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# LESSON PLAN

for

# SIDEBAND CONVERTER

# MODEL SBC-1

WORLD WIDE SUPPLIERS OF ELECTRONIC COMMUNICATIONS EQUIPMENT

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

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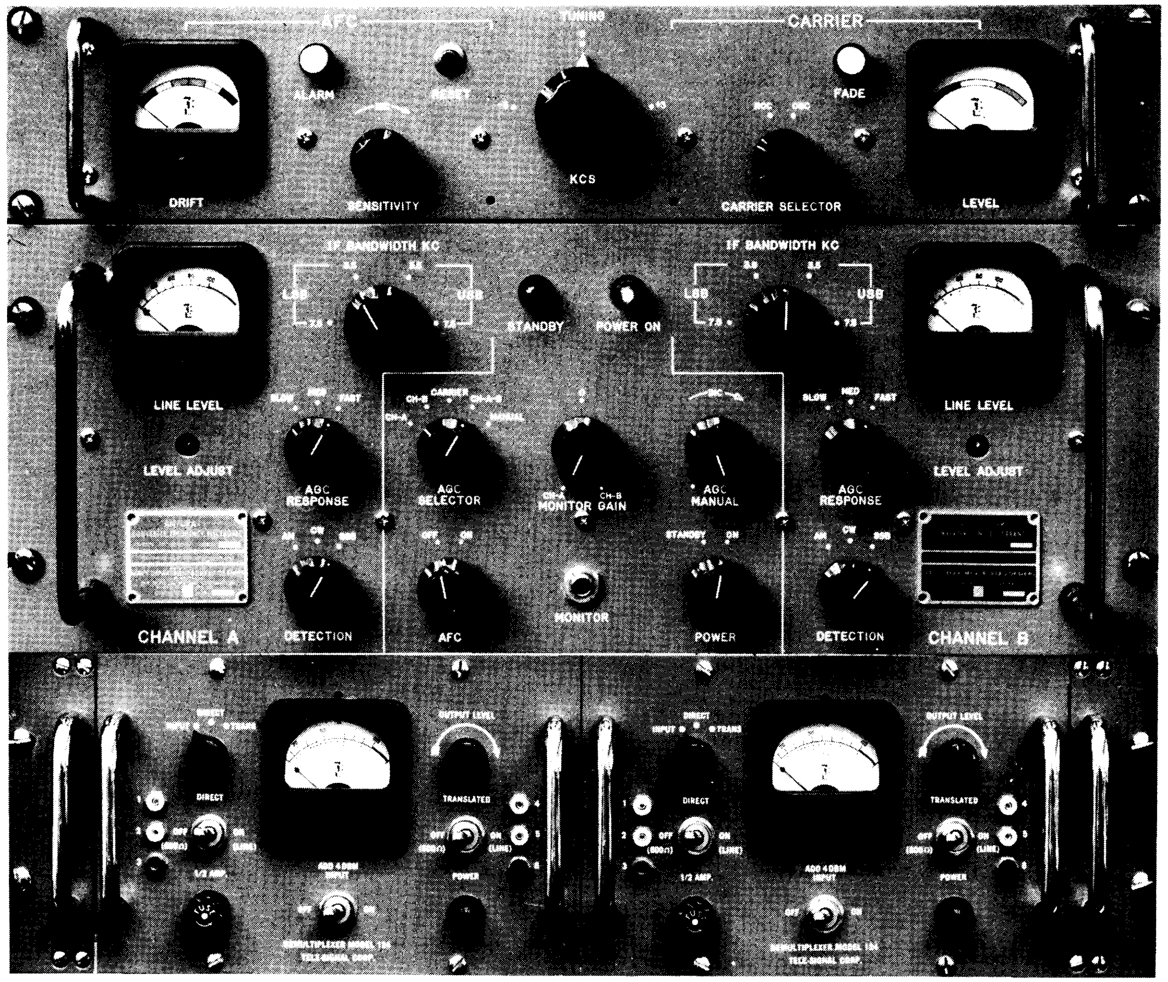
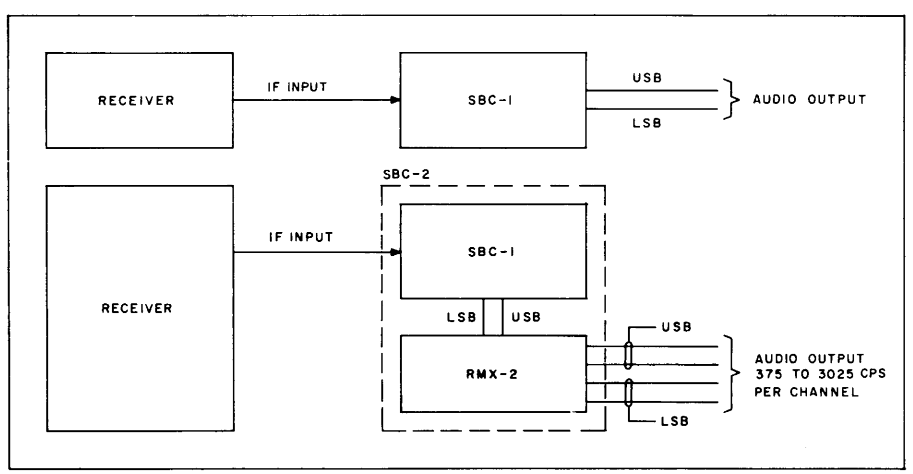


TMC MODEL SBC-2




SIMPLIFIED BLOCK DIAGRAM*



THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, NEW YORK

AND ITS SUBSIDIARIES . . .

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TMC Industrial Corp., Mamaroneck, N. Y.
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TMC Systems, (Texas), Inc., Garland, Texas
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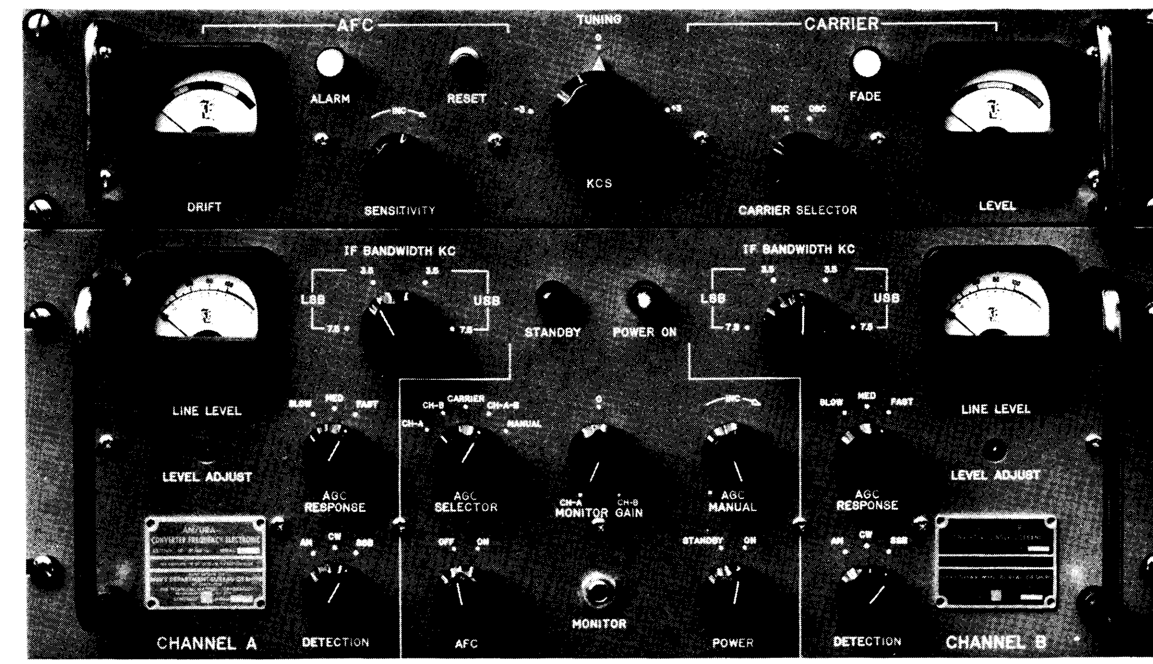
# TECHNICAL BULLETIN NUMBER 4003

## Sideband Converters
## TMC Models SBC



TMC MODEL SBC-1

TMC Models SBC sideband converters are IF type receiving adapters which provide optimum reception of SSB or ISB signals, with or without Automatic Frequency Control. The AFC will function with up to 30 db carrier suppression and may be disabled for the reception of fully suppressed carrier signals.

Model SBC-1 provides two discrete audio output channels for independent sideband operation. Independent AGC for each channel allows complete flexibility in reception of independent sideband information, such as speech on one sideband and multichannel information on the other sideband, where the levels of each sideband is different. Model SBC-2 incorporates a dual voice frequency demultiplexer, TMC Model RMX-2, which provides four 3 kc outputs for ISB multiplex operation.

Either Model SBC may be used with an appropriate Communications Receiver and carrier terminal equipment such as the AN/FGC-29, AN/FGC-60, TMC Model TTS, TMC Model TTM or AN/FGC-61.

| | |
|---|---|
| CROSS CHANNEL DISTORTION: | −60 db. |
| AGC SYSTEM: | The Model SBC-1 has provision to control the receiver gain from an AGC voltage derived from the upper sideband, lower sideband or the carrier, independently selectable by front panel switch. The AGC system has a fast attack time and an adjustable release time. |
| AGC CONTROLS: | Channel A plus B<br>Channel A only<br>Channel B only<br>Carrier only<br>Manual |
| IF BANDWIDTHS: | A. Normally supplied.<br>1. ±1.5 db 250 to 7500 cps, USB<br>2. ±1.5 db 250 to 7500 cps, LSB<br>3. ±1.5 db 250 to 3300 cps, USB<br>4. ±1.5 db 250 to 3300 cps, LSB<br>B. Available on special order.<br>1. ± 1.5 db 250 to 6000 cps, USB<br>2. ± 1.5 db 250 to 6000 cps, LSB<br>3. ± 1.5 db 1 kc symmetrical<br>4. ± 1.5 db 6 kc symmetrical<br>5. ± 1.5 db 15 kc symmetrical |
| AFC ACCURACY: | Less than 1 cycle error over the entire AFC control range. |
| AFC CHARACTERISTICS: | The AFC system will synchronize with a 30 db suppressed carrier which has an error of ±50 cps and will follow a maximum drift rate of ±10 cps/Second. The system will stay synchronized over a minimum frequency range of ±1,000 cps from the center frequency. |
| AFC CORRECTION: | The AFC circuit will maintain the frequency of the audio output within a residual error of less than 1 cycle of the transmitted intelligence. |
| STABILITY: | The stability of the SBS-1, without AFC, is within 1 cycle. |
| DRIFT ALARM: | A drift alarm light indicates when the carrier error is greater than ±750 cps. |
| FADE ALARM: | A fade alarm circuit is incorporated which provides a visual indication when the carrier is interrupted or fades below a predetermined level. Connections for a remote fade alarm indicator are available on rear apron. |

## Sideband Converters

| | |
|---|---|
| MONITORING: | A separate monitoring circuit is provided to permit headphone monitoring of either audio channel without disturbing the audio output circuits. |
| THRESHOLD: | A continuously adjustable threshold control is provided on the front panel of the AFC to reduce the system sensitivity when excess noise is encountered. |
| AUDIO OUTPUTS: | A. High Level. Two 0 to 1 watt balanced 600 ohm audio channels.<br>B. Low Level. Two 0 to 100 milliwatt balanced 600 ohm audio channels. |
| AUDIO RESPONSE: | The amplitude response of the audio amplifier is $\pm 1.5$ db over the frequency range of 100 to 22,000 cps. |
| AUDIO DISTORTION: | –45 db. |
| METERING: | A. Independent VU indicators are provided to monitor each low level 600 ohm channel.<br>B. AFC drift indicator.<br>C. Carrier level indicator. |
| HUM OUTPUT: | –50db. |
| ENVIRONMENT: | The Model SBC-1 is designed for continuous duty within a temperature range of 0 to 50 degrees C, and any value of humidity up to 90%. |
| ORIENTATION: | Any |
| INPUT POWER: | SBC-1: 115/230 volts AC, 50/60/400 cps, single phase, approx. 320 Watts.<br>SBC-2: 115/230 volts AC, 50/60/400 cps, single phase, approx. 328 Watts. |
| SIZE: | SBC-1: 10 1/2" h × 19" w × 17" d<br>AFC-2 3 1/2" h × 19" w × 17" d<br>SBS-1 7" h × 19" w × 17" d<br>SBC-2: 15 3/4" h × 19" w × 17" d |
| INSTALLED WEIGHT (Approx.): | SBC-1 50 lbs.<br>SBC-2 72 lbs. |
| SHIPPING WEIGHT AND CUBE (Approx.): | SBC-1 85 lbs. 6.3 cu. ft.<br>SBC-2 120 lbs. 11.8 cu. ft. |
| COMPONENTS AND CONSTRUCTION: | All equipment manufactured in accordance with JAN/MIL specifications wherever practicable. |

* RMX-2 is also available to meet International requirements of 250-3000 cps and 250-6000 cps in accordance with CCIR specifications.

The Models SBC feature newly developed electronic circuits packaged on a building block principle to provide maximum flexibility. The Model SBC-1 consists of two major rack mounted units, the Model AFC-2, Automatic Frequency Control, and the Model SBS-1, Sideband Selector. The Model SBC-2 adds a third unit, the Model RMX-2 Demultiplexer.

The Model AFC-2 features a unique dual loop electronic frequency control system. The first loop provides a fast response time for small frequency errors while the second loop corrects for larger errors. Both loops are coupled to an electronic memory circuit. This combination provides ease of tuning by means of a ±50 cps capture range and will remain synchronized over a drift range of ±1000 cps while the memory circuit holds the wanted frequency during normal carrier fades or signal interruption.

The Model SBS-1, Sideband Selector, consists of four plug-in IF amplifier/sideband filter channels, each with its own AGC system. Two discrete detector/audio amplifier channels may be switched to any one or any combination of the IF channels. Standard channels provided are 7.5 kc upper and lower sideband, 3 kc upper and lower sideband. Intermediate frequencies of 6 kc upper and lower sideband, and 1 kc, 6 kc and 15 kc symmetrical, are available on special order.

The Model RMX-2 Demultiplexer is a dual unit consisting of two Model RMX-1 Demultiplexers (TD-411/UGC) which provides four 375 to 3025 cps audio channels by means of frequency division. This is used on independent sideband circuits where each sideband is divided into two independent voice frequency circuits.

The Model SBC-1 is a modern replacement for the CV-157/URR and the Model SBC-2 replaces the CV-157/TD-98 combination.

## TECHNICAL SPECIFICATIONS: Models AFC-2 and SBS-1

| | |
|---|---|
| TYPES OF DETECTION: | SSB, ISB, with full carrier or up to 30 db carrier suppression with AFC, or SSB, ISB, AM, CW, MCW with AFC disabled. |
| SIDEBAND SELECTION: | Upper sideband, lower sideband, or independent sideband by means of a front panel switch. |
| INPUT FREQUENCY: | 455 kc. (others available on special order). |
| INPUT IMPEDANCE: | 50 ohms nominal, also high impedance. |
| INPUT TUNING RANGE: | ±3 kc electrical bandspread tuning is provided. |
| INPUT VOLTAGE RANGE: | 50 ohms: 1 millivolt to 1 volt<br>Hi-Z: Up to 3 volts. |
| CARRIER REINSERTION: | A. Reconditioned carrier.<br>B. Local carrier or oven controlled crystal oscillator. |
| CARRIER SUPPRESSION: | Will operate with carrier suppression of 0 db to −30 db. |
| UNWANTED SIDEBAND REJECTION: | Undesired sidebands, removed more than 250 cps from the carrier, are rejected by a minimum of 60 db. |
| INBAND DISTORTION: | −40 db. |



## TECHNICAL SPECIFICATIONS: Model RMX-2

| | |
|---|---|
| NUMBER OF INPUTS: | Two. |
| INPUT BANDWIDTH: | 375 to 5915 cps. * |
| INPUT IMPEDANCE: | 600 ohms balanced. |
| NUMBER OF OUTPUTS: | Four. |
| OUTPUT BANDWIDTHS: (per channel) | 375 to 3025 cps. * |
| OUTPUT IMPEDANCE: | 600 ohms balanced. |
| INPUT LEVEL: | |
| TELEPHONE: | −15 to +4 dbm. |
| FACSIMILE: | −15 to +4 dbm. |
| TELEGRAPH (16 channel) | −25 to +4 dbm per channel. |
| NOMINAL OUTPUT LEVELS: | |
| TELEPHONE: | −4 dbm. |
| FACSIMILE: | 0 dbm. |
| TELEGRAPH (16 channel) | −10 dbm per channel. |
| MAXIMUM OUTPUT LEVEL: (single frequency) | +16 dbm. |
| INTERNAL CARRIER STABILITY: | Approximately 1 part in $10^6$ per degree C. |
| INTERNAL CARRIER ACCURACY: | Within 0.1 cps at 6290 cps. |
| METERING: | Two VU meters. Switchable to either input or output channels. |
| POWER REQUIREMENT: | 115/230 volts ac, 50/60 cps, single phase, Approximately 8 watts. (400 cps optional) |
| DIMENSIONS: | 5 1/4" h × 19" w × 11 1/2" d. |
| WEIGHT: | Approximately 22 pounds. |
| TRANSISTOR COMPLEMENT: | 15 each 2N414 or equivalent.<br>4 each 2N156 or equivalent.<br>3 each 2N1284 or equivalent. |
| COMPONENTS AND CONSTRUCTION: | All equipment is manufactured in accordance with JAN/MIL specifications wherever practicable. |

* RMX-2 is also available to meet International requirements of 250-3000 cps and 250-6000 cps in accordance with CCIR specifications.

**Title:** Model SBC-1 Sideband Converter

Military Nomenclature:

Single Sideband Converter Group AN/URA-42.

**Objectives:**

a) to discuss the characteristics, capabilities, limitations and special features of the Model SBC-1 Sideband Converter.

b) to assure a complete understanding of the system by means of a detailed discussion of a three part system block diagram. The three parts include:

   (1) Converter and IF Deck

   (2) Detector and Audio Deck

   (3) Automatic Frequency Control Unit

c) to provide a detailed discussion of the system circuitry, pointing up significant circuit parameters.

d) to demonstrate, with appropriate test equipment, the alignment of the system.

e) to provide a general operating procedure for the system.

f) to provide maintenance and troubleshooting data.

**References:**

a) TMC Technical Bulletin 4003.

b) Complete schematic, Model SBS-1 (CK-561)

c) Complete schematic, Model AFC-2 (CK-551)

d) TMC specification S-657: General description, theory and troubleshooting data on SBS-1 power supply assembly A-2209.

e) TMC specification S-705: Test Procedure, SBS-1.

f) TMC specification S-628: Test Procedure, Power Supply A-2209.

g) TMC specification S-679: Test Procedure, Model AFC-2A.

h) Complete schematic, 7.5 KC USB and LSB IF strip (CK-521).

i) Complete schematic, 3.5 KC USB and LSB IF strip (CK-519).

Training Aids:

a) Model SBC-1 system, s t up for operation.

b) AF VTVM: Ballentine Model 314 (ME-6/U series)

c) RF VTVM: Hewlett Packard Model 410B (AN/USM-34)

d) RF Signal Generator: Measurements Corp. Model 82 (AN/URM-25D)

e) Two 600 ohm, 1 watt resistors.

f) Audio Signal Generator: H.P. Model 200 CD (TS-382D/U)

g) Frequency Counter: H.P. Model 524C (AN/USM-26)

h) One 50 ohm 1 watt resistor.

i) Variable Bias Supply (described in alignment section)

Presentation:

A. General Description and Orientation:

1. General Information:

a) The Model SBC-1 Sideband Converter is an IF type receiving adapter designed to provide optimum reception of SSB and ISB signals, with or without Automatic Frequency Control. With the automatic frequency control disabled, AM, CW and MCW operation is possible in addition to the SSB and ISB modes.

b) The Model SBC-1 consists of two major units:

(1) Model SBS-1 Sideband Converter

(2) Model AFC-2A Automatic Frequency Control

c) The Model SBS-1 Sideband Converter contains, essentially:

(1) a 705 KC converter injection oscillator for AFC OFF operation.

(2) a 250 KC product detector injection oscillator for AFC OFF operation.

(3) a 250 KC converter and IF circuit.

(4) four plug in IF filter-amplifier-AGC units, providing IF and AGC outputs, switch selected.

(5) dual detector and audio amplifier sections.

(6) an AGC comparator, AGC response control, manual gain control and selector arrangement.

(7) a power supply for the entire system.

d) The Model AFC-2A automatic frequency control unit contains, essentially:

(1) a 250 KC filter and carrier amplifier chain.

(2) a 250 KC product detector injection oscillator for AFC ON operation.

(3) a 705 KC converter injection oscillator for AFC ON operation.

(4) a phase detector circuit and correction arrang ment to change the frequencies of the 250 KC and 705 KC outputs of the AFC-2A oscillators in response to carrier drift.

(5) various alarm and indicator circuits.

e) Table of Specifications:

TYPES OF DETECTION:

SSB, ISB, with full carrier or up to 30 db carrier suppression with AFC. SSB, ISB, CW, MCW with AFC disabled.

SIDEBAND SELECTION:

Upper sideband, lower sideband or independent sideband selected by means of front panel switch.

INPUT FREQUENCY:

455 KC

INPUT IMPEDANCE:

50 ohms nominal. A high impedance input is also provided.

INPUT VOLTAGE RANGE:

50 ohm low impedance input: 1 millivolt to 1 volt

High impedance input: up to 3 volts

CARRIER REINSERTION:

AFC ON operation: reconstructed carrier or controll d crystal oscillator.

AFC OFF operation: local fixed crystal oscillator.

CARRIER SUPPRESSION:

will operate with carrier suppressed as much as 30 db.

UNWANTED SIDEBAND REJECTION:

Undesired sidebands, removed more than 250 cps from the carrier, are rejected by a minimum of 60 db.

AGC SYSTEM:

The Model SBC-1 controls the receiver gain by employing an AGC voltage derived from the upper sideband, the lower sideband, the carrier, the stronger of the selected sidebands, or a manual gain control, independently selectable by a front panel switch. The AGC system has a fast attack time and an adjustable decay time.

IF BANDWIDTHS:

USB, 250 to 7500 cps, plus or minus 1.5 db.
LSB, 250 to 7500 cps, plus or minus 1.5 db.
USB, 250 to 3300 cps, plus or minus 1.5 db.
LSB, 250 to 3300 cps, plus or minus 1.5 db.

Table of Specifications, continued:

AFC ACCURACY:

Less than 1 cycle error over the entire AFC control range.

AFC CHARACTERISTICS:

The AFC system will synchronize with a 30 db suppressed carrier which has an error of plus or minus 50 cps, and will follow a maximum drift rate of 10 cycles per second.
The system will remain synchronized over a minimum frequency range of plus or minus 1 KC.

STABILITY:

The stability of the system without AFC is within 1 cycle.

HUM OUTPUT:

Hum is down 50 db, at 1 watt audio output.

INPUT POWER:

115/230 volts AC, single phase. Power consumption approximately 320 watts.

