevent failure of the equipment due to corrosion, dust, or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to.

At periodic intervals, the equipment should be removed from its mounting for cleaning and inspection. All accessible covers should be removed and the wiring and all components inspected for dirt, corrosion, charring, discoloring or grease. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease from other parts with any suitable cleaning solution. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichloroethylene or methyl chloroform may be used, providing the necessary precautions are observed.

NOTE

When using toxic solvents, make certain that adequate ventilation exists. Avoid prolonged or repeated breathing of the vapor. Avoid prolong or repeated contact with skin. Flammable solvents shall not be used on energized equipment from which a spark may be received. Smoking, "hot work", etc., is prohibited in the immediate area.

CAUTION

When using trichloroethylene,

avoid contact with painted surfaces due to its paint removing effects.

5-2. TROUBLESHOOTING.

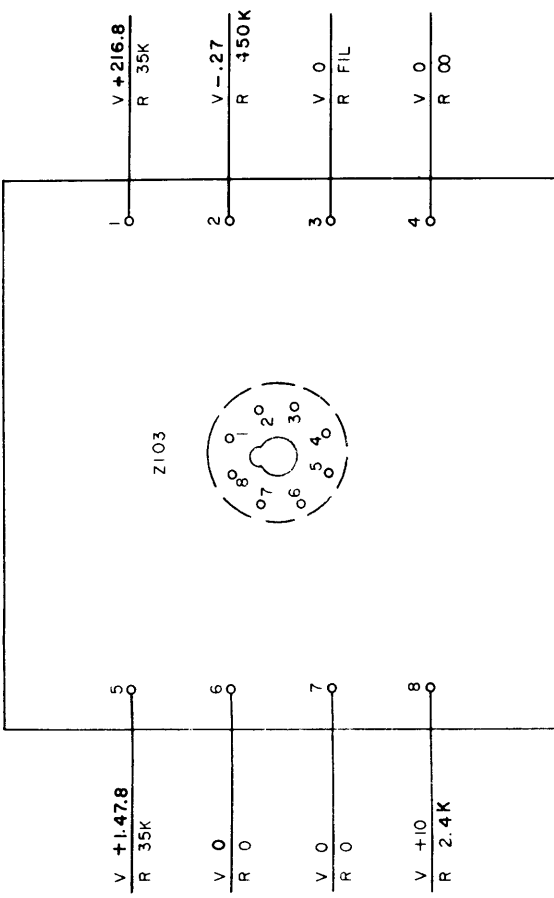
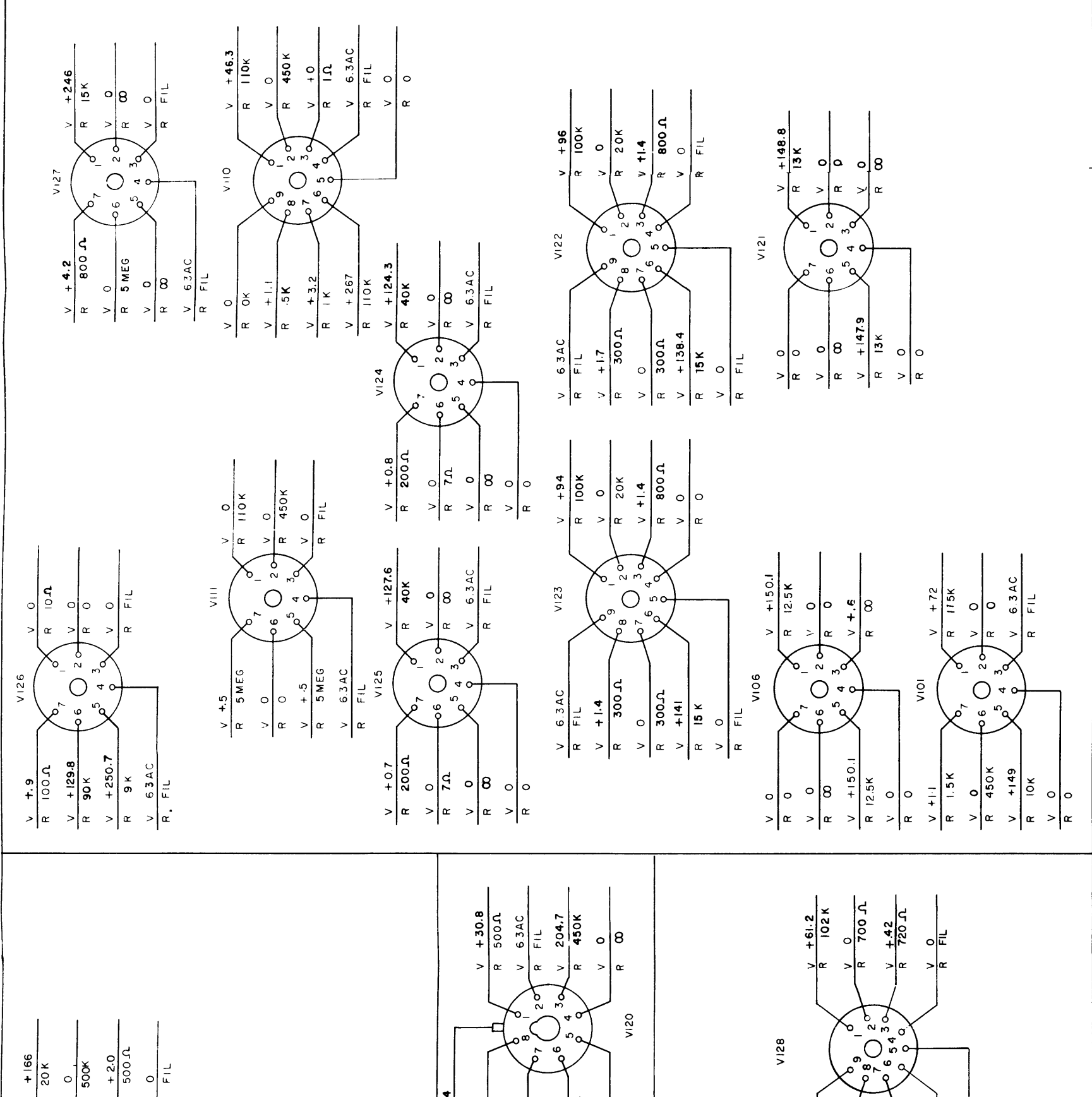
a. GENERAL CONSIDERATIONS. - When a piece of equipment has been working satisfactorily and suddenly fails, the cause of failure may be apparent either because of circumstances occurring at the time of failure or because of symptoms analogous to past failures. In this case, it is necessary to follow a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

A second major point in troubleshooting is to ascertain that all tubes and fuses are in proper working order; also that the equipment receives proper supply voltages. Many times this eliminates further investigation.

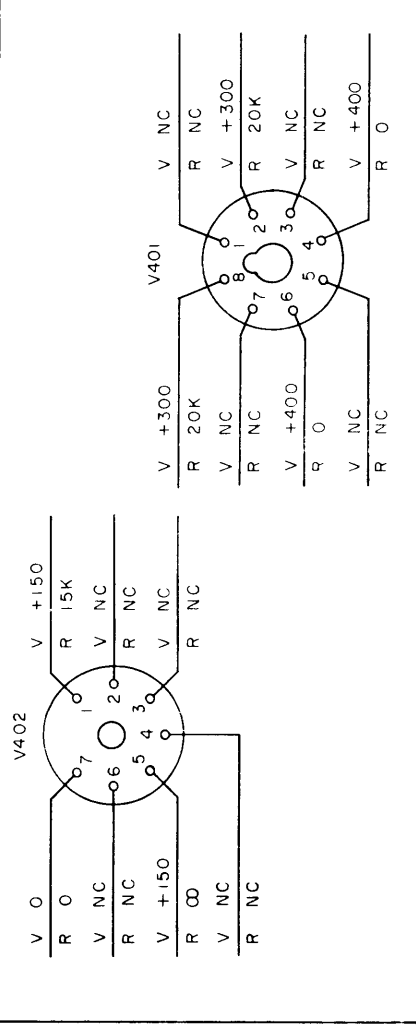
A third major point is to examine the equipment, section by section, for burned-out elements, charring, corrosion, arcing, excessive heat, dirt, dampness, etc. It is important to recognize that defective elements may have become defective due to overloaded operation or to tube and allied circuit component failure.

b. TROUBLESHOOTING CHARTS BASED ON OPERATING PROCEDURES. - Refer to Section 3 and to table 5-1. The general purpose of these charts is to localize the source of trouble.

c. VOLTAGE AND RESISTANCE DATA. - Voltage and resistance data is given in figure 5-1. Large deviations from the nominal value should be carefully investigated. When taking voltage and resistance measurements, use the schematic diagrams given in Section 7.



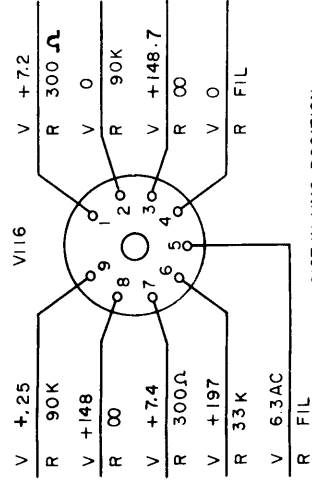
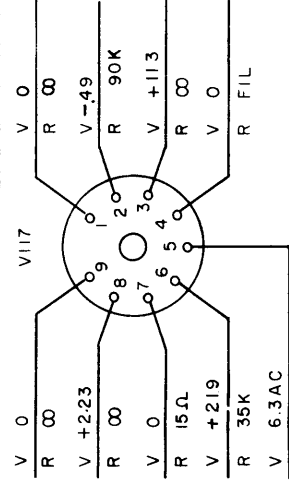
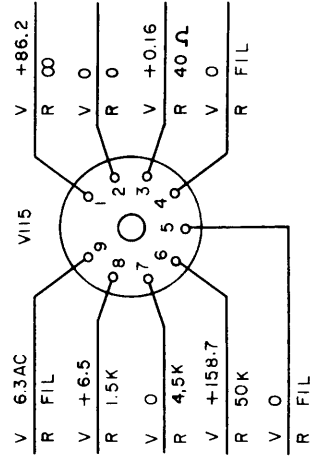
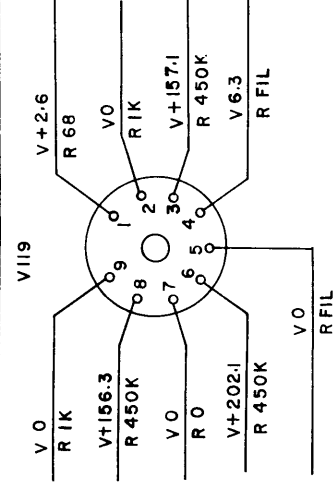
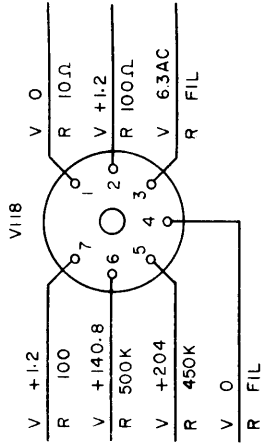
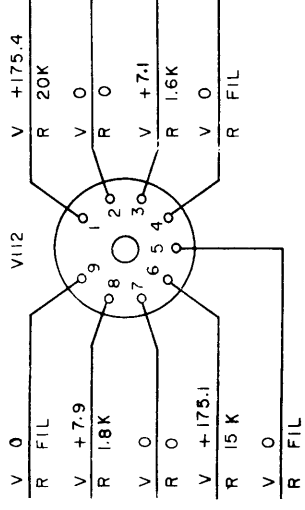
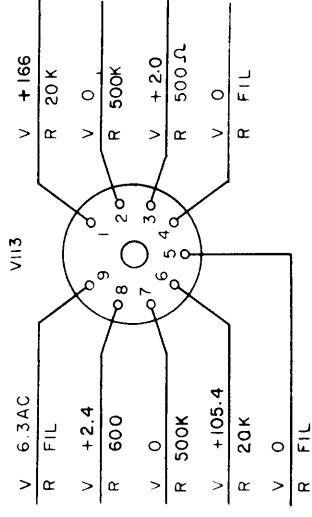
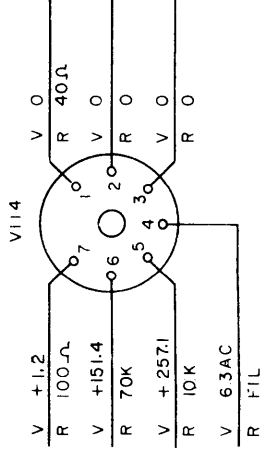
SBE-3 POWER SUPPLY



- CONDITIONS
VOLTAGE MEASUREMENTS
1. NO SIGNAL INPUT
2. ALL CONTROLS AT OFF OR MINIMUM.
3. ALL MEASUREMENTS TAKEN WITH A COHU DIGITAL VOLTMETER MODEL 510 AND A TUBE ADAPTER.
4. DIGITAL VOLTMETER IMPEDANCE MINIMUM 1000 MEGOHMS.
5. ALL MEASUREMENTS TAKEN WITH 115 VOLTS A.C. LINE VOLTAGE AND ARE ± 10 %

- RESISTANCE MEASUREMENTS
1. ALL POWER OFF
2. POWER PLUGS DISCONNECTED
3. ALL MEASUREMENTS TAKEN WITH RESPECT TO GROUND USING A SIMPSON MODEL 260 AND A TUBE ADAPTER.
4. ALL FRONT PANEL SWITCHES AND CONTROLS AT OFF OR MINIMUM POSITIONS
5. UNLESS OTHERWISE SPECIFIED ALL RESISTANCE VALUES ARE IN OHMS.

