NAVSHIPS 93163

INSTRUCTION BOOK

for

SINGLE SIDEBAND EXCITER MODEL SBE-2

(AN/URA-23A)

THE TECHNICAL MATERIEL CORP.

Mamaroneck, New York Ottawa, Ontario

Title Page and Cover

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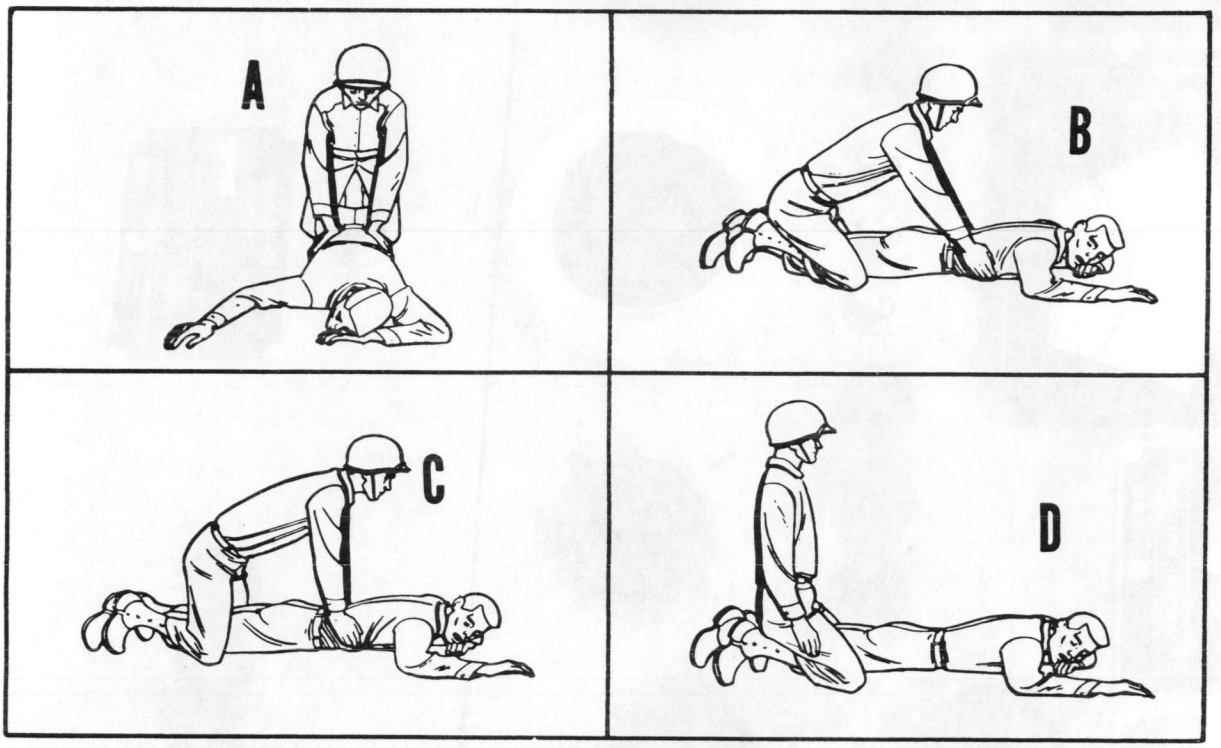
WARNING!

THE VOLTAGES USED IN THIS EQUIPMENT ARE SUFFICIENTLY HIGH TO ENDANGER LIFE: PRECAUTIONS HAVE BEEN OBSERVED IN THE DESIGN TO SAFEGUARD THE OPERATING PERSONNEL. POWER SHOULD BE REMOVED COMPLETELY AND THE HIGH VOLTAGE CAPACITORS IN THE POWER SUPPLY DISCHARGED.

RESUSCITATION PROCEDURE

IN CASE OF ELECTRIC SHOCK

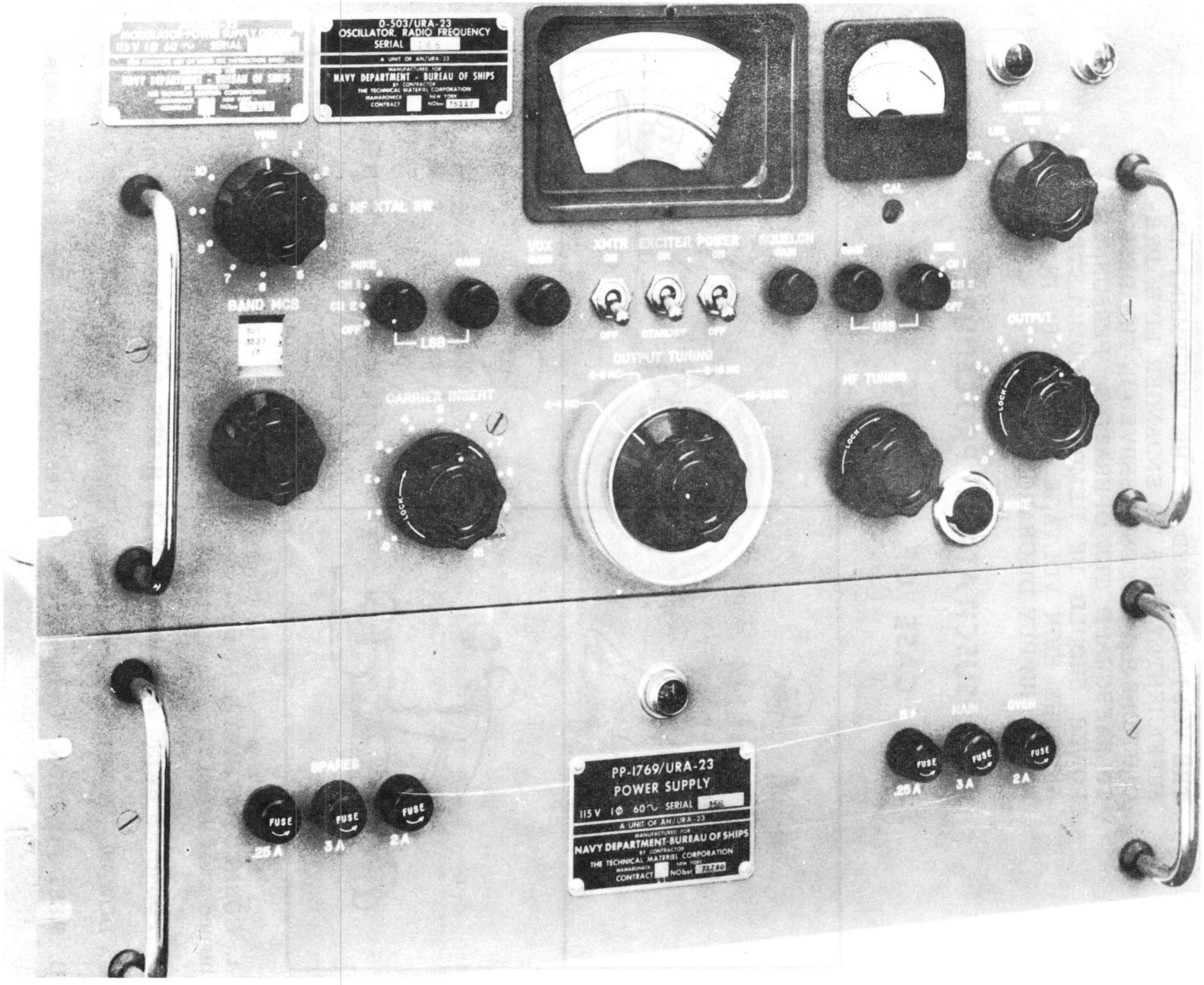


A. CORRECT POSITION: Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.

B. FORWARD SWING AND POSITION OF HANDS. Little finger rests on last rib.

C. DOWNWARD PRESSURE. Arms and thighs vertical.

D. REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for two seconds.


O-503/URA-23
OSCILLATOR, RADIO FREQUENCY
SERIAL
A UNIT OF AN/URA-23
MANUFACTURED FOR
NAVY DEPARTMENT - BUREAU OF SHIPS
BY CONTRACTOR
THE TECHNICAL MATERIEL CORPORATION
MAMARONECK NEW YORK
CONTRACT NObsr 75117
MF XTAL SW
BAND MCS
VOX
XMTR EXCITER POWER
SQUELCH
CAL
OUTPUT TUNING
CARRIER INSERT
MF TUNING
OUTPUT
LSB
USB
PP-1769/URA-23
POWER SUPPLY
115 V 1Ø 60~ SERIAL 356
A UNIT OF AN/URA-23
MANUFACTURED FOR
NAVY DEPARTMENT-BUREAU OF SHIPS
BY CONTRACTOR
THE TECHNICAL MATERIEL CORPORATION
MAMARONECK NEW YORK
CONTRACT NObsr 73780
SPARES
MAIN
OVEN
FUSE
.25A
3A
2A

1. GENERAL DESCRIPTION

1.1 PURPOSE AND BASIC PRINCIPLES

The Model SBE, Mode Selector, Transmitting, is a filter type single or double sideband generator designed for radio telephone, telegraph and frequency shift operation. It is continuously tunable from 2 to 32 megacycles.

The SBE-2 Modulator, Power Supply Group (AN/URA-23A) consists of the following:

O-503A/URA-23 - Oscillator, Radio Frequency

PP-1769/URA-23 - Power Supply

The SBE is primarily intended for use as an exciter unit for the Model AN/URT-17 transmitter. It is excellently suited, however, to serve as an exciter for any well-designed, linear radio frequency amplifier that requires up to 3 watts excitation through 72 ohms input impedance.

A voice operated (VOX) control circuit is provided to assure that transmission will occur only when the operator is speaking directly into the microphone. A squelch circuit is used to prevent the sound from local speakers from operating the VOX circuit. Both are front panel controls and may be easily adjusted for best performance over a wide range of operating conditions.

The following Modes of Operation may be selected and used with continuously adjustable amounts of carrier insertion.

1.	Carrier Amplitude Modulation	(AM)
2.	Single Sideband	(SSB)
3.	Double Sideband	(DSB)
4.	Independent Sideband	(Separate Intelligence)
5.	CW Telegraphy (A, or A2)	(CW)

1.2 DESCRIPTION OF UNIT

The Model SBE requires 14 inches of height and 15 inches of depth in any standard 19 inch relay rack. The Exciter and the Power Supply weigh 35 and 36 pounds respectively. Each is easily supported by its 3/16 inch thick front panel. The Exciter Unit requires 8-3/4 inches of space and the Power Supply an additional 5-1/4 inches.

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

1.3 TECHNICAL SPECIFICATIONS

A. EXCITER UNIT

FREQUENCY RANGE: 2 to 32 Mcs continuous, bandswitched

OPERATING MODES:	* Single Sideband * Double Sideband * Independent Sideband (separate intelligence) Amplitude Modulation, CW or MCW *May be used with any degree of carrier insertion.
FREQUENCY CONTROL:	Temperature controlled crystals or external VFO.
FREQUENCY DETERMINING ELEMENTS:	Contained in two temperature controlled, high mass aluminum ovens designed for high thermal inertia.
CRYSTAL OVEN TEMPERATURES:	75°C for 17 Kc and 287 Kc oscillator, and 70°C for MF and HF oscillator.
STABILITY:	1 PPM for 24 hour period.
CRYSTAL POSITIONS:	Ten crystals, each with independent trimmer. Selection by front panel switch.
CRYSTAL SOCKETS:	For HC-6/U Holders. (CR-27/U Crystal)
VMO INPUT FREQUENCY:	2 - 4.0 Mc to cover entire range 2-32 Mc.
VMO INPUT IMPEDANCE:	72 ohm nominal.
VMO INPUT VOLTAGE:	Approximately 1.5 V RMS.
TUNING CONTROLS:	Directly calibrated in frequency.
OUTPUT POWER:	Continuously adjustable from zero to a maximum of 3 watts PEP.
OUTPUT IMPEDANCE:	72 ohms nominal.
CARRIER SUPPRESSION:	At least 55 db down from PEP level.
CARRIER INSERTION:	Continuously adjustable.
CONNECTIONS:	VFO Input - BNC RF Output - BNC Monitor - BNC Audio, Control - Terminal Barrier Mike Input - 3 pin MIKE jack
SPURIOUS OUTPUT:	At least 60 db below PEP output.
DISTORTION PRODUCTS:	At full PEP output, 3rd order distortion products are at least 45 db below either tone of a standard two tone test.
HARMONIC RADIATION:	Second harmonic at least 40 db below PEP output. All other harmonics at least 50 db below PEP output.

REJECTION OF UNUSED SIDEBAND: 500 cps tone 60 db below transmitted PEP.

AUDIO INPUT: Two independent 600 ohm channels, balanced or unbalanced, -20 db level for full RF output. 500 K ohms for high impedance crystal or dynamic mike, -50 db for full RF output

AUDIO RESPONSE: Within 3 db from 350 to 3300 cps.

VOX OPERATION: Voice control with anti-trip features, adjustable gain and squelch controls.

METERING: Peak reading VTVM indicates audio level of either upper (USB) or lower (LSB) sideband. MF (mid frequency) indicates level of mid frequency channel. RF Output (indicates % of maximum power)

FRONT PANEL CONTROLS:

MF XTAL SW	LSB MIKE
BAND MCS	EXCITER ON/STANDBY
CARRIER INSERT	XMTR ON/OFF
OUTPUT TUNING	POWER ON/OFF
MF TUNING	VOX GAIN
OUTPUT	SQUELCH GAIN
USB GAIN	METER SW
USB MIKE	METER CALIBRATE ADJUSTMENT (CAL)
LSB GAIN	METER BALANCE (CAL)

TUBE COMPLEMENT:

3 each	6AB4	Audio Amplifier
3 each	6U8	Amplifiers, oscillators
4 each	12AT7	Combining amplifier, mixer VOX, Squelch amplifier
3 each	12AU7	Oscillator, Relay tube
2 each	6CL6	Amplifier
1 each	6146	Power Amplifier
2 each	6AH6	Amplifier
3 each	CK711	Modulator
1 each	0A2	Voltage regulator
1 each	6AL5	Squelch & VOX Rectifier

B. POWER SUPPLY

INPUT POWER: 110/220 volts, 50/60 cps, single phase. 120 watts average consumption; 140 watts at intervals when oven cycles.

TUBE COMPLEMENT:

1 each	5R4	Rectifier
1 each	0A2	Voltage Regulator

FRONT PANEL:

FUSES	@ 110 V	@ 220 V
B+	0.25A	0.25A
Main	3 0A	1.5A
Oven	2.0A	1.0A
INDICATOR LAMP	PWR ON/OFF	

2. THEORY OF OPERATION

2.0 Functionally, the SBE can be considered as four similar stages in which signals are amplified and raised in frequency. They are the (1) audio, (2) low, (3) medium and (4) high frequency modulation stages. These are followed by the final RF amplication and tuning section. Either channel in the first stage receives the microphone or other AF input, amplifies it and applies it to the audio balanced modulator where an exceptionally stable 17 Kc carrier from a crystal controlled oscillator is also applied. The two principle sidebands normally generated by modulation and the appreciably attenuated 17 Kc carrier appear in the output. Both sidebands are then sent to a special sharp filter which removes one and passes the other on to the 17 Kc notch filter. The other audio input channel in the first stage is similar in operation with the exception that where the first channel passes the lower sideband from its modulator, the second channel passes only the upper sideband from its modulator. Both channels are used simultaneously in the A.M., double sidebands, and independent sideband modes of operation

The first stage has been described. Note that a pattern has developed which will be repeated, with variations, three more times. Briefly, the input to th stage has been amplified and used to modulate a higher frequency in two special devices (balanced modulators), in this case, for the generation of sidebands without carrier. One sideband was eliminated in each by a filter, one each passed on to serve as an input to the next stage where with some exceptions, the process begins again.

The 17 Kc notch filter which follows the audio frequency balanced modulators and filters is used to reduce any remaining 17 Kc carrier to a negligible level. The carrier to be transmitted for any of the reasons previously explained may then be inserted by a front panel control. All outputs from this section are then passed to the Low Frequency (LF) amplifier where the next stage begins.