ENVIRONMENT:

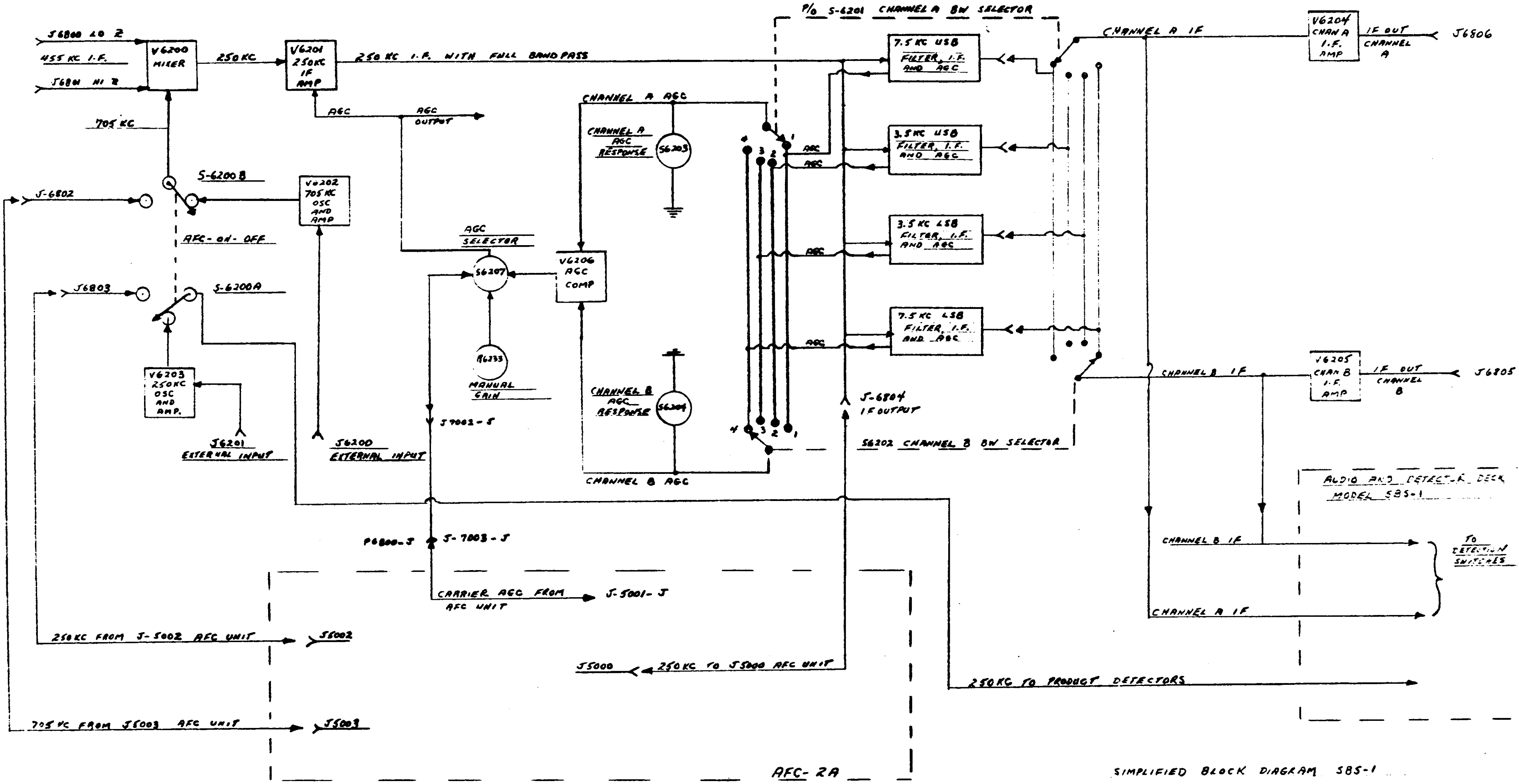
The Model SBC-1 is designed for continuous duty within a temperature range of 0 to 50 degrees centigrade, and any value of humidity up to 90%.

f) Table of Nomenclatures:

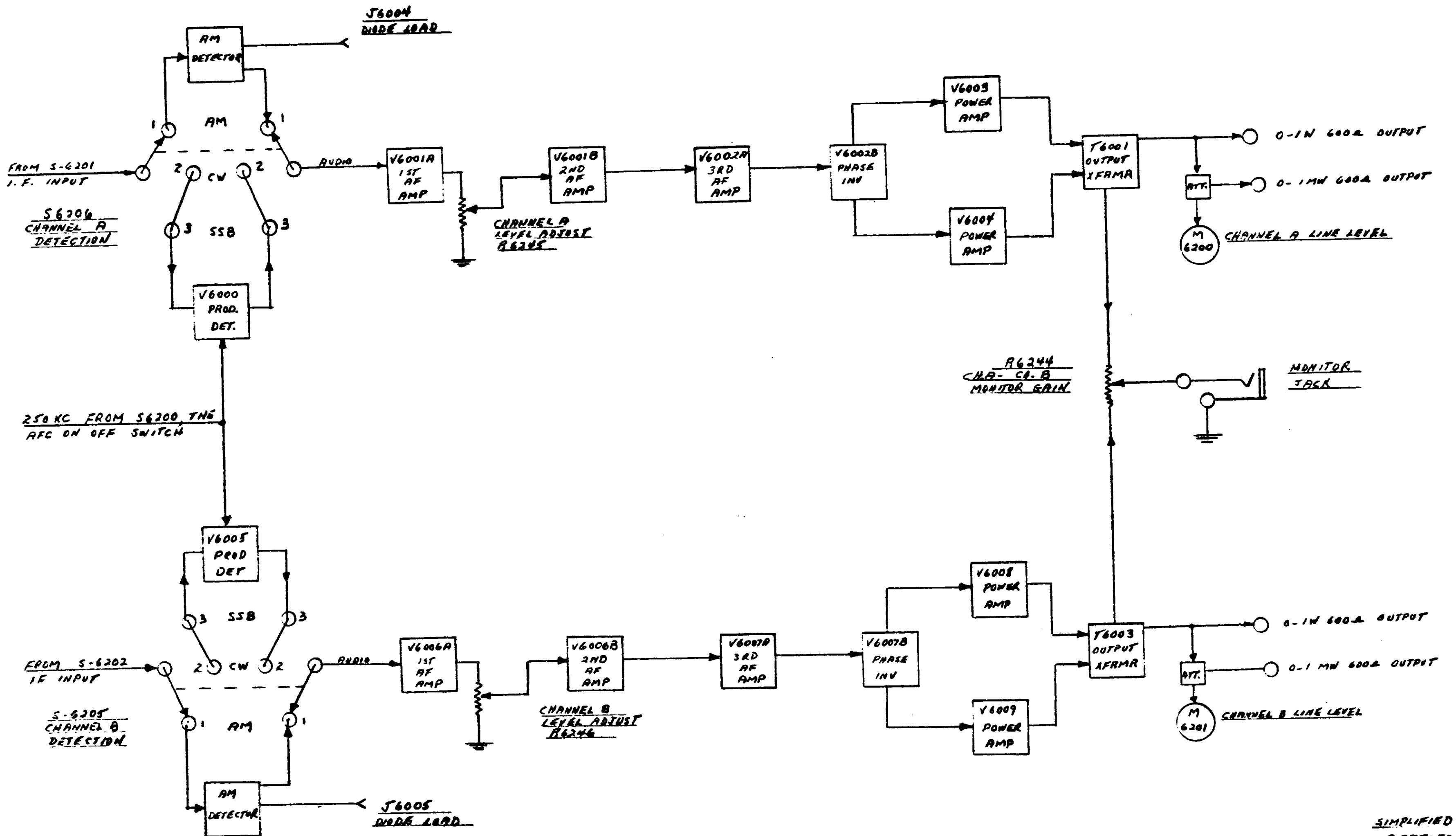
TMC: Model SBC-1 Sideband Converter
MIL: AN/URA-42: Single Sideband Converter Group.

TMC: Model SBS-1 Sideband Selector
MIL: CV-1288/UR: Converter, Single Sideband

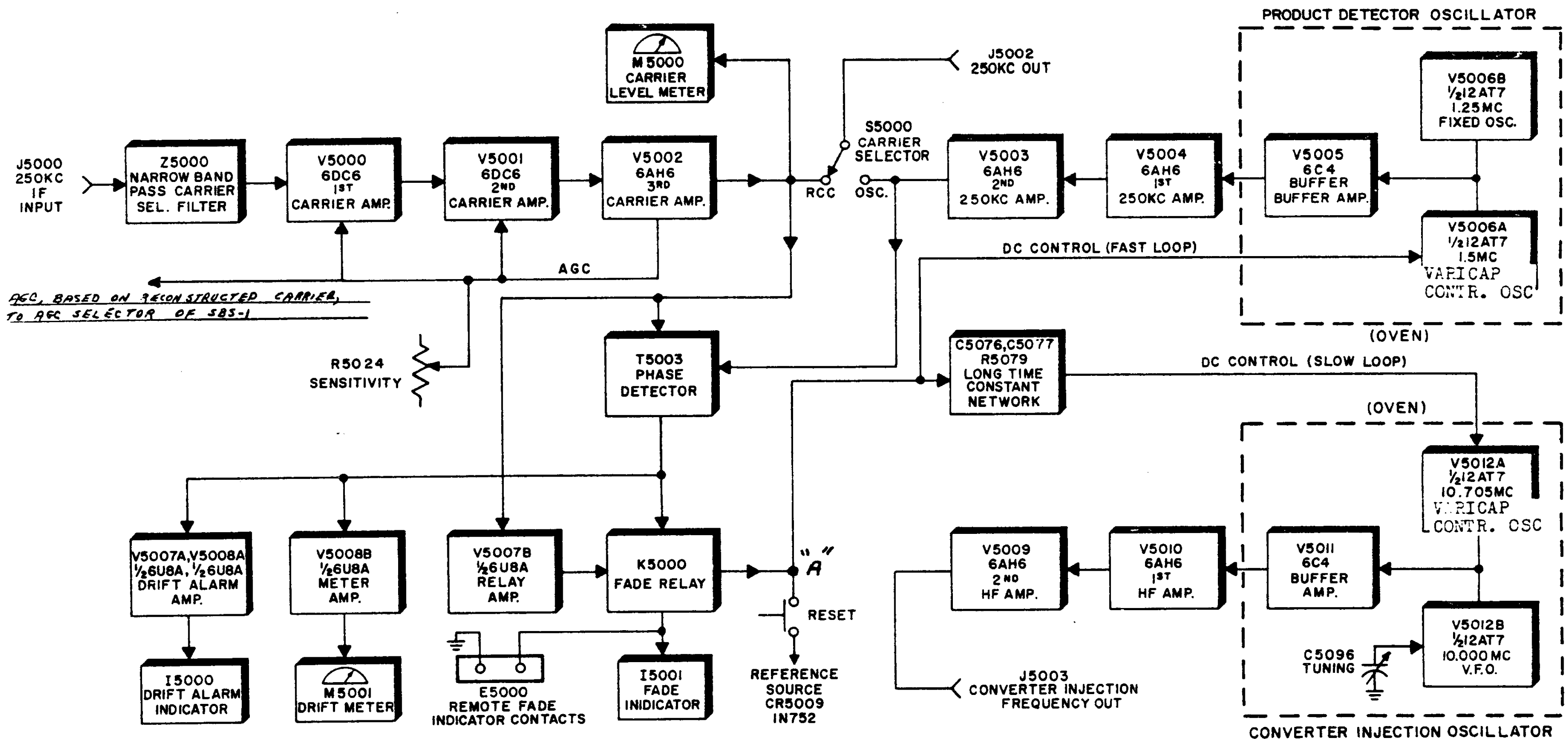
TMC: Model AFC-2A Automatic Frequency Control
MIL: C-4071/UR: Control, Receiver




SIMPLIFIED BLOCK DIAGRAM SBS-1
CONVERTER AND IF DECK
PART OF SBC-1 SYSTEM
11-62




SIMPLIFIED BLOCK DIAGRAM SBS-1
DETECTOR AND AUDIO DECK
PART OF SBC-1 SYSTEM
11-62




Block Diagram: AFC-2A
Part of SBC-1 system

2. Discussion of the simplified system block diagram:

a) Converter and IF Deck: (page 6)

(1) the 455 KC IF frequency from the associated receiver, with full bandpass, is applied to mixer V-6200. Either the high impedance or the low impedance input jack may be used, depending on the output conditions of the associated receiver.

(2) the converter injection frequency is 705 KC. This may originate in the SBS-1 or in the AFC-2A, depending on the position of S-6200, the AFC ON OFF switch.

(3) the system is shown in the AFC OFF condition. The 705 KC converter injection frequency is provided by V-6202, the 705 KC crystal oscillator and amplifier.

(4) J-6200 is provided to insert the output of an external oscillator, if desired.

(5) the output of V-6200 is an inverted sideband signal. This is a significant point which will become apparent in subsequent discussions.

(6) one stage of IF amplification, V-6201, follows the converter. The output of this stage is applied simultaneously:

(a) to four plug in IF amplifier units

(b) to J-6804, from which point it is delivered to the AFC-2A for reference and carrier reconstruction.

(7) the IF plug in units are similar in all respects but one; the input circuit of each strip contains a filt r which determines the bandpass characteristic of the strip.

(8) each plug in strip contains, in addition to the filter:

(a) two tuned IF amplifier stages

(b) an AGC amplifier

(c) an AGC circuit with AGC DELAY control. The AGC developed is applied to the first IF stage in the strip, and is conducted to one section of the IF BANDWIDTH selector switches, S-6201 and S-6202.

(9) the IF output of each strip is conducted to another section of the IF BANDWIDTH selector switches, S-6201 and S-6202.

(10) note the arrangement of these selector switches:

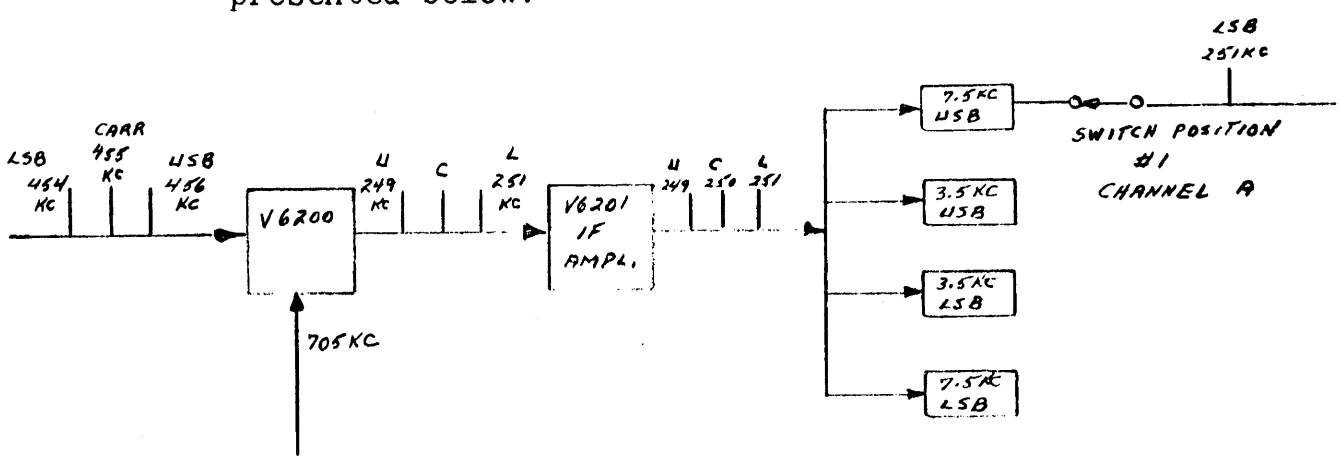
(a) Channel A and Channel B IF BANDWIDTH selectors may independently select the IF output of any strip.

(b) Channel A and Channel B AGC selector sections select the AGC output of the strips selected in (a) above.

(c) note the front panel of the SBS-1. Positions 1, 2, 3 and 4 of the IF BANDWIDTH selector switches, reading in a clockwise direction, indicate that the 7.5 KC LSB, 3.5 KC LSB, 3.5 KC USB and 7.5 KC USB strips are being selected in that order.

(d) the block diagram indicates that positions 1, 2, 3 and 4 select the 7.5 KC USB, 3.5 KC USB, 3.5 KC LSB, and 7.5 KC LSB strips, in that order. This is an important consideration for maintenance personnel.

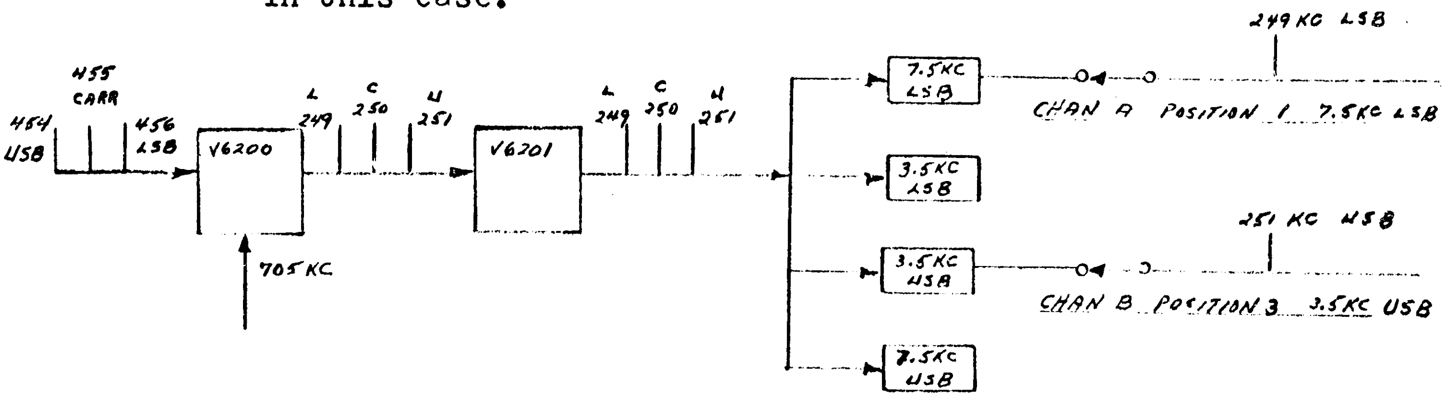
(11) it has been pointed out that when the Channel A IF BANDWIDTH selector switch is in position 1, the front panel indicates that the 7.5 KC LSB IF strip is being used. Actually, the IF signal is being sent through the 7.5 KC USB strip. This is due to the sideband inversion taking place in mixer stage V-6200. A simplified sketch of this condition is presented below:




| | | |
|---|---|---|
| 705 KC | 705 KC | 705 KC |
| - 454 KC | -455 KC | -456 KC |
| 251 KC | 250 KC | 249 KC |

As far an an operator is conc rned, Channel A is actually selecting the strip indicated on the front panel, and the LSB is being passed.

(12) it is possible that certain type of associated receiver might deliver the 455 KC IF signal to V-6200 inverted. This will occur in triple conversion receivers. In such a case, maintenance personnel will remove the IF strips from the SBS-1, and re-insert them in the order corresponding to the front panel controls. The simplified sketch below shows the information path in this case.




| | | |
|---|---|---|
| 705 KC | 705 KC | 705 KC |
| - 454 KC | - 455 KC | - 456 KC |
| 251 KC | 250 KC | 249 KC |
| USB | CARR | LSB |

(13) the selected Channel A and Channel B IF outputs are applied:

(a) to Channel A and Channel B IF output amplifiers, the terminations of which are available at J-6806 and J-6805, respectively. These amplifiers and jacks are provided to operate ancillary equipments, such as spectrum analyzers, IF monitors, etc.

(b) to the DETECTION switches in the Detector and Audio section of the Model SBS-1.

(14) the selected Channel A and Channel B AGC outputs are applied:

(a) to corresponding Channel A and Channel B AGC RESPONSE selector circuits. These are three position front panel controls, which change the decay time constants of the AGC circuits.

(b) to AGC comparator circuit V-6206, acting in conjunction with AGC SELECTOR S-6207 and MANUAL GAIN control R-6233. The AGC SELECTOR switch has five positions, as follows:

Position 1: CHANNEL A
Position 2: CHANNEL B
Position 3: CARRIER
Position 4: CHANNEL A - CHANNEL B
Position 5: MANUAL

(c) in each case, the output of the AGC circuits is applied to IF amplifier V-6201 and to certain terminal points, from which the AGC may be delivered to the associated receiver or other points as required.

(1) in Position 1, "CHANNEL A", the AGC from the selected Channel A IF strip is used.

(2) in Position 2, "CHANNEL B", the AGC from the selected Channel B IF strip is used.

(3) in Position 3, "CARRIER", the AGC developed in the AFC-2A unit, via the reconstructed carrier, is used.

(4) in Position 4, "CHANNEL A - CHANNEL B", the stronger of the selected Channel A and Channel B AGC signals is used.

(5) in Position 5, "MANUAL", the MANUAL GAIN control applies a variable negative voltage to the AGC output. As the MANUAL GAIN control is advanced clockwise, the negative voltage decreases, increasing the gain. At some further clockwis point, the nominal AGC voltage is stronger than the manual gain voltage, and the stronger of the AGC voltages from Channel A and B determines the output AGC voltage.

(15) The 250 KC Product Detector Oscillator Circuits:

(a) in AFC ON operation a 250 KC signal from the AFC-2A enters the SBS-1 at J-6803. This is applied, via one section of S-6200A, to the product detectors of the Detector and Audio section of the SBS-1.

(b) in AFC OFF operation, V-6203, a 250 KC crystal oscillator and amplifier circuit, furnishes the injection for the product detector circuits. If desired, an external oscillator may be connected at J-6201.

b) Detector and Audio Deck: (page 7)

(1) the Channel A and Channel B selected IF signals are applied to th Channel A and Channel B DETECTION switches, S-6206 and S-6205, respectively.

(2) the 250 KC frequency from the AFC-2A or the 250 KC oscillator and amplifier circuits of the SBS-1 is applied to the control grid circuits of the Channel A and Channel B product detectors, V-6000 and V-6005, respectively.

(3) since both Detector and Audio channels are identical, only Channel A will be discussed.

(4) in position 1 of the DETECTION switch, (AM), the IF input is routed to a conventional diode detector circuit. The detector output is routed to the audio amplifier chain. This position is also used for MCW operation.

(5) in positions 2 and 3 of the DETECTION switch, (CW) and (SSB), the IF input is routed to the cathode circuit of the product detector. The product detector, in effect, re-inserts the carrier, which beats with the sidebands to reproduce the original modulation frequencies.

(6) the product detector output is routed to the audio amplifier chain.

Note:

For CW operation, the receiver must be detuned slightly or the incoming signal must be displaced by approximat ly 1 KC from the assigned frequency, at the transmitter. Note that no BFO circuit is incorporated. If the IF frequency is 250 KC, and the product detector injection frequency is 250 KC, no resultant audio will be heard.

(7) the audio amplifier chain is conventional. Three stag s of voltage amplification are followed by a phase inverter circuit, which drives a push pull output stage.

(8) the audio level is controlled by a LEVEL ADJUST potentiometer, inserted between the first and second voltage amplifier stages. The LEVEL ADJUST control is a screwdriver adjustment located under the LINE LEVEL meter on the front panel of the SBS-1.

(9) each channel provides a 0 - 1 watt 600 ohm output and a 0 - 1 milliwatt 600 output.

(10) the LINE LEVEL meters, calibrated in VU, continuously monitor the audio output in each channel.