Figure 5-1. Voltage and Resistance Diagram



SI07 IN VMO POSITION

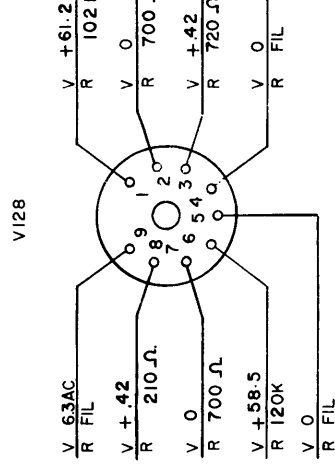
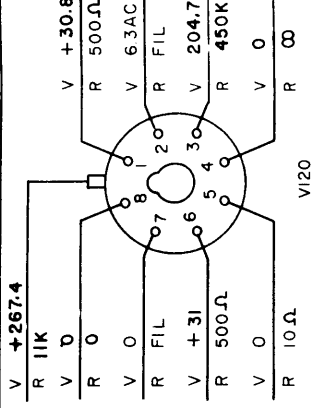


TABLE 5-1. OVERALL TROUBLESHOOTING CHART

STEP	CONTROL OPERATED	NORMAL INDICATION	REMEDY
1	Set POWER switch S103 at ON.	Power supply indicator I103, OVEN indicator lamp I102, dial lamps, and tube filaments should all light.	Set POWER switch S103 at OFF. Check fuses F201 and F402, and power cord. Check incoming power.
2	Set EXCITER switch S105 at ON.	EXCITER indicator lamp I101 should light.	Set POWER switch S103 at OFF. Check fuse F403 and wire connections.
3	Set XMTR switch S104 at ON.	Activates transmitter, eliminates need for VOX, or push-to-talk, through EXCITER switch S105.	Check final plate relay circuit of transmitter.
4	<p>a. Set XMTR switch S104 at OFF.</p> <p>b. Set EXCITER switch S105 at STANDBY.</p> <p>c. Connect a mike to MIKE input jack J101. Start talking directly into mike and at the same time slightly rotate VOX GAIN control R140.</p> <p>d. At conclusion of this step, return XMTR and EXCITER switches to ON.</p>	Transmitter can be operated by VOX or push-to-talk circuits when EXCITER switch S105 is set at STANDBY EXCITER indicator lamp I101 remains lit with normal speech level and goes off with no speech input.	Visually check all wire connections to the XMTR and EXCITER switches, fault may also be in VOX section. If EXCITER indicator lamp does light, set EXCITER switch S105 at ON to test EXCITER lamp; otherwise, fault may be within VOX section. Should the EXCITER indicator lamp light erratically with no direct speech input, SQUELCH GAIN control R129 is not adjusted properly; refer to VOX alignment procedure (paragraphs 5-3 and 5-4).
5	<p>MF TUNING</p> <p>a. Turn METER SW S109 to CAL, and zero meter.</p> <p>b. Turn METER SW to MF.</p> <p>c. Turn MF XTAL SW to VMO or crystal.</p> <p>d. Set MF dial to frequency of VMO or XTAL by use of MF TUNING control.</p> <p>e. Turn USB, LSB, and XMTR switches to OFF.</p> <p>f. Turn CARRIER INSERT control fully CW.</p> <p>g. Adjust MF TUNING control slightly.</p>	Meter indicates zero for step a. In step b as the MF TUNING control is rotated, the meter deflection needle should read maximum.	<p>If meter does not calibrate to zero or the meter does not indicate a reading with METER SW set MF, proceed as follows:</p> <p>Check V112 and R135. Visually check all meter and various control and switch wire connections. If these are normal, probable cause is within MF section. Refer to alignment procedures (paragraphs 5-3 and 5-4).</p>
6	<p>RF TUNING</p> <p>a. Do not alter previous settings of MF TUNING control.</p> <p>b. Turn BAND MCS to frequency range desired.</p>	Maximum meter needle deflection.	Visually check all control wire connections; if these are normal, probable cause is within the RF section. Refer to alignment procedures given in paragraphs 5-3 and 5-4.

TABLE 5-1. OVERALL TROUBLESHOOTING CHART (Cont'd)

STEP	CONTROL OPERATED	NORMAL INDICATION	REMEDY
6 Cont'd	<p>c. Turn OUTPUT TUNING switch to frequency range desired.</p> <p>d. Turn METER SW switch to RF.</p> <p>e. Using OUTPUT TUNING control, tune SBE to output frequency.</p> <p>f. Advance OUTPUT control as required to obtain indication on meter.</p> <p>g. Adjust OUTPUT TUNING control for peak indication on r-f meter.</p>		
7	<p>DOUBLE SIDEBAND (Without Carrier)</p> <p>a. Turn USB switch to desired channel.</p> <p>b. Turn CARRIER INSERT control to 0.</p> <p>c. Turn LSB switch to OFF. Turn METER SW switch to USB.</p> <p>d. Advance USB GAIN control until meter indicates 50%.</p> <p>e. Turn USB switch to OFF. Turn LSB switch to desired channel.</p> <p>f. Turn METER SW switch to LSB.</p> <p>g. Advance LSB GAIN control until meter indicates 50%.</p> <p>h. Turn METER SW switch to RF.</p> <p>i. Advance OUTPUT control until meter indicates 50%.</p> <p>j. Turn LSB switch to OFF. Turn USB switch to position selected in step a.</p> <p>k. Adjust USB GAIN to obtain meter indication of 50%.</p> <p>l. Turn LSB switch to desired channel as selected in step g.</p>	<p>Combined gain for USB and LSB GAIN control settings should be approximately 100% on meter.</p> <p>NOTE</p> <p><i>The meter circuit within the SBE, as is the case with most VTVM's, has a small amount of waveform error. For this reason, when each sideband is set up independently of the other and when each is added on the meter, the sum of 50% and 50% may be slightly less than 100%. This is due to the presence of a modulated envelope which is generated when 2 or more frequencies are present in the output at the same time.</i></p>	<p>If combined meter reading of the USB and LSB differs considerably from 100%, alternately switch USB and LSB switches to OFF; and readjust each channel for a meter indication of 50%. If either channel can not peak to meter indication of 50%, malfunction may be in either or both LSB or USB audio sections. Refer to alignment procedures given in paragraphs 5-3 and 5-4.</p>

5-3. ALIGNMENT PROCEDURES.

Alignment procedures given in this section are continuous and must be performed in the order given. Refer to figures 5-2 and 5-3 for component location.

a. TEST EQUIPMENT REQUIRED. - Table 5-2 lists the test equipment required to align the SBE.

b. PRELIMINARY PROCEDURES.

(1) Attach jumper to terminals 2 and 3 of E101.

(2) With POWER switch set at OFF and power plug disconnected, check oven heaters by measuring resistance between pins D and E of J109. For 115 vac connections, resistance should be 300 ohms $\pm 10\%$; for 230 vac connections, resistance should be 600 ohms $\pm 10\%$.

(3) Check ALDC circuitry as follows: from J113 to ground (chassis), resistance measurement should be 470 K ohms $\pm 10\%$; from J113 to pins 2 and 7 of V113, resistance measurement should be 23 K ohms $\pm 10\%$ in each case.

(4) Ensure that calibration marks of

RF and MF dial align with fiducial line on dial window at counterclockwise dial stop.

(5) Connect 70-ohm load to RF OUT jack J103.

(6) Place test crystals in oven as follows:

POSITION	FREQUENCY
1	2.0 mc
2	4.0 mc
3	2.25 mc
4	4.25 mc

(7) Connect exciter unit to power supply, and apply a-c power; oven and dial lamps should light. After brief warm-up period, oven lamp should commence to cycle on and off.

(8) With METER SW switch set at CAL, adjust CAL potentiometer for zero indication on front-panel meter.

c. ALIGNMENT OF 250 KCS OSCILLATOR.

(1) Ensure that preliminary procedures outlined in paragraph 5-3b have been completed.

(2) Using VTVM, check output voltage

TABLE 5-2. TEST EQUIPMENT REQUIRED

QTY.	ITEM	MANUFACTURER AND MODEL
1	Frequency Counter	Hewlett Packard, Model 524-C or equivalent
1	AC Voltmeter	Ballantine, Model 314 or equivalent
1	VTVM	Hewlett Packard, Model 410B or equivalent
1	Audio Generator	Hewlett Packard, Model 200CD or equivalent
1	Oscilloscope	Tektronix, Model 543 or equivalent
1	Spectrum Analyzer	The Technical Materiel Corp., Model PTE or equivalent
1	Resistor, 70 ohm, 2 watt	
1	Resistor, 1 megohm, 1/2 watt	
1	Crystal, 2.000 MC	TMC, Type CR-27A/U*
1	Crystal, 2.250 MC	TMC, Type CR-27A/U*
1	Crystal, 4.000 MC	TMC, Type CR-27A/U*
1	Crystal, 4.250 MC	TMC, Type CR-27A/U*

*These crystals are recommended as a matter of convenience. Any VMO capable of supplying the indicated frequencies at a stability of 1 part in 10^6 may be substituted.

of 250-kcs oscillator at pin 8 of Z103; indication should be between .8 and 1.2 volts.

(3) Using frequency counter, check frequency of 250-kcs oscillator at pin 8 of Z103; adjust C120 as required to obtain 250 kcs + 3 cps.

d. ALIGNMENT OF AUDIO INPUT AND BALANCED MODULATOR STAGES.

(1) TUNING T125 AND 250-KCS CARRIER BALANCE, LSB.

(a) Ensure that procedures outlined in paragraphs 5-3b, and 5-3c have been completed.

(b) Turn OUTPUT TUNING bandswitch to 4-8 mc band. Set LSB switch selector at CH 1; set all other channel controls at OFF or minimum position.

(c) Connect AF generator to terminals 6 and 8 of E101, channel 1, for balanced line operation. To minimize unwanted pick up, use twisted shielded pair shield grounded to terminal 7; then connect jumper from terminal 7 to terminal 5.

(d) Adjust AF generator frequency for approximate mid point of audio bandpass (refer to technical specifications given in section 1) at .05 volt output.

(e) Connect VTVM to output terminals of Z110, and adjust LSB GAIN control for 10-db deflection on .1 volt scale. Adjust top and bottom slugs of T125 for maximum deflection.

(f) Connect VTVM across input of Z110. Turn off AF generator, and adjust R265 for minimum deflection on VTVM.

(2) TUNING T126 AND 250-KCS CARRIER BALANCE, USB. - Repeat the above steps (paragraph 5-3d, part 1) for T126, filter Z111, and R266 (carrier balance control).

(3) AUDIO AND SIDEBAND REVERSAL.

(a) MICROPHONE INPUT. - Upon completion of paragraphs (1) and (2) above, proceed as follows:

1. Connect unbalanced output of AF generator in series with 1-megohm resistor to pin 1 of MIKE jack; connect grounded side of AF generator output and to pin 2.

2. Set USB and LSB selector switches at OFF; set CARRIER INSERT control at minimum (fully counterclockwise).

3. Tune AF generator for 1000 cps signal at .05 volt output. Set LSB and METER SW selector switches of SBE at MIKE and LSB respectively. Adjust LSB GAIN control for meter indication of 100%. The 100% meter

indication should be obtained before LSB GAIN control reaches maximum position.

4. Using VTVM arranged for 0-1 vac, measure output of LSB filter Z110. Set OUTPUT TUNING bandswitch at 1.75 - 4 mc; output indication should now be transferred from LSB filter Z110 to USB filter Z111.

(b) CHANNEL 1 INPUT. - Upon completion of paragraphs (1), (2), and (3) above, proceed as follows:

1. Using twisted shielded pair, connect balanced output of AF generator to terminals 6 and 8 of E101. Connect shield to terminal 7; connect terminal 7 to terminal 5.

2. Set USB and LSB selector switches at OFF; set CARRIER INSERT control at minimum (fully counterclockwise).

3. Set OUTPUT TUNING bandswitch at any position except 1.75 - 4 mcs.

4. Set LSB selector switch at CH 1, and repeat procedure outlined in steps 3 and 4 above for MICROPHONE INPUT.

(c) CHANNEL 2 INPUT. - Channel 2 input circuitry is checked in a manner similar to that outlined for channel 1. The channel 1 procedure outlined above will apply as written with the following exceptions:

1. The balanced output of the AF generator should be connected to terminals 10 and 12 of E101. Terminal 11 of E101 should be connected to terminal 9.

2. The USB selector switch should be set at CH 1 in step 4. The USB GAIN control should be adjusted for a meter indication of 100%. Voltage measurement should be made first at Z111; when the OUTPUT TUNING bandswitch is set at 1.75 - 4 mc, the output indication will be transferred from Z111 to Z110.

e. ALIGNMENT OF MF BALANCED MODULATOR.

(1) Perform procedures outlined in paragraphs 5-3b, 5-3c and 5-3d.

NOTE

When performing step (2), two frequencies (250-Kc when carrier is inserted, and an MF injection frequency) will appear at the mixer grid of V113.

(2) Connect a variable master oscillator (such as TMC's VOX-5) capable of providing minimum voltages specified in step (3) to VMO input jack J104. When using VOX-5, maintain a .1 indication on output meter.