The LF stage raises all frequencies previously centered about 17 Kc to the 270 Kc level. Once again a stable oscillator, this time 287 Kc, provides a carrier for the balanced modulator. Notice that there is no sideband filter as such employed in this stage. The bandpass characteristics of the following amplifier serves as a filter by passing only the lower sideband, centered on 270 Kc.

The mid-frequency (MF) stage which follows the LF stage is tuned according to the MF injection frequency (VMO or XTAL). The stage raises and amplifies the signal frequency just as the previous ones do. The high frequency (HF) modulator (Z107) raises the MF output to the final RF range by use of a selected crystal controlled HF oscillator. This completes the last of the four modulation stages in the Model SBE.

Final frequency adjustments, tuning and amplification are accomplished in th RF amplifier stages. The output of the exciter can range from 0 to 3 watts peak envelope power (PEP) by operation of the output control on the front panel

2.1 GENERAL DESCRIPTION OF CIRCUITS

A. AUDIO CHANNELS

Connections for two audio input channels (600 ohm balanced or unbalanced) are provided on terminal strip E101. Channel 1, terminals 6, 7, 8: Channel 2, terminals

10, 11, 12. Terminals 7 and 11 may b grounded for system balanced to ground. Terminals 8 and 12 may he grounded when used for systems unbalanced to ground -20 db audio level is required at each channel input for full output of th exciter When high impedanc mike is plugged into the front panel MIKE jack, a pre-amp stage (V101) raises the signal level to that required for direct channel input (-20 db). The outputs of V101, T101 and T102 are fed to S101 upper (USB) and S102 lower (LSB) sideband selector switches. The audio selected by thes switches (Channel 1, 2 or MIKE) then goes to R168 (USB) and R169 (LSB) GAIN controls. R168 and R169 center arms are connected to S106D, for inverting upper and lower sideband input when the exciter is operating in the 3.73 to 4 270 range. Inversion takes place at this point to allow for a modulation inversion which occurs in a later circuit. The audio taken from S106D is amplified by V102 and V103, audio amplifiers. Audio is also taken from the center arms of R168 (USB GAIN) and R169 (LSB GAIN) to feed metering amplifiers V107A and V107B. Outputs of these amplifiers are connected to CR104 and CR105 where incoming signal peaks are rectified and coupled to V112/M101, a bridge type VTVM. This circuit is a peak reading device rather than an RMS indicating meter circuit.

Other inputs on terminal board E101 include the following:

Terminal 1 and Ground is intended for push-to talk keying line when the VOX and squelch circuits are not in use.

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

Terminal 4 is grounded by K101 (exciter control relay) and can be used to energize an associated R.F. Amplifier/Transmitter.

Terminal 13 is the squelch input which is normally obtained from the 600 hm output of a receiver at the operating position.

Terminals 5, 9, 14 are grounded.

B. AUDIO BALANCED MODULATOR AND SIDEBAND FILTERS

V102 and V103 operate as either upper or lower sideband amplifiers as explained in Part A above. However, T104 and CR101 will be referred to as the LSB audio balanced modulator, and T103 and CR102 as the USB audio balanced modulator. This sideband relationship is always true when using intermediate frequency; inversion of sidebands occurs in a later mixing circuit.

T104 couples incoming audio (from S106D amplified by V103) to CR101, a bridge type diode modulator. Pins 7-8 and 5-6 of CR101 form one set of bridge arms; and pins 2 and 3 form the other set. Z104 and Z105 are in a very stable amplitude regulated 17 Kc crystal oscillator circuit, the output of which is coupled to the enter arm of R110 and R112 through T105.

R110 and R112 are used to equalize the injection voltage to pins 2 and 3 of CR101 and CR102. When this is achieved, the inputs to Z101 and Z102 will consist of two low frequency signals of (17 Kc plus audio) and (17 Kc minus audio); e.g. if a single 1000 cps tone were applied to channel 1 transformer T101, and S101 (USB) switch is put in CH 1 position, the input to Z101 is (17 Kc plus 1 Kc) and (17 Kc minus 1 Kc) or 18 and 16 Kc respectively. Th 17 Kc carrier is almost completely balanced out by th proper adjustment of R110 and R112.

Z101 LSB filter is designed to pass only frequencies from 13.7 Kc to 16 650 K , thus only the sideband below the suppressed 17 Kc carrier is passed on to Z106 Z102 USB filter performs in the same manner as Z101, differing in that it passes frequencies between 17 350 Kc and 20.650 Kc, or the upper sideband, to Z106

C. 17 KC NOTCH FILTER

In operational modes where both sidebands are used simultaneously, upper and lower sidebands will not hetrodyne but will pass together through the 17 Kc notch filter (Z106) where any remaining carrier is reduced to an insignificant level

D. LOW FREQUENCY AMPLIFIER

V108A and V108B are conventional RC coupled class A amplifiers which amplify USB and/or LSB frequencies centered about 17 Kc which are transformer coupled to the next stage by T106.

E. VOX CIRCUIT

The VOX circuit is operated by a portion of the 17 Kc USB and/or LSB energies taken from pin 2 of T106 and coupled to pin 2 (control grid) of V110 squelch and VOX amplifier. The gain of this amplifier is controlled by R140, VOX GAIN Th output is coupled to pin 2 (plate) of V111 squelch and VOX rectifier. DC output is developed across R145/C129 and amplified by V109A, relay amplifier, which operates K101, the exciter actuating relay. The threshold of the signal l vel required to operate this circuit is controlled by R140, VOX GAIN.

F. SQUELCH CIRCUIT

Some negative DC is also applied to the control grid of V109A by the squelch section of V111 rectifier, pins 1-7. The actuating signal for this part of th circuit is supplied by the squelch amplifier section V110, pins 1, 8, and 9, the input for which is terminal 13, E101, through SQUELCH GAIN control R129. Th action of the squelch circuit is such that audio, originating from a receiver audio output terminal causes the opposite action of the VOX circuit on the control grid of V109A. The purpose of the squelch circuit is to prevent the audio from any nearby receiver from actuating the exciter. When VOX and SQUELCH gains are properly set, only the operator talking directly into the mike will actuate th exciter.

G. CARRIER INSERTION

Front panel control R106 (CARRIER INSERT) selects any degree of carrier insertion from -55 db to full output of the exciter. It does so by taking a small amount of 17 Kc output from T105 and applying this in a controlled amount to pin 8 (cathode) of V108B, I.F. amplifier.

H. LOW FREQUENCY BALANCED MODULATOR

Either or both sideband signals amplified by V108 and coupled to th I.F. balanced modulator CR103 ar generated about a center frequ ncy of 17 Kc. Further mixing processes are now necessary to bring the output signal to the desired fre-

qu ncy. Sidebands centered on 17 Kc are applied to pins 5-6, 7-8 of CR103 287 Kc injection voltage is taken from pin 8 of V105 (287 Kc oscillator) through C124 R113 provides a means of balancing the 287 Kc voltage on pins 2 and 3 of CR103 (modulator bridge) 270 Kc output (287 Kc - 17 Kc) sideband nergy is taken from pins 2 and 3 of CR103 and passes through the 270 Kc I.F. transformer T108.

I. 270 KC AMPLIFIER

Sideband energy centering around 270 Kc passes through T108 (270 Kc I.F. transformer) and is applied to pin 7 (grid) of V109B which is a conventional class A amplifier. The 270 Kc output of V109B is coupled to V113, the MF modulator, by T107

J MID FREQUENCY MODULATOR

Sideband energy centering around 270 Kc is coupled by T107 to pins 2 and 7 of push-pull amplifier V113. Mid frequency injection is obtained from V115 which is controlled by the crystal oscillator section or VMO input from J104. This injection frequency is 270 Kc above the output of the M.F. modulator. The mid frequency dial is calibrated to read directly in terms of the M.F. injection frequency although its circuit (C167 etc.) is actually tuned 270 Kc below it. The VMO or M.F. crystal frequency corresponds to this dial reading. The balancing out of the mid frequency injection is accomplished by the M.F. balance control R130 which varies the gain of th A and B sections of V113 so that the mid frequency injection cancels in the primary of T109. However, the mid frequency (injection minus 270 Kc) is passed through T109.

K. MID FREQUENCY AMPLIFIER

V114 is a Class A R.F. Amplifier in which the input and output circuits are tuned to the M.F. output of V113. The output level of V114 is metered by M101 through CR106, S109 and V112. The output of V114 is applied to the H.F. balanced modulator through T110.

L. HIGH FREQUENCY MODULATOR

Th function of the H.F. Modulator (Z107) is to provide final output frequencies from 4 27 Mc to 32.27 Mc by modulating the output of the M.F. Amplifier with an injection frequency from the H.F. Oscillator. Outputs below 4.27 Mcs, as previously explained, are exactly as produced in the M.F. Modulator (V113).

Injection frequencies from 8 Mc to 34 Mc in 2 Mc steps are supplied by the crystal controlled H.F. oscillator, V117. The proper injection is selected by use of th BAND MCS switch, a front panel control. The injection is always between 1 73 Mc and 3.73 Mc higher than the output of Z107. The BAND MCS switch is used in the O position when SBE output below 4.27 Mc are required. In this case an 18 Mc injection is applied to Z107 to prevent intermodulation distortion by keeping the diodes CR107 and CR108 properly biased. The 18 Mc injection and the sidebands produced in Z107 are not passed by the R.F. Amplifiers which are tuned to 4.27 Mc or less (approx. 13 Mc away) in this instance.

The output of Z107 is coupled t V118, the first R.F. Amplifier

M. AMPLIFIERS, V118, V119 and V120

The R.F. output taken from R205 is now at the output frequency of th exciter. Th purpose of V118, V119 and V120 is to build up the generated signal t the rated 3 watt PEP output of the exciter. These stages are gang tuned and bandswitched by S106A, B, C, D to continuously cover the frequency range of 2 to 32 Mc. A small portion of the output is applied to R210 and R211 where through C176 and CR109 a small DC voltage is produced which is proportional to the output envelope peaks of the exciter. This voltage is indicated by the V112/M101 metering circuit. An output indication of 100 equals 3 watts PEP when S109 meter switch is in th RF OUT position.

SECTION III

3. INSTALLATION AND OPERATION

3.0 INSTALLATION AND POWER REQUIREMENTS

UNPACK THE EQUIPMENT CAREFULLY. Inspect all packing material for parts which may have been shipped as "loose items".

CHECK THE EQUIPMENT CAREFULLY for any damage which may have occured in transit. If damage is found, notify the carrier immediately.

3.1 POWER REQUIREMENTS

The Power Supply is designed for 115/230 volts, 50/60 cps, single phas power The Power Supply is factory wired for 115 volts. If 230 volt operation is required, minor wiring changes to Power Supply and to Crystal Ovens are necessary as explained on the Power Supply Schematic Diagram and the Exciter Schematic Diagram.

3.2 INSTALLATION

1. Mount the Exciter Unit and the Power Supply in a standard 19 inch relay rack or other housing as desired.

2. Connect power cable CA-346 (supplied) from J402 of the Power Supply to J109 of the Exciter Unit.

3. Place the three toggle switches in the center of the front panel to th following positions:

   XMTR ON/OFF to OFF
   EXCITER ON/STANDBY to STANDBY
   POWER ON/OFF to OFF

4. Connect power cord (supplied) from J401 of the Power Supply to an AC source as described above.

5. Connect RF OUT (J102) of Exciter Unit to the input of the associated transmitter.

6. If an external VMO is to be used, connect it to VMO IN (J104) on the rear of the Exciter Unit and use the MF XTAL SW in the VMO position.

For local voice operation, connect high impedance (1/2 meg) crystal or dynamic microphone to the MIKE jack on the front panel of the Exciter Unit.

See Section 2.2, A. for description of connections to terminal strip E101 (rear of chassis).

EXCITER UNIT

CONTROL FUNCTIONS

POWER ON/OFF (S103)	ON - Applies line voltag to power supply
	OFF - Turns off entire SBE

EXCITER ON/STANDBY (S105)	STANDBY - Allows VOX or push to talk to activate the exciter and th transmitter which the SBE serves. ON - Activates exciter without need for VOX or push to talk input and without operating transmitter.
XMTR ON/OFF (S104)	ON - Activates transmitter. Eliminates need for VOX or push to talk, through S105 (above), by completing the ground circuit of the XMTR final plates relay. OFF - Transmitter operated by VOX or push to talk circuit when EXCITER switch is in STANDBY position.
LSB	Switch selects audio input source for Lower Sideband channel. GAIN - Adjusts level of LSB AUDIO input.
USB	Switch selects audio input source for Upper Sideband Channel. GAIN - Adjusts level of USB AUDIO input.
VOX GAIN	Voice operated transmitter circuit gain control
SQUELCH GAIN	Used in conjunction with VOX GAIN (See Sections K and L OPERATION).
MF XTAL SW	Selects either external oscillator (VMO) or proper crystal for mid frequency oscillator.
BAND MCS	Indicates injection frequency range of HF modulator in 2 megacycle increments. It is controlled by the knob beneath the dial.
CARRIER INSERT	Controls level of carrier insertion.
OUTPUT TUNING	Selects output frequency band and adjusts setting of main tuning dial centrally located above knob.
MF TUNING	Selects setting of mid frequency as indicated in lower section of main tuning dial.
OUTPUT	Adjusts exciter output power level.
METER SW	Selects point in system to be measured by built-in VTVM circuit. CAL position is used to zero meter.

CAL	Meter adjustment located directly beneath meter. Use screwdriver to zero meter when METER SW is in CAL position.
EXCITER Lamp	Glows during operation when EXCITER switch is on or EXCITER is activated by VOX or push to talk.
OVEN Lamp	Glows during operation when thermostats demand oven heating (automatic).
MIKE	Input jack to audio pre-amp for all high impedance (500 K) microphones.

POWER SUPPLY

LAMP	Glows during operation. Indicates MAIN fuse intact nd power is applied.
B+ FUSE MAIN FUSE OVEN FUSE	These fuses protect their respectiv circuits.

3.3 OPERATION

A. GENERAL

The Model SBE tuning is done in a series of steps, depending upon the mode of operation required. The following is a general tuning procedure giving specifi examples where needed for clarity. The built-in VTVM may be used for all measurements necessary for operation. Check points called out in the following text may be selected by use of the METER SW.

B. INITIAL ADJUSTMENTS

1. Turn POWER ON/OFF switch to ON. Allow one hour warm up period
2. Turn METER SW to CAL and zero meter by screw driver adjustment through opening located directly beneath the meter.

The equipment is now ready to be tuned.

C. INSTALLATION OF CRYSTALS

See page 5-1 for proper crystal selection for desired output frequency. To insert crystals, open oven top by turning snap screws 1/2 turn counter-clockwise Remove cover and celotex insulation, install crystals. Sockets 1, 2, 3 etc c rrespond 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 these trimmer adjustments.

D. M.F. TUNING

Refer to pag 5-1 to determine proper VMO or rystal frequency

1 Plac METER SW in MF position

2 Place MF XTAL SW in VMO position or crystal position corresponding to frequency necessary for desired output frequency.
3. Using MF TUNING control, set MF dial to corr spond to VMO or crystal frequency selected.

4. Turn VOX GAIN control fully counter-clockwise.
5. Place USB, LSB and XMTR switches in OFF position.
6. Place EXCITER ON/STANDBY switch in STANDBY position.
7. Turn CARRIER INSERT control fully clockwise.
8. Using MF TUNING control, tune for peak reading on meter.

NOTE: USB and LSB will be reversed in the region 3.73 to 4.0 mc when VMO input is used.
USB and LSB will be reversed in the region 4.0 to 4.27 mc when crystal input is used.

E. R.F. TUNING

1. Set BAND MCS SW to frequency range being used.
2. Set OUTPUT TUNING band switch to frequency being used.
3. Place METER SW in RF position.
4. Using OUTPUT TUNING control, set output tuning dial to output frequency.
5. Place EXCITER ON/STANDBY switch in ON position.
6. Advance OUTPUT control for any reading on the meter.
7. Using OUTPUT TUNING control, tune for peak reading on meter.