(11) a front panel MONITOR jack and associated MONITOR GAIN control may be used to monitor the output of either audio channel locally.

c) Model AFC-2A Automatic Frequency Control (page 8)

(1) the second IF frequency at a nominal 250 KC leaves the Converter and IF section of the SBS-1 at J-6804. This signal is applied to the Model AFC-2A at J-5000.

(2) Z-5000 is a narrow band pass carrier selective filter. It will pass a range of frequencies at 250 KC, plus or minus 50 cycles. This filter, then, strips the sideband intelligence from the carrier. This filter is also responsible for the plus or minus 50 cycle "capture" range of the AFC system.

(3) the output of the carrier filter is applied to a carrier amplifier chain. Three cascade high gain stages are employed. The gain is high in order that a carrier suppressed as much as 30 db may be "reconstructed".

(4) the output of the carrier amplifier chain is applied:

(a) to a front panel CARRIER LEVEL meter, which indicates the relative strength of the 250 KC carrier.

(b) to S-5000, the RCC-OSC switch, which determines the mode of operation of the unit. With the switch in the position shown, the unit is operating in th "RCC" mode; the output of the carrier amplifier chain is applied to the product detector circuits of the SBS-1 via J-5002, and the AFC ON OFF switch on the SBS-1.
With S-5000 in the "OSC" position, the product detectors of the SBS-1 receive the 250 KC signal from the internal 250 KC oscillator and amplifier circuits of the AFC-2A, via the AFC-ON OFF switch of th SBS-1.

(c) to a relay amplifier circuit, V-5007B, which op rates the FADE relay, K-5000.

(d) to an AGC circuit, which furnishes AGC based on the reconstructed carrier, to the carrier amplifier chain and to the AGC selector switch of the SBS-1.

(e) to a phase detector circuit.

(5) the phase detector circuit receives two inputs:

(a) a nominal 250 KC from the carrier amplifier chain.

(b) a nominal 250 KC from the internal 250 KC oscillator and amplifier circuits of the AFC-2A.

(6) the phase detector compares the two inputs; the carrier amplifier input is taken as the reference frequency. The phase detector produces a correction voltage, th amplitude and polarity of which depends on the amount and direction of the error between the two input signals. The correction voltage is applied to FADE relay K-5000.

(7) the FADE relay is operated by the relay amplifier, which receives its input from the carrier amplifier circuits. When the amplitude of the carrier is sufficient, the relay amplifier causes the FADE relay to be de-energiz d. Under these conditions, the FADE indicator is extinguished and the correction voltage from the phase detector appears at point "A".
When the carrier amplitude falls below a certain point, the relay amplifier causes the FADE relay to be energized. Under these conditions, the correction voltage from the phase detector does not appear at point "A", and the FADE indicator is illuminated.

(8) the correction voltage at point "A" is applied:

(a) to a drift meter circuit. This provides a front panel indication of the amount of drift.

(b) to a drift alarm circuit. The drift alarm is lighted when the carrier drift reaches about plus or minus 750 cycles.

(c) to the Varicap circuit of the internal 250 KC oscillator circuits of the AFC-2A. The correction voltage acts immediately on these circuits to bring the frequency to the exact frequency of the carrier amplifier chain.

(d) to the Varicap circuit of the internal 705 KC oscillator circuits, via a delay-memory network. This changes the frequency of the 705 KC oscillator, in such a manner that the IF frequency from the mixer of the SBS-1 again becomes 250 KC.

(9) the delay, or memory network delays the 705 KC loop from returning to a neutral position under conditions of temporary carrier fade. Under conditions of carrier fad , the FADE relay interrupts the correction voltage from the phase detector. The memory circuit retains the correction voltage stored in it at the time of fad .

(10) the "pull in" range of the AFC-2A is about 100 cycles; the "hold in" range is about 2 KC. Suppose that a drifting signal near the limit of the "hold in" range should temporarily fade. Without the memory circuit, the loop would return to a neutral position. When the carrier returned, it would be beyond the "pull in" range and the unit would not synchronize.

(11) a RESET button, S-5001, connects the memory circuit to a reference voltage. The reference voltage represents the neutral position of the phase detector circuit, that is, the "zero" correction voltage. The RESET button returns the system to the neutral position when required.

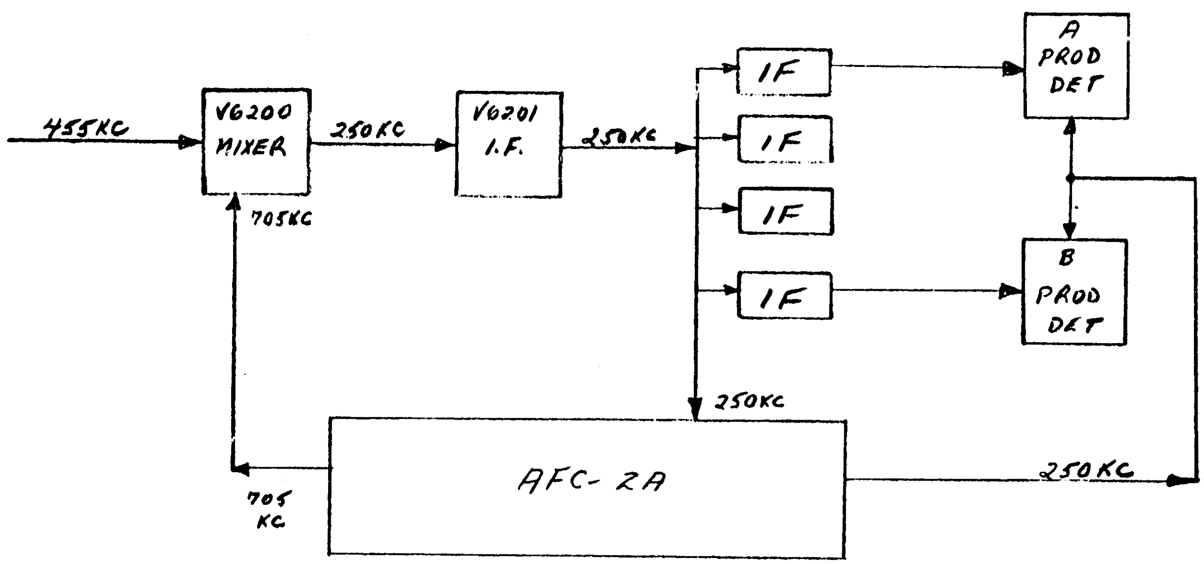
(12) a manual front panel TUNING KCS control allows tuning the internal 705 KC oscillator circuits over a plus or minus 3 KC range.

(13) in the OSC position of S-5000, the product detectors of the SBS-1 receive the 250 KC injection frequency from the internal 250 KC circuits of the AFC-2A, via the AFC-ON OFF switch on the SBS-1. The remainder of the AFC-2A circuitry functions as discussed.

(14) the output of the 705 KC circuits is applied to the mixer circuit of the SBS-1 via J-5003 in the AFC-2A, J-6802 and S-6200B of the SBS-1.

(15) an example of the operation of the system is presented below. It should be noted that changes are gradual rather than instantaneous, and that the circuits act simultaneously, rather than in sequence.

Assume that the system is in AFC ON operation. A simple block shows the signal paths and the interconnection of the SBS-1 and the AFC-2A.




(a) assume that the system is in operation, and that no drift or fade is being encountered. The frequencies are as shown on the simple block diagram above.

(b) suppose that the first IF, from the associated receiver, drifts to 455,001 cycles.

(c) the second IF output of the mixer will drift to 249,999 cycles.

(d) the phase detector will receive the new "drifted" IF; it will produce a correction voltage which will cause the 705 KC oscillator to increase its frequency to 705,001 cycles.

(e) meanwhile, the phase detector is causing the product detectors to receive a re-inserted carrier equal in frequency to the second IF, keeping the sidebands in their proper perspective.

(f) as the converter injection frequency approaches 705,001 cycles, the second IF approaches 250 KC.

(g) the correction voltage in the phase detector returns to the reference point.

(h) if the first IF frequency remains at 455,001 cycles, the system will oscillate, with small incremental changes, around this point, as explained below:

(1) when the memory circuit discharges by $\Delta e$, the converter injection frequency will decrease by $\Delta f$.

(2) a correction voltage, $\Delta e$, will be developed to increase the converter injection frequency, and the action continues thus.

(i) if the first IF frequency returns to 455,000 cycles, the circuit will return to its original condition of equilibrium, with the correction voltage at the reference point.

(j) if the carrier drifts at a rate faster than 10 cps, the system will not follow.

(16) A second example of the operation of the system is given below:

(a) suppose that the first IF frequency drifts to 455,500 cps.

(b) the second IF will drift to 249,500 cps.

(c) a correction voltage will be developed which causes the converter injection frequency to become 705,500 cps. The second IF again becomes 250 KCS.

(d) suppose that the carrier now fades; the fade relay energizes, isolating the memory circuit from the phase detector. The memory circuit causes the converter injection frequency to be maintained at 705,500 cycles.

(e) suppose that the carrier now returns at 455,460 cycles. The second IF will appear at 250,040 cycles. This is within the capture range of the unit.

(f) the fade relay will again de-energize, connecting the phase detector to the memory circuit. The phase detector will cause a correction voltage of the proper amplitude and polarity to bring the converter injection frequency to 705,460 cycles; this will cause a second IF of 250 KC to be produced.

B. Detailed Discussion of SBC-1 Circuitry:

1. Model SBS-1 Sid band Converter:

(refer to schematics: CK-561: SBS-1
CK-519: 3.5 KC USB, LSB IF strip
CK-521: 7.5 KC USB, LSB IF strip

a) mixer, IF amplifier, and 705 KC oscillator-amplifier: V-6200, V-6201 and V-6202:

(1) the first IF frequency at a nominal 455 KC arrives at the control grid of mixer V-6200 from the IF output circuit of the associated receiving apparatus. Either input jack may be used, d p nding on the impedance and voltage input considerations. The 50 ohm low impedance input is commonly used. This has an associated INPUT LEVEL ADJ control, R-6800, a screwdriver adjustment.

(2) the converter injection frequency, a nominal 705 KC, is applied to the cathode circuit of V-6200 via S-6200B (rear), one section of the AFC ON OFF switch. In the AFC OFF position, shown, the 705 KC originates at V-6202. In the AFC ON position, the 705 KC is applied at J-6802 from the AFC unit, and reaches the mixer via contact 2 and the wiper of S-6200B (rear).

(3) the output at the plate of V-6200 is an inverted sideband signal. This is applied to a double tuned RF transformer, T-6200, which is "swamped" to insure full bandpass. The output at the secondary of T-6200 is delivered to the control grid circuit of IF amplifier V-6201.

(4) V-6201 is a tuned RF stage; plate tank T-6201 is peaked at 250 KC. AGC voltage is applied to the control grid of this stage via a low pass filt r arrangement.

(5) the 250 KC IF signal is conducted from the secondary of T-6201 to:

(a) the signal input circuits of the four plug in IF strips via pin 2 of J-6000, J-6001, J-6002 and J-6003.

(b) the carrier input circuits of the AFC-2A via J-6804.

(6) one half of V-6202 is a Colpitts oscillator operating at 705 KC. Two important adjustments are to be found in this circuit:

(a) frequency adjust C-6214, tuned for 705 KC

(b) degeneration adjust R-6215, which controls the conduction of V-6202A.

(7) J-6200 is provided to insert another oscillator, which may be at a frequency different from 705 KC. This need not be considered in the SBC-1 system. This jack might prove valuable in troubleshooting, however.

(8) contacts 1 and 2 of S-6200A (rear) control the plate supply voltage to V-6202. In the AFC OFF position, shown, regulated plus 200 volts is applied to the plate circuits of V-6202. In th AFC ON position, this voltage is removed, disabling the 705 KC oscillator and amplifier circuits.

b) Plug In IF Strip:

(refer to either schematic CK-519 or CK-521)

(1) the plug in IF strips are identical except for the input filter, which determines the bandpass characteristic of the strip.

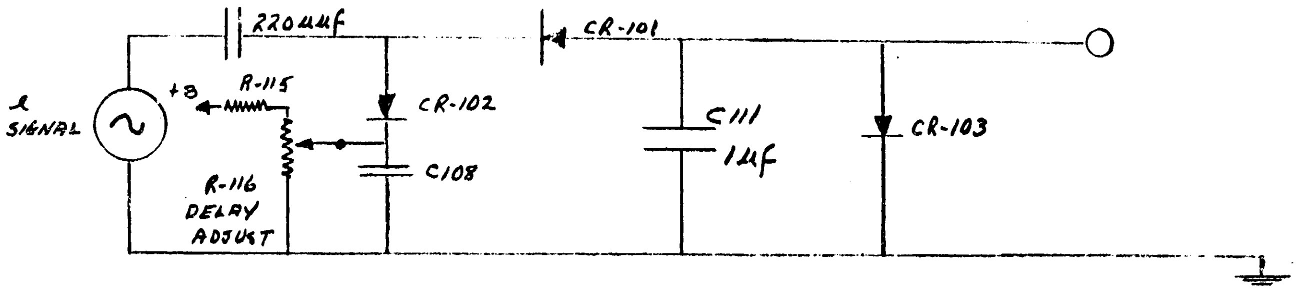
(2) the input signal, filament voltage, plate supply, AGC and ground connections are made at P-101, which mates with J-6000 through J-6003, as appropriate.

(3) the crystal filters assure sharp cutoff at 250 KC.

(4) the IF input from the main chassis is applied at pin 2. This is applied to crystal filter Z-1, which determines the maximum response of the circuits which follow. The output of Z-1 is coupled to two cascade tuned IF amplifiers of conventional design, V-101 and V-102, which are designed to amplify the IF as well as to preserve the frequency response established by the input filter.

(5) the IF is taken off at J-102, and is applied, via P-6200 through P-6203, as appropriate, to the proper contact of S-6201B and S-6202B, the IF BANDWIDTH selector switches.

(6) the IF signal is sampled at the tertiary winding of T-103 and applied to AGC amplifier V-103. The output of this amplifier is applied to the AGC circuit, shown in simplified form below:




(a) R-115 and R-116 form a voltage divider network to the plate supply. The voltage at the wiper of R-116, the DELAY ADJUST potentiometer, may be varied between 0 and about 140 volts.

(b) C-108 is a bypass capacitor; it maintains the voltage at the wiper of R-116 essentially constant with changes in the current through CR-102.

(c) the AGC voltage is developed and stored in C-111, a 1.0 uf capacitor. The discharge path of this capacitor is through the AGC RESPONSE network, on the main chassis.

(d) diode CR-103 has been inserted for protection. It insures that the AGC voltage is clamped negatively.

(e) CR-101 is the AGC rectifier, and CR-102 is the positiv peak rectifier.

(f) when R-116 is set to a voltage higher than the peak input voltage at the 220 uuf capacitor, no AGC voltage will be developed, since diode CR-102 will never conduct and the 220uuf capacitor can never change its charge.

(g) when R-116 is set for 0 volts, the 220 uuf capacitor will charge up to the peak value of the input voltage, and discharge into C-111 on the negative excursions of the input signal. Maximum voltage for AGC will thus be developed.

(h) R-116, then, delays the creation of AGC voltage until the input signal reaches a certain amplitude.

(i) R-116, the DELAY ADJUST potentiometer, is set as follows:

The AGC bus on the IF strip is grounded. A signal generator is connected at the signal input to the IF strip, and its output adjusted to 250 KCS. The signal generator output amplitude is adjusted to provide an IF output at J-102 of 1.0 volt RMS.
The signal generator output is increased, to provide an IF output at J-102 of 1.5 volts RMS.
The ground is removed from the AGC bus, and the delay adjust pot, R-116, is set to provide an IF output at J-102 of 1.0 volt.

(j) it will be noted, after the above adjustment is completed, that a large change in input voltage will result in a minimum change of IF output voltage at J-102. It will also be noted that, at extremely low levels of input signal, no AGC will be developed.

(k) it is again stressed that the physical placement of the IF strips will depend on whether the IF frequency from the associated receiver arrives at mixer V-6200 inverted or uninverted. The equipment will arrive with the strips properly placed, but subsequent maintenance and troubleshooting may give rise to confusion.

(l) the following numbers are stamped on the input filters, for identification purposes:

FX-173: 7.5 KC LSB

FX-172: 7.5 KC USB

FX-169: 3.5 KC LSB

FX-168: 3.5 KC USB

These numbers are the TMC part numbers for the crystal filters.

c) AGC Circuits:

(1) the AGC output of each plug in IF strip is removed at pin 5 of P-101 on the strip.

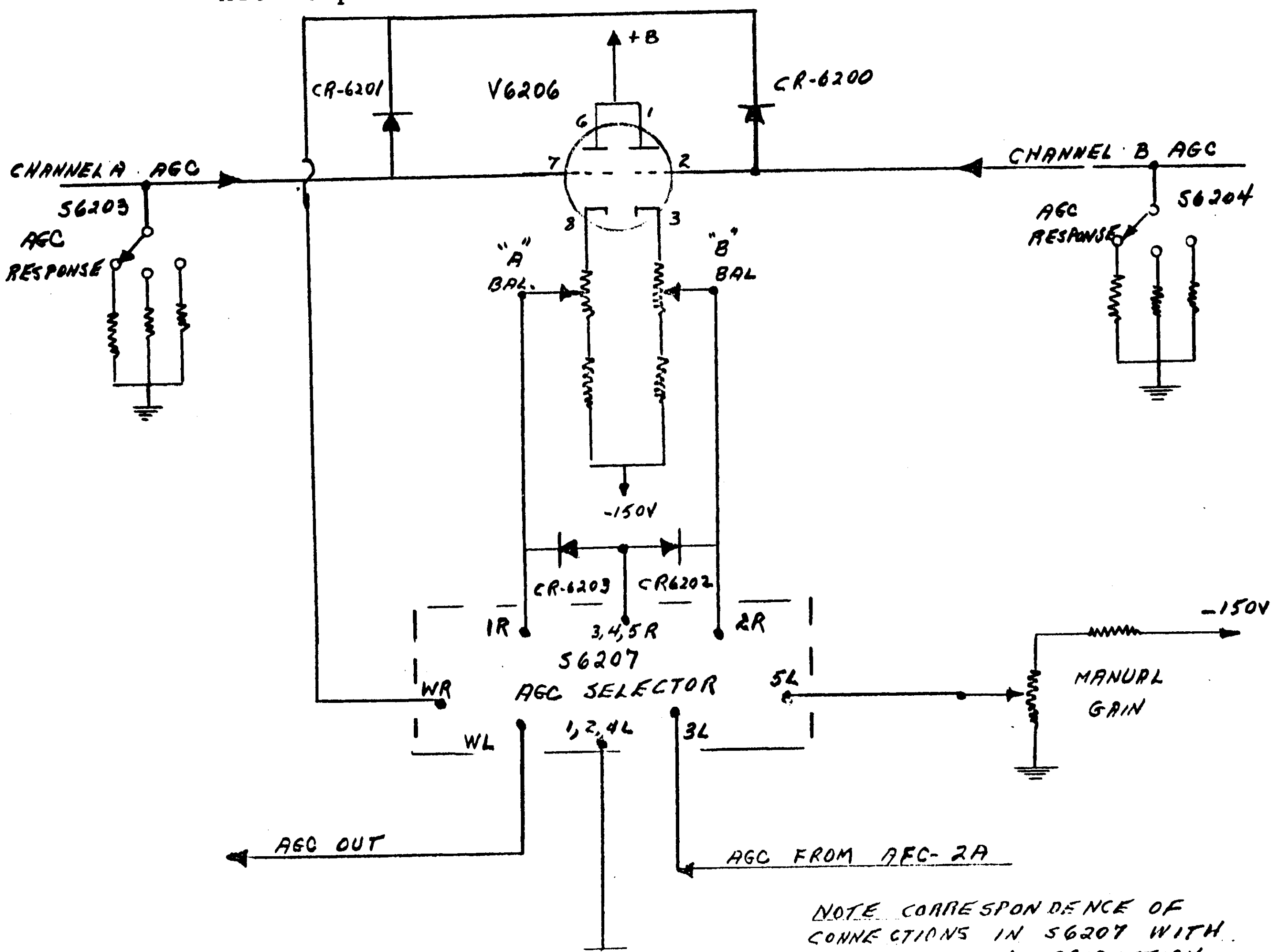
(2) the AGC outputs are conducted to the appropriate terminals of IF BANDWIDTH selector switch sections S-6201C and S-6202C, which perform the AGC selections.

(3) the selected Channel A and Channel B AGC outptus are conducted, via the wipers of S-6201C and S-6202C, to:

(a) the Channel A and Channel B AGC response switches, S-6203 and S-6204, respectively.

(b) to the control grid circuits of V-6206, the AGC Comparator stage. V-6206 is a dual triod . The Channel A AGC is applied at pin 7; the Channel B AGC is applied at pin 2.

(4) the AGC SELECTOR switch, S-6207, works in conjunction with the AGC Comparator circuit. A simplified sketch of the AGC Comparator circuit is presented below:




NOTE CORRESPONDENCE OF CONNECTIONS IN S6207 WITH TERMINALS ON PRODUCTION SCHEMATIC.
WL = WIPER, LEFT
3L = CONTACT 3, LEFT, ETC.

Explanation of the Simplified Sketch on the Preceding Page:

a) the Channel A and Channel B AGC RESPONSE selectors shunt the AGC voltage stored in the 1 uf capacitors of the selected IF strips. Thus, the AGC decay time may be adjusted. In actual practice, the AGC RESPONSE switches are set for the steadiest indication on the LINE LEVEL meters of the audio section.

b) the plates of V-6206 are returned to B Plus. The cathodes are returned to -150 volts via voltage divider networks. With no AGC, the tube sections conduct heavily and the voltage at the wipers of the balance potentiometers is close to 0 volts.

c) S-6207 Position #1: CHANNEL A:

line 1R is connected directly to WL, the AGC output. No other connections need be considered, since they do not affect the circuit. The selected Channel A AGC reduces the conduction of the left side of V-6206, and the voltage at the wiper of the "A" balance pot goes negative. Thus, Channel A AGC <u>only</u> determines the output AGC.

d) S-6207 Position #2: CHANNEL B:

line 2R is connected directly to WL, the AGC output. The system functions identically as for Position #1, except that only Channel B is effective.

e) S-6207 Position #3: CARRIER:

line 3L is connected to line WR; line 3,4,5 R is connected to WL, the AGC output. This connects the relatively large valu of AGC developed from the reconstructed carrier in the AFC-2A to both control grids of V-6206 via CR-6201 and CR-6200. The negative voltage at 3,4,5 R is connected to the AGC output.

f) S-6207 Position #4: CHANNEL A AND B:

lines 3,4,5 R are connected to WL, the AGC output. The <u>strongest</u> AGC from either channel thus controls the AGC output.

g) S-6207 Position #5: MANUAL:

line 5L is connected to line WR; line 3,4,5 R is connected to WL, the AGC output. A variable negative voltage from the manual gain control is used in a configuration similar to position #4. The manual gain voltage over-rides the normal AGC voltage until the manual gain voltage is reduced to the nominal value of the selected Channel A and Channel B AGC voltages. Beyond this point, the stronger of the selected Channel A and Channel B AGC voltages controls the gain.

d) Detector Circuits:

(1) since Channel A and Channel B detector circuits are identical, only the Channel A circuits will be discussed.

(2) in position 1 of S-6206, the Channel A DETECTION switch, the selected IF output from the Channel A IF BANDWIDTH selector switch section S-6201B is applied to the Channel A AM detector circuit. The output of the detector is applied to the grid circuit of the first audio amplifier.