(3) Connect RF voltmeter at junction of C163 and C164; measure voltages under conditions

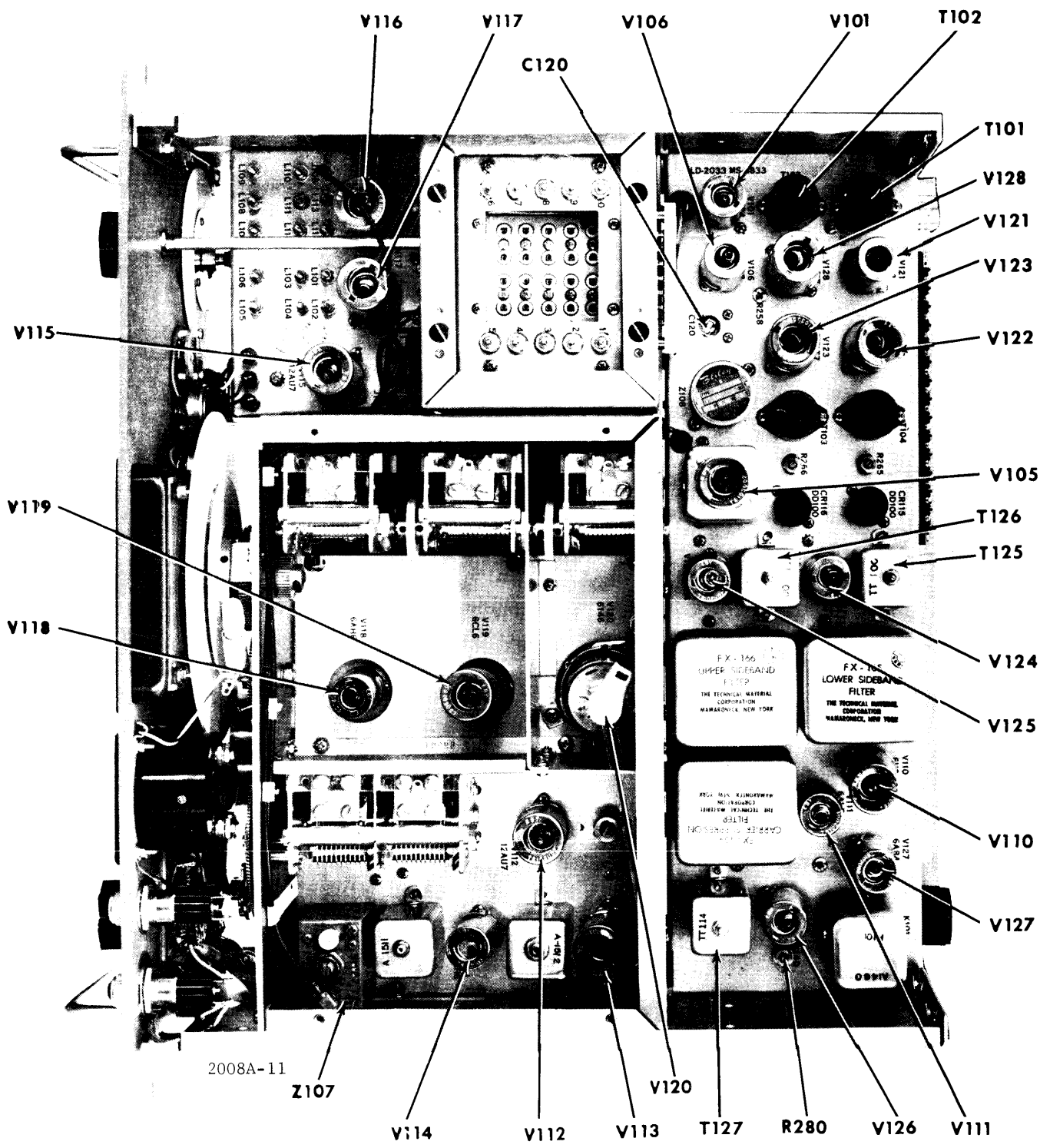


Figure 5-2. Component Locations SBE, Top View

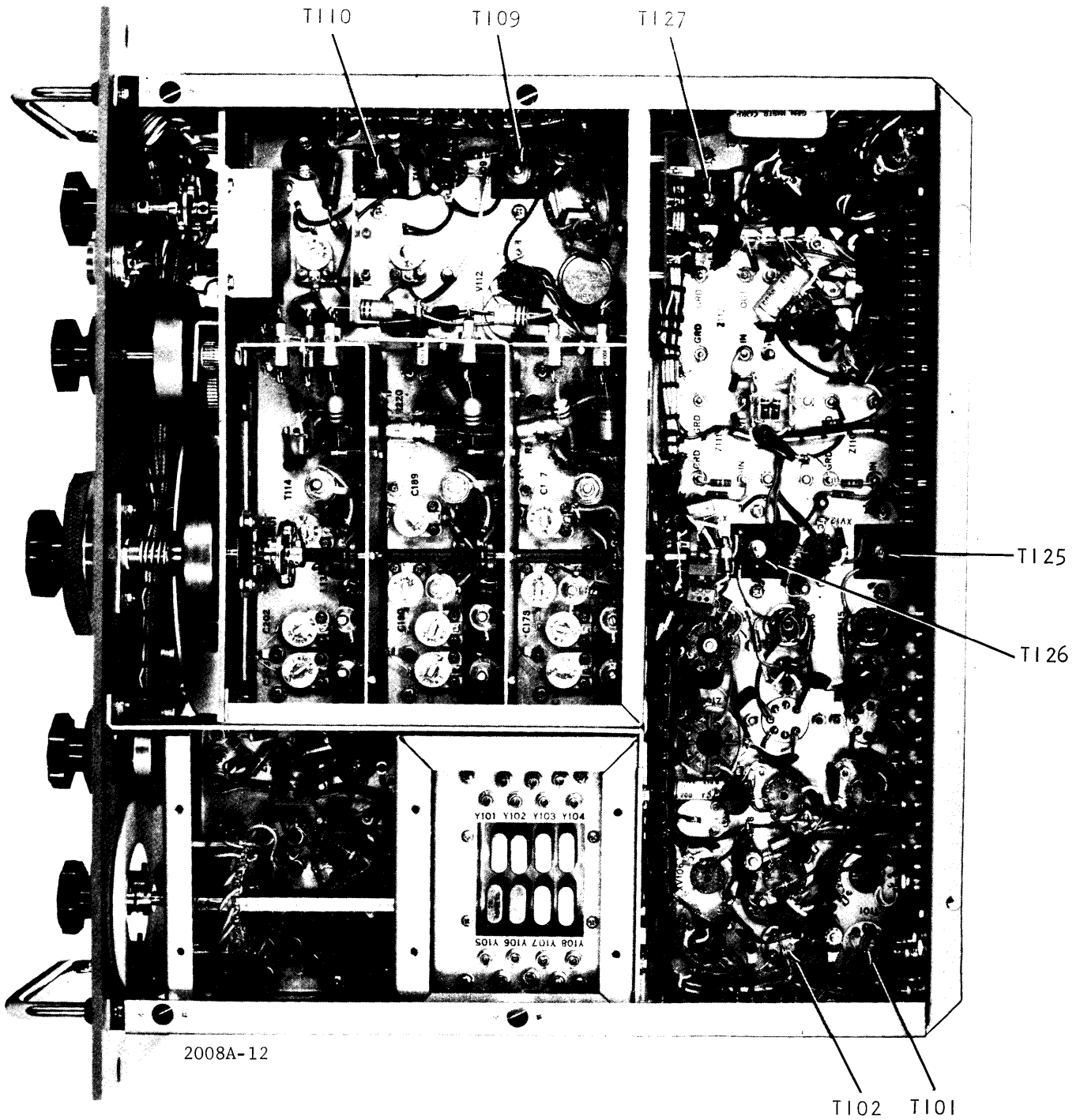


Figure 5-3. Component Locations SBE, Bottom View

indicated below.

<u>MF XTAL SW POSITION</u>	<u>FREQUENCY</u>	<u>MIN. VOLTAGE LIMIT</u>
1	2.0 MC	1.5 V
2	4.0 MC	.6 V
VMO	2.0 MC	1.5 V
VMO	4.0 MC	.6 V

(4) Before aligning MF section, ensure that MF tuning capacitors are fully meshed when calibration mark (to left of 2.0 mc frequency indication on MF dial) aligns with fiducial line.

(5) Remove P107 from J110 of Z107; connect VTVM to pin 2 of Z107. Rotate MF balance control R130 either clockwise or counterclockwise to create unbalanced condition.

NOTE

A variable master oscillator may be used in place of MF crystals (refer to table 5-2) in the following steps.

(6) Set MF XTAL SW switch at 1 (2.000 mc) and adjust MF TUNING control as required to obtain 2.25 mc on MF dial. Tune T109 and T110 for maximum indication on VTVM.

(7) Set MF XTAL SW switch at 2 (4.000 mc) and adjust MF TUNING control as required to obtain 4.25 mc on MF dial. Tune trimmers C140 and C141 for maximum indication on VTVM.

NOTE

The above preliminary alignment insures subsequent selection of the proper mixer product on the MF dial.

(8) Set MF XTAL SW switch at 1 (2.000 mc) and adjust MF TUNING control as required to obtain 2.25 mc on MF dial.

(9) Set CARRIER INSERT control fully counterclockwise. Set METER SW switch at MF, and adjust R130 as required for minimum carrier as indicated on front-panel meter.

(10) Lock R130 and re-connect P107 to J110.

(11) Rotate CARRIER INSERT control fully clockwise. Adjust MF TUNING control for 2.0 mc on MF dial. Tune T109 and T110 for maximum indication on VTVM. Using CARRIER INSERT control, reduce carrier as required to provide sharp tuning indication on VTVM.

(12) Set MF XTAL SW switch at 2 (4.000 mc), and adjust MF TUNING control as

required for 4.0 mc on MF dial. Tune trimmers C140 and C141 for maximum indication on VTVM. Using CARRIER INSERT control, reduce carrier as required to provide sharp tuning indication on VTVM.

(13) Repeat steps (11) and (12) above until band is tracked. Lock slugs of T109 and T110.

f. ALIGNMENT OF HF OSCILLATOR AND MULTIPLIER STAGES. - Ensure that procedures outlined in paragraphs 5-3b, 5-3c, 5-3d, and 5-3e have been completed. Proceed as follows:

(1) Remove lead from J108 and connect Amphenol series 27, 50-ohm "T" connector to J108. Connect P105 to one side of "T" connector; connect other side of "T" connector to RF VTVM.

(2) Set all controls except POWER and EXCITER switches at OFF or minimum position.

(3) Adjust L101 through L114 for 2 volts indication on RF VTVM at the corresponding "INJECTION" frequency shown below.

(4) Remove VTVM and substitute frequency counter.

(5) Adjust proper capacitor for correct frequency indication on frequency counter for frequencies shown in "INJECTION" column below.

(6) Repeat steps (c), (d), and (e) above until frequency and output voltages are correct. Reconnect P105 to J108.

NOTE

When adjusting coil slugs L101 through L114, turn slug all the way out and adjust on the first 2 volt peak indication.

<u>BAND MCS DIAL NUMERIC</u>	<u>XTAL F. (MC)</u>	<u>INJECTION F. (MC)</u>	<u>ADJUSTMENTS</u>
4	8	8	C285 L101
5	10	10	C286 L102
6	12	12	C287 L103
7	14	14	C233 L104
8	8	16	C234 L105
9	18	18	C235 L106
10	10	20	C236 L107
11	11	22	C237 L108
12	12	24	C238 L109
13	13	26	C239 L110
14	14	28	C240 L111
15	10	30	C288 L112
16	8	32	C289 L113
17	17	34	C290 L114

g. ALIGNMENT OF RF AMPLIFIER STAGES.

*NOTE

NOTE

When performing alignment procedures for RF Amplifier stages, a variable master oscillator may be substituted for MF crystals (refer to table 5-2).

The 18 mc injection frequency is applied to the balanced modulator to maintain bias on modulator diodes thus preventing intermodulation distortion. The sum and difference frequencies produced by the 18 mc injection frequency will have no effect on circuit operation.

(1) PRELIMINARY PROCEDURE. - Ensure that procedures outlined in paragraphs 5-3b, 5-3c, 5-3d, 5-3e, and 5-3f have been completed, and proceed as follows:

(a) Ensure that output tuning capacitors C181A, C181B, and C181C are fully meshed when calibration mark (to left of 1.75 mc frequency indication on RF dial) aligns with fiducial line.

(b) Set controls at positions indicated below.

<u>CONTROL</u>	<u>POSITION</u>
USB selector switch	OFF
LSB selector switch	OFF
MF XTAL SW	1 (2.000 mc)
CARRIER INSERT	Fully CW
METER SW	MF
MF TUNING	As required to obtain 2 mc on MF dial. Continue to adjust MF TUNING control for peak indication on front-panel meter.

(c) Ensure that RF OUTPUT jack J103 is terminated with 70-ohm load; connect RF VTVM across 70-ohm load.

(2) 1.75 - 4 MC BAND ALIGNMENT.

NOTE

During the following alignment procedure, it may be necessary to adjust the OUTPUT control to maintain minimum meter indications.

(a) Ensure that procedures outlined in paragraph (1) above have been completed.

(b) Set controls at positions indicated below.

<u>CONTROL</u>	<u>POSITION</u>
OUTPUT TUNING band-switch	1.75 - 4 MC
METER SW	RF
BAND MCS	As required to obtain 1.75 - 4 mc band (dial numeric=0; 18 mc hfo crystal position*)

(c) Adjust OUTPUT TUNING control for 1.75 mc on RF dial.

(d) Tune T116 and T120 for maximum indication on VTVM.

(e) Set MF XTAL switch at 4 (4.250 mc); set METER SW switch at MF.

(f) Adjust MF TUNING control for 4.250 mc on MF dial. As required to obtain 2 mc on MF dial. Continue to adjust MF TUNING control for peak indication on front-panel meter.

(g) Set METER SW switch at RF. Set OUTPUT TUNING control at 4.0 mc on RF dial.

(h) Adjust C191 and C179 for maximum indication on VTVM.

(i) Repeat steps (b) through (h) with OUTPUT control adjusted for reduced drive to insure sharp tuning peaks and proper band tracking.

(3) 4 - 8 MC BAND ALIGNMENT.

NOTE

During the following alignment procedure, it may be necessary to adjust the OUTPUT control to maintain minimum meter indications.

(a) Ensure that procedures outlined in paragraphs (1) and (2) above have been completed.

(b) Set controls at positions indicated below.

<u>CONTROL</u>	<u>POSITION</u>
OUTPUT TUNING band-switch	4 - 8 MC
MF XTAL	4 (4.250 mc)
METER SW	MF

(c) Adjust MF TUNING control for 4.250 mc on MF dial. As required to obtain 2 mc on MF dial. Continue to adjust MF TUNING control for peak indication on front-panel meter.