F. ADJUSTMENTS FOR SINGLE SIDEBAND OPERATION WITHOUT CARRIER

1. Set USB and/or LSB switches to desired input. (CH 1, CH 2 or MIKE).
2. Set METER SW to desired sideband.
3 Set CARRIER INSERT to zero.
4. Set VOX GAIN control fully counter-clockwise.
5. By speaking directly into the mike or monitoring on channels 1 or 2, advance appropriate GAIN control (USB or LSB) until voice or tone peaks just reach 100 on the meter.
6. Set METER SW to RF.
7. Adjust OUTPUT control for desired output level.

NOTE: With METER SW in USB, LSB or RF positions, meter peaks must never exceed 100 on the meter as intermodulation distortion will become excessive beyond this point.

G ADJUSTMENTS FOR DOUBLE SIDEBAND OPERATION WITHOUT CARRIER

The double sideband mode may be selected to transmit the same information on both sidebands or separate information on each simultaneously. To achieve this, place one sideband selector switch on one information source and the other sideband selector switch on the second source.

EXAMPLE: If it is desired to transmit a voice channel on USB and a teletype channel on LSB, the separate sources would be available at channel 1 and channel 2 inputs to the exciter (or MIKE and CH 1 or CH 2). The USB selector switch should b set to either MIKE or CH 1 and th LSB s lector switch s t to CH 2.

1. Set USB switch to desired channel.
2. Set CARRIER INSERT in zero.
3. Set LSB switch to OFF.
4. Set METER SW to USB.
5. Advance USB GAIN until meter shows a reading of 50 on peaks.
6. Set USB switch to OFF.
7. Set LSB switch to desired channel.
8. Leave CARRIER INSERT at zero.
9. Set METER SW to LSB.
10. Advance LSB GAIN until meter shows a reading of 50 on peaks.
11. Set METER SW to RF.
12. Advance OUTPUT control until meter reads 50 on peaks (LSB switch ON, USB switch OFF).
13. Turn LSB switch to OFF.
14. Set USB switch to position selected in line (1) above.
15. Adjust USB GAIN to obtain a meter reading of 50 on peaks.
16. Set LSB switch to desired channel as selected in line (7) above. Combined peaks should now read approximately 100 on the meter
17. Adjust OUTPUT control for proper tuning and driving of transmitter.

If the same information is to be transmitted on both sidebands, repeat the foregoing steps with the USB and LSB switches both in the same (desired) channel position.

P L E A S E N O T E

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 independent of the other and when they are added on the meter the sum of 50 per cent and 50 per cent may be slightly less than 100 per cent. This is due to the presence of a modulated envelope which is generated when two or more frequencies are present in the output at the same time.

H. CARRIER INSERTION

Any degree of carrier insertion may be employed with the above modes up to th full PEP.

EXAMPLE: If it is desired to inject a carrier 20 db down from full PEP, proceed as follows.

1. Set METER SW to RF.
2. Set OUTPUT control to give a meter reading of 90 with one or both information channels, as desired, in operation. (USB and/or LSB).
3. Turn USB and LSB switches to OFF.
4. Advance CARRIER INSERT control to obtain a meter reading of 10.
5. Turn LSB and/or USB switches to respective channel(s). (SSB or DSB).
6. Adjust OUTPUT control until meter peaks just reach 100, or, as explained in a paragraph M, Adjustment of Exciter with an Associated Transmitter.

I. CONVENTIONAL AM

For AM transmission, the Model SBE must be set up as in Section G above, except that both LSB and USB switches must be on the same channel. Then proceed as follows.

1. Using the OUTPUT control (with METER SW in RF position) reduce the peak meter reading to 50.
2. Turn USB and LSB switches to OFF.
3. Advance the CARRIER INSERT control for a meter reading of 50.
4. Turn LSB and USB switches back to channel selected previously.
5. Adjust OUTPUT control as explained on page 3-8.

AM with one sideband may be obtained by turning either sideband to OFF and advancing the remaining sideband GAIN control for a reading as explained on page 3-8.

J. C.W. OPERATION

1. Remove jumper from pins 1 and 3. (E101 on rear of exciter unit).
2. Attach key from pin 3 to ground.
3. Set LSB and USB switches to OFF position.
4. Set CARRIER INSERT to maximum clockwise position.
5. Set METER SW to RF position.
6. Advance OUTPUT control to drive transmitter properly.

K. VOX ADJUSTMENT

The VOX circuit will function only in the SSB and DSB operation of the unit and not with Conventional AM or SSB with full carrier.

1. Set EXCITER ON/STANDBY switch to STANDBY position.
2. Talking directly into the mike, adjust VOX GAIN until EXCITER lamp 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.

L. SQUELCH GAIN ADJUSTMENT

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 Model SBE.
2. Advance SQUELCH GAIN until audio from the station receiver will no longer trip the VOX circuit.

M. ADJUSTMENT OF EXCITER AND AN ASSOCIATED TRANSMITTER

1. Tune the Model SBE as explained in sections B, C, D and E above.
2. Advance OUTPUT control fully clockwise.
3. Adjust transmitter to the output frequency of the Model SBE. (Refer to transmitter Instruction Manual).
4. Place transmitter in SSB mode. (Refer to transmitter Instruction Manual).

5. Place Model SBE in desired output mode. (Refer to Sections E, F, G, H and I above).
6. Advance OUTPUT control of the exciter until PA grid current of the transmitter flows on modulation peaks. Then decrease the OUTPUT control until this grid current just ceases to flow.
7. With the METER SW in RF position, the meter reading on the exciter should never exceed 100.

N. SOME BASIC THEORY FOR OPERATORS

1. An explanation of gain controls and metering.

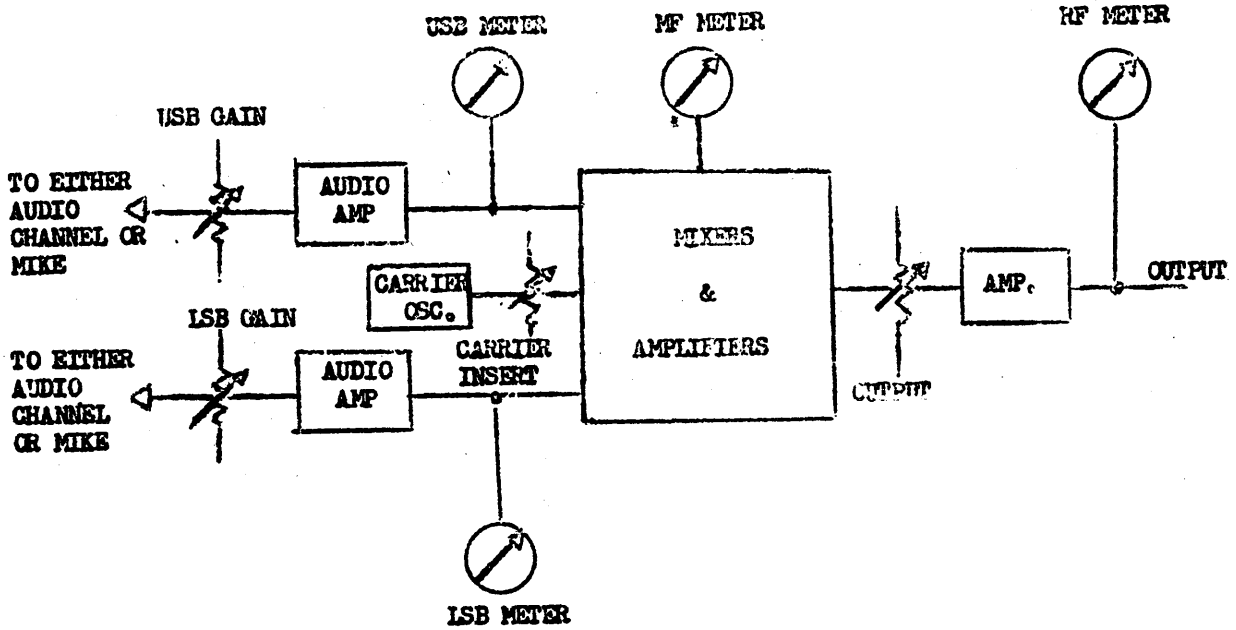


Figure I is added here to give the operator a clear idea of where his gain controls are electrically and what he is metering.

USB METER POSITION	-	Indicates only the USB channel audio level.
LSB METER POSITION	-	Indicates only the LSB channel audio level.
MF METER POSITION	-	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.
RF METER POSITION	-	Indicates the sum total of both sidebands and carrier, when used.

2 HOW THE SIDEBANDS ARE APPORTIONED

As is shown in Figure 2, it is possible to set the sideband in many ways depending upon the type of operation.

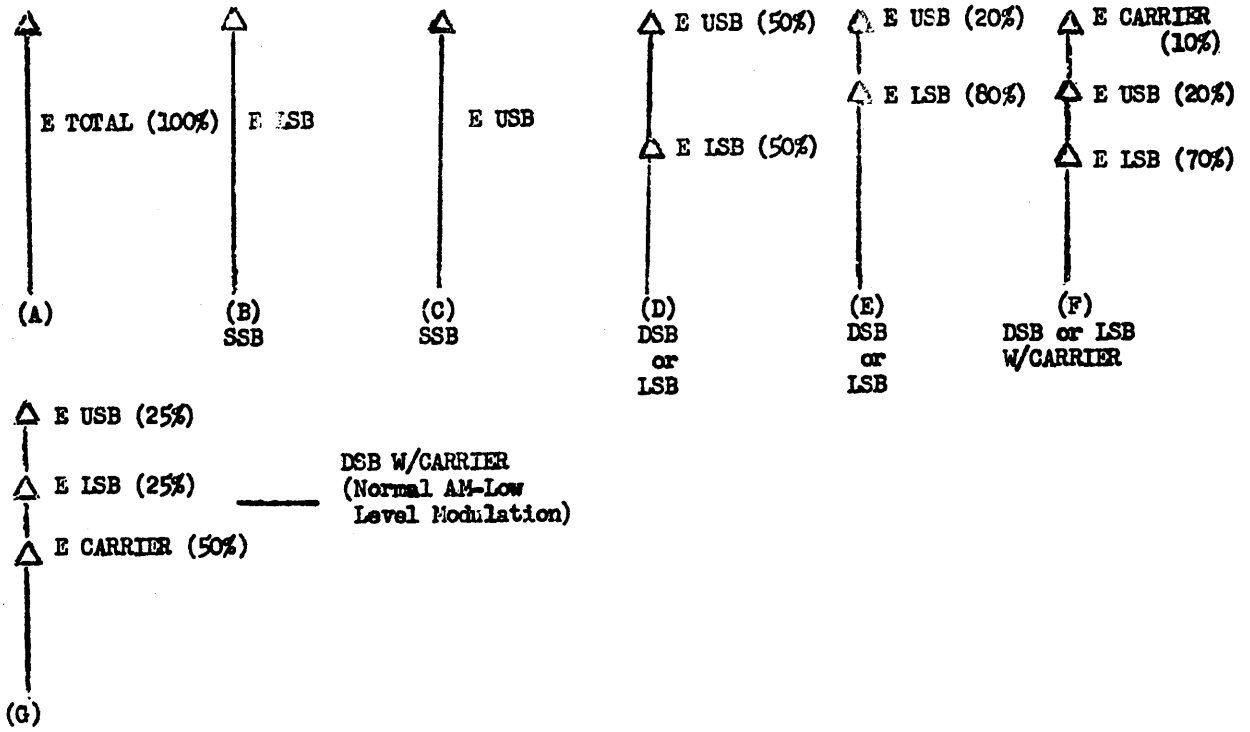


FIGURE 2

Suppose the maximum total voltage which causes the meter to read 100 per cent is shown by the arrow of figure 2A; this arrow can be made up of either the LSB or USB alone as in figure 2 B or C. The meter indication of the sideband being used would then read 100 per cent on peaks.

Suppose that both sidebands must work at the same time and it is decided that ½ the available power shall be in each sideband - this is the case of figure 2 D. It is also possible to apportion the voltages so that one sideband carries more power then the other as in figure 2 E. Here the USB gain is adjusted so that audio peaks drive the meter to only 20 per cent and the LSB gain is adjusted for 80 per cent - the total still being 100 per cent.

Such a set-up might be used where th USB is to carry a cueing chann l while th LSB carries important information.

In figur 2F, each sideband has been set by means of the USB and LSB meter so that a small percentage of the 100 per cent arrow remains for carrier insertion. (This is usually done in automatic frequency control systems known as AFC). Since, as shown in figure 1, the carrier is inserted after the LSB or USB metering, th RF meter must be calibrated against the LSB or USB meter by means of the Output control and then the carrier insertion can be correctly read on the RF meter. (This procedure is outlined in sections H and I. Figure 2G is simply another version of F but, because this is normal AM, the operator has no choice but to set the carrier and sidebands at the percentage shown.

The operator must bear in mind that once he has set the USB and LSB gain controls and carrier insertion control, with the aid of the RF meter, he can then vary the Output control to suit the transmitter being driven. This is so because the Output control does not affect the way the arrow percentages are added but only the sum total.

4.0 MAINTENANCE

A. GENERAL

The Model SBE (Power Supply and Exciter Unit) is designed to provide long term trouble free operation under continuous duty conditions. It is recommended that any necessary maintenance be accomplished by competent technicians familiar with sideband techniques.

B. OPERATORS MAINTENANCE

NOTE

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.

All fuses and a power indicator lamp are located on the front panel of the Power Supply.

The Model 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 fails to light when the EXCITER switch is in the ON position, check F403 (B+ fuse). If dial lights and tube filaments fail to light when POWER ON/OFF switch is in the ON position, check F402 (MAIN fuse).

If after one hour warm up period the OVEN lamp fails to cycle every four or five minutes, check F401 (OVEN fuse).

C. PREVENTIVE MAINTENANCE

1. In order to prevent failure of the equipment due to corrosion, tube failure, dust or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to.

2. At periodic intervals (at least every six months) the equipment should be removed from the rack for cleaning, and inspection. All accessible covers should be removed and all terminal boards, wiring harnesses, tube sockets etc. should be inspected for dirt, corrosion, charring, discoloring or grease. Dust may be removed with a soft brush or a vacuum cleaner if one is available. Remove dirt or grease from electrical parts with carbon-tetrachloride. Remove dirt or grease from other parts with any good dry cleaning fluid.

WARNING

CARBON TETRACHLORIDE (CCl_4) IS A TOXIC SUBSTANCE.
DO NOT INHALE ITS FUMES. AVOID CONTACT WITH SKIN.

3. While unit is out of the rack and covers are removed, it is advisable to check the tubes, all of which are accessible from the top of the chassis. Tubes should be removed and check one at a time to eliminate th danger of replacing a tube in the wrong socket Do not fail to replace tube shields.

4. Should the gear train (directly behind the front panel) show signs of becoming dry, apply one drop of any high quality light machine lubricant to each gear. Recommended time interval; once a year.

5. Carefully inspect for loose solder connections or screws, especially those on solder lugs. Recommended time interval; every six to twelve months, depending on the amount of vibration encountered in service.

D. CORRECTIVE MAINTENANCE

1. GENERAL

Before any alignment or internal adjustment of the equipment is attempted, it should be established that all tubes and fuses are in proper working order. See Figure 4 for suggested preliminary trouble shooting procedure.

NOTE

IT WILL SELDOM BE NECESSARY TO INVESTIGATE FURTHER IF ALL TUBES AND FUSES ARE CHECKED FIRST.

2. VOLTAGE CHECKS

If, after checking tubes and fuses, and following trouble shooting chart, (at this point the trouble should be localized to a particular section or stage), check the tube socket voltages with a reliable 20,000 ohm per volt meter. See Figure 3 Voltage Chart for tube socket voltages.

3 ALIGNMENT

Before any attempt is made to align the equipment, the following checks must be made in the order given.

a. 17 Kc OSCILLATOR

Using a reliable AC VTVM a reading of 1.0 to 1.5 volts should be obtained from the center arm of R110 or R112 to ground. If this voltage is not obtained, check for faulty components in the 17 Kc Oscillator Section (Z105).

b. 287 Kc OSCILLATOR

Using a reliable VTVM with a suitable RF probe attached to the center arm of R113, there should be 1.0 to 1.5 volts to ground at this point. If this voltage is not obtained, check for faulty components in the 287 Kc Oscillator Section (Z103).

c. MID FREQUENCY OSCILLATOR

Connect VMO or signal generator (2 to 4 mc at 2 volts) to VMO input. Place 2 mc and 4 mc crystals in positions 1 and 2 respectively in the MF XTAL OVEN. Connect R.F. voltmeter to the junction of C163 and C164. Measure for the following voltages.