(3) the AM detector is a simple half wave rectifier circuit, followed by a low pass filter to remove the RF component of the output. TP-1 is provided to sample the audio output.

(4) in positions 2 and 3 of the DETECTION switch, the selected IF output is applied to the cathode circuit of product detector V-6000 via a voltage divider network.

(5) the control grid circuit of the product detector receives a nominal 250 KC signal from the AFC-2A in AFC ON operation, or a crystal controlled 250 KC signal from V-6203 in the SBS-1 in AFC OFF operation.

(6) like other mixer circuits, the plate will contain sum, original and difference frequencies. The signal path from the plate of the product detector to the first audio amplifier contains a filter to remove all but the difference audio frequencies. The plate supply voltage to the product detector is also well filtered to keep these frequencies out of the power supply.

(7) the plate supply voltage for the 250 KC oscillator and amplifier circuits of the SBS-1 is also controlled by the detection switch. In order for V-6203 to receive its plate supply, the AFC ON OFF switch must be in the AFC OFF position, and the DETECTION switch must be in the SSB or CW position.

e) Audio Amplifier Circuits:

no detailed discussion of these circuits will be made, since they are common and conventional.

f) 250 KC oscillator and amplifier circuits:

(1) the circuits of V-6203 are similar to the circuits of V-6202, except for component values and crystal frequency.

(2) it should be noted that both the crystals in these 250 KC and 705 KC oscillators are enclosed in temperature controlled ovens.

g) Power Supply:

(1) all power requirements for the system are furnished by the power supply chassis of the SBS-1. The TMC symbol for the power supply chassis is A-2209.

(2) assume that the power cable is connected to a 115 Volt 60 cycle 1 Ø source, and that S-6208, the POWER ON STDBY switch is in the STANDBY position.

(3) in this position:

(a) one side of the line is connected to the upper open contact of K-7002, the ON OFF relay.

(b) one side of the line is connected to terminals 3,4, of time delay relay K-7001.

(c) full line voltage is applied to T-7002, which supplies the filament voltages for V-7001 and V-7002.

(d) full line voltage is applied to T-7001, which supplies 6.3 volts AC to:

(1) the heater of time delay relay K-7001.

(2) one side of K-7002, the ON OFF relay.

(3) pins C,D, of J-7003, the AFC-2A interconnection.

(4) pins C,D, of J-7002, the SBS-1 interconnection.

(4) pins C,D, of J-7003 supply the voltage for the 250 KC and 705 KC ovens in the AFC-2A.

(5) pins C,D, of J-7002 supply:

(a) the voltage for the 250 KC and 705 KC crystal ovens of the SBS-1.

(b) the voltage to illuminate the STANDBY indicator, I-6200, through closed contacts of the POWER ON STANDBY switch, S-6208.

Note that in the POWER ON position of S-6208, this same voltage is used to light the POWER ON indicator, I-6201.

(6) after a time delay of about 60 seconds, the time d lay relay, K-7001, closes its contacts. Line voltage is across the open contacts of the ON OFF relay, K-7002.

(7) Thus, in a STANDBY condition, the critical oven circuits are energized. The power cord should never be disconnected unless the entire equipment must be shut down for maintenance or emergency reasons.

(8) when the POWER STANDBY ON switch is thrown to the ON position, one section of S-6208 completes the 6.3 volt AC circuit to the other side of K-7002, the ON OFF relay, which energizes, closing its contacts.

(9) full line voltage is applied to T-7003, the power supply transformer. Blower motor B-7001 is also set in motion.

(10) filament voltages for the various filaments are supplied by contact pairs 15-14, 13-12, and 11-10 of T-7003.

(11) terminals 9,8 of T-7003 supply AC voltage for a full wave bridge rectifier circuit, the output of which is applied to the voltage regulator circuit. The regulator circuit furnishes regulated plus 200 volts to pin K of J-7003, J-7002 and J-7004.

A note is interjected here regarding J-7004. This jack interconnects an RF system in certain installations employing the SBS-1. It need not be considered in the SBC-1 installation.

(12) terminals 7, 6 and 5 of T-7003 furnish AC voltage to a full wave rectifier. This supply furnishes regulated -150 volts where needed. It also furnishes the reference voltage for the regulator circuits of the B Plus supply.
The regulated -150 volts is made available at pin H of J-7002, J-7003 and J-7004.

(13) the B Plus regulator circuit operates as follows:

(a) V-7001 is a series regulator tube, through which all of the load current must flow. The voltage difference between the output of the rectifier-filter at C-7003 and the regulated 200 volts at F-7001 is dropped across this tube.

(b) V-7002 is a DC amplifier stage, which changes the resistance of V-7001 with changes in the regulated output at F-7001.

(c) R-7006, R-7007 and R-7008 form a divider network from regulated B Plus to regulated B Minus, at the anode of CR-7007. The voltage at the wiper of R-7007 establishes the bias on V-7002. R-7007 is adjusted to provide exactly plus 200V at the output.

(d) assume that the B Plus at F-7001 rises above 200 v.

(e) the voltage at the wiper of R-7007 will become less negative, increasing the conduction of V-7002.

(f) with increased conduction of V-7002, its plate voltage falls; this fall is felt at the control grids of V-7001.

(g) the resistance of V-7001 is now increased. Th load current continues to flow in this tube, but through an increased resistance.

(h) V-7001 will now drop more voltage; the increased drop across V-7001 will exactly compensate for the rise at F-7001 above 200 volts.

2. Model AFC-2A Automatic Frequency Control:

(Refer to CK-551: complete schematic, Model AFC-2)

a) IF Input and Carrier Amplifier Circuits:

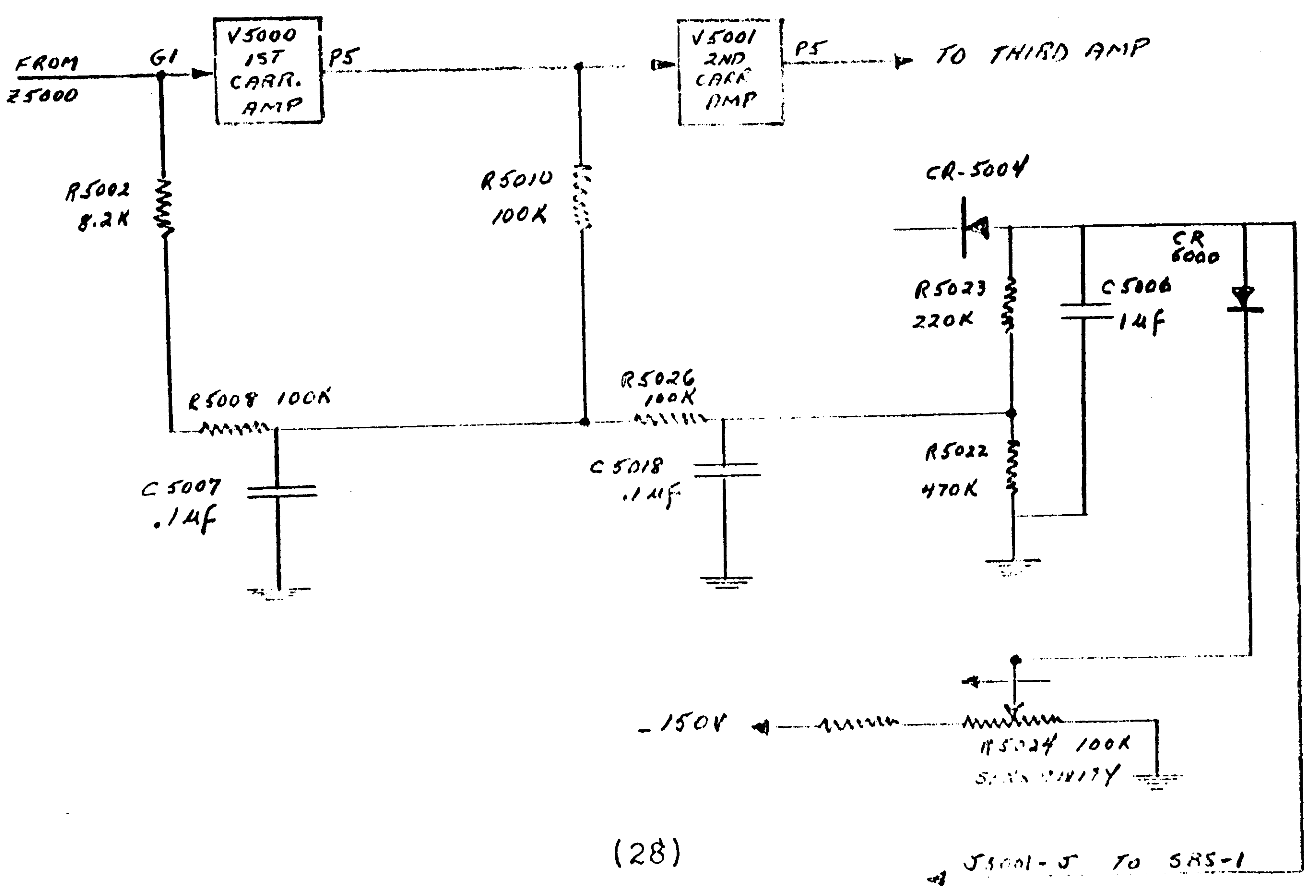
(1) the second IF input at a nominal frequency of 250 KC arrives from the IF circuits of the SBS-1 at J-5000; this is applied to a filter, Z-5000.

(2) Z-5000 will pass a band of frequencies from 249.950 KC to 250.050 KC; that is, 250 KC plus or minus 50 cycles. This filter determines the "pull in" range of the AFC unit.

(3) the output of Z-5000 is applied to a three stage carrier amplifier chain, V-5000, V-5001 and V-5002.

(4) the first two stages employ high Q tanks, L-5030 and L-5031, for tuning the plate circuits. These stages also employ cathode degeneration to improve stability.

(5) the control grid circuits of the first two stages are returned to an AGC - SENSITIVITY network. A simplified sketch of this arrangement is shown below:



(6) the AGC voltage, derived from the output of the carrier amplifier chain, is developed at the anode of CR-5004, the AGC diode. A portion of this voltage is tapped off at R-5022; this is applied to the control grid circuits of V-5000 and V-5001 via decoupling networks and grid resistors.

(7) the full AGC voltage is taken off to pin J of J-5000, the interconnection jack for the SBS-1. This voltage is used in the CARRIER position of the AGC SELECTOR on the SBS-1.

(8) with the front panel SENSITIVITY control fully CCW, a -150 volt supply:

(a) back biases CR-5004.

(b) forward biases CR-5000

(c) applies a large negative voltage to the control grid circuits of V-5000 and V-5001.

Note: the interaction of the SENSITIVITY control on the AFC-2A with the SBS-1 and the AGC output with the AGC SELECTOR in CARRIER position should be considered.

(9) with the SENSITIVITY control fully CW:

(a) the cathode of CR-5000 is grounded.

(b) the AGC circuit functions, back biasing CR-5000.

(c) the sensitivity is now a function of the AGC voltage.

(10) the transition from the first condition to the second occurs at that setting of the SENSITIVITY control which just cuts off CR-5000 as the control is moved clockwise. Further clockwise rotation beyond this point has no effect.

(11) the final carrier amplifier stage, V-5002, employs fixed bias. The output of this stage is applied:

(a) to a CARRIER LEVEL meter circuit via the secondary of T-5000 and C-5029.

(b) to the RCC-OSC selector switch, S-5000, via the secondary of T-5000.

(c) to the phase detector circuit via C-5113 and R-5028.

(d) to the relay amplifier circuit via C-5113 and C-5032.

(e) to the AGC circuit via C-5112.

b) CARRIER LEVEL Meter Circuit:

(1) on the positive excursions of the carrier signal, C-5029 charges via CR-5006.

(2) on the negative excursions of the carrier signal, CR-5006 cannot conduct; C-5029 discharges via a low pass filter circuit and CARRIEL LEVEL meter M-5000.

(3) the low pass filter prevents RF from entering the meter movement, and establishes an average value of DC proportional to the carrier level.

(4) the meter face is graduated into three colored areas, reading, from left to right, RED, YELLOW, and GREEN.

c) The RCC-OSC Selector Switch:

(1) the 250 KC output of the AFC-2A is made available at J-5002. This output is delivered to the product detectors of the SBS-1 via the AFC ON OFF switch on that unit.

(2) J-5002 is connected to terminals 3 and 7 of the RCC-OSC selector switch, S-5000, via C-5036.

(3) on the schematic, the switch is shown in the RCC position; J-5002 receives its signal from the carrier amplifier chain via terminals 2 and 3 of the switch. Note that in this position the output of the internal 250 KC oscillator and amplifier circuits is terminated with a 47 ohm resistor via terminals 8 and 9.

(4) in the OSC position of S-5000 terminal 2 of the switch is terminated with a 47 ohm resistor via terminal 1. The output of the internal 250 KC oscillator and amplifier circuits is applied to J-5002 via terminals 7 and 8.

(5) it should be noted that, regardless of the position of S-5000, the phase detector circuit receives an input from both the carrier amplifier chain and the internal 250 KC oscillator and amplifier circuits.

d) The Phase Detector Circuit:

(1) the output of the 250 KC oscillator and amplifier circuits is applied to the phase detector via terminals 3 and 6 of T-5003.

(2) the output of the carrier amplifier chain is applied to the phase detector via C-5113, R-5028 and the wiper of the balance adjust potentiometer, R-5031.

(3) terminals 1 and 2 of T-5003 are connected to a DC reference voltage of plus 2.7 volts. The reference voltage is the "neutral" position of the phase detector circuit; that is, the reference voltage is the "zero correction voltage" position for the Varicap circuits of the 250 KC and 705 KC oscillator circuits.

(4) the phase detector compares the phases of the two nominally identical frequencies and produces a correction voltage at the wiper of the balance pot. The amplitude and polarity of the correction voltage depends on the magnitude and direction of the error between the two input signals. The output of the carrier amplifier circuits is taken as the reference input.

(5) the correction voltage is applied to the Varicap circuits of the internal 250 KC oscillator and 705 KC oscillator circuits, in a manner to be described.

(6) the balance adjust potentiometer is set as follows:

(a) with no input signal from the carrier amplifier chain, the reference voltage is measured at terminals 1 and 2 of T-5003. This voltage will be close to plus 2.7 volts.

(b) a DC VTVM is connected to the wiper of the balance adjust pot, R-5031. The wiper is adjusted for the exact same reading obtained in the preceding step. The adjustment is then locked.

e) The Relay Amplifier Circuit:

(1) V-5007B is the relay amplifier. The plate, pin 1, is connected to B Plus through the coil of FADE relay, K-5000.

(2) on the positive excursions of the output of the carrier amplifier circuits, CR-5005 conducts, allowing C-5032 to charge. On the negative excursions, CR-5005 cannot conduct; C-5032 discharges into a low pass filter circuit, which presents the control grid of V-5007B with an average negative voltage proportional to the carrier amplitude. With normal carrier amplitude, this negative voltage is sufficient to cut off V-5007B. This condition causes the FADE relay, K-5000, to be de-energized. This is the condition shown on the schematic.

(3) note that the lower contact of K-5000 grounds the FADE indicator. The upper contact causes the correction voltage from the phase detector to be delivered to:

(a) the drift meter amplifier, V-5008B, via R-5080.

(b) the drift alarm amplifier, V-5007A, V-5008A, via R-5080 and R-5075.

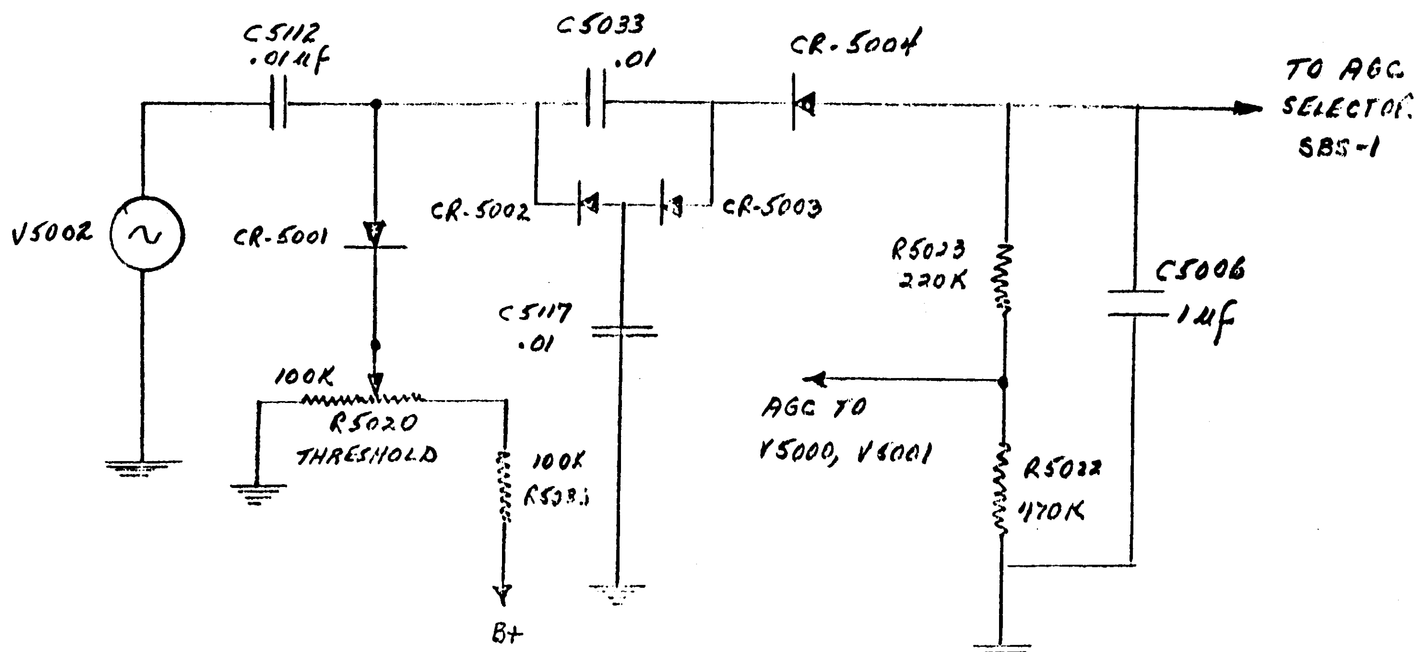
(c) the memory - delay circuit via R-5079.

(4) when the amplitude of the signal from the carrier amplifier chain falls below a predetermined level, V-5007B conducts; this energizes K-5000; the correction voltage is interrupted, and the FADE indicator is illuminated. The Varicap circuits of the oscillators continue to receive the voltage stored in the memory circuit at the time of fade.

f) The AGC Circuit:

(1) the output at the plate, pin 5, of the third carrier amplifier is applied to the AGC circuit via C-5112.

(2) a simplified sketch of the AGC circuit is drawn below:

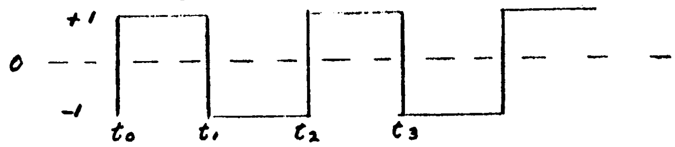


(3) the full AGC voltage is developed at the anode of CR-5004, the AGC diode. This is stored in a 1 uf capacitor, C-5006. A portion of the full AGC voltage is tapped off at R-5022; this is delivered to the control grid circuits of V-5000 and V-5001 via decoupling networks.

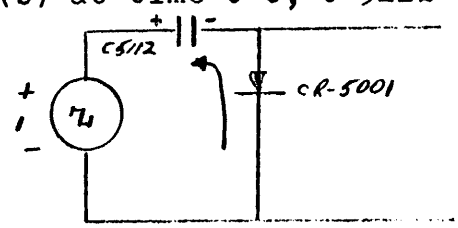
(4) the full AGC voltage, or voltage presented by the SENSITIVITY control, is delivered to the AGC SELECTOR switch in the SBS-1, for use in the CARRIER position.

(5) the circuit is essentially a voltage quadrupler; a discussion of its operation follows. It is assumed that R-5020 is fully CCW, grounding the cathode of CR-5001. For simplicity of explanation, a 2 volt peak to peak square wave input is assumed.

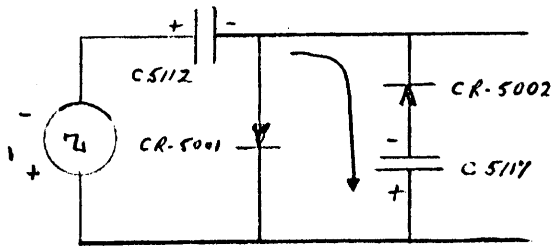
(a) input waveform assumed:



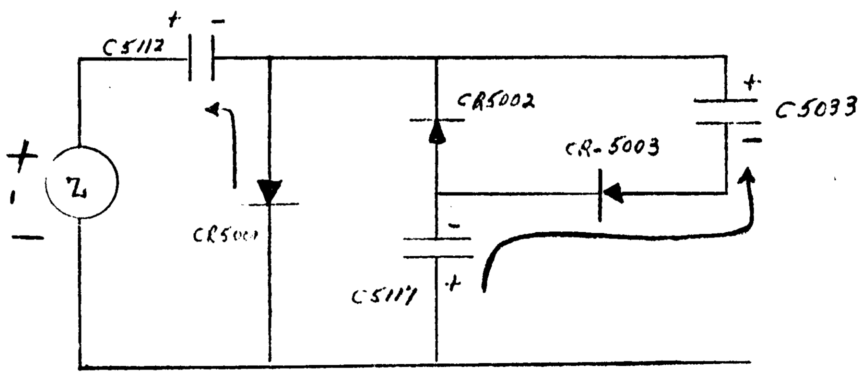

(b) at time t-0, C-5112 charges to 1 volt via CR-5001.




(c) at time t-1, the input becomes -1 volt. C-5117 charges to -2 volts via CR-5002.

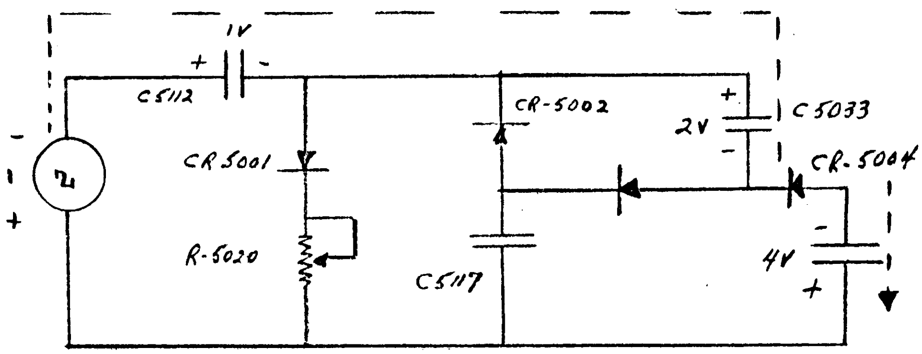



(d) at time t-2, the input again becomes plus 1 volt. C-5112 again charges to 1 volt via CR-5001. At th same time, C-5117 discharges into C-5033 via CR-5003 in the manner shown.



(e) at time t-3, the input becomes -1 volt.
The cathode of the AGC diode, CR-5004, is -4 volts negative with respect to ground; C-5006 charges to -4 volts. Thus, the circuit quadruples the peak input voltage.