(d) Set METER SW switch at RF. Set OUTPUT TUNING control at 4 mc on RF dial.

(e) Tune T113, T117 and T121 for maximum indication on VTVM.

(f) Set controls at positions indicated below.

<u>CONTROL</u>	<u>POSITION</u>
CARRIER INSERT	Fully CCW (minimum carrier)
MF XTAL*	VMO
BAND MCS*	As required for 4.25-6.25 mc band (dial numeric=4; 8 mc hfo crystal position).
OUTPUT TUNING control	8 mc on RF dial

NOTE

The internal hfo crystal oscillators are employed as the frequency source for further alignment of the RF bands.

(g) Adjust capacitors C203, C192, and C180 for maximum indication on VTVM.

(h) Repeat steps (b) through (g) with OUTPUT control adjusted for reduced drive to insure sharp tuning peaks and proper band tracking.

(4) 8-16 MC BAND ALIGNMENT.

NOTE

During the following alignment procedure, it may be necessary to adjust the OUTPUT control to maintain minimum meter indications.

(a). Ensure that procedures outlined in paragraphs (1), (2), and (3) above have been completed.

(b) Set controls at positions indicated below.

<u>CONTROL</u>	<u>POSITION</u>
OUTPUT TUNING band-switch	8 - 16 mc
BAND MCS	As required for 4.25-6.25 mc band (dial numeric=4; 8 hfo crystal position).
OUTPUT TUNING control	8 mc on RF dial

(c) Adjust T115, T119, and T122 for maximum indication on VTVM.

(d) Set controls at positions indicated below.

<u>CONTROL</u>	<u>POSITION</u>
OUTPUT TUNING control	16 mc on RF dial
BAND MCS	As required for 12.25-14.25 mc band (dial numeric=8; 16 mc hfo crystal position).
METER SW	RF

(e) Adjust capacitors C202, C190, and C178 for maximum indication on VTVM.

(f) Repeat steps (b) through (e) with OUTPUT control adjusted for reduced drive to insure sharp tuning peaks and proper band tracking.

(5) 16-32 MC BAND ALIGNMENT.

NOTE

During the following alignment procedure, it may be necessary to adjust the OUTPUT control to maintain minimum meter indications.

(a) Ensure that procedures outlined in paragraphs (1), (2), (3), and (4) above have been completed.

(b) Set controls at positions indicated below.

<u>CONTROL</u>	<u>POSITION</u>
OUTPUT TUNING band-switch	16-32 mc
METER SW	RF
BAND MCS	As required for 12.25-14.25 mc band (dial numeric=8; 16 mc hfo crystal position).
OUTPUT TUNING control	16 mc on RF dial

(c) Adjust T114, T118, and T112 for maximum indication of VTVM.

(d) Set controls at positions indicated below.

<u>CONTROL</u>	<u>POSITION</u>
OUTPUT TUNING control	32 mc on RF dial
BAND MCS	As required for 28.25-30.25 (dial numeric=16; 32 mc hfo crystal position)

(e) Adjust capacitors C201, C189, C177 for maximum indication on VTVM.

(f) Repeat steps (b) through (e) with OUTPUT control adjusted for reduced drive to ensure sharp tuning peaks and proper band tracking.

(6) ALIGNMENT OF HF CARRIER BALANCE. - Upon completion of RF Alignment procedure outlined in paragraphs (1) through (5) above, proceed as follows.

(a) Set controls at positions indicated below.

<u>CONTROL</u>	<u>POSITION</u>
CARRIER INSERT	Fully CCW (minimum carrier)
METER SW	RF
OUTPUT	5
BAND MCS	As required for 1.75-4.25 mc band (dial numeric=0; 18 mc hfo crystal position*)

NOTE

The 18 mc injection frequency is applied to the balanced modulator to maintain bias on modulator diodes thus preventing intermodulation distortion. The sum and difference frequencies produced by the 18 mc injection frequency will have no effect on circuit operation.

(b) Adjust potentiometer and variable capacitor of Z107 for minimum indication of front-panel meter. Lock potentiometer.

5-4. COMPONENT REPAIR AND REPLACEMENT.

Repair and replacement of SBE components is

obvious upon inspection; detailed procedures are therefore not given in this manual. Certain precautions should be observed when replacing fuses and electron tubes (refer to paragraphs a and b below).

a. REPLACEMENT OF ELECTRON TUBES. - When replacing electron tubes, particular attention should be paid to the following:

(1) When withdrawing miniature tubes from their sockets, pull them straight out; do not rock or turn them. If pins of miniature tubes are bent, straighten them with a proper pin straightener before replacing the tube.

(2) Some circuits, for example oscillator circuits, may function better with one tube than with another even though both tubes are new or both tubes measure the same when checked on a tube tester. Replacement of a tube in these circuits may result in subsequent re-alignment of the circuit.

(3) Tubes should not be replaced or discarded merely because they have been used for some time. Satisfactory operation in a circuit is the final proof of tube quality; the tube in use may work better than a new tube.

b. REPLACEMENT OF FUSES. - All fuses are located on the front panel of the power supply (refer to figure 3-2 and table 3-2).

CAUTION

If a fuse burns out, do not replace it 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.

SECTION 6

PARTS LIST

6-1 INTRODUCTION

The parts list presented in this section is a cross-reference list of parts identified by a reference designation and TMC part number. In most cases, parts appearing on schematic diagrams are assigned reference designations in accordance with MIL-STD-16. Wherever practicable, the reference designation is marked on the equipment, close to the part it identifies. In most cases, mechanical and electro-mechanical parts have TMC part numbers stamped on them.

To expedite delivery when ordering any part, specify the following:

- a. Generic name.
- b. Reference designation.
- c. TMC part number.
- d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

For replacement parts not covered by warranty (refer to warranty sheet in front of manual), address all purchase orders to:

The Technical Materiel Corporation
Attention: Sales Department
700 Fenimore Road
Mamaroneck, New York

<u>Assembly or Subassembly</u>	<u>Page</u>
Transmitting Mode Selector Model SBE-8, 9, 10 (Symbol Series 100 and 200)	6-2
Transmitting Mode Selector Power Supply (Symbol Series 400)	6-34

PARTS LIST

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C101 thru C115	NOT USED	
C116	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf, GMV; 500 WVDC.	CC100-16
C117	Same as C116.	
C118	CAPACITOR, FIXED, MICA DIELECTRIC: 1000 uuf, $\pm 2\%$; 500 WVDC. (Part of Z103)	CM20F102G03
C119	NOT USED	
C120	CAPACITOR, VARIABLE, CERAMIC: 1.5-7 uuf, 500 WVDC.	CV11A070
C121	Same as C116.	
C122	CAPACITOR, FIXED, MICA DIELECTRIC: 220 uuf, $\pm 2\%$; 500 WVDC. (Part of Z103)	CM15F221G03
C123	CAPACITOR, FIXED, CERAMIC: 10 uuf, 500 WVDC. (Part of Z103)	CC21SL100D
C124	Same as C116.	
C125	Same as C116.	
C126	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 uuf, GMV; 500 WVDC.	CC100-29
C127	Same as C116.	
C128	Same as C126.	
C129	NOT USED	
C130	CAPACITOR, FIXED, MYLAR DIELECTRIC: .1 uf, $\pm 10\%$, 200 WVDC.	CN108C1003K

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C131	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1.5 uuf, <u>+5%</u> , 500 WVDC.	CC2ISL1R5C
C132 thru C134	Same as C126.	
C135	Same as C116.	
C136	Same as C126.	
C137	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 8 uuf, <u>+10%</u> ; 500 WVDC.	CC2ISL080K
C138	Same as C137.	
C139	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 47 uuf, <u>+5%</u> ; 500 WVDC.	CC2ISL470J
C140	CAPACITOR, VARIABLE, CERAMIC: 3-12 uuf, 500 WVDC.	CV11A120
C141	Same as C140.	
C142 thru C150	NOT USED	
C151 thru C153	Same as C116.	
C154	NOT USED	
C155	NOT USED	
C156 thru C158	Same as C116.	
C159	NOT USED	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C160	NOT USED	
C161	Same as C116.	
C162	Same as C116.	
C163	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 47 uuf, $\pm 10\%$; 500 WVDC.	CC21SL470K
C164	Same as C163.	
C165	NOT USED	
C166	Same as C116.	
C167 A, B	CAPACITOR, VARIABLE, AIR DIELECTRIC: 2 sections, 12.5 to 270 uuf, each section.	CB127-1
C168 thru C171	Same as C116.	
C172	NOT USED	
C173	Same as C116.	
C174	Same as C132.	
C175	Same as C126.	
C176	CAPACITOR, FIXED, MICA DIELECTRIC: 100 uuf, $\pm 5\%$; 500 WVDC.	CM15F101J03
C177	CAPACITOR, VARIABLE, CERAMIC: 4-30 uuf, 500 WVDC, char. C.	CV11C300
C178 thru C180	Same as C177.	
C181A	CAPACITOR, VARIABLE, AIR DIELECTRIC: 12.5 to 270 uuf, each section.	CB137-1

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C181B	CAPACITOR, VARIABLE, AIR DIELECTRIC: 12.5 to 270 uuf, each section.	CB137-2
C181C	CAPACITOR, VARIABLE, AIR DIELECTRIC: 12.5 to 270 uuf, each section.	CB137-3
C182	Same as C118.	
C183	Same as C132.	
C184	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 uuf, +20%, 500 WVDC.	CK70AW102M
C185 thru C187	Same as C132.	
C188	CAPACITOR, FIXED, ELECTROLYTIC: 50 uf, 50 WVDC.	CE63C500G
C189 thru C192	Same as C177.	
C193	Same as C118.	
C194	Same as C132.	
C195	NOT USED	
C196	Same as C132.	
C197	Same as C116.	
C198 thru C200	Same as C184.	
C201 thru C203	Same as C177.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C204	Same as C184.	
C205	Same as C118.	
C206	Same as C132.	
C207	Same as C132.	
C208	Same as C184.	
C209 thru C212	Same as C126.	
C213	Same as C184.	
C214	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 5 uuf, $\pm 5\%$; 500 WVDC.	CC21SL050C
C215	Same as C126.	
C216	Same as C126.	
C217	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100 uuf, $\pm 2\%$; 500 WVDC.	CC26SL101G
C218	Same as C126.	
C219	Same as C139.	
C220	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 150 uuf, $\pm 2\%$; 200 WVDC.	CC111R151G
C221	Same as C184.	
C222	CAPACITOR, FIXED, PAPER DIELECTRIC: .05 uf, $\pm 5\%$; 400 WVDC.	CN113-1
C223	CAPACITOR, VARIABLE, GLASS: 1-8 uuf, 1000 VDC at mid-cap.	CV101-1

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C224 thru C232	Same as C223.	
C233	CAPACITOR, VARIABLE, GLASS DIELECTRIC: 1-60 uuf, 1000 WVDC.	CV115
C234 thru C240	Same as C233.	
C241	CAPACITOR, FIXED, MICA DIELECTRIC: 220 uuf, $\pm 5\%$; 500 WVDC. (Part of L101)	CM15D221J
C242	CAPACITOR, FIXED, MICA DIELECTRIC: 130 uuf, $\pm 5\%$; 500 WVDC. (Part of L102)	CM15C131J
C243	CAPACITOR, FIXED, MICA DIELECTRIC: 82 uuf, $\pm 5\%$; 500 WVDC. (Part of L103)	CM15C820J
C244	CAPACITOR, FIXED, MICA DIELECTRIC: 47 uuf, $\pm 5\%$; 500 WVDC. (Part of L105)	CM15C470J
C245	CAPACITOR, FIXED, MICA DIELECTRIC: 24 uuf, $\pm 5\%$; 500 WVDC. (Part of L106)	CM15C240J
C246	Same as C184.	
C247 thru C249	Same as C184.	
C250 thru C252	Same as C116.	
C253	Same as C184.	
C254	Same as C116.	
C255	NOT USED	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C256	CAPACITOR, FIXED, MICA DIELECTRIC: 51 uuf, $\pm 5\%$; 500 WVDC. (Part of L104)	CM15C510J
C257	Same as C116.	
C258 thru C260	NOT USED	
C261	Same as C130.	
C262 thru C268	Same as C116.	
C269	CAPACITOR, FIXED, MICA DIELECTRIC: 1000 uuf, $\pm 10\%$; 300 WVDC; button type.	CB21QB102K
C270 thru C273	Same as C269.	
C274 thru C278	Same as C116.	
C279 thru C281	Same as C269.	
C282	CAPACITOR, FIXED, MYLAR DIELECTRIC: .2 uf, $\pm 10\%$; 200 WVDC.	CN108C2003K
C283	CAPACITOR, FIXED, MICA DIELECTRIC: 1, 500 uuf, $\pm 10\%$; 300 WVDC; button type.	CB21PB152K
C284	Same as C126.	
C285 thru C290	Same as C233.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C291	CAPACITOR, FIXED, MICA DIELECTRIC: 510 uuf, $\pm 5\%$; 500 WVDC.	CM15F511J
C292	Same as C291.	
C293	CAPACITOR, FIXED, MICA DIELECTRIC: 270 uuf $\pm 5\%$; 500 WVDC.	CM15F271J
C294	Same as C293.	
C295	CAPACITOR, FIXED, MICA DIELECTRIC: 130 uuf, $\pm 5\%$; 500 WVDC.	CM15F131J
C296	Same as C295.	
C297	CAPACITOR, FIXED, MICA DIELECTRIC: 62 uuf, $\pm 5\%$; 500 WVDC.	CM15C620J
C298	Same as C297.	
C299	CAPACITOR, FIXED, MICA DIELECTRIC: 680 uuf, $\pm 2\%$; 500 WVDC.	CM20F681G03
C300	Same as C176.	
C301	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, $+80\%-20\%$; 100 WVDC.	CC100-28
C302	Same as C116.	
C303	Same as C176.	
C304	Same as C301.	
C305	Same as C116.	
C306	Same as C131.	
C307	NOT USED	
C308	NOT USED	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C309	Same as C299.	
CR101 thru CR110	NOT USED	
CR111	SEMICONDUCTOR DEVICE, DIODE: silicon; max. peak inverse voltage 175V; current rating 30 ma at 25°C or 15 ma at 150°C; two axial wire lead type terminals; hermetically sealed glass case.	1N463
CR112	Same as CR111.	
CR113	SEMICONDUCTOR DEVICE, DIODE: germanium; min. peak inverse voltage 100V; current rating 60 ma at 25°C; axial wire lead type terminals; hermetically sealed glass case.	1N100
CR114	Same as CR113.	
CR115	DIODE ASSEMBLY: germanium; four diodes; hermetically sealed.	DD100
CR116	Same as CR115.	
E101	TERMINAL BOARD, BARRIER: 14 brass nickel plated 6-32 binding head machine screws; moulded phenolic body.	TM100-14
E102	CLIP ELECTRICAL: ceramic body.	HB102-2
EV101	SHIELD, ELECTRON TUBE: 7 pin miniature; 1-3/4" high x .930" base dia.	TS102U02
EV102 thru EV104	NOT USED	
EV105	SHIELD, ELECTRON TUBE: 9 pin noval; 1-15/16" high x 1.065" base dia.	TS103U02