MF XTAL SW	VOLTS (APPROX)
Position 1 (2 mc)	2.5
Position 2 (4 mc)	1.2
VMO (2 mc)	2.0
VMO (4 mc)	1.0

If these voltages are not obtained, check for faulty components in the mid frequency section.

d. H.F. OSCILLATOR

Connect R.F. voltmeter to top of R205 (output control), turn off MF oscillator by placing MF XTAL SW in a vacant position. Voltage should vary from 2 to 5 volts as BAND MCS switch is rotated from 0 to 14.

e. 270 Kc I.F. ALIGNMENT (PRELIMINARY)

1. Set R113 (LF BALANCE) to approximately mid position.
2. Remove P103 from J106.
3. Attach sensitive R.F. voltmeter to pin 2 of V113A.
4. Remove CR103 and V105.
5. Attach signal generator output to pins 2 and 3 of CR103 socket
6. Set signal generator frequency to 270 Kc.
7. Keep output voltage at pin 2 V113A below 0.1 volts. Use output control of signal generator and slug adjustments at bottom of T107 and T108 to get peak reading on the R.F. voltmeter.

f. SIGNAL ALIGNMENT OF 270 Kc I.F. AMPLIFIER

1. Replace CR103 and V105.
2. Remove signal generator from CR103 socket.
3. Advance CARRIER INSERT control to maximum clockwise position.
4. Use slug adjustments of T107 and T108 to get new peak on R.F. voltmeter. (at pin 2 of V113A).
5. Replace P103 in J106.

g. MID FREQUENCY ALIGNMENT

1. Remove P107 from Z107 and connect sensitive R.F. voltmeter to the top of output potentiometer R205.
2. Place 2.0 and 4.0 Mc crystals in socket 1 and 2 respectively of mid frequency oven (or use external VMO connected to J104). Replace oven insulation and cover.
3. Turn CARRIER INSERT control to zero.
4. Turn R130 either fully clockwise or fully counter-clockwise to upset balance in the MF modulator.

5. Set MF XTAL SW to position 1 (or VMO to 2 Mc).
6. Set M.F. dial to 2.27 Mc.
7. Tune T109 and T110 slugs only (on underside of chassis) to obtain peak reading on R.F. voltmeter
8 Set MF XTAL SW to position 2 (or VMO to 4 Mc).
9. Set M.F. dial to 4.27 Mc.
10. Tune trimmers C140 and C141 to obtain peak reading on R.F. voltmeter.
11. Using R130, rebalance M.F. modulator.
12. Remove R.F. voltmeter from R205.
13. Set MF XTAL SW to position 1 (or VMO to 2 Mc).
14. Set M.F. dial to exactly 2.0 Mc.
15. Turn METER SW to MF position.
16. Advance CARRIER INSERT control until a half scale meter reading is obtained on the front panel meter.
17. Tune T109 and T110 slugs to obtain peak meter reading.
18. Set MF XTAL SW to position 2 (or VMO to 4 Mc).
19. Set M.F. dial to exactly 4.0 Mc.
20. Advance CARRIER INSERT control until a half scale reading is obtained on the meter.
21. Tune trimmers C140, C141 to obtain peak meter reading.
22. Repeat steps 13 through 21 until ends of tuning range track.
23. Put P107 back into J110 receptacle of Z107.

h. R.F. ALIGNMENT

1. Disconnect P103 and P105.
2. Turn OUTPUT control to maximum clockwise position.
3. Connect output of signal generator to top of R205.
4. Terminate R.F. output (J103) with non inductive 72 ohm resistor.
5. Place R.F. voltmeter across the 72 ohm resistor.
6. Using a signal generator output of approx. 0.1 volts with a frequency accuracy of 1.0% peak the output R.F. voltmeter as per the following table.

BAND SET	OUTPUT DIAL SET	SIGNAL GEN. FREQUENCY	TUNING ADJUSTMENT
*2 to 4 mc	2.00 mc 4.00 mc	2.00 mc 4.00 mc	T116, T120, C191, C179
*4 to 8 mc	4.00 mc 8.00 mc	4.00 mc 8.00 mc	T113, T117, T121, C203, C191, C180
*8 to 16 mc	8.00 mc 16.00 mc	8.00 mc 16.00 mc	T115, T179, T122, C202, C190, C178
*16 to 32 mc	16.00 mc 32.00 mc	16.00 mc 32.00 mc	T114, T118, T112, C201, C189, C177

*NOTE: Repeat process alternately from lower to higher frequency to assure tracking at band ends.

7. Lock all slug adjustments immediately after the adjustment is made. Observe the R.F. meter reading while doing so to prevent possible detuning while tightening the lock nuts

8. Connect P103 to J106, and P105 to J108.

4. CARRIER SUPPRESSION ADJUSTMENTS

a. PRELIMINARY

NOTICE

BE SURE THAT RF IS ALIGNED BEFORE PROCEEDING.

THE FOLLOWING TEST EQUIPMENT IS REQUIRED FOR THIS SECTION:

1. **A sensitive oscilloscope having an overall vertical sensitivity of at least .05 volts per inch.**
2. **Test leads and a .05 mfd. capacitor to be used with the above.**
3. **Non-metallic aligning tool.**

A WARM-UP AND STABILIZATION PERIOD OF APPROXIMATELY THREE HOURS IS REQUIRED.

b. 17 KC NOTCH FILTER ADJUSTMENT (Proceed in given order)

1. Turn CARRIER INSERT control (front panel) fully CCW.
2. Turn USB and LSB input switches (front panel) OFF.
3. Remove V105 (12AU7) from its position on the Z103 287 kc oscillator enclosure.
4. Remove CR103 (CK-711) from the IF balanced modulator circuit.
5. Connect a .05 mfd. capacitor in series with the test lead from the vertical amplifier input of the oscilloscope and attach to pins 7-8 of the CR103 socket.
6. Connect oscilloscope vertical amplifier input ground to chassis of SBE.
7. Unbalance the 17 kc modulator by setting R110 (LSB BAL.) and R112 (USB BAL.) potentiometers fully clockwise. These controls are located on rear apron of chassis.
8. Set oscilloscope vertical amplifier range for the most sensitive (highest amplification) operating condition.
9. Advance the oscilloscope vertical gain control until the maximum amplitude of the trace is obtained or until it expands to fill the extreme graduations on the scope overlay pattern.
10. Adjust the oscilloscope sweep rate and synchronize controls until a steady 17 kc sine wave is observed.
11. Remove K101 (VOX relay) for access to C119 located on side of Z106 (17 kc notch filter).

12 Adjust C119 and R109 (Z106) until minimum 17 kc amplitude is displayed on scope B sure to us nothing but a non-metallic alignment tool when adjusting C119 Adjust controls alternately until best reading is obtain d. Watch scope carefully when tightening R109 shaft lock

c 17 KC BALANCED MODULATOR ADJUSTMENT

1. Remove oscilloscope vertical amplifier input test lead from CR103 and connect .05 mfd, capacitor in series as before to the junction of R171 and R172. Be sure that ground lead remains connected to chassis.
2. LSB and USB potentiometers R110 and R112 must now be returned from full clockwise to their proper positions. Adjust them alternately until the vertical oscilloscope pattern is minimum. Watch pattern to be sure that no amplitude increase occure when R110 and R112 shafts are locked.
3. Replace K101, V105 and CR103.

d. 270 KC MODULATOR ADJUSTMENT

1. Remove V104 (6U8, 17 kc osc.).
2. Remove P103 from J106 (MF OUT).
3. Connect test lead from oscilloscope vertical amplifier input through a .05 mfd. capacitor to pin 2, V113A, (12AT7, MF MOD.).
4. Oscilloscope to be adjusted as before with the exception that SWEEP and SYNC controls must be changed for 287 kc presentation.
5. Adjust R113 (LF BAL) until minimum amplitude is displayed on oscilloscope. Watch scope when locking R113 shaft to see that no change occurs.
6. Replace V104 and P103. Remove all test leads.

e. MF BALANCED MODULATOR ADJUSTMENT

1. Connect external VMO to J104 or locate the MF XTAL OVEN by following the MF XTAL SW shaft which enters directly into it. Release the fasteners holding the oven cover in place by turning each 1/4 turn CCW. Remove the oven cover and the celotex insulation found beneath it.
2. Plug a 4 mc crystal into a socket in the oven. Note the number of the socket chosen or if VMO is used adjust it to 4.0 mc.
3. Place the MF XTAL SW to the position bearing the same number unless VMO is used.
4. Replace the celotex insulation and the oven cover. Be sure that the cover is oriented so that its numbers correspond to the crystal positions below.
5. Proceed after a one hour warm-up period; adjust the MF TUNING dial to read 4.27 mc.
6. Adjust the OUTPUT TUNING dial to 4.0 mc.
7. Turn the EXCITER ON/STANDBY switch to ON.
8. Turn the METER SW to RF.
9. Adjust the output control clockwise until the meter registers a mid-scale reading.
10. Adjust R130, located in the mid-frequency compartment near the MF TUNING capacitor, until a minimum reading is indicated on the meter.
11. Advance the OUTPUT control CW to maximum and again adjust R130 for a minimum reading.

f HF BALANCED MODULATOR ADJUSTMENT

1. Turn BAND MCS switch to 4.27 - 6.27 mc position.
2. With EXCITER ON/STANDBY switch ON turn OUTPUT TUNING large knob until dial reads 8 0 mc
3. If METER indicates a hard-over maximum lower it to approximately half scale by detuning it with the large OUTPUT TUNING knob.
4. Adjust R150, located in Z107 next to MF TUNING capacitor, for minimum reading.

5. OSCILLATOR FREQUENCY ADJUSTMENTS

a. PRELIMINARY

THE FOLLOWING TEST EQUIPMENT IS REQUIRED FOR THIS SECTION:

1. An RF frequency meter accurate to one part per million.
2. An RF generator accurate to one part per million.
3. A sensitive RF VTVM.
4. A sensitive communications receiver (AM).

b. 287 KC OSCILLATOR

This oscillator is factory adjusted and should not require attention in the field. If adjustment is proven necessary the oscillator output may be taken from the arm of R113, LF BAL, and adjusted by C120 located under the chassis deck behind the crystal oven.

c. MF XTAL ADJUSTMENTS

1. Remove cover from MF XTAL OVEN.
2. Insert crystals to be used noting their values and locations.
3. Replace oven insulation and cover.
4. Allow a one hour warm-up period if set is cold.
5. Insert a short length of insulated wire through access slot in MF OVEN cover slot near crystal adjustments. Couple this wire to the antenna of a good communications receiver and to the accurate RF frequency generator.
6. Adjust the generator and the receiver tuning to frequency marked on the crystal selected.
7. Adjust the appropriate trimmer (C223-C232) with the tool provided until a zero beat is heard from the receiver.
8. Repeat steps (6) and (7) for each crystal.
9. Remove wire from MF XTAL OVEN.

d. HF XTAL ADJUSTMENTS

1. Place insulated wire near trimmer capacitor in HF XTAL OVEN by passing it through access slots in cover. This oven is located on under side of chassis directly beneath the MF XTAL OVEN. Test equipment is connected in the same way as for MF XTAL ADJUSTMENTS.

2. The following chart provides information for testing each HF XTAL.

BAND MCS Switch Position	XTAL FREQ.	ADJUST
4.27 - 6.27	8.0 mc	C233
6.27 - 8 27	10 0 mc	C234
8.27 - 10.27	12.00 mc	C235
10.27 - 12.27	14.00 mc	C236
14.27 - 16.27	18.00 mc	C237
18.27 - 20.27	11.00 mc	C238
22.27 - 24.27	13.0 mc	C239
30.27 - 32.27	17.0 mc	C240

3. Use a sensitive HF VTVM to measure the voltage at the center conductor of J108 while adjusting the inductive trimmers L101-L114 (numbered 1-14) located on the deck between the MF XTAL OVEN and the front panel. The following chart provides instructions for each adjustment.

BAND MC Switch Positions	XTAL FREQ. (Mc)	HF INJECTION FREQ. (Mc)	ADJUST TRIMMER
4.27 - 6.27	8	8	L101
6.27 - 8.27	10	10	L102
8 27 - 10.27	12	12	L103
10.27 - 12.27	14	14	L104
12 27 - 14.27	8	16	L105
14.27 - 16.27	18	18	L106
16 27 - 18.27	10	20	L107
18 27 - 20.27	11	22	L108
20.27 - 22.27	12	24	L109
22.27 - 24.27	13	26	L110
24.27 - 26.27	14	28	L111
26.27 - 28.27	15	30	L112
28.27 - 30.27	16	32	L113
30.27 - 32.27	17	34	L114

SECTION V

DATA

DETERMINING CRYSTAL OR VMO FREQUENCIES FOR THE MODEL SRE-2

For crystal or VMO operation from 4.27 Mcs to 32.27 Mcs.

$$F_{\text{xtal or vmo}} = 2.000\ (N) - F_{\text{output}} + .270$$

Where all frequencies are in Mcs and F_{output} is assumed to be the frequency of the imaginary or actual carrier.

MODULATOR BAND	N	OUTPUT BAND
4.27 - 6.27	4	4 - 8
6.27 - 8.27	5	4 - 8 & 8 - 16
8.27 - 10.27	6	8 - 16
10.27 - 12.27	7	8 - 16
12.27 - 14.27	8	8 - 16
14.27 - 16.27	9	8 - 16 & 16 - 32
16.27 - 18.27	10	16 - 32
18.27 - 20.27	11	16 - 32
20.27 - 22.27	12	16 - 32
22.27 - 24.27	13	16 - 32
24.27 - 26.27	14	16 - 32
26.27 - 28.27	15	16 - 32
28.27 - 30.27	16	16 - 32
30.27 - 32.27	17	16 - 32

Example: Suppose an output frequency of 10.5 Mcs. is desired

$$F_{\text{xtal or vmo}} = 2.000\ (7) - 10.500 + .270$$

$$F_{\text{xtal or vmo}} = 3.770 \text{ Mcs.}$$

For Crystal or VMO operation from 2 Mcs. - 4.27 Mcs.

OPERATING FREQUENCY RANGE(F)	MODULATOR BAND	OUTPUT BAND	CRYSTAL	VMO	SEE NOTE
2 - 3.73	2 - 4.27	2 - 4	Fo + .270	Fo + .270	
3.73 - 4.00	2 - 4.27	2 - 4	Fo + .270	Fo - .270	1
4.00 - 4 27	2 - 4.27	4 - 8	Fo + .270	Fo - .270	2

ALL FREQUENCIES ARE IN MCS.

NOTES: 1 Upper and lower sideband will be reversed in the region of 3.73 Mcs. to 4.00 Mcs. when using the VMO.

2 Upper and lower sidebands will be reversed in the region of 4 Mcs. to 4.27 Mcs. when using the Crystal, (see page 2-2, Theory of Operation).

Crystal used: CR-27/U

AVERAGE DC VOLTAGE CHART SBE-2

CONDITIONS: H.F. Oscillator Switch 4 27-6.27 Mcs, Output tuned to 8.0 Mcs, Band Switch 4-8 Mcs, Meter Switch in RF position Output Control set to 100% on Meter, RF Output terminated with 70 ohm noninductive load, MF Xtal Switch in VMO position, LSB & USB Gain Controls min , Mike/ Channel Selector "OFF", Main Power "ON", Exciter "ON", Xmtr OFF" V104 and V105 Data taken at Octal Socket.