(f) the THRESHOLD control, R-5020, varies the back bias on CR-5001 from 0 to about 100 volts. This control is a voltage delay, which prevents the production of AGC until the peak input signal voltage exceeds the back bias set by R-5020.




g) The DRIFT METER Circuit:

(1) the DC correction voltage from the phase detector is applied to the control grid of the drift meter amplifier, V-5008B, via R-5080.

(2) the cathode circuit of V-5008B contains the drift meter; the face of this meter is graduated in RED, YELLOW and GREEN areas on each side of zero center scale.
A voltage divider adjustment, R-5074, permits zeroing the meter when the correction voltage is zero. (plus 2.7 V)

(3) a negative correction voltage will cause the tube to conduct less; this will cause a deflection of the meter to the left. A positive correction voltage will cause the meter to deflect to the right.

(4) the circuits are designed to that the meter indication is a measure of the total amount of drift. As an approximation:

(a) GREEN extends to 500 cycles.

(b) YELLOW extends from about 500 cycles to 1 KC.

(c) RED extends from about 1 KC.

RED, then, indicates the limit of the "hold in" range.

h) The DRIFT ALARM circuit:

(1) the drift alarm utilizes two identical stages, V-5007A and V-5008A.

(2) the control grid of V-5008A receives the DC correction voltage from the phase detector circuit.

(3) the control grid of V-5007A contains the alarm zero adjust potentiometer, R-5064, in a voltage divider network. One end of this network connects to the -150 volt supply; the other end of the network connects to B Plus via R-5071. The voltage at the wiper of R-5064 can be brought close to 0 volts. (actually, to the "zero reference" voltage)

(4) each plate is connected to a terminal of a neon alarm indicator, I-5000.

(5) with zero correction voltage from the phase detector, R-5064 is adjusted for approximate zero; both tubes then conduct equally, and the difference of potential across the neon indicator is zero.

(6) a correction voltage from the phase detector unbalanc s the conduction of the two alarm tubes; unequal plate voltages are developed.

(7) the circuits are designed such, that, for a plus or minus carrier drift of about 750 cycles, the plate voltage unbalance is of sufficient magnitude to light the n on indicator.

i) The Memory or Delay Circuit:

(1) the correction voltage from the phase detector is applied to two memory capacitors, C-5076 and C-5077, via R-5079. Note that the voltage on these capacitors is applied to the Varicap circuit of the 705 KC oscillator arrangement.

(2) when the carrier is not fading, the memory capacitors can charge and discharge to follow the correction voltag from the phase detector; they do so relatively slowly, due to the time constant of the circuit. Note that the correction voltage to the Varicap circuits of the 250 KC oscillator arrangement is applied immediately, with no delay.

(3) when the carrier fades, the fade relay removes the correction voltage; the memory circuit is suspended, as it were, and cannot discharge; thus, the converter injection oscillator frequency is maintained until the carrier returns.

(d) should it become necessary to return the memory circuit to a neutral position quickly, a RESET button has been incorporated. This connects the memory circuit to th reference voltage of the phase detector.

j) The Product Detector Oscillator and Amplifier Circuits:

(1) the product detector oscillator and amplifier circuits produce a stable, nominal 250 KC signal to be delivered, in the OSC position of the RCC-OSC switch, to the product detectors of the SBS-1 via the AFC ON OFF switch on that unit.

(2) V-5006A is a 1.5 mc crystal oscillator. The frequency of this circuit may be controlled, over a limited range, by Varicap control C-5069, which is excited by the correction voltage from the phase detector.

(3) a change in the Varicap bias of plus or minus 1 volt results in a respective decrease or increase in frequency of 50 cycles.

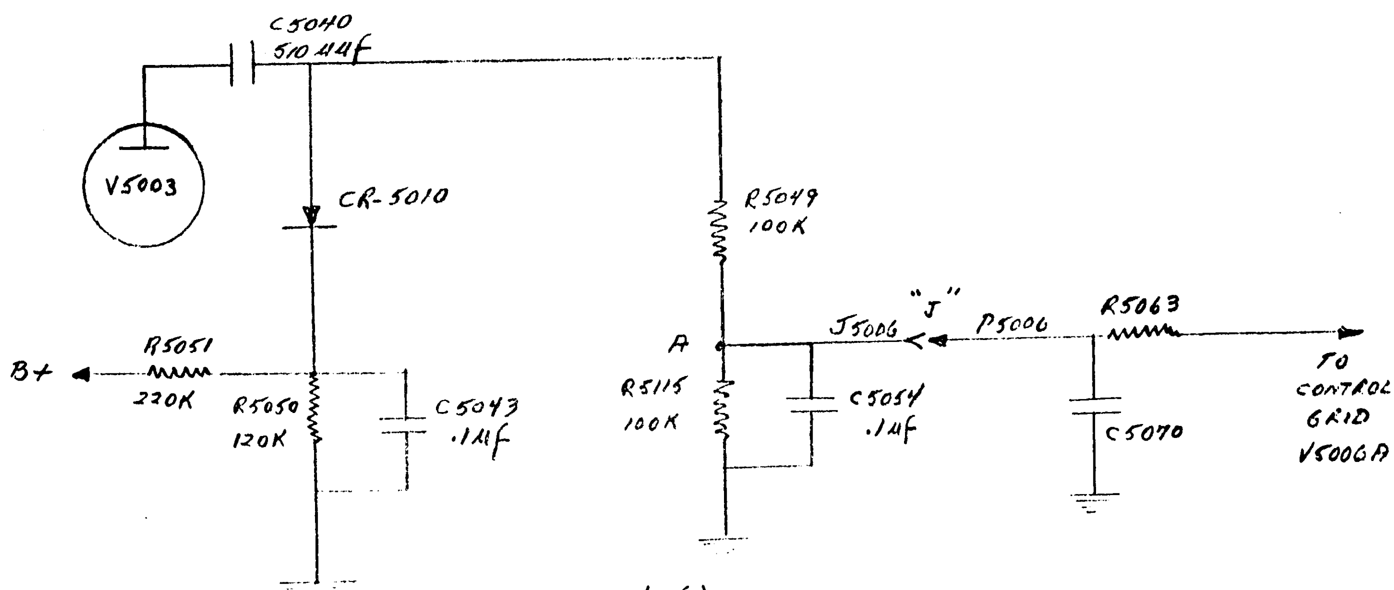
(4) V-5006B is a 1.25 mc crystal oscillator and mixer circuit. The 1.5 and 1.25 mc frequencies are mixed in this stage, resulting in a 250 KC difference frequency at the plate.

(5) the 250 KC difference frequency from V-5006B is applied to a buffer stage, V-5005, the plate circuit of which is tuned by resonant tank L-5033.

(6) V-5005 and V-5006, together with their associated crystals and Varicap, are enclosed in a temperature controlled oven. A heat sensitive control maintains the oven temperature at 70 degrees C.

(7) the nominal 250 KC signal from buffer stage V-5005 is applied to two cascade 250 KC stages, V-5004 and V-5003. Resonant tanks are employed for tuning the plate circuits.

(8) V-5003, the final 250 KC amplifier, has an associated AGC circuit, a simplified sketch of which is shown below. The operation of the circuit is discussed on the following page.



(9) CR-5010 is back biased by a voltage divider network, R-5050 and R-5051. C-5043 bypasses R-5050, to maintain the bias essentially constant.

(10) the output of V-5003 is coupled, via C-5040, to voltage divider network R-5049 and R-5115. C-5054, which bypasses R-5115, has such a low reactance at 250 KC that point A may be considered to be at RF ground.

(11) when the peak amplitude of the 250 KC signal exceeds the bias on CR-5010, the diode conducts, charging C-5054 negatively. The AGC voltage developed here is applied to the control grid of V-5006A.

(12) the output of the internal 250 KC circuits is delivered:

(a) to S-5000, the RCC-OSC selector switch, via the YELLOW tap on the secondary of T-5001.

(b) to the phase detector circuit via the GREEN secondary lead of T-5001.

k) The Converter Injection Oscillator and Amplifier Circuits:

(1) the converter injection oscillator and amplifier circuits produce a stable, nominal 705 KC signal to be used by the mixer stage of the SBS-1 when the system is in AFC ON operation.

(2) V-5012A is a 10.705 mc crystal oscillator. The frequency of this circuit may be controlled, over a limited range, by a Varicap control, C-5107, excited by the correction voltage from the phase detector and memory circuit.

(3) a change in the Varicap bias of plus or minus 1 volt results in a respective increase or decrease in the frequency of 1 KC. Note that this effect is opposite to that encountered in the 250 KC circuits. Note also that a change in bias has ten times the effect on the 705 KC circuits, than on the 250 KC circuits.

(4) V-5012B is a 10 mc crystal oscillator and mixer circuit. The 10.705 mc and 10 mc frequencies are mixed in V-5012B, resulting in a 705 KC difference frequency at the plate of this stage.

(5) the 705 KC difference frequency from V-5012B is applied to a buffer stage, V-5011, the plate circuit of which is tuned by resonant tank Z-5002.

(6) V-5012 and V-5011, together with their associated crystals and Varicap, are contained in a temperature controlled oven. A heat sensitive element maintains the oven temperature at 70 degrees C.

(7) the nominal 705 KC signal from buffer stage V-5011 is applied to two cascade 705 KC amplifiers, V-5010 and V-5009. Cathode degeneration is employed in V-5010; V-5009 uses fixed bias. Both stages are tuned by means of resonant plate tanks.

(8) an AGC system similar to that found in the product detector oscillator and amplifier circuits is employed.

(9) the 705 KC output is made available at J-5003, from which point it is delivered to the mixer circuit of the SBS-1 when the system is in AFC ON operation.

C. Operation of the Model SBC-1 Sideband Converter:

1. It is assumed that the unit has power applied at the input and that the POWER STANDBY ON switch is in the STANDBY position. The power cable should not be disconnected, nor input power switched off unless the equipment is to be completely shut down for maintenance or emergency reasons. In STANDBY condition, power is applied to the oscillator oven circuits, the power supply control circuits, and the power supply filaments.

2. It is difficult to set forth a rigid set of rules for the operation of the SBC-1, due to its versatility. This procedure is in the nature of a guide for personnel handling the SBC-1 for the first time. Experienced operators will doubtless discover short cuts and "kinks" peculiar to their own particular installations and modes of reception.

3. It will be assumed that an ISB signal is to be received, with suppressed carrier. The 3.5 KC bandpass filters will be selected.

4. Preliminary:

a) SBS-1:

(1) Set the Channel A and Channel B DETECTION switches to the SSB mode.

(2) Set the Channel A IF BANDWIDTH selector switch to the 3.5 KC LSB position.

(3) Set the Channel B IF BANDWIDTH selector switch to the 3.5 KC USB position.

Note: these positions may be reversed, if desired; that is, the USB may be brought through Channel A and the LSB may be brought through Channel B.

(4) Set the Channel A and Channel B AGC RESPONSE controls to the FAST position.

(5) Set the MONITOR gain control to the "O" position.

(6) Place the AFC ON OFF switch to the OFF position.

(7) Place the MANUAL gain control fully CCW.

(8) Place the AGC SELECTOR to CARRIER.

Note: even though the AFC is OFF, the circuits of that unit still function. The carrier amplifier chain reconstructs the carrier, and produces an AGC voltage which is used in the CARRIER position of the AGC SELECTOR.

(9) LEVEL ADJUST controls to their mid positions.

(10) If loudspeakers are being used to monitor the audio outputs, the MONITOR jack is not used. If monitoring is to be done locally, at the unit, headphones may be inserted at the MONITOR jack. In the "0" position of the CH-A CH-B MONITOR GAIN control, the output signal to the phones is grounded. If the control is moved to the left, only Channel A audio will be heard. If the control is moved to the right, only Channel B audio will be heard.

b) AFC-2A:

(1) SENSITIVITY control fully CW

(2) TUNING KCS control to the "0" position.

(3) CARRIER SELECTOR to the OSC position.

4. Operation: (AFC OFF)

(1) Place the POWER STANDBY ON switch to ON.

(2) Tune the associated receiver to the carrier frequency assigned.

(3) The LINE LEVEL meters will indicate the audio output. The monitors may be used to monitor each channel, to assist in tuning.

(4) The AGC SELECTOR may be switched, if desired, to the mode of AGC control desired, if CARRIER position is not wanted.

(5) The LEVEL ADJUST controls should be set to adjust the appropriate LINE LEVEL meters to "0 VU". This is the setting for the standard audio output.

(6) The AGC RESPONSE controls should be set to the position which prevents the LINE LEVEL meters from swinging above "0 VU", on fluctuations.

5. Operation: (AFC ON)

(1) Place the AFC ON OFF switch to the ON position.

(2) Hold down the RESET button; adjust the TUNING KCS control for maximum indication on the CARRIER LEVEL meter, and a zero center scale reading on the DRIFT meter.

(3) Release the RESET button. The system is now operating with automatic frequency control.

| DATE | TMC SPECIFICATION NO. S657 |
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| SHEET 1 OF 14 | |
| COMPILED / CHECKED RK | TITLE: |
| Ron Kohn APPROVED | |

GENERAL DESCRIPTION, PERFORMANCE SPECIFICATION,

THEORY OF OPERATION AND TROUBLE SHOOTING DATA

FOR THE { SBS-1 POWER SUPPLY
SBS-2 POWER SUPPLY }

# TMC SPECIFICATION NO. S 657

COMPILED | CHECKED RK | TITLE:

Ron Kolin
APPROVED

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## CHARTS AND GRAPHS

# TMC SPECIFICATION NO. S657

COMPILED | CHECKED RK | TITLE:

Ron Kahn
APPROVED

1. GENERAL DESCRIPTION:

The SBS-1 Power Supply Section is a self contained power supply used not only to supply power to the SBS-1 but to the TMC Model AFC-2 as well when the two are combined in the SBC-1 system. The supply also provides power to the TMC model HFR-1 in some combinations of the DDR-5 receiver systems. In the DDR-5 system, the power supply is re-designated SBS-2 Power Supply Section and supplies power to the AFC-3 as well as the SBS-2. The supply provides B+, C-, oven heater voltage and primary A.C. to the system.

1.1 Physical Size: The power supply is designed to fit on top of the filter chassis of the SBS-1 and is fastened by seven screws holding the supply to the sideplates. The power supply is 16 3/4" wide x 5 1/2" deep x 5 1/8"high and weighs approximately 30 pounds.

1.2 Output Connections: Three TMC type JJ-200 quick disconnect multi-conductor jacks are used to connect the various units to the power supply. The input power receptacle is a TMC type JJ-235, three prong twist lock. Three fuses are used within the unit to provide overload protection for the B+, C- and A.C. Line and are located on the rear plate.

1.3 Switches & Controls: The power supply requires remote turn-on by the SBS-1 through interconnect jack J7002. A voltage adjust potentiometer is located on the rear plate for setting the B+ output voltage.

1.4 Blower: A muffin fan is contained within the power supply and is mounted on a sub-chassis which is connected to the rear plate. The fan is readily made accessable by prying off the grill in front of the fan. The fan provides forced air cooling for the SBS-1 system.

2. PERFORMANCE SPECIFICATION:

2.1 Primary A.C. Voltages: AC line voltage is supplied to the Frequency standard/oven amplifier power supply in the HFR-1 (if used) through pins A & B, J7004. AC line voltage for the AFC-2 oscillator ovens is supplied through pins A & B, J7003. Either 115V or 230V lines may be used with the proper modifications of transformer primaries.

2.2 Filament Voltages: A 6.3V 17 ampere line is used to supply filament voltage to all the units in the system. This voltage is applied to pins E & F, J7003 and J7004, and pins E,Z,W and F,Y,X of J7002. Separate filament lines for the audio channels are supplied through J7002.

2.3 Oven Heater Voltage: In addition to the oven heater voltage to the AFC-2 noted in paragraph 2.1, 6.3 volts AC is applied to pins C and D of J7002 for the ovens in the SBS-1 converter section.

2.4 Bias Voltage: A regulated bias voltage of -105 volts is supplied to the units in the system through pin H, J7002, J7003, J7004.

2.5 B+ Voltage: Regulated B+ voltage is supplied to the units in the system through pin K, J7002, J7003, J7004.

2.6 AGC Line: The AGC line from the AFC-2 is supplied to the SBS-1 through interconnection in the power supply. The HFR-1 is also connected to the AGC line within the power supply.

2.7 Remote Turn-On: The power supply may be switched from the STANDBY condition to the OPERATE condition by connecting pin U, J7002 to pin P, J7002. The POWER switch, S6208 in the SBS-1, performs this function.

3. THEORY OF OPERATION:

Power distribution and circuitry are illustrated in "Schematic Diagram, Power Supply Section", TMC drawing number CK-523 (8 SIZE). It is assumed the reader has this drawing available for reference to clarify any further explanations contained in sections 3 and 4. CK-561 (ROLL SIZE) should also be consulted.

3.1 Sequence of operation:

3.1.1 OFF: The unit will be completely OFF only if the line cord is removed from J7001 or if F7002 is open or missing.

3.1.2 Standby: When the line cord is inserted into J7001, the power supply is placed in the STANDBY condition. Primary voltage is applied to T7001 and T7002, resulting in filament voltage being applied to V7001 and V7002 by the secondary T7002. The secondary of T7001 supplies heater voltage to K7001, the TIME DELAY RELAY, as well as oven heater voltage to pins C & D, J7002. One side of this line is also connected to the coil of K7002, the ON/OFF relay. In the STANDBY position, A.C. line voltage is applied directly to pins A & B, J7003 and J7004. The STANDBY indicator in the SBS-1 is across the oven heater line and will light.

3.1.3 Time Delay: If the POWER switch S6208 in the SBS-1 is set to the POWER ON position immediately upon insertion of the line cord, the unit will remain in the STANDBY position for a nominal 60 seconds before switching to POWER ON. This is the time required for

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TIME DELAY RELAY K7001 to close. The time delay is required on initial turn-on to allow regulator tubes V7001 and V7002 the proper cathode warm up period. The relay and regulator tube filaments are operated continuously and the time delay will no longer be encountered when switching from STANDBY to POWER ON after initial turn-on under the conditions noted.

3.1.4 Power On: Let us assume 60 seconds have elapsed since insertion of the line cord. K7001 has closed and we now set S6208 on the SBS-1 from STANDBY to POWER ON. Pin P, J7002 is now connected to pin U, J7002, through S6208 in the SBS-1. Connecting pins P & U places 6.3 VAC from the secondary of T7001 (the oven heater line) across the coil of ON/OFF Relay K7002 and K7002 will energize. Primary voltage is applied through K7002 to T7003. The muffin fan, B7001, will start running as 115V is applied to its windings. The secondary of T7003 supplies filament voltage to the SBS-1, AFC-2 and HFR-1 from pins 10 & 11 and filament voltage for the audio channels in the SBS-1 from pins 14 & 15 (Channel "A") and 12 & 13 (Channel "B"). The higher voltage windings will be discussed in the detailed descriptions of their associated circuits so for the present we shall say that B+ and C- will be applied to the system through J7002, J7003 and J7004. Setting S6208 from STANDBY to POWER-ON will cause the STANDBY indicator to extinquish and the POWER-ON indicator to light.

3.2 The Bias Supply Circuit: The bias supply circuit consists of a full wave rectifier, an LC filter and a Zener Diode controlled shunt regulator.

3.2.1 Rectifier and Filter: The secondary of T7003 supplies 240V RMS between terminals 5 and 7, center tapped at terminal 6. This voltage is rectified by two silicon rectifiers, CR7005 and CR7006, of type 1N547. The resultant negative D.C. voltage developed across input capacitor C7004 is approximately -160 volts. The LC filter consisting of C7004, L7001 and C7005 is used for ripple reduction and the DC voltage across C7005 is approximately -150 volts.

3.2.2 Shunt Regulator: The shunt regulator section of the bias supply is made up of a Zener Diode voltage regulator and series resistor R7014. Input voltage and load current variations are absorbed by the Zener Diode, CR7007, type 1N3006RB. The Zener breakdown voltage is a nominal -105 volts. The diode regulator maintains this voltage by adjusting its Zener current to vary the IR drop across R7014. As a result of this characteristic, diode dissipation will be max. at min. load. CR7007 dissipates a maximum power of 7 watts. The Zener Diode acts against ripple variations in the same manner as input voltage variations and the ripple output of the bias supply is less than 1MV with 125 volts line voltage at full load.

3.3 The B+ Supply: The B+ supply is comprised of a bridge type full-wave rectifier, filter capacitor, and output voltage regulator.

3.3.1 Rectifiers and Filter: The secondary of T7003 provides a 270V RMS output between terminals 8 and 9 for rectification by a full-wave bridge circuit consisting of CR7001, CR7002, CR7003, and CR7004 of type 1N547. A 50 ohm surge resistor, R7012, is used to prevent excessive surge currents from destroying the silicon diodes in the bridge circuit. The resultant D.C. output voltage across C7003 is a nominal +300 volts at full load. This voltage will exceed 400 volts under no load conditions.

3.3.2 Regulator Section: The B+ regulator section is comprised of four sub-sections; a series regulator or passing tube, V7001; a D.C. amplifier tube, V7002; a voltage reference, CR7007 (Zener bias regulator); and a comparator network of R7006, R7007 and R7008. The voltage between F 7001 and ground is B+.

a. The output voltage between F7001 and ground is the difference between the voltage across C7003 and the voltage drop across V7001. V7001 acts as a variable resistor, controlled by its grid potential.

b. The plate of V7002 is direct coupled to the grids of V7001 through parasitic suppressors R7004 and R7005. It can be seen that the plate of V7002 and the grids of V7001 are at the same potential and a change in V7002 plate voltage will change the resistance of V7001.

c. The comparator network of R7006, R7007 and R7008 is connected between F7001 and CR7007. The arm of potentiometer R7007 is direct coupled to the grid of the D.C. amplifier tube. (Pin 1 of V7002). The difference between the voltage at the arm of R7007 and the cathode of V7002 is the bias voltage for V7002 and hence will determine the quiescent point of the tube. The plate voltage at this point will determine the grid voltage of V7001 and hence the output voltage at F7001. The output voltage at F7001 can be adjusted by changing the position of the arm of R7007 and should normally be set at 200 volts.

d. If the voltage across CR7007 is a constant, then any change in output voltage at F7001 will produce a change of grid bias on V7002 and a resultant change in the resistance of V7001. The change in this resistance and the resultant I.R. drop across V7001 will compensate for the original change at F7001 and maintain the output voltage at F7001 a constant. The circuit operates as a closed loop system to compensate for line voltage variations and changes in load current.

e. Let us assume that the voltage at F7001 is adjusted for 200 volts at a constant load. If the line voltage decreases, the D.C. input voltage to the regulator will decrease across C7003.

The output voltage at F7001 will also decrease as a result, causing the grid of V7002 to go more negative. Plate current in V7002 will decrease with a resultant increase in V7002 plate voltage. The grid of V7001 will become less negative with respect to the cathode, causing the resistance of V7001 to decrease. The voltage drop across V7001 will decrease, causing the output voltage at F7001 to return to 200 volts.

f. If the line voltage increases, the input to regulator will increase, causing an increase in output voltage. This increase in output voltage will cause the grid of V7002 to go less negative increasing the plate current. The plate current increase will cause a reduction in plate voltage and therefore the grid of V7001 will become more negative with respect to the cathode. The resistance of V7001 will increase and the voltage drop across V7001 will increase to reduce the output voltage to 200 volts. The regulator acts against ripple voltage in a similiar manner.

g. Let us assume that the line voltage is constant, and that the output voltage is adjusted at 200 volts between F7001 and ground at a certain load current. The load in this case being across F7001 and ground. If the load current increases, the output voltage across the load will decrease due to a re-division of voltage between V7001 and the load. A feedback action as in paragraph (e) occurs, returning the output voltage to 200 volts.

h. If the load current decreases, the output voltage at F7001 will increase due to a re-division of voltage between V7001 and the load. A feedback action as in paragraph (f) occurs, returning the output voltage to 200 volts.