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
EV106	SHIELD, ELECTRON TUBE: 7 pin miniature; 2-1/4" high x .930" base dia.	TS102U03
EV107 thru EV109	NOT USED	
EV110	Same as EV105.	
EV111	Same as EV101.	
EV112	Same as EV105.	
EV113	Same as EV105.	
EV114	Same as EV101.	
EV115	Same as EV105.	
EV116	SHIELD, ELECTRON TUBE: 9 pin noval; 2-3/8" high x 1.065" base dia.	TS103U03
EV117	Same as EV105.	
EV118	Same as EV101.	
EV119	Same as EV116.	
EV120	NOT USED	
EV121	Same as EV106.	
EV122	Same as EV105.	
EV123	Same as EV105.	
EV124 thru EV127	Same as EV101.	
EV128	Same as EV105.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
I101	LAMP, GLOW: neon; 110/125 volts, 1/25 watt; min. bayonet base.	BII00-51
I102	Same as I101.	
I103	LAMP, INCANDESCENT: miniature bayonet base 6-8 volts, 125 amp; frosted lens, T-3-1/4.	BII01-44 (AF)
J101	CONNECTOR, RECEPTACLE, ELECTRICAL: 3 female contacts, chassis type.	JJ133-3
J102	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 round female contact, straight type; series BNC to BNC.	UG625*/U
J103	Same as J102.	
J104	Same as J102.	
J105	CONNECTOR, RECEPTACLE, ELECTRICAL: one male contact, 50 ohm.	JJ154
J106 thru J108	Same as J105.	
J109	CONNECTOR, RECEPTACLE, ELECTRICAL: male.	MS3102A-2027P
J110	Same as J105. (Part of Z107)	
J111	Same as J105.	
J112	NOT USED	
J113	Same as J102.	
K101	RELAY ASSY; solenoid, plug in type, octal base.	A1460
L101	COIL, RADIO FREQUENCY: 8 mc; .95-1.01 uh, Q greater than 115.	CL207

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L102	COIL, RADIO FREQUENCY: 10 mc; .95-1.01 uh, Q greater than 115.	CL208
L103	COIL, RADIO FREQUENCY: 12 mc; .95-1.01 uh, Q greater than 115.	CL209
L104	COIL, RADIO FREQUENCY: 14 mc; .95-1.01 uh, Q greater than 115.	CL210
L105	COIL, RADIO FREQUENCY: 16 mc; .95-1.01 uh, Q greater than 115.	CL211
L106	COIL, RADIO FREQUENCY: 18 mc; .95-1.01 uh, Q greater than 115.	CL212
L107	COIL, RADIO FREQUENCY: 20 mc; .95-1.01 uh, Q greater than 115.	CL213
L108	COIL, RADIO FREQUENCY: 22 mc; .77-.83 uh, Q greater than 115.	CL214
L109	COIL, RADIO FREQUENCY: 24 mc; .67-.73 uh, Q greater than 115.	CL215
L110	COIL, RADIO FREQUENCY: 26 mc; .58-.64 uh, Q greater than 115.	CL216
L111	COIL, RADIO FREQUENCY: 28 mc; .46-.50 uh, Q greater than 115.	CL206
L112	COIL, RADIO FREQUENCY: 30 mc; .40-.45 uh, Q greater than 115.	CL204
L113	COIL, RADIO FREQUENCY: 32-34 mc; .29-.34 uh, Q greater than 115.	CL205
L114	Same as L113.	
L115	COIL, RADIO FREQUENCY: fixed, 10 uh, 75 ma 3 Pi.	CL101-4
L116	COIL, RADIO FREQUENCY: fixed, 2.8 uh.	CL105-3

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L117	COIL, RADIO FREQUENCY: fixed; 150 uh, 100 ma.	CL140-2
L118	COIL, RADIO FREQUENCY: fixed; 2.5 uh, 100 ma.	CL140-1
L119	Same as L117.	
L120	Same as L117.	
L121	Same as L118.	
L122	Same as L117.	
L123	Same as L118.	
L124	Same as L118.	
L125	COIL, plate peaking.	CL187
L126	COIL, RADIO FREQUENCY: fixed; 128 uh.	CL177
L127	COIL, RADIO FREQUENCY: fixed; 750 uh, 75 ma, 2 Pi.	CL100-5
L128	NOT USED	
L129	COIL, RADIO FREQUENCY: fixed; 4 uh.	CL105-2
L130	Same as L129.	
L131	Same as L129.	
L132	Same as L117.	
L133 thru L142	NOT USED	
L143 thru L149	Same as L117.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L150	COIL, RADIO FREQUENCY: fixed; molded, 120.0 uh, 20 mc approximate, 3.2 ohms, powdered iron coil form.	CL240-120
L151	COIL, RADIO FREQUENCY: fixed; 5.6 uh, $\pm 10\%$; DC current 1,560 ma; molded case.	CL270-5.6
L152	COIL, RADIO FREQUENCY: fixed; 3.3 uh, $\pm 10\%$; DC current rating 530 ma; molded case.	CL270-3.3
L153	COIL, RADIO FREQUENCY: fixed; 0.9 uhy, ± 0.05 uhy; operating frequency 25 MCS; solenoid winding, close wound.	CL241
L154	COIL, RADIO FREQUENCY: fixed; 0.68 uh, $\pm 20\%$; DC current rating 1,870 ma; molded case.	CL270-0.68
M101	METER, D.C. : 0-200 ua; spade type pointer; black phenolic case with matte finish; stud mounted.	MR100-8
P101	CONNECTOR, PLUG, ELECTRICAL: male. (Part of W101)	MS3106B20-27P
P102	CONNECTOR, PLUG, ELECTRICAL: female. (Part of W101)	MS3106B20-27S
P103	CONNECTOR, PLUG, ELECTRICAL: min. coaxial type.	PL154
P104 thru P106	Same as P103.	
P107	CONNECTOR, PLUG, ELECTRICAL: min. coaxial type.	PL155
P108	Same as P103.	
PS101	SUPPRESSOR, PARASITIC	AX164
PS102	SUPPRESSOR, PARASITIC	AX160

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
PS103	SUPPRESSOR, PARASITIC	AX161
R101	RESISTOR, FIXED, COMPOSITION: 560 ohms, +5%; 1/2 watt.	RC20GF561J
R102	Same as R101.	
R103	RESISTOR, FIXED, COMPOSITION: 470,000 ohms, +5%; 1/2 watt.	RC20GF474J
R104	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, +5%; 1/2 watt.	RC20GF104J
R105	RESISTOR, FIXED, COMPOSITION: 1,500 ohms, +5%; 1/2 watt.	RC20GF152J
R106	NOT USED	
R107	NOT USED	
R108	RESISTOR, FIXED, COMPOSITION: 1,800 ohms, +5%; 1/2 watt.	RC20GF182J
R109 thru R119	NOT USED	
R120	RESISTOR, FIXED, WIREWOUND: 5,000 ohms, +5%; 10 watts.	RW109-32
R121 thru R123	NOT USED	
R124	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, +5%; 1 watt.	RC32GF472J
R125	Same as R104.	
R126	Same as R103.	
R127	Same as R103.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R128	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, $\pm 5\%$; 1/2 watt. (Part of Z103)	RC20GF102J
R129	RESISTOR, VARIABLE, COMPOSITION: 5000 ohms, $\pm 10\%$; 2 watts.	RV4NAYSA-502AYY
R130	RESISTOR, VARIABLE, COMPOSITION: 1,000 ohms, $\pm 10\%$; 2 watts.	RV4LAYSA-102A
R131	RESISTOR, FIXED, COMPOSITION: 820 ohms, $\pm 5\%$; 1/2 watt.	RC20GF821J
R132	Same as R104.	
R133	RESISTOR, FIXED, COMPOSITION: 10 meg. ohm, $\pm 5\%$; 1/2 watt.	RC20GF106J
R134	RESISTOR, FIXED, COMPOSITION: 680,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF684J
R135	RESISTOR, VARIABLE, COMPOSITION: 1,000 ohms, $\pm 10\%$; 2 watts	RV4NAYSA-102AYY
R136	Same as R104.	
R137	Same as R104.	
R138	RESISTOR, FIXED, COMPOSITION: 82,000 ohms, $\pm 5\%$; 2 watts.	RC42GF823J
R139	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, $\pm 5\%$; 2 watts.	RC42GF104J
R140	RESISTOR, VARIABLE, COMPOSITION: 100,000 ohms, $\pm 20\%$; 2 watts.	RV4NAYSA-104AYY
R141	RESISTOR, FIXED, COMPOSITION: 470 ohms, $\pm 5\%$; 1/2 watt.	RC20GF471J
R142	Same as R128.	
R143	Same as R103.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R144	Same as R103.	
R145	Same as R133.	
R146	RESISTOR, FIXED, COMPOSITION: 2.2 meg-ohms, <u>+5%</u> ; 1/2 watt.	RC20GF225J
R147	Same as R104.	
R148	Same as R133.	
R149	Same as R133.	
R150	NOT USED	
R151	Same as R131.	
R152	Same as R138.	
R153	Same as R134.	
R154	RESISTOR, FIXED, COMPOSITION: 1.5 meg-ohms, <u>+5%</u> ; 1/2 watt.	RC20GF155J
R155	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, <u>+5%</u> ; 1 watt.	RC32GF223J
R156	Same as R155.	
R157	RESISTOR, FIXED, COMPOSITION: 1,200 ohms, <u>+10%</u> ; 1/2 watt.	RC20GF122K
R158	Same as R157.	
R159	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, <u>+5%</u> ; 1 watt.	RC32GF223J
R160	Same as R154.	
R161	Same as R105.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R162	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF472J
R163	Same as R134.	
R164 thru R167	NOT USED	
R168	Same as R129.	
R169	Same as R129.	
R170	Same as R105.	
R171 thru R180	NOT USED	
R181	Same as R131.	
R182	Same as R104.	
R183	Same as R133.	
R184	Same as R134.	
R185 thru R190	NOT USED	
R191	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, <u>+5%</u> ; 1 watt.	RC32GF102J
R192	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, <u>+10%</u> ; 1/2 watt.	RC20GF473K
R193	Same as R192.	
R194	NOT USED	
R195	NOT USED	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R196	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, $\pm 5\%$; 2 watts.	RC42GF103J
R197	RESISTOR, FIXED, COMPOSITION: 68 ohms, $\pm 5\%$; 1/2 watt.	RC20GF680J
R198	Same as R197.	
R199	RESISTOR, FIXED, COMPOSITION: 39 ohms, $\pm 10\%$; 1/2 watt.	RC20GF390K
R200	RESISTOR, FIXED, COMPOSITION: 100 ohms, $\pm 5\%$, 1/2 watt.	RC20GF101J
R201	Same as R197.	
R202	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF473J
R203	RESISTOR, FIXED, COMPOSITION: 1200 ohms, $\pm 5\%$; 1 watt.	RC32GF122J
R204	RESISTOR, FIXED, COMPOSITION: 220,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF224J
R205	RESISTOR, VARIABLE, COMPOSITION: 5,000 ohms, $\pm 10\%$; 2 watts.	RV4NAYSD-502C
R206	Same as R200.	
R207	RESISTOR, FIXED, WIREWOUND: 20 watts. (Part of TB101)	RR102-1
R208	Same as R207.	
R209	RESISTOR, FIXED, COMPOSITION: 390,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF394J
R210	Same as R128.	
R211	RESISTOR, FIXED, COMPOSITION: 560 ohms, $\pm 5\%$; 1/2 watt.	RC20GF561J