TUBE	TYPE	SOCKET PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V101	6AB4	57V	NC	0	6.3*	130V	0	1.0V	-	-
V102	6AB4	125V	NC	0	6.3*	130V	0	1.7V	-	0
V103	6AB4	125V	NC	0	6.3*	130V	0	1.8V	-	-
V104	6U8	.35V	0	.44V	0	6.3*	140V	0	150V	-
V105	12AU7	230V	8.5V	6.3*	.2V	150V	0	0	VAR.	-
V106	0A2	150V	NC	NC	NC	150V	NC	0	-	-
V107	12AT7	95V	0	1.4V	6.3*	6.3*	95V	0	1.4V	0
V108	12AT7	130V	0	2.4V	6.3*	6.3*	260V	0	4.2V	0
V109	12AT7	240V	.65V	.46V	6.3*	6.3*	255V	0	2 6V	0
V110	6U8	48V	0	0	6.3*	0	260V	2.9V	1.0V	0
V111	6AL5	.2V	0	0	6.3*	.8V	NC	0	-	-
V112	12AU7	230V	0	4.1V	0	0	230V	0	3.9V	6.3*
V113	12AT7	155V	0	3.0V	0	0	155V	0	3.2V	6 3*
V114	6AH6	0	0	0	6.3*	245V	110V	0.9V	-	-
V115	12AU7	85V	-14V	.16V	0	0	150V	0	7.0V	6.3*
V116	6CL6	6.0V	-16V	150V	0	6.3*	210V	6.0V	NC	-16V
V117	6U8	NC	-10V	115V	0	6.3*	220V	.1V	NC	NC
V118	6AH6	0	0	6.3*	0	190V	105V	1.4V	-	-
V119	6CL6	3.7V	NC	150V	6.3*	0	190V	0	-	0
V120	6146	28V	0	190V	-	0	28V	6.3*	0	260V

NC = No Connection

* = AC Voltages

5-3
does not print

RESISTANCE CHART - SBE-2

CONDITIONS: 1. All Power Off
2. Power Plugs Disconnected
3. All Measurements Taken With Respect To Ground Using a Hewlett-Packard Model 410B VTVM or Equivalent.
4. All Front Panel Switches & Controls in Max. CW Position.

TUBE	TYPE	SOCKET PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
V101	6AB4	Inf.	NC	Fil	Fil	NC	470K	1.5K	-	-
V102	6AB4	Inf.	NC	Fil	Fil	NC	.1M	1.5K	-	-
V103	6AB4	Inf.	NC	Fil	Fil	NC	.1M	1.5K	-	-
V104	6U8	Inf.	2.2M	Inf.	Fil	Fil	Inf.	68	1K	68K
V105	12AU7	Inf.	470K	0	Fil	Fil	Inf.	470K	1K	Fil
V106	0A2	Inf.	0	NC	0	Inf.	NC	0	-	-
V107	12AT7	Inf.	.1M	1.2K	Fil	Fil	Inf.	.1M	1.2K	Fil
V108	12AT7	Inf.	82K	1.5K	Fil	Fil	Inf.	100K	1.2K	Fil
V109	12AT7	83K	7M	820	Fil	Fil	Inf.	390K	330	Fil
V110	6U8	Inf.	470K	100K	Fil	Fil	150K	1K	470	5K
V111	6AL5	100K	470K	Fil	Fil	7M	NC	7M	-	-
V112	12AU7	Inf.	1.5M	1.7K	Fil	Fil	Inf.	0	1.7K	Fil
V113	12AT7	Inf.	47K	500	Fil	Fil	Inf.	47K	500	Fil
V114	6AH6	39	0	Fil	Fil	Inf.	Inf.	100	-	-
V115	12AU7	Inf.	220K	0	Fil	Fil	Inf.	4.7K	1.5K	Fil
V116	6CL6	330	100K	Inf.	Fil	Fil	Inf.	330	Inf.	100K
V117	6U8	NC	100K	Inf.	Fil	Fil	Inf.	0	NC	NC
V118	6AH6	270	0	Fil	Fil	100K	133K	100	-	-
V119	6CL6	68	10	156K	Fil	Fil	100K	0	156K	10
V120	6146	500	Fil	100K	250	10	500	Fil	NC	Inf.

K = Thousand
M = Million
NC = N Connection
Inf. = Infinite Resistanc
Fil = Filament

SEE-2 (O-503A/URA-23)

EXCITER UNIT

TMC PART NO.	DESCRIPTION	SYMBOLS	QUAN.
CC-100-16	CAPACITOR, fixed: ceramic; .01 ufd, +80% -20%.	C101,102,103, 112,113,114, 115,116,117, 121,124,125, 127,135,150, 151,152,153, 156,157,158, 161,162,165, 166,168,169, 170,171,173, 176,197,250, 251,252,254, 257,260	38
CC-100-29	CAPACITOR, fixed: ceramic; .001 ufd, +80% -20%.	C104,105,106, 107,108,109, 110,126,128, 132,133,134, 136,148,174, 175,183,185, 186,187,194, 195,196,206, 207,209,210, 211,212,215, 216,218	32
CP53B1EF501K	CAPACITOR, fixed: paper; .5 ufd, ±10%, 600 wvdc.	C111	1
CM20D102K	CAPACITOR, fixed: mica; 1000 uufd, ±10%, 500 wvdc, char. D.	C118,182,193 205	4
CV11C450	CAPACITOR, variable: ceramic; 7-45 uufd, 500 wvdc, char. C.	C119,258,259	3
CV11A070	CAPACITOR, variable: ceramic; 1.5-7 uufd, 500 wvdc, char. A.	C120,189,201	3
CM20D221K	CAPACITOR, fixed: mica; 220 uufd, ±10%, 500 wvdc, char. D.	C122	1
CC21SL100D	CAPACITOR, fixed: ceramic; 10 uufd, ±5 uufd; 500 wvdc, char. SL.	C123	1
CM106C104K	CAPACITOR, fixed: mylar; .1 ufd, ±10%, 200 wvdc, char. C.	C129,130	2
CM15C511J	CAPACITOR, fixed: composition; 510 uufd, ±5%; 500 wvdc, char. C	C131	1

THC PART NO.	DESCRIPTION	SYMBOLS	QUAN.
CC21SL180K	CAPACITOR, fixed: ceramic; 8 uufd, ±10%; 500 wvdc, char. SL.	C137,138,219	3
CC21SL470G	CAPACITOR, fixed: ceramic; 47 uufd, ±2%; 500 wvdc, char. SL.	C139,163,164, 217,220	5
CV11A120	CAPACITOR, variable: ceramic; 3-12 uufd, 500 wvdc; char. A.	C140,141	2
CN-111-5	CAPACITOR, fixed: metallized paper; .04 ufd, 200 wvdc.	C142,143,144 145	4
CM10F1102F	CAPACITOR, fixed: mica; 11,000 uufd, ±0.5%.	C146,147	2
CM20D331G	CAPACITOR, fixed: mica; 330 uufd, ±2%; 500 wvdc, char. D.	C149	1
CM20D162G	CAPACITOR, fixed: mica; 1600 uufd, ±2%; 500 wvdc, char. D.	C154,155,159, 160	4
CB-127-1	CAPACITOR, variable: air; 2 sections; 12.5 - 282 uufd each section.	C167A,B	1
	Not Used	C172	
CV11C300	CAPACITOR, variable: ceramic; 4-30 uufd; 500 wvdc, char. C.	C177,178,179 180,190,191, 192,201,202, 203	10
CB-137-1	CAPACITOR, variable: air; 2 section; 12.5 - 282 uufd each section.	C181A	1
CB-137-2	CAPACITOR, variable: air; 2 section; 12.5 - 282 uufd each section.	C181B	1
CB-137-3	CAPACITOR, variable: air; 2 section; 12.5 - 282 uufd each section.	C181C	1
CC108-1-P1000M	CAPACITOR, fixed: ceramic; 1000 uufd, +20%, 500 wvdc, char. P.	C184,198,199, 200,204,208, 213,221,246, 247,248,249, 253	13
CE63C5000	CAPACITOR, fixed: dry electrolytic; 50 ufd, 50 wvdc, char. C.	C188	1
CC21SL150J	CAPACITOR, fixed: ceramic; 15 uufd, ±5%; 500 wvdc, char. SL.	C214	1
CN-100-3	CAPACITOR, fixed: paper; .05 ufd, +40% -10%, 400 wvdc.	C222	1

TMS PART NO.	DESCRIPTION	SYMBOLS	QUAN.
CV-101-1	CAPACITOR, variable: 1-8 uufd.	C223,224,225, 226,227,228, 229,230,231, 232,233,234, 235,236,237, 238,239,240	18
CM15D221J	CAPACITOR, fixed: mica; 220 uufd, ±5%, 500 wvdc, char. D.	C241	1
CM15C131J	CAPACITOR, fixed: mica; 130 uufd, ±5%, 500 wvdc, char. C.	C242	1
CM15C820J	CAPACITOR, fixed: mica; 82 uufd, ±5%, 500 wvdc, char. C.	C243	1
CM15C470J	CAPACITOR, fixed: mica; 47 uufd, ±5%, 500 wvdc, char. C.	C244	1
CM15C240J	CAPACITOR, fixed: mica; 24 uufd, ±5%, 500 wvdc, char. C.	C245	1
CM20C270J	CAPACITOR, fixed: mica; 27 uufd, ±5%, 500 wvdc, char. C.	C255	1
CM15C510J	CAPACITOR, fixed: mica; 51 uufd, ±5%, 500 wvdc, char. C.	C256	1
CK-711	DIODE ASSEMBLY, germanium; 4 diodes, hermetically sealed.	CR101,102,103	3
IN-300	DIODE, silicon.	CR104,105,106, 109	4
IN-67	DIODE, germanium.	CR107,108,110	3
TM-100-4	BOARD, terminal; 14 contacts.	E101	1
HB-102-2	CLIP, electrical: ceramic body.	E102	1
BI-100-51	LAMP, neon: T-3-⅛ bulb.	I101,102	2
BI-101-47	LAMP, incandescent: T-3-¼ bulb.	I103	1
JJ-133-3	CONNECTOR, receptacle: female; 3 contacts.	J101	1
UG-625/U	CONNECTOR, receptacle: female; 1 contact.	J102,103,104	3
JJ-154	CONNECTOR, receptacle: male; 1 contact.	J105,106,107, 108,110	5
AN3102A-20-27P	CONNECTOR, receptacle.	J109	1

TMC PART NO.	DESCRIPTION	SYMBOLS	QUAN.
A-1460	RELAY ASSEMBLY, solenoid.	K101	1
A-1445-4	COIL, R.F : 8 mc; .95 - 1.01 uhy; Q greater than 115.	L101	1
A-1445-5	COIL, R.F.: 10 mc; .95 - 1.01 uhy; Q greater than 115.	L102	1
A-1445-6	COIL, R.F.: 12 mc; .95 - 1.01 uhy; Q greater than 115.	L103	1
A-1445-7	COIL, R.F.: 14 mc; .95 - 1.01 uhy; Q greater than 115.	L104	1
A-1445-8	COIL, R.F.: 16 mc; .95 - 1.01 uhy; Q greater than 115.	L105	1
A-1445-9	COIL, R.F.: 18 mc; .95 - 1.01 uhy; Q greater than 115.	L106	1
A-1445-10	COIL, R.F.: 20 mc; .95 - 1.01 uhy; Q greater than 115.	L107	1
A-1445-11	COIL, R.F.: 22 mc; .77 - .83 uhy; Q greater than 115.	L108	1
A-1445-12	COIL, R.F.: 24 mc; .67 - .73 uhy; Q greater than 115.	L109	1
A-1445-13	COIL, R.F.: 26 mc; .58 - .64 uhy; Q greater than 115.	L110	1
A-1445-3	COIL, R.F.: 28 mc; .46 - .50 uhy; Q greater than 115.	L111	1
A-1445-1	COIL, R.F.: 30 mc; .40 - .45 uhy; Q greater than 115.	L112	1
A-1445-2	COIL, R.F.: 32-34 mc; .29 - .34 uhy; Q greater than 115.	L113,114	2
C1-101-4	COIL, R.F.: 10 uhy; 75 ma, 3 Pi.	L115	1
C1-105-3	COIL, R.F.: 2.8 uhy.	L116	1
A-1023	COIL, R.F.: 128 uhy.	L117,119,120, 122,126,132	6
CL-100-5	COIL, R.F.: 750 uhy; 75 ma, 2 Pi.	L118,121,123, 124,127	5
p/o A-1466	COIL, plate peaking.	L125	1
p/o A-1461	COIL, R.F.: 15.8 uhy.	L128	1

TMC PART NO.	DESCRIPTION	SYMBOLS	QUAN.
CL-105-2	COIL, R.F.: 4 uhy	L129,130,131	3
MR-100-8	METER, DC: micro amp; 0-200.	M101	1
MS3106B-20-27P	CONNECTOR, plug: male; AN pin type.	P101	1
MS3106B-20-27S	CONNECTOR, plug: female; AN pin type.	P102	1
PL-154	CONNECTOR, plug: min. coaxial type.	P103,104,105, 106	4
PL-155	CONNECTOR, plug: min. coaxial angle type.	P107	1
A-1453	SUPPRESSOR, parasitic.	PS101	1
RC20GF561K	RESISTOR, fixed: composition; 560 ohms, ±10%, 1/2 watt.	R101,102,194, 195	4
RC20GF474K	RESISTOR, fixed: composition; 470, 000 ohms, ±10%, 1/2 watt.	R103,126,127, 143,144,213	6
RC20GF104K	RESISTOR, fixed: composition; 100,000 ohms, ±10%, 1/2 watt.	R104,125,132, 136,137,147, 176,182,229, 233,235	11
RC20GF152K	RESISTOR, fixed: composition; 1500 ohms, ±10%, 1/2 watt.	R105,139,161, 170,175,178	6
RV4ATRD503B	RESISTOR, variable: composition; 50,000 ohms, ±20%, 2 watts.	R106	1
RC20GF682K	RESISTOR, fixed: composition; 6800 ohms, ±10%, 1/2 watt.	R107	1
RC20GF182K	RESISTOR, fixed: composition; 1800 ohms, ±10%, 1/2 watt.	R108	1
RV4ATSD503A	RESISTOR, variable: composition; 50,000 ohms, ±20%, 2 watts.	R109	1
RV4ATXA101A	RESISTOR, variable: composition; 100 ohms, ±10%, 2 watts.	R110,112,113	3
RC20GF223K	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1/2 watt.	R111,117,159, 160,187,188, 190,232,234	9
RC20GF102K	RESISTOR, fixed: composition; 1000 ohms, ±10%, 1/2 watt.	R114,123,128, 142,166,167, 179,180, 222	9
RC20GF683K	RESISTOR, fixed: composition; 68,000 ohms, ±10%, 1/2 watt.	R115,215	2

TMC PART NO.	DESCRIPTION	SYMBOLS	QUAN.
RC20BF225K	RESISTOR, fixed: composition; 2 2M, ±10%, 1/2 watt.	R116,146	2
RC20BF680K	RESISTOR, fixed: composition; 68 ohms, ±10%, 1/2 watt.	R118,197,198, 201,219	5
RC20BF184K	RESISTOR, fixed: composition; 180, 000 ohms, ±10%, 1/2 watt.	R119	1
RW-109-32	RESISTOR, fixed: wire wound; 5000 ohms, ±5%, 10 watts.	R120	1
RC20BF106K	RESISTOR, fixed: composition; 10 M, ±10%, 1/2 watt.	R121,133,145, 148,149,183	6
RC20BF153K	RESISTOR, fixed: composition; 15,000 ohms, ±10%, 1/2 watt.	R122	1
RC30BF472K	RESISTOR, fixed: composition; 4700 ohms, ±10%, 1 watt.	R124	1
RV4ATSA502B	RESISTOR, variable: composition; 5000 ohms, ±20%, 2 watts.	R129	1
RV4ATXA102A	RESISTOR, variable: composition; 1000 ohms, ±10%, 2 watts.	R130	1
RC20BF821K	RESISTOR, fixed: composition; 820 ohms, ±10%, 1/2 watt.	R131,151,181	3
RC20BF224K	RESISTOR, fixed: composition; 220, 000 ohms, ±10%, 1/2 watt.	R134,153,163, 184,204	5
RV4ATSA102A	RESISTOR, variable: composition; 1000 ohms, ±10%, 2 watts.	R135	1
RC42BF823K	RESISTOR, fixed: composition; 82,000 ohms, ±10%, 2 watts.	R138,152	2
RC42BF104K	RESISTOR, fixed: composition; 100,000 ohms, ±10%, 2 watts.	R139	1
RV4ATSA104B	RESISTOR, variable: composition; 100, 000 ohms, ±20%, 2 watts.	R140,168,169	3
RC20BF471K	RESISTOR, fixed: composition; 470 ohms, ±10%, 1/2 watt.	R141	1
RV4ATXA501A	RESISTOR, variable: composition; 500 ohms, ±10%, 2 watts.	R150	1
RC20BF155J	RESISTOR, fixed: composition; 1.5 M, ±5%, 1/2 watt.	R154	1