## 4. TROUBLE SHOOTING DATA

This section is devoted to aiding the technitian in locating troubles which may develop in the power supply.

4.1 Normal Operation: Figures 4.1.1, 4.1.2, 4.1.3 and 4.1.4 show normal performance of the power supply. The unit is fully tested at the factory to insure proper operation and no adjustment of any kind is required upon installation of the equipment.

4.2 Voltage Measurements: Before voltage measurements can be made, the power supply section must be removed from the SBS-1 chassis. Fig. 4.2.1 shows power supply removal. The bottom of the power supply is open to facilitate access to components and tube sockets. After removal, the power supply may be turned upside—down and and the SBS-1 reconnected to J7002.

4.2.1 Voltage Measurement Chart: Terminal board TB7001 mounts almost all of the circuit components and is a handy place to perform voltage measurements Figure 4.2.2 shows the board with numbered test points for voltage measurement. The chart of Fig. 4.2.2 refers to these test points. All D.C. voltage measurements made with a 20,000-ohms-per-volt meter. A.C. voltages measured with a DAVEN model 861 VTVM. The voltages noted are for 115V line voltage.

4.2.3 Adjustment of B+ Voltage: The output of the B+ supply should be adjusted at 200 volts with the system units connected and working. Place a voltmeter between F7001 and ground and adjust R7007 for 200 volts. F7001 is accessable through the top cover.

DATE

SHEET 9 OF 14

# TMC SPECIFICATION NO. S557

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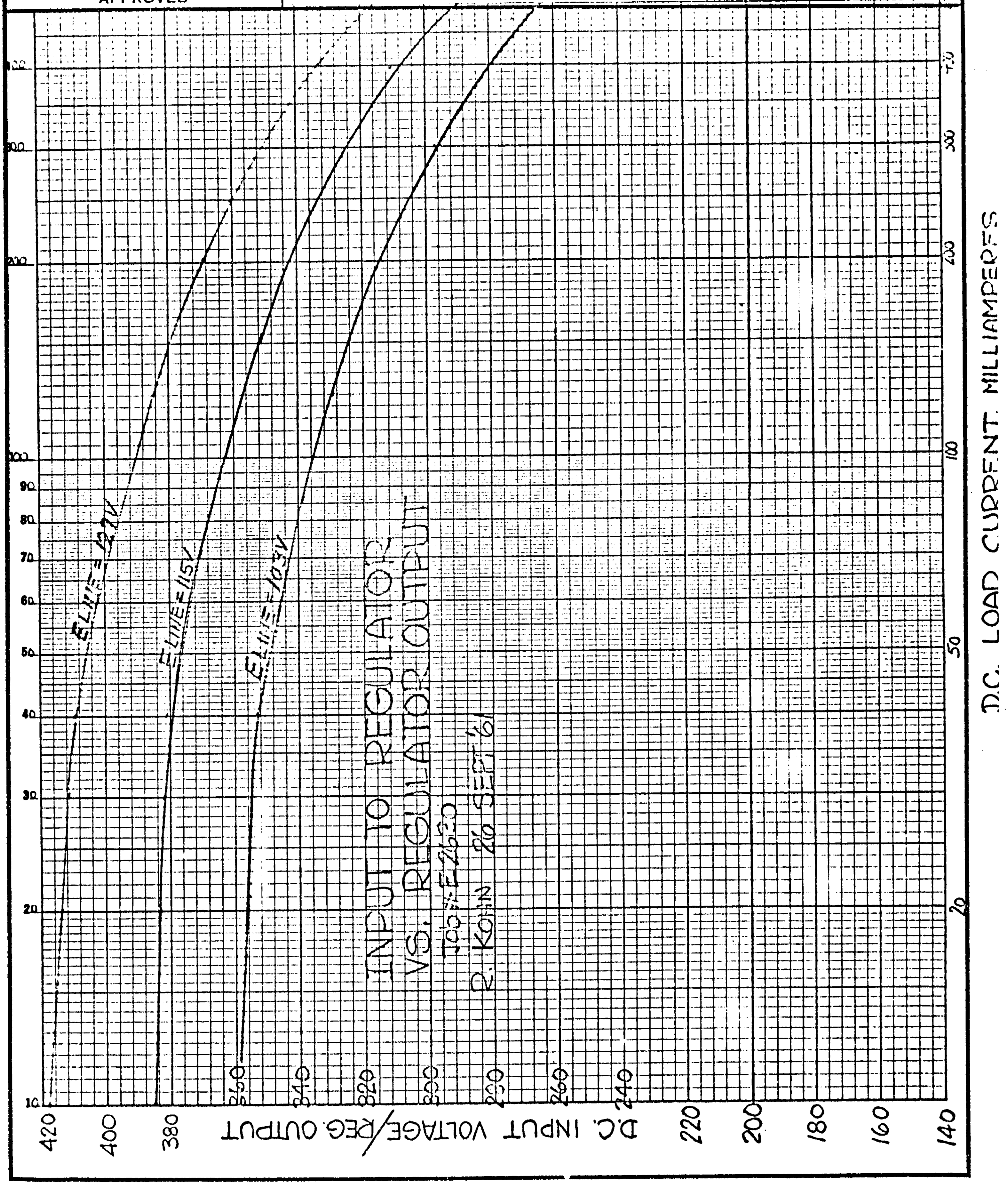
APPROVED





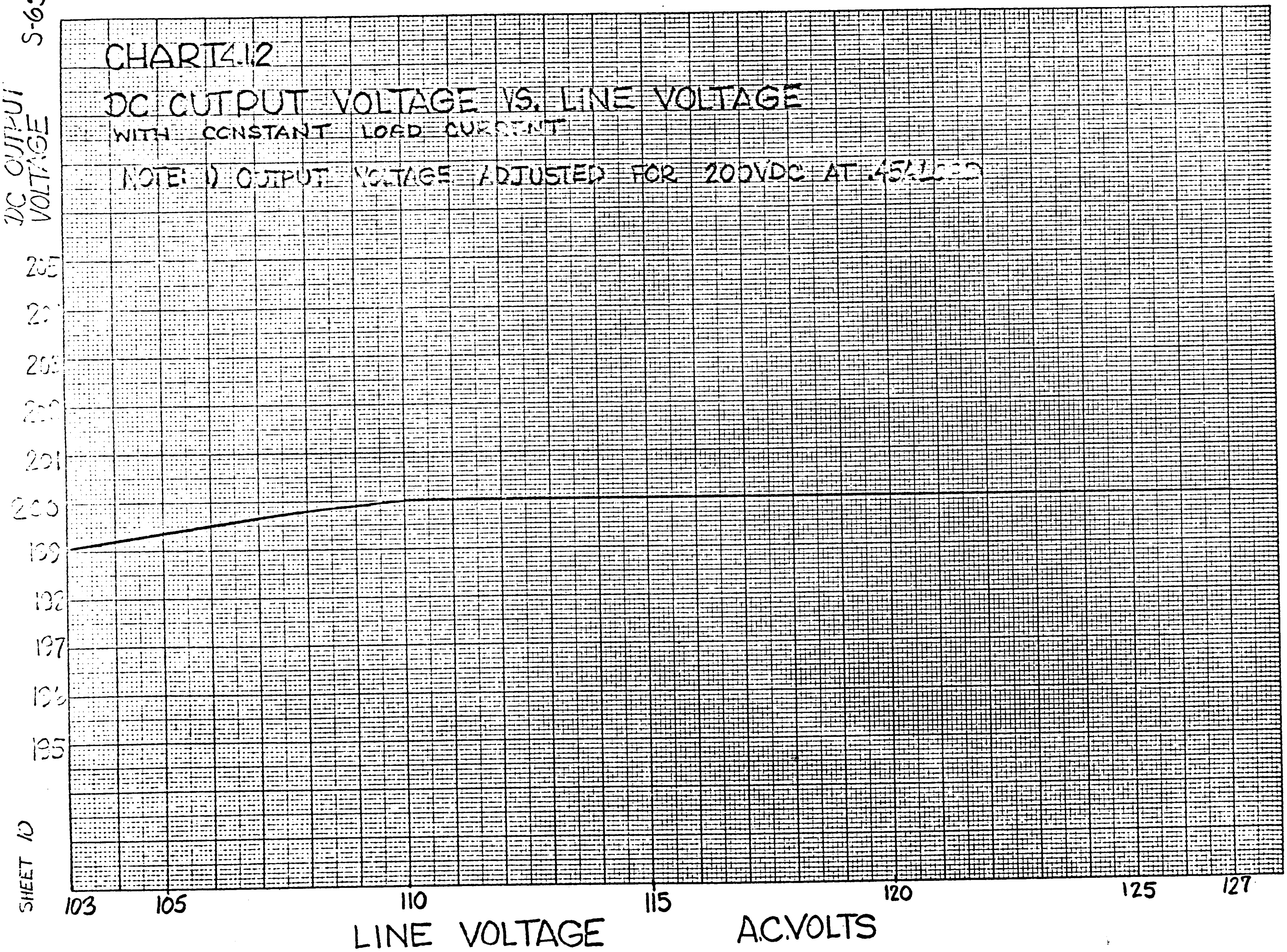
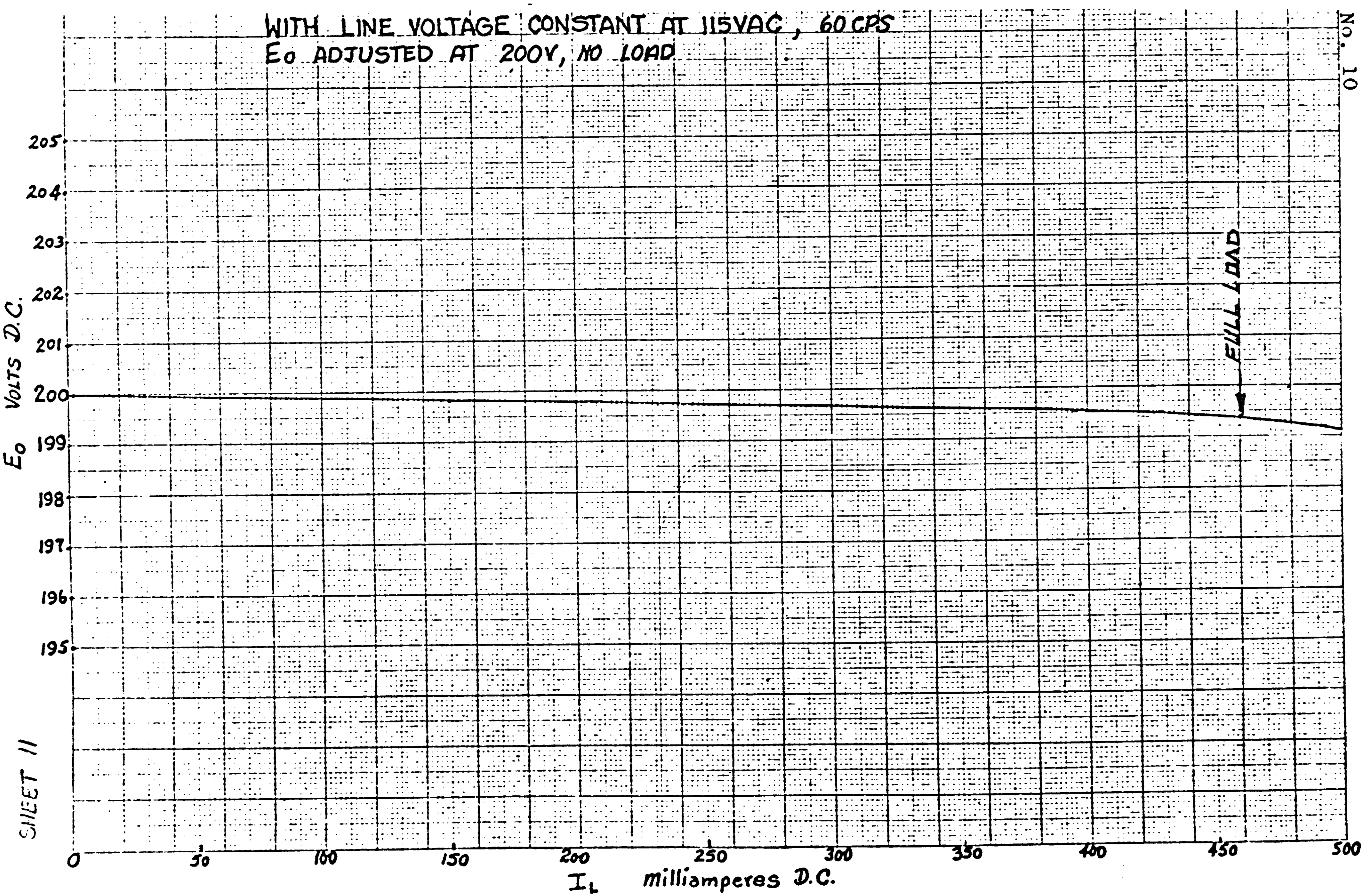
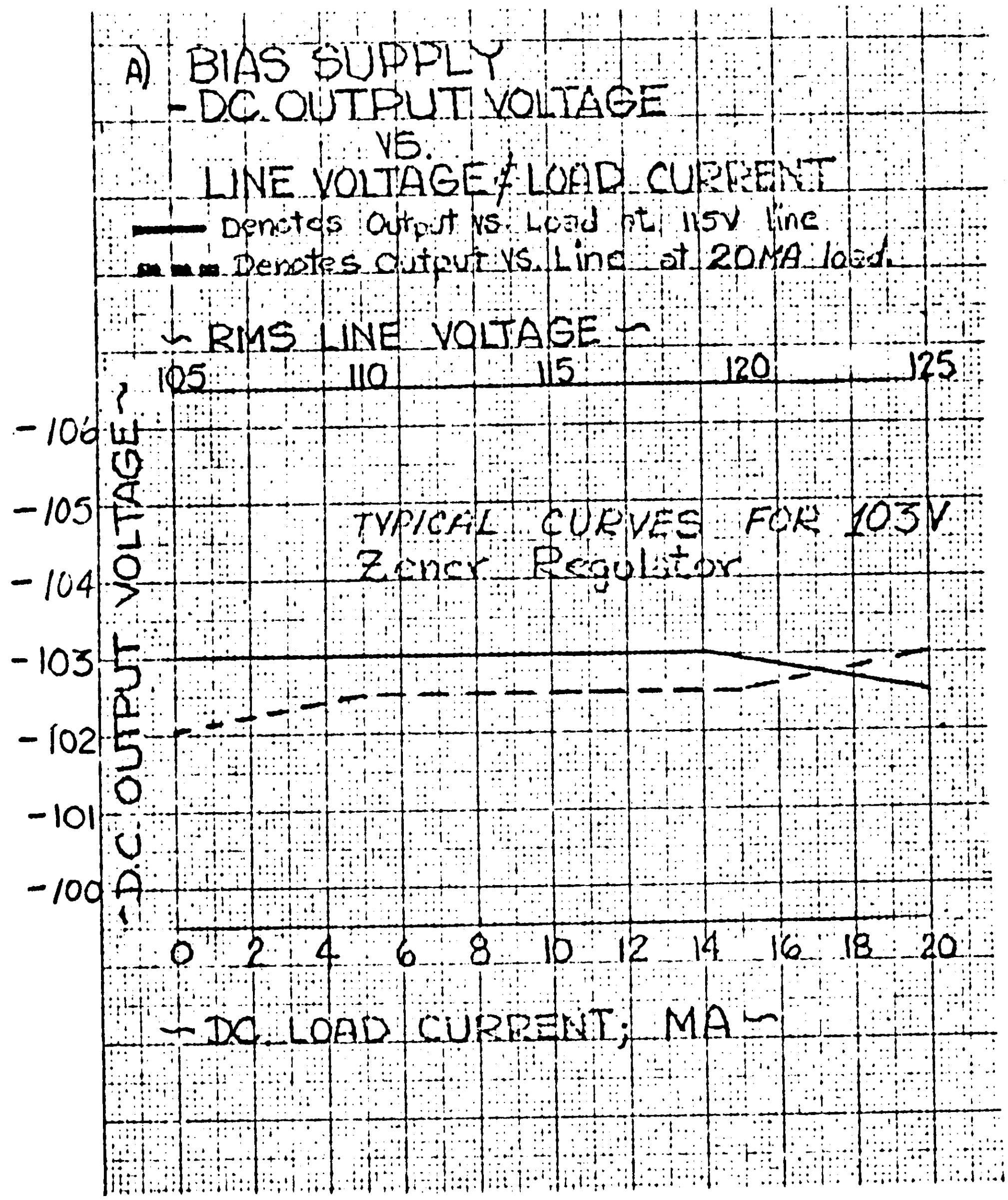


CHART 4.1.2
DC OUTPUT VOLTAGE VS. LINE VOLTAGE
WITH CONSTANT LOAD
NOTE: 1) OUTPUT VOLTAGE ADJUSTED FOR 200VDC AT
DC OUTPUT VOLTAGE
205
203
201
199
197
195
103
105
110
115
120
125
127
LINE VOLTAGE A.C.VOLTS

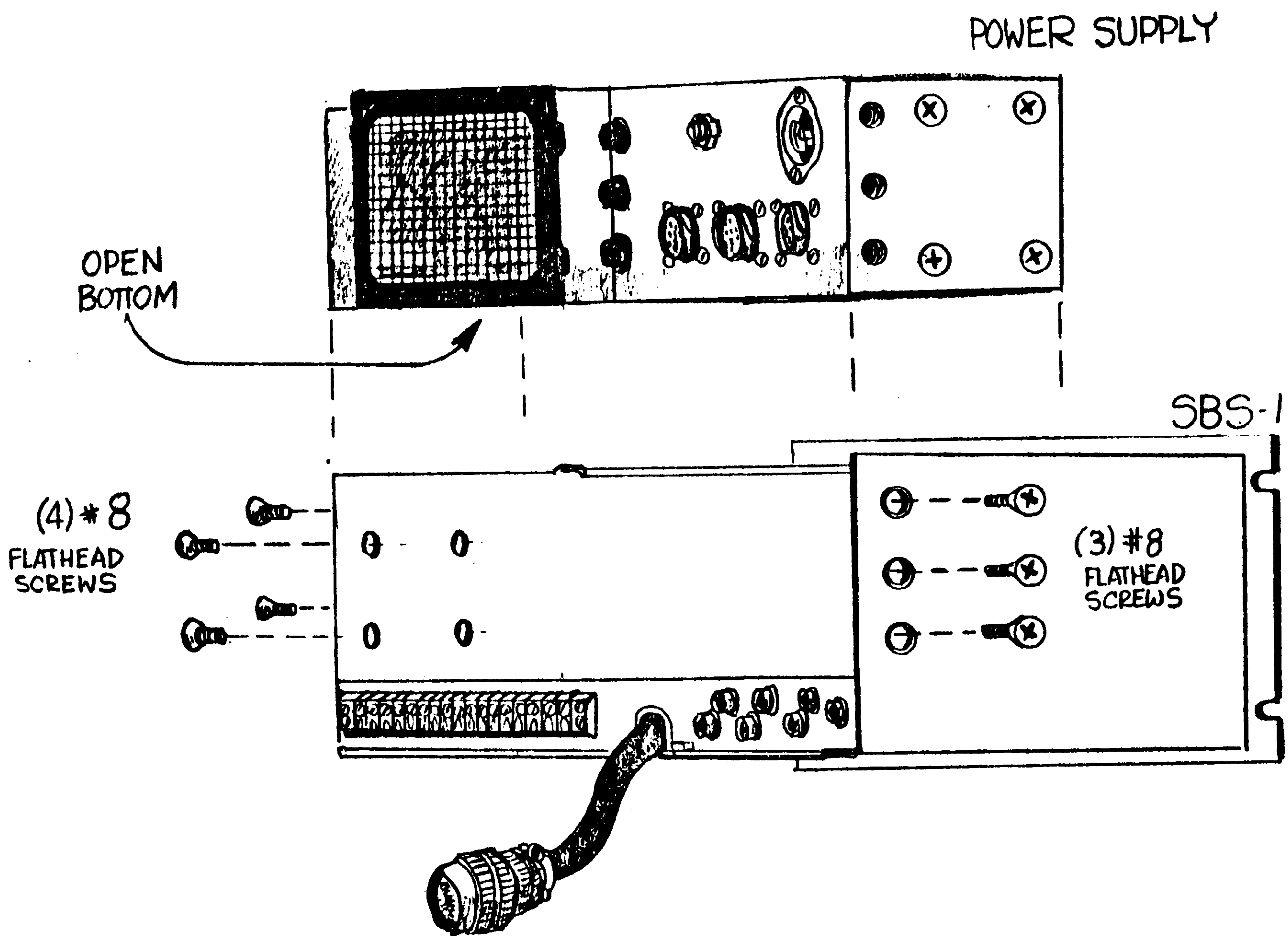
# FIG. 4.1.3 D.C. OUTPUT VOLTAGE VS. LOAD CURRENT



| | |
|---|---|
| DATE ____ SHEET 12 OF 14 | TMC SPECIFICATION NO. S657 |
| COMPILED / CHECKED | TITLE: FIG. 4.1.4 |
| APPROVED | |

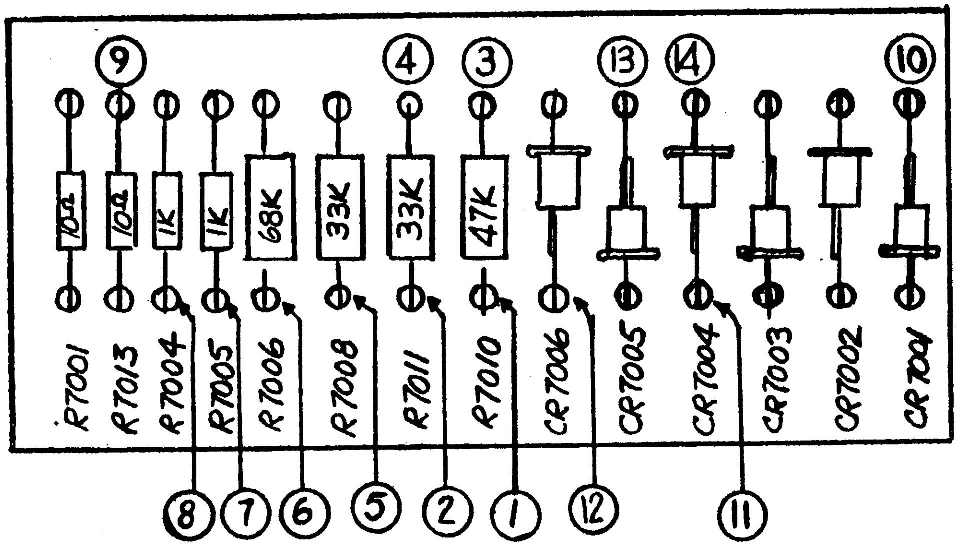


| DATE | TMC SPECIFICATION NO. S657 |
|---|---|
| SHEET 12 A OF 14 | |
| COMPILED / CHECKED RK | TITLE: FIG. 4.2.1 |
| APPROVED | |