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R212	Same as R128.	
R213	Same as R103.	
R214	RESISTOR, FIXED, COMPOSITION: 10 ohms, $\pm 10\%$; 1/2 watt.	RC20GF100K
R215	RESISTOR, FIXED, COMPOSITION: 68,000 ohms, $\pm 10\%$; 1/2 watt.	RC20GF683K
R216	RESISTOR, FIXED, WIREWOUND: 500 ohms, $\pm 5\%$; 10 watts.	RW109-19
R217	RESISTOR, FIXED, COMPOSITION: 5,600 ohms, $\pm 10\%$; 1 watt.	RC32GF562K
R218	Same as R199.	
R219	Same as R197.	
R220	Same as R214.	
R221	NOT USED	
R222	Same as R128.	
R223	RESISTOR, FIXED, COMPOSITION: 33,000 ohms, $\pm 10\%$; 1/2 watt.	RC20GF333K
R224	Same as R214.	
R225	Same as R200.	
R226	Same as R214.	
R227	RESISTOR, FIXED, COMPOSITION: 2,700 ohms, $\pm 10\%$; 1/2 watt.	RC20GF272K
R228	RESISTOR, FIXED, COMPOSITION: 330 ohms, $\pm 5\%$; 1/2 watt.	RC20GF331J
R229	Same as R104.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R230	RESISTOR, FIXED, COMPOSITION: 2,700 ohms, <u>+10%</u> ; 1 watt. (Part of L125)	RC32GF272J
R231	RESISTOR, FIXED, COMPOSITION: 6,800 ohms, <u>+10%</u> ; 1 watt.	RC32GF682J
R232	Same as R159.	
R233	Same as R104.	
R234	NOT USED	
R235	Same as R104.	
R236	NOT USED	
R237	RESISTOR, FIXED, COMPOSITION: 270 ohms, <u>+10%</u> ; 1/2 watt.	RC20GF271K
R238	RESISTOR, FIXED, COMPOSITION: 560,000 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF564J
R239	Same as R105.	
R240	Non-replaceable item. (Part of T109)	
R241	RESISTOR, FIXED, COMPOSITION: 270 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF271J
R242 thru R244	Same as R241.	
R245	RESISTOR, FIXED, COMPOSITION: 180 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF181J
R246	Same as R245.	
R247	RESISTOR, FIXED, COMPOSITION: 8,200 ohms, <u>+5%</u> ; 1/2 watt.	RC20GF822J
R248	Same as R247.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R249	RESISTOR, FIXED, COMPOSITION: 18,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF183J
R250	Same as R249.	
R251	Same as R247.	
R252	RESISTOR, FIXED, COMPOSITION: 3,900 ohms, $\pm 5\%$; 1/2 watt.	RC20GF392J
R253	Same as R252.	
R254	RESISTOR, FIXED, COMPOSITION: 11,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF113J
R255	Same as R254.	
R256	RESISTOR, FIXED, COMPOSITION: 15,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF153J
R257	Same as R256.	
R258	Same as R120.	
R259	Same as R241.	
R260	Same as R241.	
R261	RESISTOR, FIXED, COMPOSITION: 33,000 ohms, $\pm 5\%$; 1 watt.	RC32GF333J
R262	Same as R261.	
R263	RESISTOR, VARIABLE, WIREWOUND: 250 ohms, $\pm 10\%$; 2 watts, linear taper.	RA10IASRD-251A
R264	RESISTOR, FIXED, COMPOSITION: 2,200 ohms, $\pm 5\%$; 1/2 watt.	RC20GF222J
R265	RESISTOR, VARIABLE, COMPOSITION: 250 ohms, $\pm 10\%$; 1/2 watt; linear taper.	RV106UX8B-251A

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R266	Same as R265.	
R267 thru R272	NOT USED	
R273	Same as R200.	
R274	RESISTOR, FIXED, COMPOSITION: 82,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF823J
R275	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF223J
R276	Same as R105.	
R277	Same as R103.	
R278	RESISTOR, FIXED, COMPOSITION: 220 ohms, $\pm 10\%$; 2 watts.	RC42GF221K
R279	Same as R128.	
R280	RESISTOR, VARIABLE, COMPOSITION: 2,500 ohms, $\pm 10\%$; 1/2 watt; linear taper.	RV106UX8B- 252A
R281	Same as R128.	
R282	Same as R104.	
R283	RESISTOR, FIXED, COMPOSITION: 220 ohms, $\pm 5\%$; 1/2 watt.	RC20GF221J
R284	RESISTOR, FIXED, COMPOSITION: 20,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF203J
R285	Same as R128.	
R286	Same as R283.	
R287	Same as R104.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R288	Same as R284.	
S101	SWITCH, ROTARY: 4 positions, double throw; non-shorting type; glass melamine insulation.	SW181
S102	Same as S101.	
S103	SWITCH, TOGGLE: SPST; solder lug terminals, 110/250 volts AC or DC.	ST103-1-62
S104	Same as S103.	
S105	Same as S103.	
S106A, B, C	WAFER, SWITCH: four positions, shorting type.	WS101
S106D	WAFER, SWITCH: four positions, shorting type.	WS103
S106E	WAFER, SWITCH: 1 section, 4 positions; 30° angle of throw; shorting type contacts, silver plated brass; mycalex wafer insulation.	WS137
S107	SWITCH, ROTARY: 1 section, 11 positions; 30° angle of throw; shorting type contacts, silver plated brass; mycalex wafer insulation.	SW419
S108A, C	SWITCH, ROTARY: 1 section, 15 positions; single pole, shorting type.	WS102
S108B	SWITCH, ROTARY: 1 section, 15 positions; shorting type contacts, silver plated brass; bakelite wafer insulation.	SW413
S109	SWITCH, ROTARY: 5 positions; shorting type, single pole, 30° detent.	SW199
S110	SWITCH, SENSITIVE: bi-metallic; 80° breaking temperature, +2°. (Part of TB101)	SS100-3
TB101	HEATER TERMINAL BOARD ASSEMBLY: consists of C222, R206, 207, 208, S110.	A1520

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
T101	TRANSFORMER, AUDIO: pri. imp. 150/600 ohms; sec. imp. 600 ohms CT; 7 terminals.	TF170
T102	Same as T101.	
T103	TRANSFORMER, AUDIO: pri. imp. 20,000 ohms CT; sec. imp. 150/600 ohms; 7 terminals.	TF138
T104	Same as T103.	
T105 thru T108	NOT USED	
T109	TRANSFORMER, RADIO FREQUENCY: 2-4 mc; single tuned.	A1512
T110	TRANSFORMER, RADIO FREQUENCY: 2-4 mc; single tuned.	A1511
T111	Non-replaceable item. (Part of Z107)	
T112	TRANSFORMER, RADIO FREQUENCY: 16-32 mc; slug tuned.	CL189-2
T113	TRANSFORMER, RADIO FREQUENCY: 4-8 mc; slug tuned.	CL163
T114	TRANSFORMER, RADIO FREQUENCY: 16-32 mc; slug tuned.	CL188-2
T115	TRANSFORMER, RADIO FREQUENCY: 8-16 mc; slug tuned.	CL164
T116	TRANSFORMER, RADIO FREQUENCY: 2-4.3 mc; slug tuned.	CL162
T117	Same as T113.	
T118	Same as T114.	
T119	Same as T115.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
T120	TRANSFORMER, RADIO FREQUENCY: 2-4.3 mc; slug tuned.	CL161
T121	Same as T113.	
T122	TRANSFORMER, RADIO FREQUENCY: 8-16 mc; slug tuned.	CL165
T123	TRANSFORMER, HIGH FREQUENCY: Osc. output; ferrite core.	TF173
T124	TRANSFORMER, HIGH FREQUENCY: VMO input.	TR166
T125	TRANSFORMER, RADIO FREQUENCY: 250 kc; double tuned.	TT100
T126	Same as T125.	
T127	TRANSFORMER, RADIO FREQUENCY: operating frequency 250 kc.	TT114
T128	TRANSFORMER, PULSE: 4.7 mh, $\pm 20\%$; 500 VDC; metal tubular case.	TF228K15
V101	TUBE, ELECTRON: RF triode; 7 pin miniature.	6AB4
V102 thru V104	NOT USED	
V105	TUBE, ELECTRON: medium-mu duo-triode, 9 pin miniature. (Part of Z103)	12AU7
V106	TUBE, ELECTRON: voltage regulator; 7 pin miniature.	OA2
V107 thru V109	NOT USED	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
V110	TUBE, ELECTRON: 9 pin miniature.	6U8
V111	TUBE, ELECTRON: duo diode; 7 pin miniature.	6AL5
V112	Same as V105.	
V113A, B	TUBE, ELECTRON: duo triode; 9 pin miniature.	12AT7
V114	TUBE, ELECTRON: sharp cutoff RF pentode; 7 pin miniature.	6AH6
V115	Same as V105.	
V116	TUBE, ELECTRON: power pentode, wide band amp; 9 pin miniature.	6CL6
V117	Same as V110.	
V118	Same as V114.	
V119	Same as V116.	
V120	TUBE, ELECTRON: beam power; large wafer octal base with sleeve.	6146
V121	Same as V106.	
V122A, B	TUBE, ELECTRON: duo triode; 9 pin miniature.	12AT7
V123A, B	Same as V122A, B.	
V124	Same as V101.	
V125	Same as V101.	
V126	Same as V114.	
V127	Same as V101.	
V128A, B	Same as V122A, B.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE -8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
W101	CABLE ASSEMBLY, ELECTRICAL: Power; consists of various size and color of MWC wire, with insulation sleeving; two connectors P101, P102. (For use with standard SBE)	CA346-3-0
W101	CABLE ASSEMBLY, ELECTRICAL: Power; consists of various size and color of MWC wire, with insulation sleeving; two connectors P101, P102. (For use with SBE when part of GPT-10K or SBT-350)	CA346-8-9
W101	CABLE ASSEMBLY, ELECTRICAL: Power; consists of various size and color MWC wire, with insulation sleeving; two connectors P101, P102. (For use with SBE when part of SBT-1K, RAK-9)	CA346-3-9
XCR101 thru XCR114	NOT USED	
XCR115	SOCKET: 7 pin miniature; molded plastic.	TS102P01
XCR116	Same as XCR115.	
XII01	SOCKET, LENS: miniature bayonet; red indicator lens.	TS106-1
XII02	SOCKET, LENS: miniature bayonet; white indicator lens.	TS106-2
XII03	SOCKET, BRACKET: miniature bayonet.	TS107-2
XK101	SOCKET, OCTAL: molded plastic.	TS101P01
XV101	Same as XCR115.	
XV102 thru XV104	NOT USED	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
XV105	SOCKET, PLUG-IN: w/can; 9 pin miniature. (Part of Z103)	PO148-9-2
XV106	Same as XCR115.	
XV107 thru XV109	NOT USED	
XV110	SOCKET, ELECTRON TUBE: 9 pin miniature; molded plastic.	TS103P01
XV111	Same as XCR115.	
XV112	Same as XV110.	
XV113	Same as XV110.	
XV114	Same as XCR115.	
XV115 thru XV117	Same as XV110.	
XV118	Same as XCR115.	
XV119	Same as XV110.	
XV120	Same as XK101.	
XV121	Same as XCR115.	
XV122	Same as XV110.	
XV123	Same as XV110.	
XV124 thru XV127	Same as XCR115.	
XV128	Same as XV110.	

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
XY101	SOCKET, CRYSTAL: steatite; cadmium plated phosphor bronze.	TS104-1
XY102 thru XY108	Same as XY101.	
XY109	NOT USED	
XY110	NOT USED	
XY111 thru XY120	Same as XY101.	
XY121	SOCKET, CRYSTAL: Non-replaceable item. (Part of Z108)	
XZ103	Same as XK101.	
XZ104 thru XZ107	NOT USED	
XZ108	Same as XK101.	
Y101	CRYSTAL, UNIT QUARTZ: 8 mc.	CR27/U- 8.000P
Y102	CRYSTAL, UNIT QUARTZ: 10 mc.	CR27/U- 10.000P
Y103	CRYSTAL, UNIT QUARTZ: 12 mc.	CR27/U- 12.000P
Y104	CRYSTAL, UNIT QUARTZ: 14 mc.	CR27/U- 14.000P
Y105	CRYSTAL, UNIT QUARTZ: 18 mc.	CR27/U- 18.000P
Y106	CRYSTAL, UNIT QUARTZ: 11 mc.	CR27/U- 11.000P

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Y107	CRYSTAL, UNIT QUARTZ: 13 mc.	CR27/U-13.000P
Y108	CRYSTAL, UNIT QUARTZ: 17 mc.	CR27/U-17.000P
Y109	NOT USED	
Y110	NOT USED	
Y111	SUPPLIED ON CUSTOMERS REQUEST.	
Y112	SUPPLIED ON CUSTOMERS REQUEST.	
Y113	SUPPLIED ON CUSTOMERS REQUEST.	
Y114	SUPPLIED ON CUSTOMERS REQUEST.	
Y115	SUPPLIED ON CUSTOMERS REQUEST.	
Y116	SUPPLIED ON CUSTOMERS REQUEST.	
Y117	SUPPLIED ON CUSTOMERS REQUEST.	
Y118	SUPPLIED ON CUSTOMERS REQUEST.	
Y119	SUPPLIED ON CUSTOMERS REQUEST.	
Y120	SUPPLIED ON CUSTOMERS REQUEST.	
Y121	CRYSTAL, UNIT QUARTZ: 250 kc.	CR47A/U-250.000KC
Z101	NOT USED	
Z102	NOT USED	
Z103	ASSEMBLY: 250 kc oscillator; consists of C118, 121, 122, 123, 124, R125, 126, 128, V105, XV105.	A1458

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Z104 thru Z106	NOT USED	
Z107	NETWORK, HF MODULATOR: resultant frequency 2-32 mc; 3-3/8" lg. x 1-3/16" wide; stud mounted.	NW127
Z108	OVEN, CRYSTAL: 250 Kc.	PO184
Z109	NOT USED	
Z110	<p>FILTER, BANDPASS: lower sideband; operating frequency approx. 3 Kc; carrier frequency 250.000 Kcs; 246.960 to 249.750 Kcs at -ldb points; input and output impedance 10K ohms unbalanced. (Model SBE-8)</p>	FX241
	<p>FILTER, BANDPASS: lower sideband; operating frequency approx. 7.5 Kc; carrier frequency 250.000 Kcs; 249.750 to 241.500 +500 cps at -2db points; input and output impedance 10K ohms unbalanced. (Model SBE-9)</p>	FX158
	<p>FILTER, BANDPASS: lower sideband; operating frequency approx. 6 Kc; carrier frequency 250.000 Kcs; 243.920 to 249.750 Kcs at -ldb points; input and output impedance 10K ohms unbalanced. (Model SBE-10)</p>	FX243
Z111	<p>FILTER, BANDPASS: upper sideband; operating frequency approx. 3 Kc; carrier frequency 250.000 Kcs; 250.250 to 253.040 Kcs at -ldb points; input and output impedance 10K ohms unbalanced. (Model SBE-8)</p>	FX238
	<p>FILTER, BANDPASS: upper sideband; operating frequency approx. 7.5 Kc; carrier frequency 250.000 Kcs; 250.250 to 258.500 +500 cps at -2db points; input and output impedance 10K ohms unbalanced. (Model SBE-9)</p>	FX160