TM5

PART NO.	DESCRIPTION	SYMBOLS	QUAN.
RC30GF223K	RESISTOR, fixed: composition; 22,000 ohms, ±10%, 1 watt.	R155,156	2
RC20GF122K	RESISTOR, fixed: composition; 1200 ohms, ±10%, 1/2 watt.	R157,158	2
RC20GF472K	RESISTOR, fixed: composition; 4700 ohms, ±10%, 1/2 watt.	R162	1
RC20GF473K	RESISTOR, fixed: composition; 47,000 ohms, ±10%, 1/2 watt.	R164,165,177, 192,193	5
RC20GF823K	RESISTOR, fixed: composition; 82,000 ohms, ±10%, 1/2 watt.	R171,172,174 202	4
RC20GF333K	RESISTOR, fixed: composition; 33,000 ohms, ±10%, 1/2 watt.	R173,223	2
RC20GF221K	RESISTOR, fixed: composition; 220 ohms, ±10%, 1/2 watt.	R185,186	2
RC20GF331K	RESISTOR, fixed: composition; 330 ohms, ±10%, 1/2 watt.	R189,228	2
RC30GF102K	RESISTOR, fixed: composition; 100 ohms, ±10%, 1 watt.	R191	1
RC42GF103K	RESISTOR, fixed: composition; 10,000 ohms, ±10%, 2 watt.	R196	1
RC20GF390K	RESISTOR, fixed: composition; 39 ohms, ±10%, 1/2 watt.	R199,218	2
RC20GF101K	RESISTOR, fixed: composition; 100 ohms, ±10%, 1/2 watt.	R200,206,225, 236	4
RC30GF122K	RESISTOR, fixed: composition; 1200 ohms, ±10%, 1 watt.	R203	1
RV4ATHD502B	RESISTOR, variable: composition; 5000 ohms, ±20%, 2 watts.	R205	1
RR-102-1	RESISTOR, fixed: wire wound; 20 watts.	R207,208	2
RC20GF335J	RESISTOR, fixed: composition; 3.3 M, ±5%. 1/2 watt.	R209	1
RC20GF102J	RESISTOR, fixed: composition; 1000 ohms, ±5%, 1/2 watt.	R210	1
RC20GF561J	RESISTOR, fixed: composition; 560 ohms, ±5%, 1/2 watt.	R211	1
RC20GF103K	RESISTOR, fixed: composition; 10,000 ohms, ±10%, 1/2 watt.	R212	1

TMC PART NO.	DESCRIPTION	SYMBOLS	QUAN.
RC20GF100K	RESISTOR, fixed: composition; 10 ohms, ±10%, 1/2 watt.	R214,220,224, 226	4
RW-109-19	RESISTOR, fixed: wire wound; 500 ohms, ±5%, 10 watt.	R216	1
RC30GF562K	RESISTOR, fixed: composition; 5600 ohms, ±10%, 1 watt.	R217	1
RC20GF394K	RESISTOR, fixed: composition; 390,000 ohms, ±10%, 1/2 watt.	R221	1
RC20GF272K	RESISTOR, fixed: composition; 2700 ohms, ±10%, 1/2 watt.	R227	1
RC30GF272K	RESISTOR, fixed: composition; 2700 ohms, ±10%, 1 watt.	R230	1
RC30GF682K	RESISTOR, fixed: composition; 6800 ohms, ±10%, 1 watt.	R231	1
RC20GF271K	RESISTOR, fixed: composition; 270 ohms, ±10%, 1/2 watt.	R237	1
RC20GF515J	RESISTOR, fixed: composition; 5.1 M, ±5%, 1/2 watt.	R238	1
SW-181	SWITCH, rotary: shorting type; four positions, double pole.	S101,102	2
ST-103-1-62	SWITCH, toggle: SPST.	S103,104,105	3
WS-101	WAFER, switch: four positions; shorting type.	S106A,106B 106C	3
WS-103	WAFER, switch: four positions; shorting type.	S106B	1
SW-200	SWITCH, rotary.	S107	1
WS-102	WAFER, switch: 15 positions; single pole; shorting type.	S108A	1
SW-191	SWITCH, rotary: 15 positions; single pole; 20° detent.	S108B	1
SW-199	SWITCH, rotary.	S109	1
SS-100-2	SWITCH, sensitive: bi-metallic; 70° breaking temperature.	S110	1
TF-170	TRANSFORMER, audio.	T101,102	2
TF-138	TRANSFORMER, audio	T103,104,105, 106	4

TMC PART NO.	DESCRIPTION	SYMBOLS	QUAN.
A-1444	TRANSFORMER, R.F.	T107,108	2
A-1512	TRANSFORMER, R.F.: 2-4 mc.	T109	1
A-1511	TRANSFORMER, R.F.: 2-4 mc.	T110	1
TF-172	TRANSFORMER, R.F.: 2-4 mc.	T111	1
A-1519-2	TRANSFORMER, R.F.: 16-32 mc.	T112	1
A-1451-3	TRANSFORMER, R.F.: 4-8 mc.	T113,117,121	3
A-1519-1	TRANSFORMER, R.F.: 16-32 mc.	T114,118	2
A-1415-4	TRANSFORMER, R.F.: 8-16 mc.	T115,119	2
A-1451-2	TRANSFORMER, R.F.: 2-4.3 mc.	T116	1
A-1451-1	TRANSFORMER, R.F.: 2-4.3 mc.	T120	1
A-1451-5	TRANSFORMER, R.F.: 8-16 mc.	T122	1
TF-173	TRANSFORMER, H.F.	T123	1
TF-183	TRANSFORMER, H.F.	T124	1
6AB4	TUBE, electron	V101,102,103	3
6U8	TUBE, electron	V104,110,117	3
12AU7	TUBE, electron	V105,112,115	3
0A2	TUBE, electron	V106	1
12AT7	TUBE, electron	V107,108,109, 113	4
6AL5	TUBE, electron	V111	1
6AH6	TUBE, electron	V114,118	2
6CL6	TUBE, electron	V116,119	2
6146	TUBE, electron	V120	1
TS-101-P01	SOCKET, octal.	XCR101,102,103 XK101,XV120, XZ103,104,105	8
TS-106-1	SOCKET, w/lens: red.	XI101	1
TS-106-2	SOCKET, w/lens: white.	XI102	1
TS-107-2	SOCKET, bracket.	XI103	1

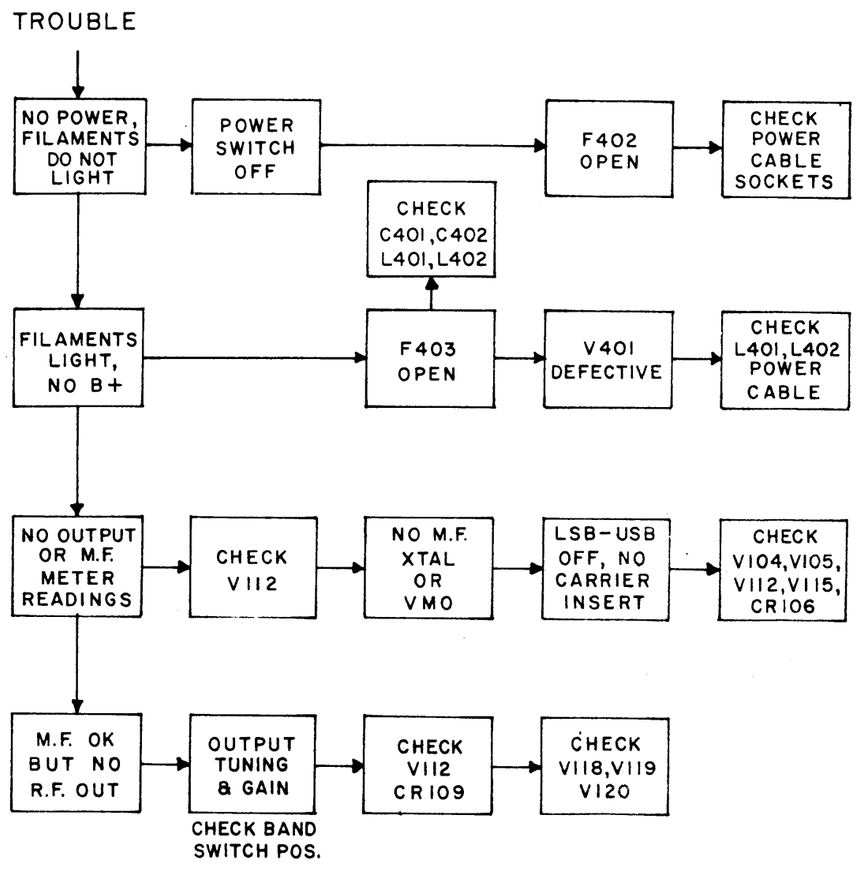
TMC PART NO	DESCRIPTION	SYMBOLS	QUAN.
TS-102-P01	SOCKET, 7 pin miniature.	XV101,102,103, 106,111,114,118	7
PO-148-9-2	SOCKET, plug in.	XV104,105	2
TS-103-P01	SOCKET, 9 pin miniature.	XV107,108,109, 110,112,113,115, 116,117,119	10
TS-104-1	SOCKET, xtal.	XY101,102,103, 104,105,106,107, 108,111,112,113, 114,115,116,117, 118,119,120	18
CR27/U-8.000P	CRYSTAL, quartz: 8 mc.	Y101	1
CR27/U-10.000P	CRYSTAL, quartz: 10 mc.	Y102	1
CR27/U-12 000P	CRYSTAL, quartz: 12 mc.	Y103	1
CR27/U-14.000P	CRYSTAL, quartz: 14 mc.	Y104	1
CR27/U-18 000P	CRYSTAL, quartz: 18 mc.	Y105	1
CR27/U-11.000P	CRYSTAL, quartz: 11 mc.	Y106	1
CR27/U-13.000P	CRYSTAL, quartz: 13 mc.	Y107	1
CR27/U-17.000P	CRYSTAL, quartz: 17 mc.	Y108	1
CR-50/U	CRYSTAL, quartz: 17 Kc.	Y109	1
CR47/U-.287P	CRYSTAL, quartz: 287 Kc.	Y110	1
FX-154	FILTER, bandpass.	Z101	1
FX-155	FILTER, bandpass.	Z102	1
A-1458	ASSEMBLY, 287 kc osc.	Z103	1
PO-147	XTAL OVEN, 17 and 287 kc.	Z104	1
A-1459	ASSEMBLY, 17 kc Osc.	Z105	1
A-1461	REJECTION NETWORK	Z106	1
A-1454	MODULATOR ASSY, H.F.	Z107	1

PARTS LIST

SBE-2 (PP-1769/URA-23)

POWER SUPPLY

TMC PART NO.	DESCRIPTION	SYMBOLS	QUAN
CE51F800R	CAPACITOR, fixed: dry electrolytic.	C401,402	2
CE52E200R	CAPACITOR, fixed: dry electrolytic.	C403A,B	2
CC-100-23	CAPACITOR, fixed: ceramic, disc type.	C404A,B	2
FU-102-.002	FUSE, cartridge: 1/2 amp.	F401	1
FU-102-.003	FUSE, cartridge: 2-1/2 amp.	F402	1
FU-102-.250	FUSE, cartridge: 1/4 amp.	F403	1
EI-101-47	LAMP, incandescent.	I401	1
JJ-100	CONNECTOR, receptacle: two prong, male.	J401	1
AN3102-A-20-27S	CONNECTOR, receptacle: female, AN pin type.	J402	1
TF-144	REACTOR, filter.	L401,402	2
RC42GF153K	RESISTOR, fixed: composition.	R401	1
RW-109-33	RESISTOR, fixed: wire wound.	R402	1
RW-109-42	RESISTOR, fixed: wire wound.	R403	1
RW-109-36	RESISTOR, fixed: wire wound.	R404	1
RC30GF104K	RESISTOR, fixed: composition.	R405	1
TF-161	TRANSFORMER, filament.	T401	1
TF-104	TRANSFORMER, power.	T402	1
5R4	TUBE, electron: duo diode; rectifier.	V401	1
OA2	TUBE, electron: voltage regulator.	V402	1
CA-103-72	CABLE, AC power.	W401	1
TS-106-1	SOCKET, indicator.	XI401	1
TS-101-P01	SOCKET, tube: octal.	XV401	1
TS-102-P01	SOCKET, tube: 7 pin min.	XV402	1



NOTE: THIS IS A BRIEF TROUBLE SHOOTING AID. IT DOES NOT LIST ALL POSSIBLE DIFFICULTIES.

INSTRUCTIONS:

1. DETERMINE THE NATURE OF THE TROUBLE.
2. FIND THE BLOCK WHICH DESCRIBES IT MOST COMPLETELY.
3. FOLLOW THE ARROW FROM THAT BLOCK TO THE FIRST SUGGESTED FAULT. INVESTIGATE.
4. IF NO TROUBLE IS FOUND, FOLLOW THE ARROW TO THE NEXT FAULT SUGGESTED. INVESTIGATE.
5. IF TROUBLE IS ONLY PARTIALLY CORRECTED, FIND THE BLOCK WHICH MOST NEARLY DESCRIBES THE REMAINING TROUBLE. INVESTIGATE.
6. PROCEED AS IN LINE 3 ABOVE.

ISSUE	ITEM	CHANGED FROM	DATE	CH. NO.	DRAFTS	CHECKER	ENG. APP.

TOLERANCES

DEC. DIM. ±
FRAC. DIM. ±
ANGULAR DIM. +

SCALE:

MAXIMUM ALLOWABLE TOLERANCES HAVE BEEN DETERMINED AND ANY DEVIATIONS WILL BE CAUSE FOR REJECTION.
REMOVE ALL BURRS AND SHARP EDGES

FOR INSTRUCTION BOOK

REQ. PER UNIT	MODEL	PROJECT NO.	ASS'Y. NO.	DATE
	SBE-1			

USED ON

REQ.	ITEM	PART NO.	DESCRIPTION	SYMBOL

STOCK SIZE

MATERIAL

TYPE & TEMPER | HEAT TREAT. SPEC. | FINISH & SPEC. NO.

THE TECHNICAL MATERIEL CORP.
MAMARONECK. NEW YORK

TROUBLE SHOOTING CHART

MODEL SBE

C.D.D.