SBS-1 Power Supply Removal

| DATE | TMC SPECIFICATION NO. S657 |
|---|---|
| SHEET 13 OF 14 | |
| COMPILED / CHECKED RK | TITLE: FIG. 4.2.2. |
| APPROVED RK | |




Voltage Measurement Chart for TB 7001

| FROM | TO | NORMAL D.C. VOLTAGE AT: NO LOAD | FULL LOAD | NORMAL AC VOLTAGE | REMARKS |
|---|---|---|---|---|---|
| TP #1 | GND | 380 | 290 | — | Plate of V7001 |
| TP #2 | GND | 380 | 290 | — | Plate of V7001 |
| TP #3 | GND | 130 | 195 | — | Plate of V7002 |
| TP #4 | GND | 320 | 270 | — | Screen of V7002 |
| TP #5 | GND | -105 | -105 | less than 1MV RMS | Output of bias supply See FIG. 4.1.4 |
| TP #6 | GND | 200 | 200 | less than 100 MV RMS | Output of B+ supply See FIG.4.1.2 and 4.1.3 |
| TP #7 | GND | 130 | 195 | — | Pin 1,V7001,Control Grid. |
| TP #8 | GND | 130 | 195 | — | Pin 4,V7001.Control Grid. |
| TP #9 | GND | -160 | -160 | | Output of bias rectifiers |

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| DATE | | TMC SPECIFICATION NO. S657 |
|---|---|---|
| SHEET 14 OF 14 | | |
| COMPILED | CHECKED RK | TITLE: FIG. 4.2.2 Continued |
| APPROVED Ron Kok | | |

## Voltage Measurement Chart for TB 7001

| FROM | TO | NORMAL D.C. VOLTAGE AT: NO LOAD | FULL LOAD | NORMAL AC VOLTAGE | REMARKS |
|---|---|---|---|---|---|
| TP #10 | TP #11 | — | — | 270 RMS | Input to B+ bridge rectifiers |
| TP #12 | TP #13 | — | — | 240 RMS | Full secondary voltage input to bias rectifiers |
| TP #14 | GND | 380 | 310 | — | Output of B+ bridge rectifiers. |

| | | |
|---|---|---|
| DATE 7/26/62<br>SHEET 1 OF 10 | | TMC SPECIFICATION NO. S 705 |
| N.P.<br>COMPILED | N.P.<br>CHECKED | TITLE: |
| APPROVED BP | | |

SBS-1 TEST PROCEDURE

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. STOCK NO. 439M

# TMC SPECIFICATION NO. S 705

| | | |
|---|---|---|
| N.P. COMPILED | CHECKED | TITLE: SBS-1 TEST PROCEDURE |
| APPROVED | | |

I TEST EQUIPMENT REQUIRED

A. 1-AC VTVM Balentine Model 314. (or equivalent)
B. 1-RF VTVM Hewlett Packard Model 410B. (or equivalent)
C. 1-RF generator Measurements Corporation Model 82. (or equivalent)
D. 1-Audio generator Hewlett Packard Model 200AB. (or equivalent)
E. 1-Counter Hewlett Packard Model 523C. (or equivalent)
F. 1-Audio analyzor Panoramic Model LP-1A. (or equivalent)
G. 1-TTG (two tone generator) (or equivalent)
H. 1-Oscilloscope Tektronix Model 515A. (or equivalent)
I. 1-50 ohm 1 watt resistor.
J. 2-600 ohm 1 watt resistors.

ADDITIONAL INFORMATION
Supporting test specifications, S-628 power supply and S-626, 250KC plug-in IF strip.

II PRELIMINARY

A. Inspect the unit for mechanical imperfections such as loose screws, terminal boards, etc.
B. Inspect for obvious wiring errors.
C. Check for B+ shorts with an ohmmeter.
D. Turn Power Switch to STAND-BY position, then plug unit into AC outlet. The filament of the power supply tubes, V-7001 and V-7002, should be on. STAND-BY lights should go on immediately
E. Turn power switch from STAND-BY to ON. 60 seconds ± 20 sec. after applying AC to the unit the fan and B+ should be on. POWER ON light should go on immediately and STAND-BY light should go off.
F. Check P+ on L-6803 of A-2232 terminal board, it should be +200 volts. Check B- on L-6805 of the same board, it should be -105 volts.

III 250KC OSCILLATOR

A. Turn AFC switch to the OFF position. This in effect engages the, 250KC crystal oscillator.
B. Turn the CHANNEL A DETECTION switch to the SSB position, and the CHANNEL B DETECTION switch to the AM position.
C. Connect VTVM to Pin 2 of V-6203, and adjust R-6249 for a reading of -1 volt.
D. Connect a counter to the output side (B1) of T-6204 (center conductor of coaxial cable is also on this point), and adjust C-6231 for 250,000 ± 1 cycle.
E. Check back to Pin 2 of V-6203 as in C. and re-adjust R-6249 if necessary. The final setting should be of C-6231 for the proper frequency reading on the counter.
F. Connect AC VTVM to the output of T-6204, it should be 1 volt ± 10%.

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G. With AC VTVM still connected as in F. turn the CHANNEL A DETECTION switch from SSB to AM. The output should drop to 0 volts. Leave in the AM position.

H. Turn the CHANNEL B DETECTION switch to the CW, then the SSB position. In both cases the AC VTVM should read approximately 1 volt.

## IV 705KC OSCILLATOR

A. With the AFC switch in the OFF position. The 705KC crystal oscillator is activated.

B. Connect VTVM to Pin 2 of V-6202, and adjust R-6215 for a reading of -1 volt.

C. Connect a counter to the output side (B1) of T-6203 (center conductor of coaxial cable is also on this point), and adjust C-6214 for 705,000 ± 1 cycle.

D. Check back to Pin 2 of V-6202 as in B. and re-adjust R-6215 if necessary. The final setting should be of C-6214 for the proper frequency.

E. Connect AC VTVM to the output of T-6213, it should be 1 volt ± 10%.

## V AGC COMPARATOR

A. Turn the AGC SELECTOR switch to the CH-A-B position.

B. Turn CHANNEL A & B AGC RESPONCE switches to the FAST position.

C. Connect the VTVM to Pin 2 then Pin 7 of V-6206, a reading of 0 volts should exist in both cases.

D. Rotate both pots R-6234 and R-6237 to the full clockwise position and place the VTVM on the slider arm of R-6234. Rotation of R-6234 should vary the DC voltage from a positive to negative voltage from CW to CCW position. Repeat the same operation with R-6237.

E. Adjust R-6234 to 0 DC volts with the VTVM on the slider arm of this pot and lock.

F. Place VTVM on the R-6237 slider arm, adjust to 0 DC volts and lock.

## VI AGC MANUAL CONTROL

A. Turn the AGC SELECTOR switch to the MANUAL position.

B. Connect the VTVM ON the post at the junction of CR-6202 and CR-6203 and rotate the AGC MANUAL control to the full clockwise position. The VTVM should read approximately 0 volts.

C. Rotation of the AGC control to the full CCW position will bring the voltage to -20 volts. Record the reading obtained on the test data sheet.

VII CONVERTER AND 250KC AMPLIFIER

A. Set the RF generator for 250KC and 10MV output. Connect to J-6800, the low Z input, and the AC VTVM on Pin 9 of V-6200. Rotate R-6800 to full CW position, AFC switch to ON and AGC MANUAL control to maximum.
B. Connect a temporary clip lead jumper from Pin 1 of V-6201 to ground. This is to prevent interaction of the secondary to the primary of T-6200.
C. Tune the top slug on T-6200 for maximum indication.
D. Remove jumper line connected in B and adjust bottom slug for minimum indication on meter. Remove AC VTVM and adjust RF generator output for 1MV.
E. Connect AC VTVM to J-6804. Adjust slug on T-6201 for maximum indication on VTVM. Meter should read approximately 7 millivolts. Record on test data sheet.
F. Connect VTVM to J-6801 HI Z input. With 1MV on J-6800, there should be 2 to 3 millivolts on J-6801. Rotation of R-6800 in the CCW direction should reduce the reading to zero volts. Rotate R-6800 back to full clockwise position. Record voltage on test data sheet.
G. Converter and 250KC Response.

a. Set the RF generator for 455KC and 1MV output, AFC switch to OFF position.
b. Connect AC VTVM as in VII E. Turn CHANNEL A DETECTION switch to SSB and CHANNEL B DETECTION switch to AM.
c. Vary the frequency of the signal generator 15KC above and below 455KC. Record the 3db drop off points. Subtracting the two frequencies will give the overall bandpass of 24KC or greater.

VIII IF AMPLIFIER OUTPUT

A. The bandpass of the crystal filters may vary with the different customer orders. The 3.5KC and 7.5KC filters are more widely used and are illustrated in this procedure. The position of the filters in relation to USB and LSB may also vary with customer orders. In this procedure the USB and LSB IF strips are plugged in as follows: 7.5KC USB IF strip to J-6000. 3.5KC LSB IF strip to J-6002, 3.5KC USB IF strip to J-6001, 7.5KC LSB IF strip to J-6003.
B. Turn the AGC SELECTOR switch to the CH-A-B position.
C. Turn CHANNEL A and B IF BANDWIDTH switches to the 7.5KC LSB position and connect AC VTVM to J-102 of the 7.5KC USB IF strip.
D. Vary the RF generator approximately 1KC below 455KC and adjust for 10MV output.

E. The VTVM should show a peak of 1 volt. If this does not occur, set R-116 for 1 volt and remove VTVM.

F. Turn CHANNEL A and B IF BANDWIDTH switches to the 3.5KC LSB position. Connect AC VTVM to J-102 of the 3.5KC USB IF strip and proceed as in step D and E.

G. Turn CHANNEL A and B IF BANDWIDTH switches to the 3.5KC USB position and connect AC VTVM to J-102 of the 3.5KC LSB IF strip.

H. Vary the RF generator approximately 1KC above 455KC and proceed as in step E.

I. Turn CHANNEL A and B IF BANDWIDTH switches to the 7.5KC USB position. Connect AC VTVM to J-102 of the 7.5KC LSB IF strip and proceed as in step E and H.

IX CHANNEL A AND B AMPLIFIERS

A. Connect 50 ohm load on J-6806 CH-A output.

B. Readjust RF generator for 1MV output.

C. Connect AC VTVM across 50 ohm load and tune T-6205 for maximum indication on VTVM. The reading should be approximately 1 volt, and recorded on test data sheet.

D. Connect 50 ohm load on J-6805 CH-B output.

E. Connect AC VTVM across 50 ohm load and tune T-6206 for maximum indication on VTVM. The reading should be approximately 1 volt, and recorded on test data sheet.

X AUDIO CHANNELS, A & B

A. Connect one 600 ohm 1 watt resistor between terminals 7 and 9 and one between terminals 17 and 19 of E-6800. Turn CHANNEL A and B DETECTION switches to SSB. Adjust CHANNEL A and B LEVEL controls for OVU or 100% on the meters.

B. Connect AC VTVM between terminals 2 and 4 of E-6800 (CHANNEL A). It should read approximately 23 volts. Record on test data sheet.

C. Connect AC VTVM between terminals 12 and 14 of E-6800 (CHANNEL B). It should read approximately 23 volts. Record on test data sheet.

D. Remove RF generator from J-6800. Switch AC VTVM to a low range and adjust R-6073 (CHANNEL B hum balance control) for minimum reading. It should read 230MV or less. Record on test data sheet. Turn CHANNEL B DETECTION switch to AM. The VTVM should read approximately 23MV. Record on test data sheet. Turn CHANNEL B DETECTION switch to SSB position.

E. Connect AC VTVM between terminals 2 and 4 of E-6800 and adjust R-6036 (CHANNEL A hum balance control) for minimum reading. It should read 230MV or less. Record on test data sheet. Turn CHANNEL A DETECTION switch to AM. The VTVM should read approximately 23MV. Record on test data sheet. Turn CHANNEL A DETECTION switch to SSB position.

F. Connect Audio generator on the post of R-6005, (15K resistor to 6S4 grid) and set frequency at 1KC and 2.5 MV output. Adjust CHANNEL A and B LEVEL controls for 0VU or 100% on the meters. Connect scope between terminals 2 and 4 of E-6800.

G. Vary the Audio generator above and below 1KC. The 3db points should be 200 cycles or lower and 10KC or higher. A clean sine wave should appear on the scope. Record on test data sheet.

H. Connect AC VTVM and scope between terminals 12 and 14 of E-6800 (CHANNEL B) and repeat step G.

I. Replace Audio generator with TTG. Set controls as follows:
   1. POWER switch to ON.
   2. RF TONE SELECTOR to OFF.
   3. AUDIO TONE SELECTOR to TWO TONE.
   4. AUDIO OUTPUT control for 2.5MV output.

J. Adjust CHANNEL A and B LEVEL controls for 0VU or 100% on the meters.

K. Connect Audio analyzor or between terminals 2 and 4 of E-6800 (CHANNEL A). Set controls as follows:
   1. POWER switch ON.
   2. VERT. CALIB. SELECTOR to DB.
   3. SWEEP RANGE SELECTOR to 20KC LOG.
   4. SCALE SELECTOR to 0.5.
   5. INPUT MULT. to X1K.
   6. INPUT POT., Set the control so that the top of the two tones is on the + 20DB line of the screen. The total distortion products should be 40db down. Record on test data sheet.

L. Connect Audio analyzor between terminals 12 and 14 of E-6800 (CHANNEL B) and repeat step K-6. Remove TTG and Audio analyzor.

XI PHONE MONITOR

A. Connect RF generator to J-6800. Connect earphones to MONITOR jack. Adjust CHANNEL A and B LEVEL controls for 0VU or 100% on the meters.

B. A 1KC tone should be heard on the phones, in the full CW and full CCW position of the MONITOR control.

C. Turn CHANNEL A IF BANDWIDTH switch to 7.5KC LSB and rotate MONITOR control to full CW position. The 1KC tone should be heard on the phones.

D. Connect AC VTVM to J-6202 MONITOR jack. It should read approximately 2 volts. Record on test data sheet (CHANNEL A). Rotating control to full CCW position should yield no signal.

E. Turn CHANNEL A IF BANDWIDTH switch to 7.5KC USB position and the CHANNEL B IF BANDWIDTH switch to 7.5KC LSB position. The VTVM should read approximately 2 volts. Record on test data sheet (CHANNEL B). Rotating control to the full CW position should yield no signal. Remove RF generator from J-6800.

XII PRODUCT DETECTORS

A. Connect AC VTVM to the post of R-6005. There should be approximately 1 volt at 250KC on this post. Record on test data sheet.

B. Connect RF generator to the post of R-6074. Set generator for 249KC and .33 volts output.

C. Adjust LINE LEVEL control on CHANNEL A for 0VU or 100% on meter. Connect AC VTVM and scope to terminals 2 and 4 of E-6800. The VTVM should read approximately 23 volts and there should be a clean sine wave on the scope. Record on test data sheet.

D. Connect RF generator to the post of R-6075.

E. Adjust LINE LEVEL control on CHANNEL B for 0VU or 100% on meter. Connect AC VTVM and scope to terminals 12 and 14 of E-6800. The VTVM should read approximately 23 volts and there should be a clean sine wave on the scope. Record on test data sheet.

XIII AM DETECTORS

A. Turn CHANNEL A and B DETECTION switches to AM.

B. Adjust RF generator for 250KC with a 1KC 50% modulation and .33 volts output.

C. Connect RF generator to pin 3 of T-6002 on detector board A-2193. Adjust CHANNEL B LINE LEVEL control for 0VU or 100% on meters. The VTVM should read approximately 23 volts and there should be a clean sine wave on the scope. Record on test data sheet.

D. Connect AC VTVM and scope to terminals 2 and 4 of E-6800.

E. Connect RF generator to pin 3 of T-6000 on detector board A-2193. Adjust CHANNEL A LINE LEVEL control for OVU 100% on meter. The VTVM should read approximately 23 volts and there should be a clean sine wave on the scope. Record on test data sheet.

XIV Repeat step III. Record oscillator volts and frequency on test data sheet. Repeat step IV. Record oscillator volts an and frequency on test data sheet.

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MAMARONECK, N.Y.

SBS-1 TEST DATA SHEET #1

SERIAL NO.__________
MFG. NO.__________

AGC COMPARATOR

BALANCE POTENTIOMETER__________OK

AGC MANUAL CONTROL

AGC__________VOLTS.
AGC POTENTIOMETER__________OK

250KC CONVERTER AND AMPLIFIER

250KC AMPLIFIER OUTPUT__________VOLTS.
LOZ INPUT AND INPUT POTENTIOMETER__________OK
HIZ INPUT__________VOLTS.
RESPONSE: 3DB POINTS__________KC AND__________KC
BANDPASS__________KC.

CHANNEL A AND B IF AMPLIFIERS

CHANNEL A IF AMPLIFIER__________VOLTS.
CHANNEL B IF AMPLIFIER__________VOLTS.

AUDIO OUTPUT

CHANNEL A__________VOLTS.
CHANNEL B__________VOLTS.

HUM BALANCE

| | SSB | AM |
|---|---|---|
| CHANNEL A | __________MV | __________MV |
| CHANNEL B | __________MV | __________MV |

AUDIO FREQUENCY RESPONSE (3DB POINTS)

CHANNEL A__________CYCLES AND__________KC
CHANNEL A WAVESHAPE__________OK.
CHANNEL B__________CYCLES AND__________KC
CHANNEL B WAVESHAPE__________OK.

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SBS-1 TEST DATA SHEET #2

AUDIO DISTORTION

CHANNEL A ____________ DB.
CHANNEL B ____________ DB

PHONE MONITOR OUTPUT

CHANNEL A ____________ VOLTS
CHANNEL B ____________ VOLTS

PRODUCT DETECTORS

250KC PRODUCT DETECTION INJECTION ____________ VOLTS.

CHANNEL A ____________ OK
CHANNEL B ____________ OK

AM DETECTORS

CHANNEL A ____________ OK
CHANNEL B ____________ OK

250KC OSCILLATOR

OSCILLATOR ____________ VOLTS.
OSCILLATOR FREQUENCY ____________ CYCLES.

705KC OSCILLATOR

OSCILLATOR ____________ VOLTS.

OSCILLATOR FREQUENCY ____________ CYCLES

DATE ____________
TESTER ____________

| DATE 4/17/62<br>SHEET 1 OF 4 | TMC SPECIFICATION NO. S 628 |
|---|---|
| R.K. COMPILED / CHECKED | TITLE: SBS-1&2 POWER SUPPLY TEST PROCEDURE |
| APPROVED | |

SBS-1&2 POWER SUPPLY TEST PROCEDURE

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DATE 4-17-62
SHEET 2 OF 4

R.K. COMPILED — RK N.I. CHECKED — [signature] APPROVED [signature]

# TMC SPECIFICATION NO. S 628

TITLE: SBS-1&2 POWER SUPPLY TEST PROCEDURE

I INTRODUCTION: The SBS power supply is designed to furnish A, B+, C-, oven heater and primary AC voltages to TMC Models SBS-1, AFC-2 and HFR-1 when the SBS-1 is used in combination with either one or both of the other two. This test procedure should thoroughly insure proper operation of the power supply if passed successfully.

II EQUIPMENT REQUIRED:

1. AVO Meter, calibrated to ± 1%. Record on test data sheet.
2. DAVEN model 170 VTVM or equiv. Record on test data sheet.
3. Variac, 500 watts minimum power capability.
4. SBS Power Supply Test Jig.
5. Line cord.
6. Timing Device. (Watch, Clock etc.)

III PROCEDURE:

1. Connect the power cables extending from the rear of the Test Jig to the power supply under test.
2. Set S1 on the Test Jig to the OFF position.
3. Set S2 on the Test Jig to the AFC FIL. position.
4. Set the SBS switch to the INT. position.
5. Set the Variac output at 115 volts. Set the Variac OFF.
6. Connect the line cord from the Variac output to J7001 on the power supply under test.
7. Connect the AVOMETER between the GND and B+ test points on the Test Jig so as to read + 250 volts DC full scale.
8. Note the time on the timing device being used and set the Variac to ON. The following results should be obtained immediately:
   * a) The HFR AC indicator should light.
   * b) The AFC AC indicator should light.
   * c) The SBS OVEN HTR. indicator should light.
   d) The fan within the Test Jig should start running.

   After a period of not less than 30 seconds, the following should be obtained:
   * e) The fan within the power supply should start running.
   f) I2 on the Test Jig should light. (RED)
   g) The meter should read between 150 and 230 volts.
9.* Adjust the VOLTAGE ADJ. potentiometer on the power supply for a 200 volt reading on the meter.
10.* Remove all the B+ fuses from the Test Jig. The output should not vary more than ± 1 volt. Replace fuses.
11.* Vary the output of the Variac from 105 to 125 volts. The meter reading should not vary more than ± 1 volt.
12.* Set S2 to the HFR FIL. position. I2 should remain lit.
13.* Set S2 to the CHAN. B FIL. position. I2 should remain lit.
14.* Set S2 to the CHAN. A FIL. position. I2 should remain lit.

* RECORD ON TEST DATA SHEET.

15. * Set S2 to the FIL. LINE position. I2 should remain lit.
16. * Set S1 to the AFC C- position. I1 should light dimly.
17. * Set S1 to the AFC B+ position. I1 should light brightly.
18. * Repeat steps 15 & 16 for SBS and HFR B+ and C- positions.
19. * Return S1 to OFF and S2 to AFC FIL. I1 should go out but I2 should remain lit.
20. Remove the AVOMETER.
21. Set the AVOMETER to read -250 volts full scale.
22. * Place the meter between the GND and C- test points on the Test Jig. The meter should read -105 ± 5 volts.
23. * Vary the output voltage of the Variac from 105 to 125 volts. The meter should not vary more than ± 1 volt.
24. Remove the AVOMETER.
25. * Place the DAVEN VTVM between the GND and B+ test points on the Test Jig. The meter should read less than 50 millivolts.
26. * Place the DAVEN VTVM between the GND and C- test points on the Test Jig. The meter should read less than 5 MV. Remove meter.
27. Set S1 in any B+ position. I1 should light.
28. * Remove F7001 from the power supply. I1 should go out.
29. Set S1 in any C- position. I1 should light.
30. * Remove F7003 from the power supply. I1 should go out.
31. * Remove F7002 from the power supply. The following results should be obtained:
    a) All remaining indicators on the Test Jig should go out.
    b) The fans within the power supply and Test Jig should stop running.
32. Set Variac to OFF.
33. Replace fuses and remove all test equipment. This completes production testing of the SBS power supply.

* RECORD ON TEST DATA SHEET

| | |
|---|---|
| DATE 4/17/62<br>SHEET 4 OF 4 | TMC SPECIFICATION NO. S 628 |
| R.K. COMPILED / N.P. CHECKED | TITLE: SBS-1&2 POWER SUPPLY TEST PROCEDURE |
| APPROVED | |

THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y.