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR MODEL SBE-8, 9, 10

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Z111 (cont)	FILTER, BANDPASS: upper sideband; operating frequency approx. 6 Kc; carrier frequency 250.00 Kcs; 250.250 to 256.080 Kcs at -1db points; input and output impedance 10K ohms unbalanced. (Model SBE-10)	FX239
Z112	FILTER, CARRIER SUPPRESSION: carrier frequency 250 Kc.	FX159

TRANSMITTING MODE SELECTOR POWER SUPPLY

C401	CAPACITOR, FIXED, ELECTROLYTIC: 80 uf, 450 WVDC; polarized.	CE51C800R
C402	Same as C401.	
C403A, B	CAPACITOR, FIXED, ELECTROLYTIC: dual; 20 uf, 450 WVDC; polarized.	CE52C200R
C404A, B	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 2 x 10,000 uuf, GMV; 1,000 WVDC.	CC100-23
EV401	NOT USED	
EV402	SHIELD, ELECTRON TUBE: 7 pin miniature; 2-1/4 inch high x 0.930 inch base dia.	TS102U03
F401	FUSE, CARTRIDGE: 2 amps; time lag; 1-1/4" long x 1/4" dia.; slow blow. (For 115 V operation)	FU102-2
F401	FUSE, CARTRIDGE: 1 amp; time lag; 1-1/4" long x 1/4" dia.; slow blow. (For 230 V operation)	FU102-1
F402	FUSE, CARTRIDGE: 3 amps; time lag; 1-1/4" lg. x 1/4" dia; slow blow. (For 115V operation)	FU102-3
F402	FUSE, CARTRIDGE: 1-1/2 amps; time lag; 1-1/4" lg. x 1/4" dia; slow blow. (For 230V operation)	FU102-1.5

PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR POWER SUPPLY

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
F403	FUSE, CARTRIDGE: 1/4 amp; time lag; 1-1/4" lg. x 1/4" dia; slow blow.	FU102-.250
I401	LAMP, INCANDESCENT: 6-8V; .250 amp; T-3-1/4 clear bulb.	BI101-47
J401	CONNECTOR, RECEPTACLE, ELECTRICAL: two prong; male.	JJ100
J402	CONNECTOR, RECEPTACLE, ELECTRICAL: female; AN pin type. (Part of W402)	MS3102A-2027S
L401	REACTOR, FILTER: 10 hy, 200 ma.	TF144
L402	Same as L401.	
P401	CONNECTOR, PLUG, ELECTRICAL: female; AC, twist lock. (Part of W401)	PL100
P402	CONNECTOR, PLUG, ELECTRICAL: male. (Part of W401)	PL171
R401	RESISTOR, FIXED, COMPOSITION: 15,000 ohms, +10%; 2 watts.	RC42GF153K
R402	RESISTOR, FIXED, WIREWOUND: 7,500 ohms, 10 watts.	RW109-33
R403	RESISTOR, FIXED, WIREWOUND: 1,000 ohms, 10 watts.	RW109-24
R404	RESISTOR, FIXED, WIREWOUND: 15,000 ohms, 10 watts.	RW109-36
R405	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, +10%; 1 watt.	RC32GF104K
T401	TRANSFORMER, POWER	TF161
T402	TRANSFORMER, FILAMENT	TF104
V401	TUBE, ELECTRON: duo diode; rectifier.	5R4

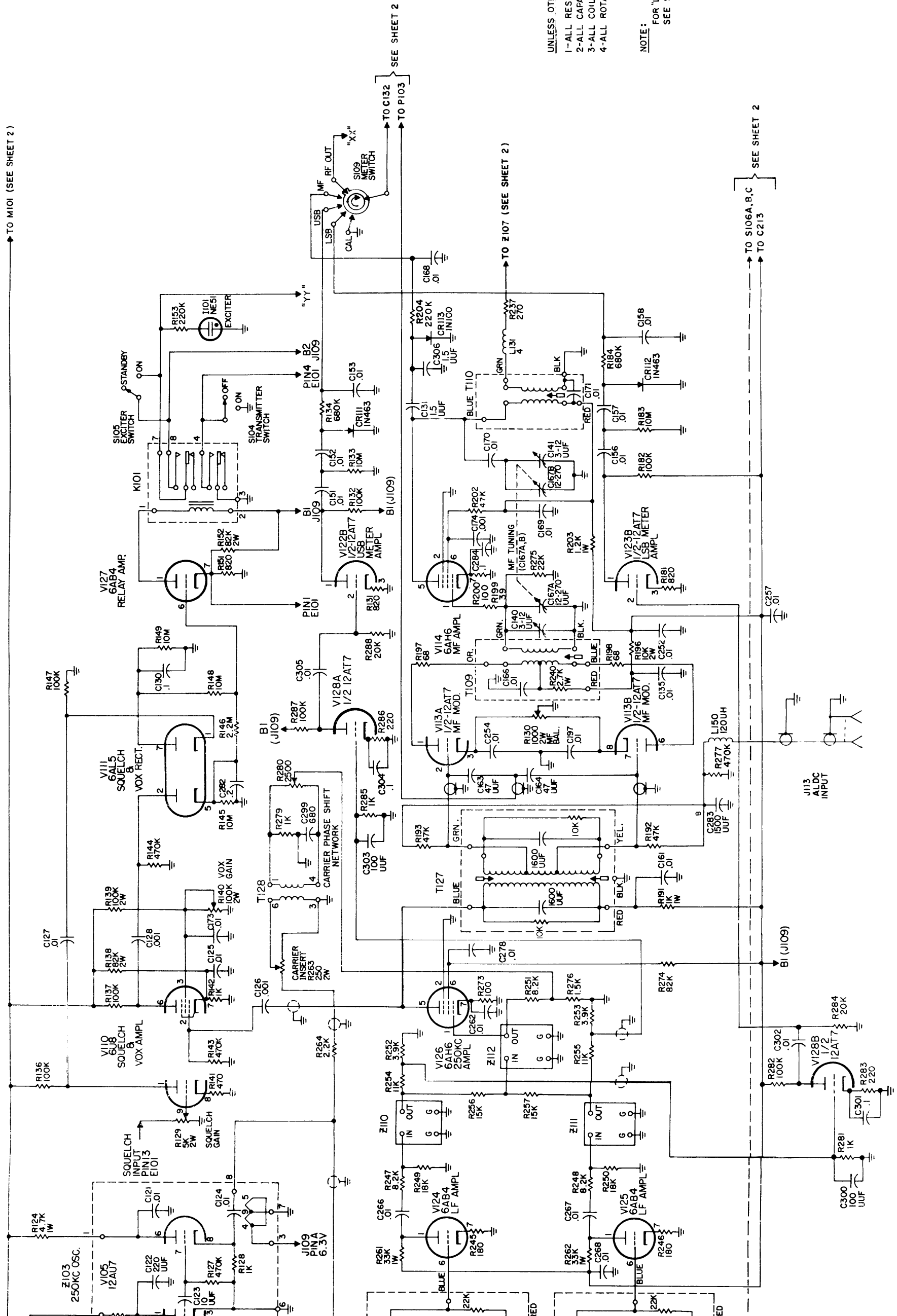
PARTS LIST (CONT)

TRANSMITTING MODE SELECTOR POWER SUPPLY

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
V402	TUBE, ELECTRON: voltage regulator.	OA2
W401	CABLE, AC POWER: w/connector, plug, 2 prong. (Consists of P401, P402)	CA103-72
W402	WIRING HARNESS, BRANCHED, ELECTRICAL: consists of various lengths and colors of MWC number 22 wire and 1 connector J402.	CA344
XC401	SOCKET, ELECTRON TUBE: 9 pin oval.	TS101P01
XC402	Same as XC401.	
XC403	Same as XC401.	
XF401	FUSEHOLDER: extractor post type for single AGC type fuse.	FH100-1
XF402	Same as XF401.	
XF403	Same as XF401.	
XI401	SOCKET, INDICATOR: w/red frosted lens.	TS106-1
XV401	Same as XC401.	
XV402	SOCKET, ELECTRON TUBE: 7 pin miniature.	TS102P01

SECTION 7
SCHEMATIC DIAGRAMS

TO M101 (SEE SHEET 2)

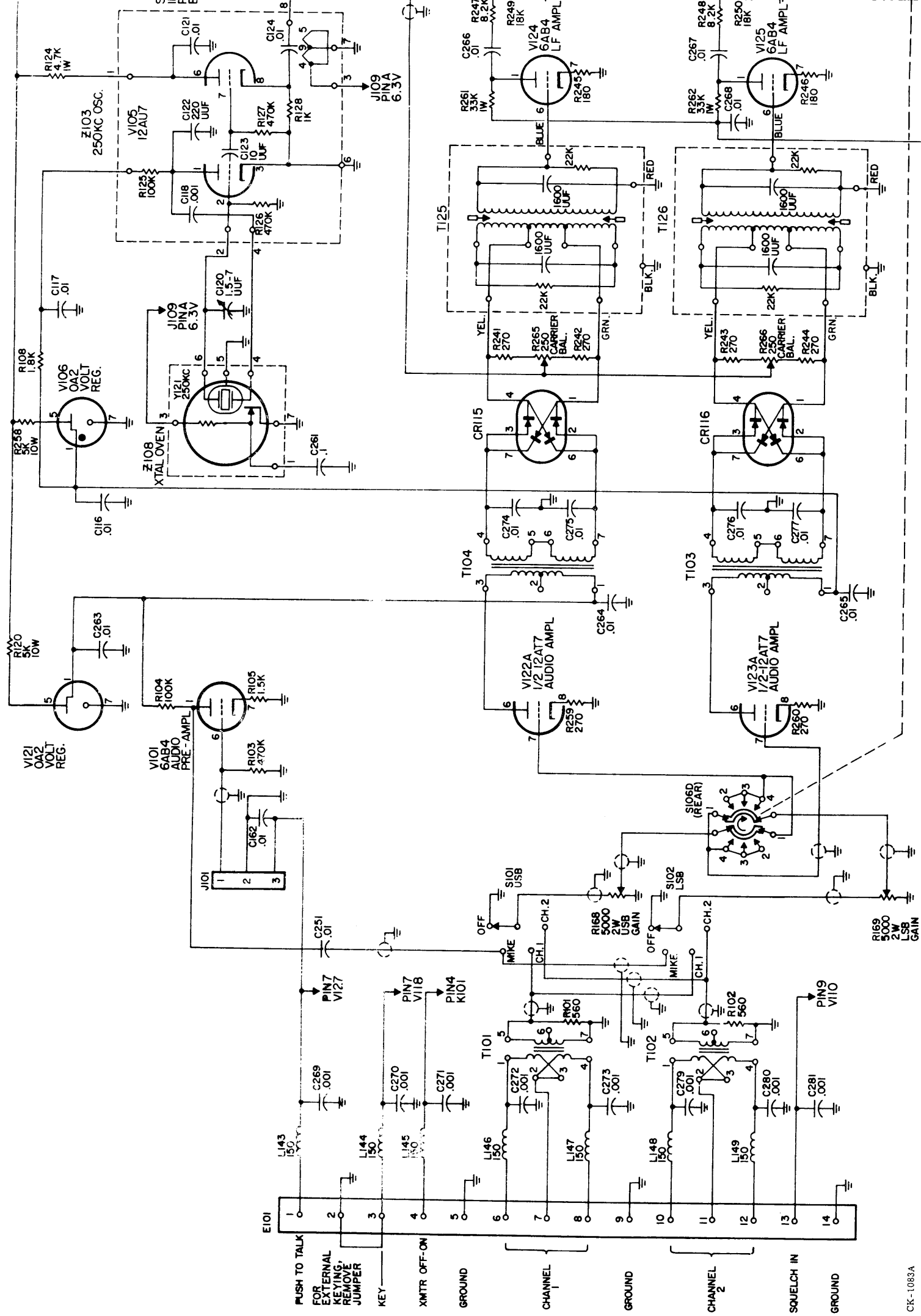


UNLESS OTHERWISE SPECIFIED

- 1-ALL RESISTORS ARE 1/2 WATT, K=1000 M=MILLION
- 2-ALL CAPACITORS ARE IN MICROFARADS.
- 3-ALL COILS ARE IN MICROHENRIES, MH=MILLIHENRIES
- 4-ALL ROTARY SWITCHES ARE SHOWN IN POSITION 1.

NOTE: FOR "LAST" & "MISSING" SYMBOLS, SEE SHEET 2.