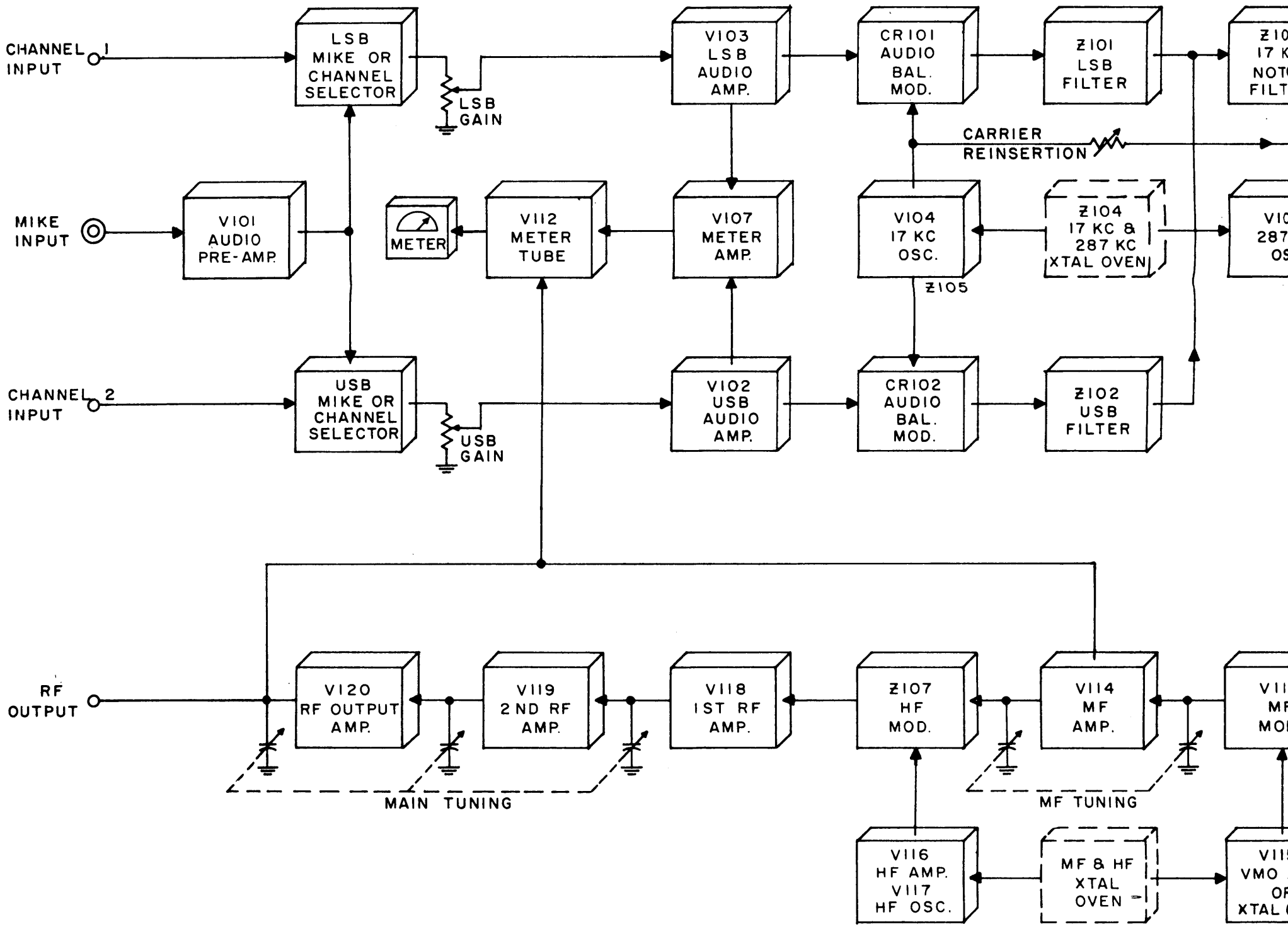
DRAWN	CHECKED	FINAL APPROVAL

ELEC. DES. APP. | MECH. DES. APP.

FORM-109-A

IF IT IS FOUND DESIRABLE TO CHANGE ANY TOLERANCE OR OTHER DETAIL SPECIFIED ON THIS DRAWING NOTIFY THE PURCHASER PROMPTLY.

MAXIMUM ALLOWABLE TOLERANCES HAVE BEEN DETERMINED AND DEVIATIONS WILL BE CAUSE FOR REJECTION.
REMOVE ALL BURRS AND SHARP EDGES



ISSUE	ITEM	CHANGED FROM	DATE	CN. NO.	DRAFTS	CHECKER	ENG. APP.
A	1	RED'WN-COMP. REV.	11 1957	1	LWG		

TOLERANCES

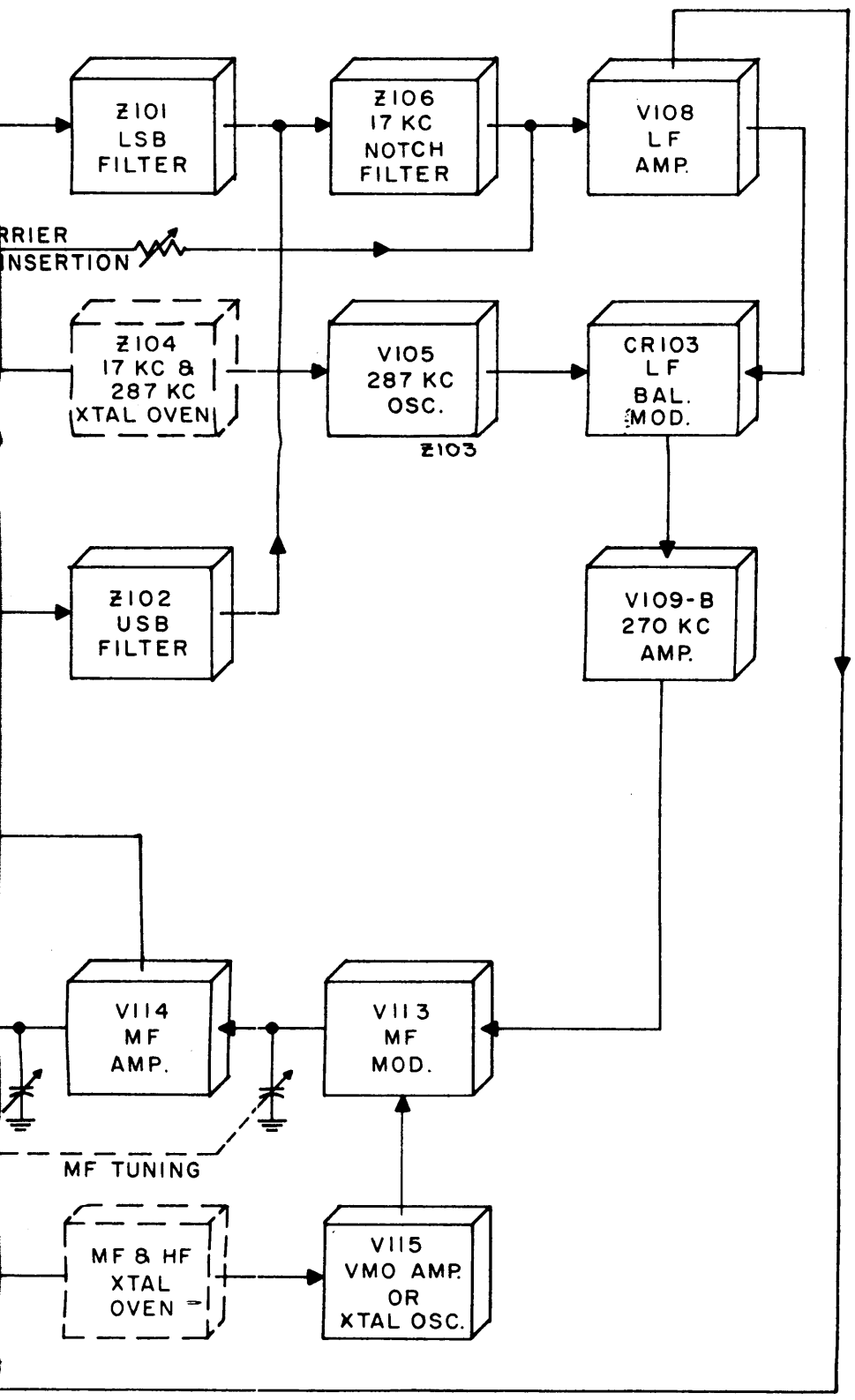
ALL OTHERS: DEC. DIM. ± / FRAC. DIM. :: / ANGULAR DIM. ±

SCALE:

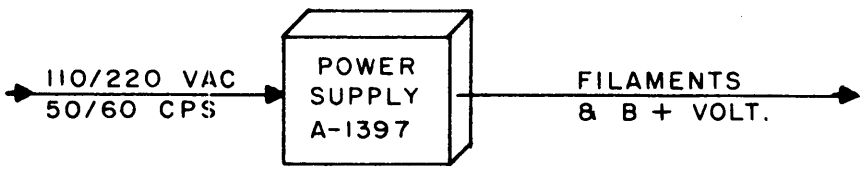
DRILL, PUNCH, COMMERCIAL STOCK SIZES AND MANUFACTURERS TOLERANCES ARE NOT INCLUDED.

REQ PER UNIT	MODEL	PROJECT NO.	
1	SBE-1		

USED ON



CK-340 | A



SCHEMATIC - CK-339 (Rcl)

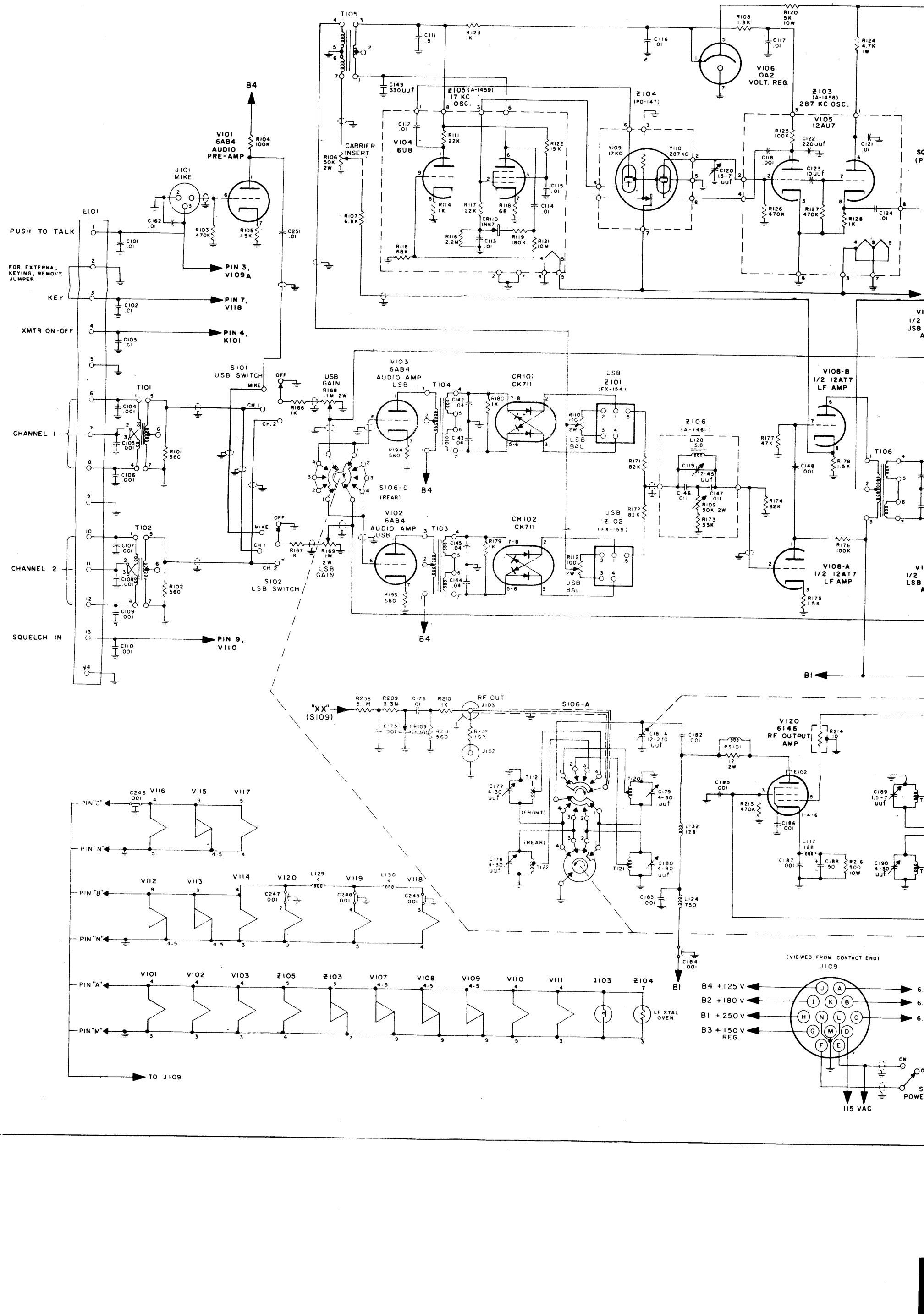
REQ.	ITEM	PART NO.	DESCRIPTION	SYMBOL
			THE TECHNICAL MATERIEL CORP. MAMARONECK. NEW YORK	
			BLOCK DIAGRAM, MODEL SBE	

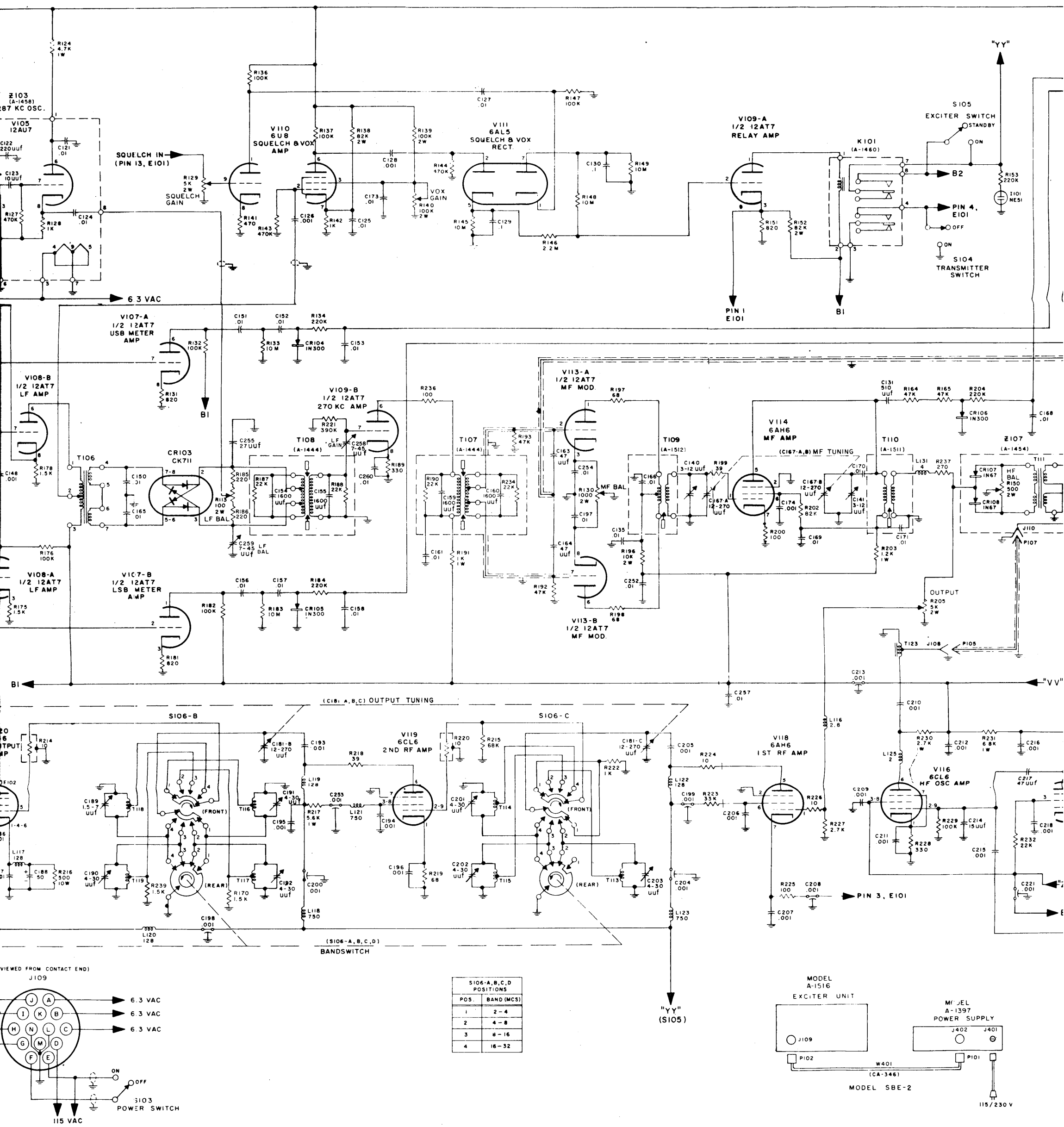
STOCK SIZE | MATERIAL | WEIGHT PER PC. | TYPE & TEMPER | HEAT TREAT. SPEC. | FINISH & SPEC. NO.

G 11-19-57 | DRAWN | ELEC. DES. APP. | MECH. DES. APP. | CHECKED | FINAL APPROVAL

CK-340 | A

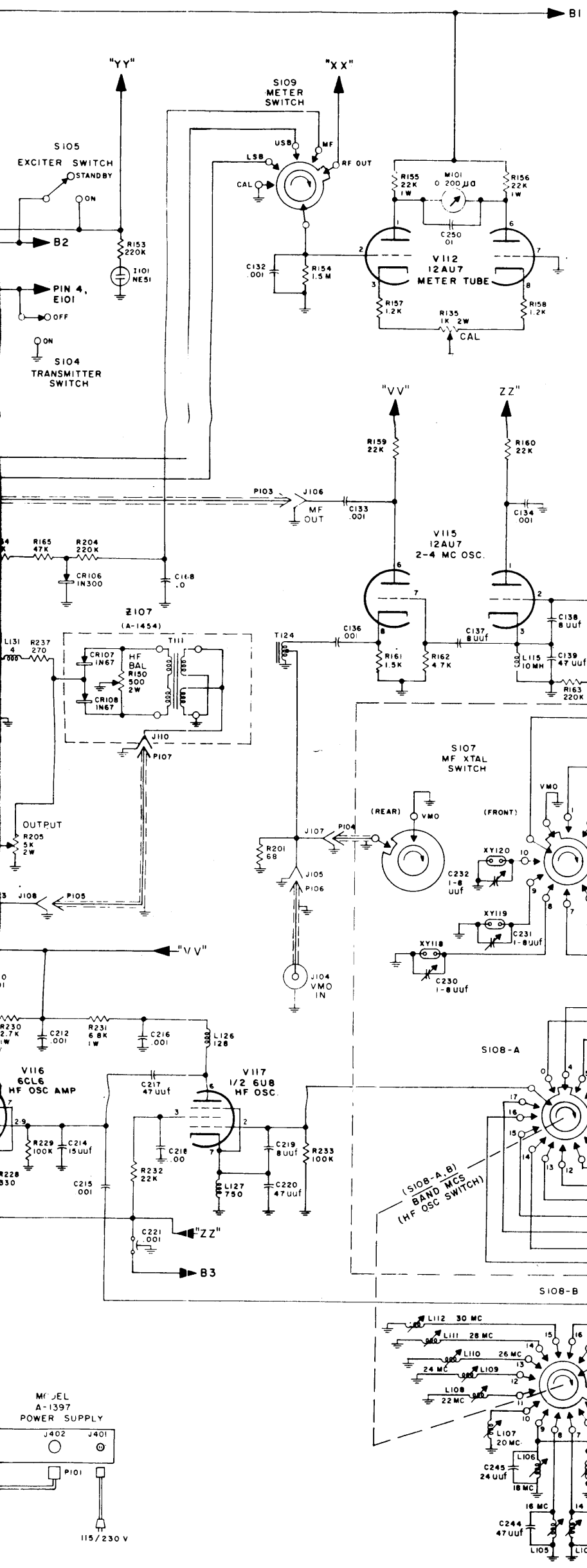
E-1			11-19-57
N DEL	PROJECT NO.	ASS'Y. NO.	DATE
USED ON			


E101
PUSH TO TALK
FOR EXTERNAL KEYING, REMOVE JUMPER
KEY
XMTR ON-OFF
CHANNEL 1
CHANNEL 2
SQUELCH IN
PIN 3, V109A
PIN 7, V118
PIN 4, K101
PIN 9, V110
J101 MIKE
V101 6AB4 AUDIO PRE-AMP
B4
T101
T102
S101 USB SWITCH
S102 LSB SWITCH
S106-D (REAR)
S106-A
CH. 1
CH. 2
MIKE
OFF
USB GAIN
LSB GAIN
V103 6AB4 AUDIO AMP LSB
V102 6AB4 AUDIO AMP USB
T104
T103
CR101 CK711
CR102 CK711
LSB Z101 (FX-154)
USB Z102 (FX-155)
LSB BAL
USB BAL
Z106 (A-1461)
V108-B 1/2 12AT7 LF AMP
V108-A 1/2 12AT7 LF AMP
T106
V105 12AU7
Z103 (A-1458) 287 KC OSC.
Z104 (PO-147)
Z105 (A-1459) 17 KC OSC.
V104 6U8
V106 0A2 VOLT. REG.
CARRIER INSERT
Y109 17KC
Y110 287KC
B1
B2
B4
"XX" (S109)
RF OUT J103
J102
V120 6146 RF OUTPUT AMP
E102
T112
T120
T122
T121
L132 12.8
L124 750
C184 .001
V116
V115
V117
V112
V113
V114
V120
V119
V118
V101
V102
V103
Z105
Z103
V107
V108
V109
V110
V111
I103
Z104
PIN "C"
PIN "N"
PIN "B"
PIN "A"
PIN "M"
TO J109
LF XTAL OVEN
(VIEWED FROM CONTACT END)
J109
B4 +125 V
B2 +180 V
B1 +250 V
B3 +150 V REG.
115 VAC
ON



S106-A,B,C,D POSITIONS	
POS.	BAND (MCS)
1	2 – 4
2	4 – 8
3	8 – 16
4	16 – 32

ISSUE	ITEM	REVISION	DATE	CR. NO.	DRAFTS	CHECKED	ENG APP
A	1	C260 ADDED	4/17/58	1			
	2	C201 WAS 4-30 MMF					
	3	C172 DELETED, R170 ADDED					



NOTE: FOR 230 V. OPERATION, REMOVE JUMPERS MARKED —×— FROM TB101, AND ADD JUMPER SHOWN IN DOTTED LINES.

LAST SYMBOL NO'S

C260
CR110
E102
I103
J110
K101
L132
M101
P107
PS101
R239
S110
T124
V120
Y110
Z107
TB101

NOTES:
1 ALL CAPACITOR VALUES ARE IN μf UNLESS OTHERWISE NOTED
2 ALL COIL VALUES ARE IN μhy UNLESS OTHERWISE NOTED
3 ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE NOTED

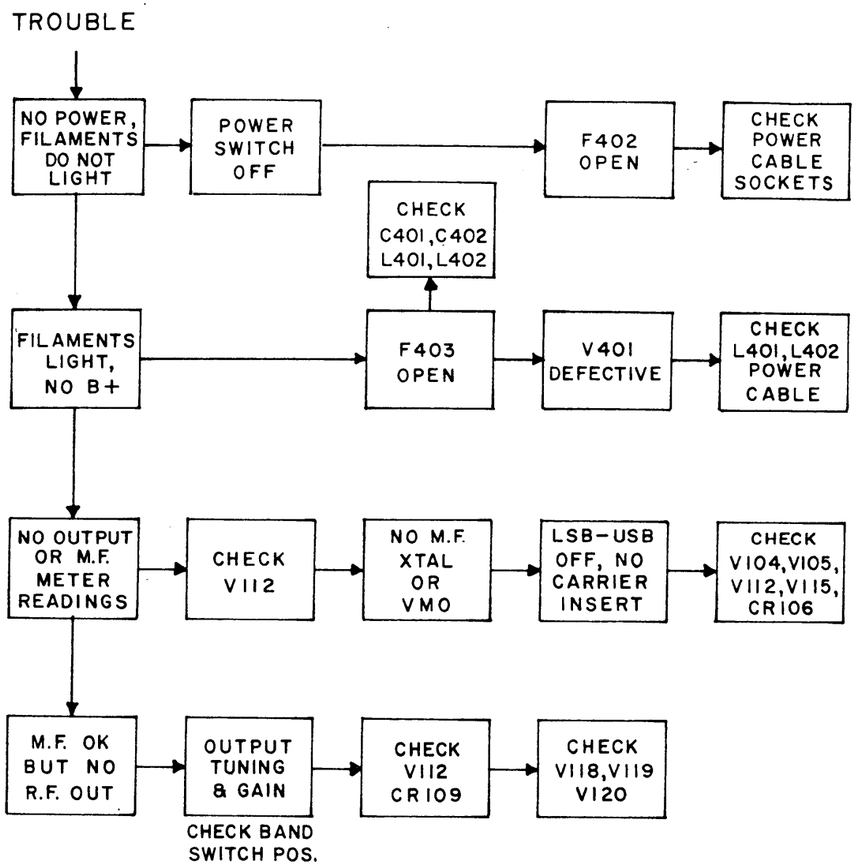
REF. CK-343(2) POWER SUPPLY

THE TECHNICAL MATERIEL CORP.
MAMARONECK, NEW YORK

SCHEMATIC DIAGRAM.

MODEL A-1516, EXCITER UNIT (MODEL SPE 2)

LWG 3/25/58		
DRAWN EDC	CHECKED RWR	FINAL APPROVAL CK-354 A
ELEC ENG APP		



NOTE: THIS IS A BRIEF TROUBLE SHOOTING AID. IT DOES NOT LIST ALL POSSIBLE DIFFICULTIES.

INSTRUCTIONS:

1. DETERMINE THE NATURE OF THE TROUBLE.
2. FIND THE BLOCK WHICH DESCRIBES IT MOST COMPLETELY.
3. FOLLOW THE ARROW FROM THAT BLOCK TO THE FIRST SUGGESTED FAULT. INVESTIGATE.
4. IF NO TROUBLE IS FOUND, FOLLOW THE ARROW TO THE NEXT FAULT SUGGESTED. INVESTIGATE.
5. IF TROUBLE IS ONLY PARTIALLY CORRECTED, FIND THE BLOCK WHICH MOST NEARLY DESCRIBES THE REMAINING TROUBLE. INVESTIGATE.
6. PROCEED AS IN LINE 3 ABOVE.

ISSUE	ITEM	CHANGED FROM	DATE	CH. NO.	DRAFTS	CHECKER	ENG. APP.

TOLERANCES

DEC. DIM. ±
FRAC. DIM. ±
ANGULAR DIM. ±

SCALE:

MAXIMUM ALLOWABLE TOLERANCES HAVE BEEN DETERMINED AND ANY DEVIATIONS WILL BE CAUSE FOR REJECTION. REMOVE ALL BURRS AND SHARP EDGES

FOR INSTRUCTION BOOK

REQ. PER UNIT	MODEL	PROJECT NO.	ASS'Y. NO.	DATE
	SBE-1			
USED ON				

REQ.	ITEM	PART NO.	DESCRIPTION	SYMBOL

STOCK SIZE

MATERIAL

TYPE & TEMPER | HEAT TREAT. SPEC. | FINISH & SPEC. NO.

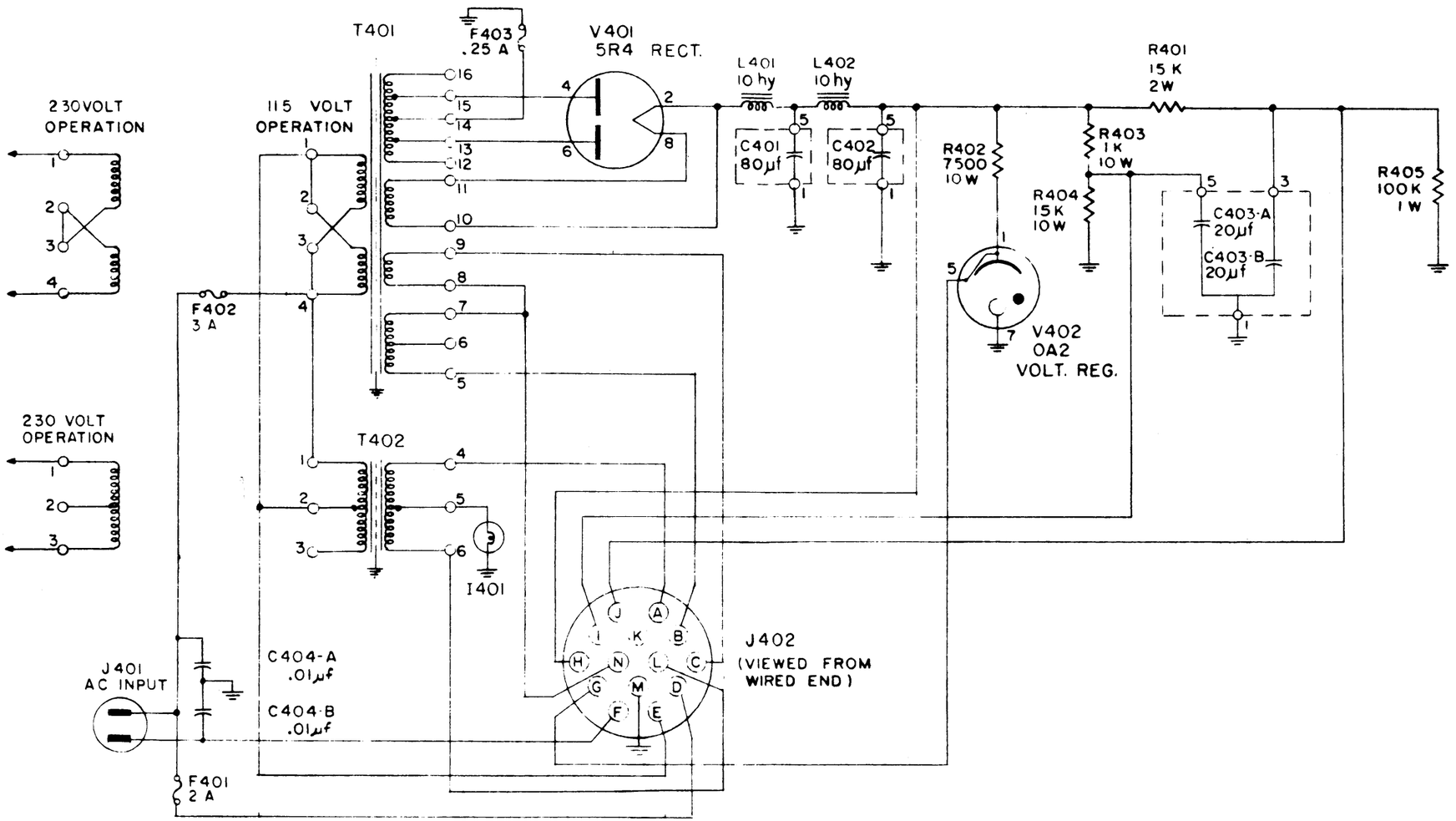
THE TECHNICAL MATERIEL CORP.
MAMARONECK. NEW YORK

TROUBLE SHOOTING CHART

MODEL SBE

C.D.D.		
DRAWN	CHECKED	FINAL APPROVAL
ELEC. DES. APP.	MECH. DES. APP.	

CK-343 C



ISSUE	ITEM	CHANGED FROM	DATE	CH. NO.	DRAFTS	CHECKER	ENG. APP.
C	1	F403 RELOCATED	4/30/57	3	[illegible]	[illegible]	AJJ
B	2	F402 WAS 2.5A (Error)	12/10/57	2	[illegible]	[illegible]	AJJ
	1	F401 WAS 1/2A (Error)					
A	6	C404 A+B ADDED	7/23/57	1	[illegible]	[illegible]	AJJ
	5	R405 WAS 1W					
	4	R403 WAS 4K					
	3	R404 WAS 10K					
	2	L & M CONN. SWITCHED					
	1	JUMPER DELE. FROM H to K					

TOLERANCES

DEC. DIM. ±
FRAC. DIM. ±
ANGULAR DIM. ±

SCALE:

MAXIMUM ALLOWABLE TOLERANCES HAVE BEEN DETERMINED AND ANY DEVIATIONS WILL BE CAUSE FOR REJECTION.
REMOVE ALL BURRS AND SHARP EDGES

REQ. PER UNIT	MODEL	PROJECT NO.	USED ON	DATE
1	A-1397		SBE-1	5-13-57

Ref. CK-339 (Roll) EXCITER UNIT

REQ.	ITEM	PART NO.	DESCRIPTION	SYMB L
			THE TECHNICAL MATERIEL CORP. MAMARONECK. NEW YORK	
		STOCK SIZE	SCHEMATIC DIAGRAM,	
		MATERIAL	Model A 1397, Power Supply	

TYPE & TEMPER	HEAT TREAT. SPEC.	DRAWN	CHECKED	FINAL APPROVAL
		5-13-57	[illegible]	AJJ

FINISH & SPEC. NO.	ELEC. DES. APP.	MECH. DES. APP.	CK-343	C
	[illegible]	[illegible]		