Figure 7-1. Schematic Diagram, Exciter Unit (Sheet 1 of 2)

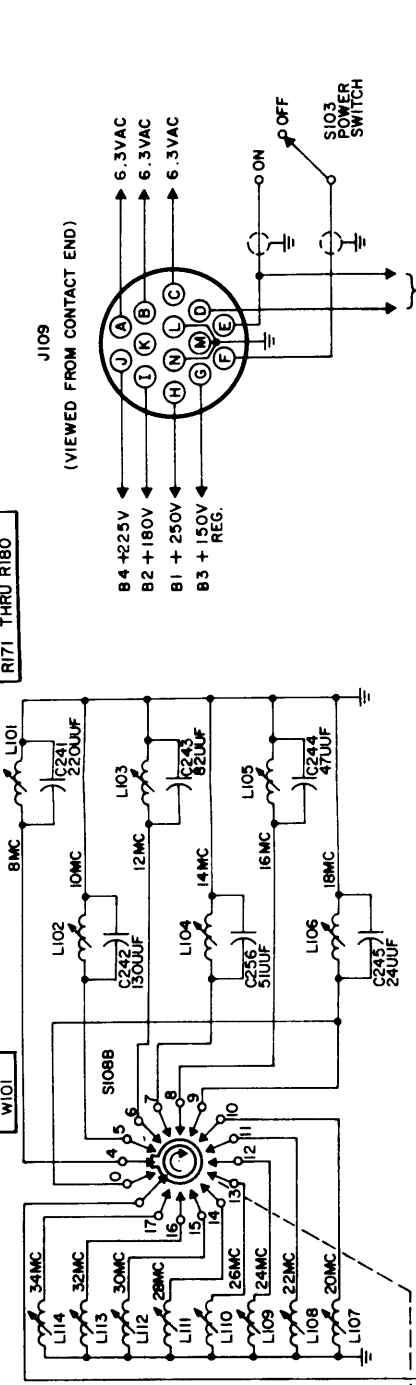


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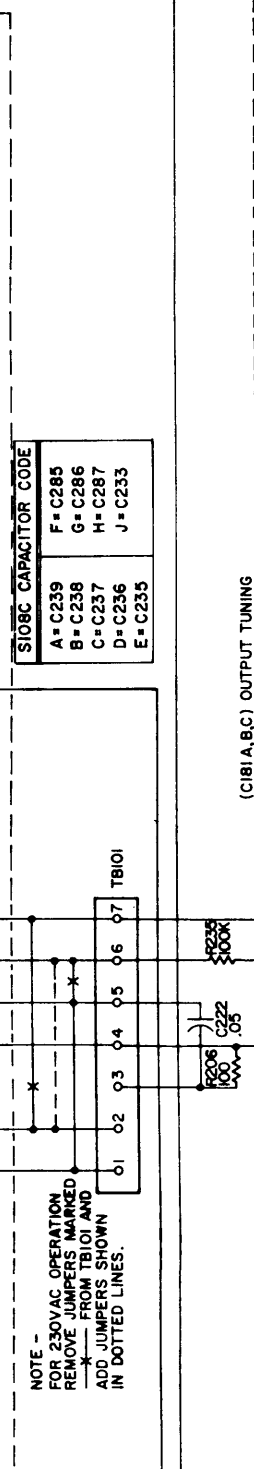
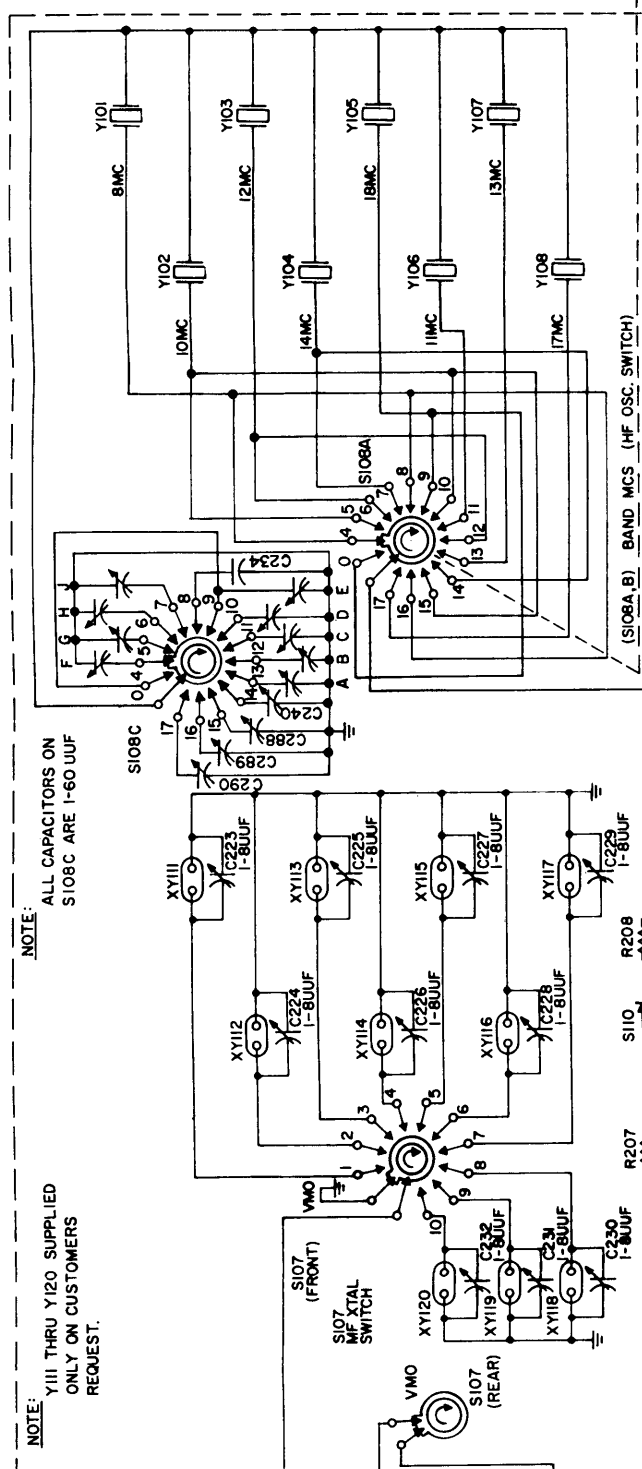
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UUF

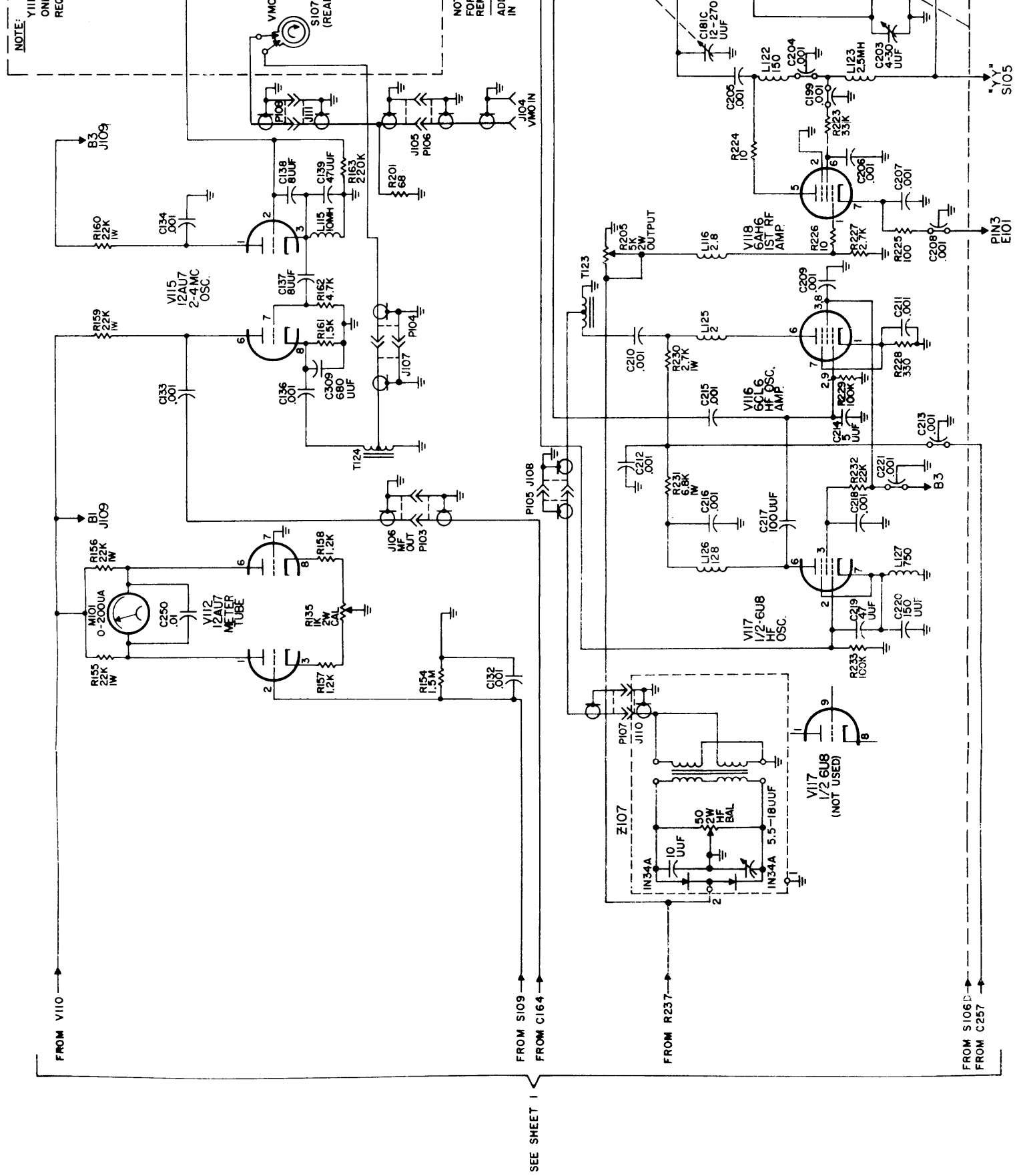
LAST SYMBOLS		MISSING SYMBOLS	
C309	FS103	C101 THRU C115, C119, C129, C142	J112
CR116	R289	THRU C150, C154, C155, C159,	K
E102	S110	C160, C165, C172, C195, C255,	L
I103	T128	C296, C299, C260, C307, C308	M
K101	TB101	T105 THRU T108, T111	P
L154	Y128	TB	PS
M101	Y121	CR101 THRU CR106, CR109, CR110	R
P108	Z112	CR107, CR108	S
	W101	R106, R107, R109 THRU R119, R121	T
		R122, R123, R164 THRU R167	
		R171 THRU R180	
		Z101, Z102, Z104, Z105, Z106, Z109	

SIO8C BAND MCS (HF OSC. SWITCH)		SIO8C CAPACITOR CODE	
A	C239	F	C285
B	C238	G	C286
C	C237	H	C287
D	C236	J	C235
E	C235		



- UNLESS OTHERWISE SPECIFIED
- 1- ALL RESISTORS ARE 1/2 WATT. K=1000 M=MILLION
 - 2- ALL CAPACITORS ARE IN MICROFARADS.
 - 3- ALL COILS ARE IN MICROHENRIES. MH=MILLIHENRIES
 - 4- ALL ROTARY SWITCHES ARE SHOWN IN POSITION 1.





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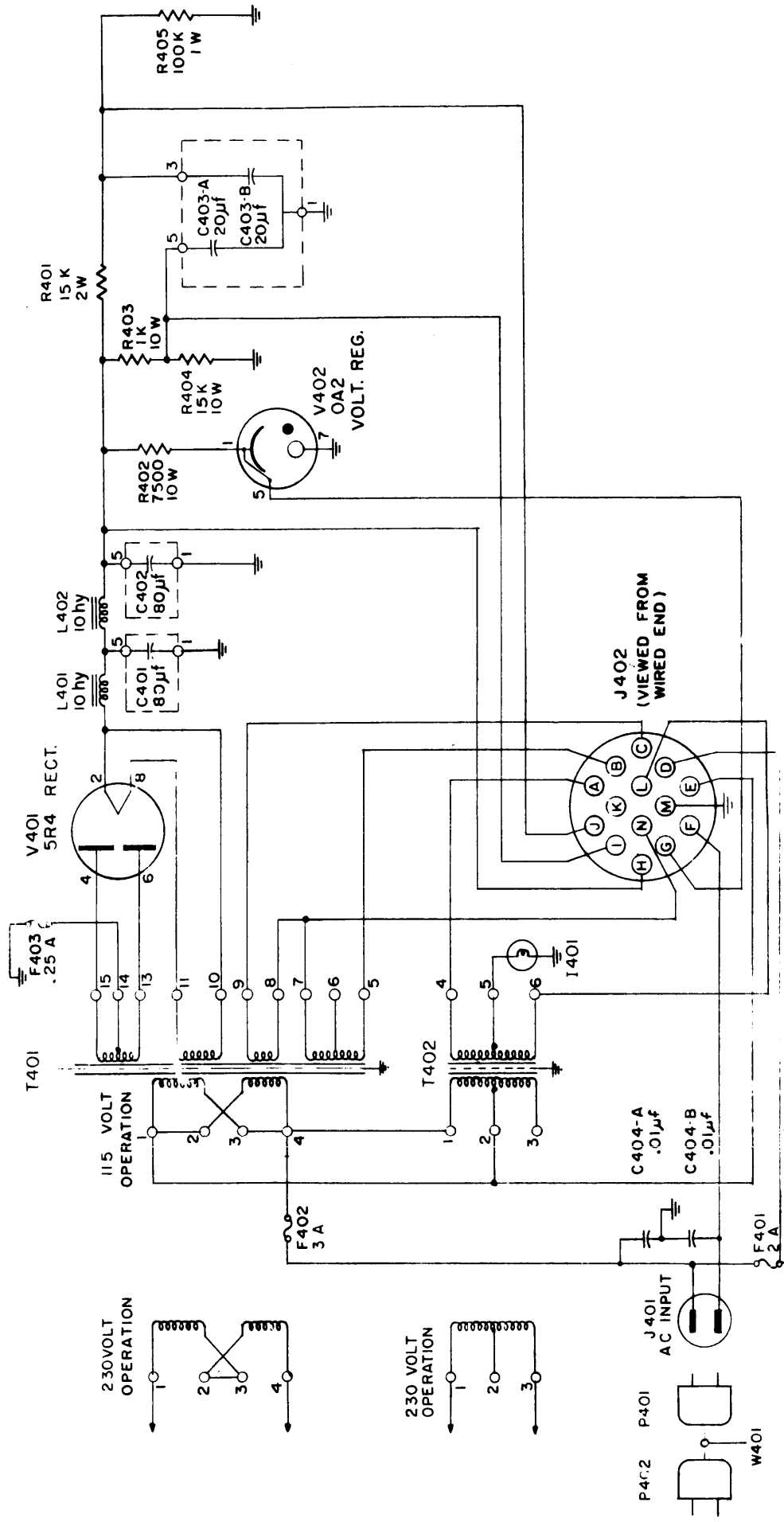


Figure 7-2. Schematic Diagram, Power Supply