SBS-1&2 POWER SUPPLY TEST DATA SHEET

SERIAL NO.__________
MFG. NO.__________

| | | |
|---|---|---|
| 8. | (a) HFR 115VAC Voltage | ________ OK |
| | (b) AFC OVEN HTR. Voltage | ________ OK |
| | (c) SBS OVEN HTR. Voltage | ________ OK |
| | (e) TIME DELAY RELAY | ________ OK |
| 9. | B+ VOLTAGE ADJ. for 200 Volts | ________ OK |
| 10. | FULL LOAD TO NO LOAD, Regulation +1 Volt | ________ OK |
| 11. | VARIATION OF LINE VOLTAGE, Regulation ±1 Volt | ________ OK |
| 12. | HFR. FIL. | ________ OK |
| 13. | SBS CHAN. B FIL. | ________ OK |
| 14. | SBS CHAN. A FIL. | ________ OK |
| 15. | SBS FIL. LINE | ________ OK |
| 16. | AFC C- Voltage | ________ OK |
| 17. | AFC B+ Voltage | ________ OK |
| 18. | SBS & HFR B+&C- Voltage | ________ OK |
| 19. | AFC FIL. | ________ OK |
| 22. | C- VOLTAGE -105V +5 Volts | ________ VOLTS |
| 23. | C- VOLTAGE, Regulation +1 Volt | ________ OK |
| 25. | B+ HUM LEVEL (less than .05 Volts) | ________ VOLTS |
| 26. | C- HUM LEVEL (less than .005 Volts) | ________ VOLTS |
| 28. | B+ fuse check | ________ OK |
| 30. | C- fuse check | ________ OK |
| 31. | MAIN fuse check | ________ OK |

DATE__________
TESTER__________

DATE 5-16-62

SHEET ______ OF ______

# TMC SPECIFICATION NO. S 679

B

| | | |
|---|---|---|
| J. Steen | [illegible] | |
| COMPILED | CHECKED | TITLE: |
| [illegible] APPROVED | | |

AFC-2A AND AFC-3 TEST PROCEDURE

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| | |
|---|---|
| DATE 5-16-62 SHEET 1 OF 6 | TMC SPECIFICATION NO. S 679 (B) |
| J. Steen COMPILED / CHECKED | TITLE: AFC-2A AND AFC-3 TEST PROCEDURE |
| APPROVED | |

I **TEST EQUIPMENT REQUIRED:**

A. Standard Signal Generator, Measurements Model 82.
B. VTVM, Hewlett Packard 410B.
C. Frequency Counter, Hewlett Packard Model 524C.
D. Variable bias supply.
E. Regulated power supply Lamda Electronics Model 25 or SBS Power Supply or equivalent.

II **PROCEDURE:**

A. Power Distribution:

1. Disconnect power cable from J5001.
2. Make the following continuity check to ground from the circuit board at the rear of the unit.
   a. L5020 approximately 10K.
   b. L5021 approximately 300K.
   c. L5022 open.
   d. L5023 open.
   e. L5024 ½ ohm.
   f. L5025 ½ ohm.
3. Connect power cable to J5001.
4. Make the following voltage checks from the circuit board.
   a. D.C. voltage - L5020 to ground: +200V.
   b. D.C. voltage - L5021 to ground: -105V.
   c. A.C. voltage - L5022 to L5023: 110V A.C.
   d. A.C. voltage - L5025 to ground: 6.3V A.C.

B. Carrier Amplifier:

1. Controls:
   a. Carrier Selector to "RCC"
   b. Sensitivity to Maximum
   c. Threshold, R5020, fully counter-clockwise
2. Connect signal generator to J5000 & adjust for .3 V at 250KC ±5 CPS
3. Terminate J5002 with 50 ohm load.
4. Connect A.C. VTVM to pin 1 of V5001.
5. Adjust L5030 for maximum indication of VTVM.
6. Connect A.C. VTVM to pin 1 of V5002.
7. Adjust L5031 for maximum indication of VTVM.
8. Adjust signal generator to 300 micro-volts at 250KC ±5 CPS
9. Connect A.C. VTVM to J5002.
10. Adjust threshold R5020 until VTVM reads 1.0V.
11. Connect (-) D.C. VTVM to pin 1 of V5001.

12. VTVM should read approximately 0 volts (not more negative than 1.0 volt).
13. Check "Level Meter" it should now read approximately the dividing line between yellow and green.
14. Increase signal generator to 10K micro-volts.
15. VTVM should now read between -6V and -7V (record) at pin 1 of V5001.
16. Reduce "Sensitivity" until "Level" meter indicates the Center of the red scale. At this point the "Fade" relay and light should operate.
17. Remove VTVM and signal generator.

This completes the alignment of the Carrier Amplifier.

C. Low Frequnecy Oscillator:

This test is to be done prior to final assembly of 250KC oscillator. Plug oscillator into tested AFC. Carrier selector switch in oscillator position.

1. No signal in.
2. Plug P5006 into J5006. Connect counter to J5002.
3. Connect bias supply to positive side of C5077
4. Turn on B+.
5. Adjust bias until counter reads 250KC ± 1cps. Increase bias by 1 volt. Frequency should decrease by at least 50 cps. Return to 250KC point. Decrease bias by 1 volt. Frequency should increase by at least 50 cps. Return to 250KC point. Record frequencies.
6. Connect AC VTVM to J5002. Meter should read approximately 1 volt.
7. Connect DC VTVM to R5115. Meter should read approximately 2 volts.
8. This completes pre-testing of the oscillator

D. Low Frequency Amp Test:

1. Controls: Carrier selector in oscillator position. No signal in. Reset switch shorted.
2. Ground AGC at R5115. Turn on B+.
3. Connect AC VTVM to pin 1 of V5004. Tune L5033 for maximum indication.
4. Connect AC VTVM to pin 1 of V5003. Tune L5032 for maximum indication.
5. Remove AGC ground. Tune T5001 for minimum indication.
6. Connect AC VTVM to J5002. VTVM should read between 1 and 1.3 volts. (record)

NOTE: FOR FOLLOWING PROCEDURES THE OVEN MUST CYCLE FOR AT LEAST ONE HOUR.

7. Connect frequency counter to J5002. Tune L5008 to 250KC ± 1 cps.

8. Connect DC VTVM between wiper arm of R5031 and terminal 2 of T5003. Adjust R5031 for 0 VDC.
9. Connect DC VTVM to terminal 2 of T5003. Should read approximately 2.7 volts. (Record)
10. Connect AC VTVM to terminal 3 of T5003. Should read approximately 3 volts. (Record)
11. Adjust R5064 for equal DC voltage on pin 6 of V5007 and pin 6 of V5008, approximately 130 volts.
12. Adjust R5074 until Drift Meter reads zero at center scale.
13. Remove short from reset button. Inject 250KC at 100 microvolts from signal generator at J5000. Connect counter to J5002.
14. Vary frequency of signal generator by 50 cycles above and below 250KC. Oscillator should follow at J5002.

E. High Frequency Oscillator:
This test to be performed prior to final assembly of oscillator. Connect oscillator to tested AFC unit. (Note: Output Frequency of AFC-2A is 705 kc. Output Frequency of AFC-3 is 2 mc. Proper plug in coils must be used.)
1. No signal in.
2. Turn on B+. Connect counter to J5003.
3. Press reset button and adjust tuning knob for center frequency. Release reset button.
4. Connect bias supply to positive side of C5077.
5. Adjust bias until counter reads center frequency (i.e. 705KC ± 100 CPS for AFC-2A and 2MC ± 100 CPS for AFC-3). Increase bias by 1 volt. Frequency should increase by at least 1000 cycles. At this point the drift meter should swing to 1/2 the yellow scale. Return to center frequency. Decrease bias by 1 volt. Frequency should decrease by at least 1000 cycles. At this point the drift meter should swing to 1/2 the yellow scale. The drift alarm should light. Return to center frequency. Record frequencies.
6. Connect AC VTVM to J5003. The meter should read approximately 1 volt.
7. Connect DC VTVM to junction of L5037 and R5096. The meter should indicate approximately 2 volts. Disconnect bias supply.
8. This completes pre-testing of oscillator.

F. High Frequency Amp Test:

1. No signal in. Reset switch shorted.
2. Ground AGC at junction of L5037 and C5091. Turn on B+.
3. Connect AC VTVM to pin 1 of V5010. Tune Z5002 for maximum indication on the VTVM.
4. Connect AC VTVM to pin 1 of V5009. Tune Z5001 for maximum indication on the VTVM.
5. Remove AGC ground. Tune Z5003 for minimum indication on the VTVM.
6. Connect AC VTVM to J5003. VTVM should read approximately 1 volt. Record

NOTE: FOR THE FOLLOWING STEPS OVEN SHOULD CYCLE FOR AT LEAST ONE HOUR.

7. Connect frequency counter to J5003. Short reset switch. Adjust tuning cap-

# TMC SPECIFICATION NO. S- 679

B

J. STEEN
COMPILED
CHECKED
APPROVED

TITLE: AFC-2A and AFC-3 TEST PROCEDURE

acitor C509 for lowest frequency. (Knob on front panel labeled TUNING.) Loosen coupling of tuning shaft and adjust tuning pointer to +3 on front panel. Retighten shaft coupling.

8. Adjust TUNING to zero. Adjust L5029 for center frequency.
9. Turn tuning to ±3 position.
   Counter should vary at least ±3 kc.
10. Remove short from Reset Switch. Connect variable battery supply with (+) side to Reset Switch and (-) to chassis.
11. Adjust battery voltage for center frequency.
12. Vary supply by approximately 1 volt (+) and (-).
   Frequency should vary by 1 kc (+) and (-).

TMC SPECIFICATION NO. S -679 B

| COMPILED | CHECKED | TITLE: AFC-2A AND AFC-3 TEST PROCEDURE |
|---|---|---|
| APPROVED | | |

TEST DATA SHEET

| | | | | |
|---|---|---|---|---|
| III. | B15 | AGC voltage at pin 1 of V5002 | ________ | -7V |
| | C5 | Frequency at J5002 | ________ | 250KC |
| | C5 | Frequency at J5002 for increase in bias of 1 volt | ________ | 250KC-50CPS |
| | C5 | Frequency at J5002 for decrease in bias of 1 volt | ________ | 250KC +50CPS |
| | D6 | 250KC voltage at J5002 | ________ | 1 VOLT |
| | D9 | DC voltage at terminal 2 ot T5002 | ________ | 2.7 VOLTS |
| | D10 | AC Voltage at terminal 3 of T5003 | ________ | 3 VOLTS |
| | E4 | Frequency at J5003 | ________ | CENTER FREQ. |
| | E4 | Frequency at J5003 for increase in bias of 1 volt | ________ | CENTER FREQ.+1KC |
| | E4 | Frequency at J5003 for drcrease in bias of 1 volt | ________ | CENTER FREQ.-1KC |
| | F6 | AC voltage at J5002 | ________ | 1 VOLT |

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. STOCK NO. 439M

# TMC SPECIFICATION NO. S679 B

J. Steen
COMPILED

CHECKED

APPROVED

TITLE: AFC-2A AND AFC-3 TEST PROCEDURE

| | ACCEPT |
|---|---|
| Tuning Control | ____________ |
| Drift Meter | ____________ |
| Level Meter | ____________ |
| Threshold | ____________ |
| Sensitivity | ____________ |
| Tade Alarm | ____________ |
| Drift Alarm | ____________ |
| Phase Detector Balance | ____________ |
| Sensitivity Control | ____________ |

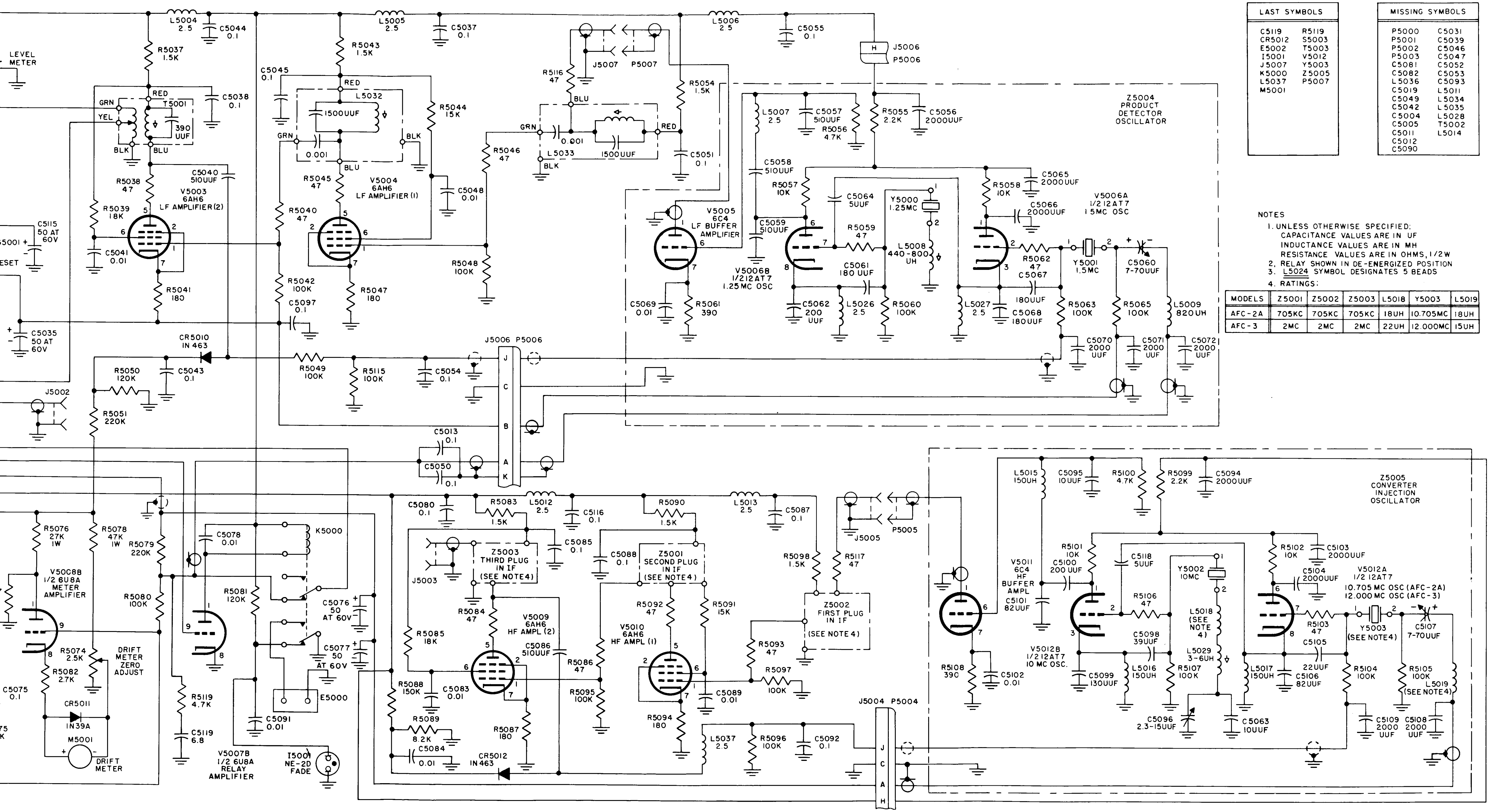
MFG. NO. ____________

SERIAL NO. ____________

DATE OF TEST ____________

TESTED BY ____________

OGILVIE PRESS, INC., BROOKLYN 17, N. Y. STOCK NO. 439M




| LAST SYMBOLS | |
|---|---|
| C5119 | R5119 |
| CR5012 | S5003 |
| E5002 | T5003 |
| I5001 | V5012 |
| J5007 | Y5003 |
| K5000 | Z5005 |
| L5037 | P5007 |
| M5001 | |

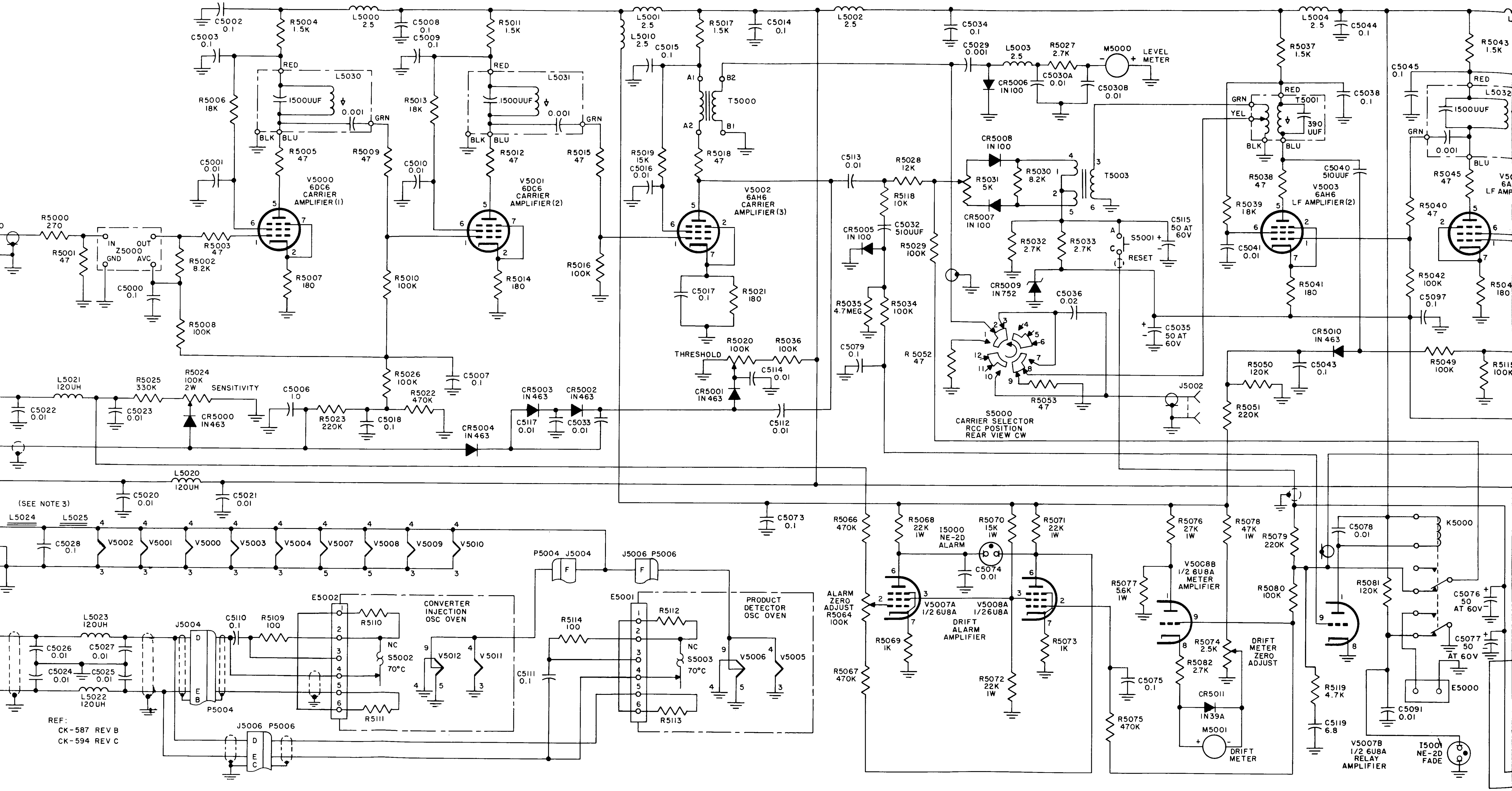
| MISSING SYMBOLS | |
|---|---|
| P5000 | C5031 |
| P5001 | C5039 |
| P5002 | C5046 |
| P5003 | C5047 |
| C5081 | C5052 |
| C5082 | C5053 |
| L5036 | C5093 |
| C5019 | L5011 |
| C5049 | L5034 |
| C5042 | L5035 |
| C5004 | L5028 |
| C5005 | T5002 |
| C5011 | L5014 |
| C5012 | |
| C5090 | |

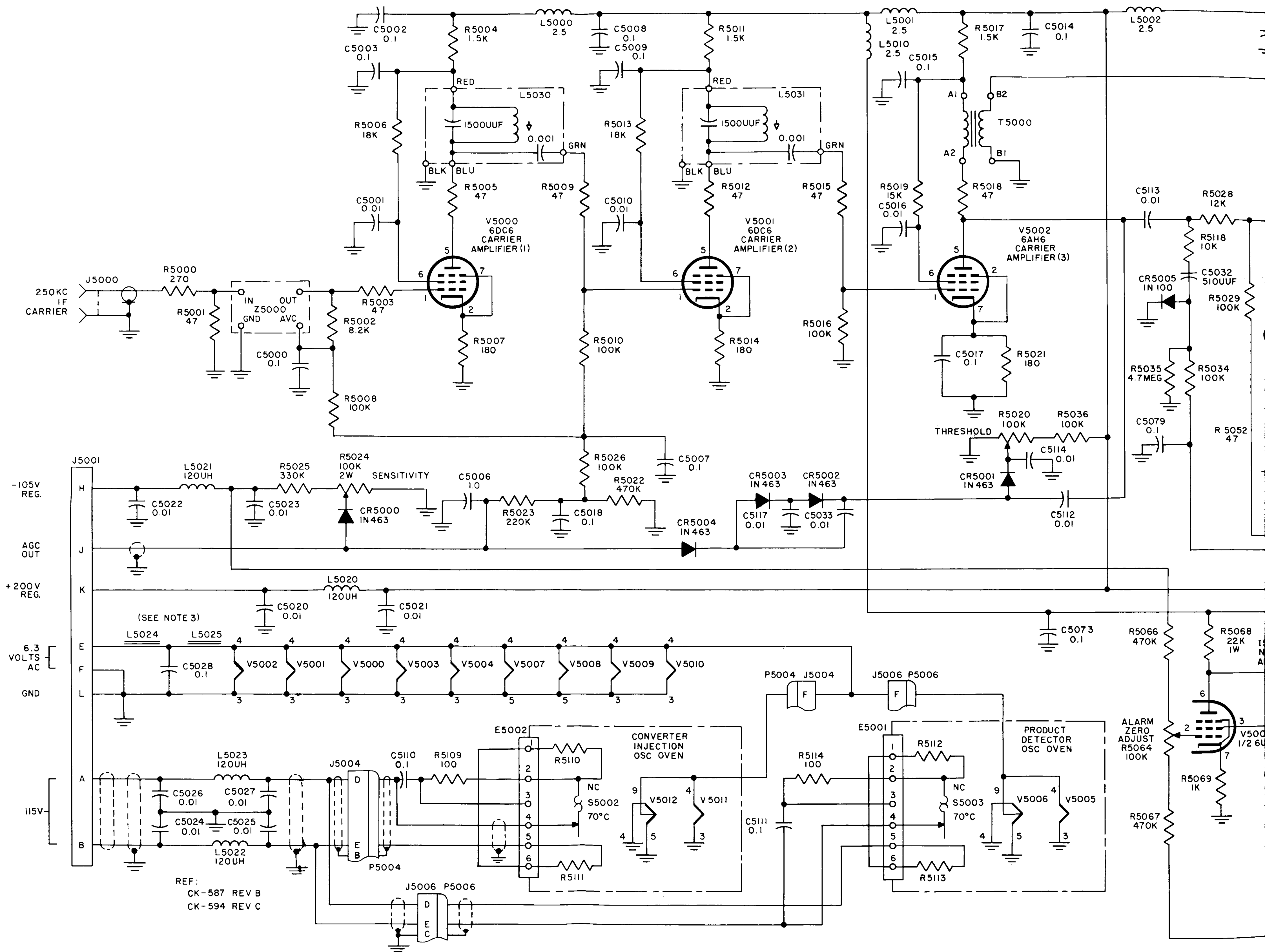
NOTES

1. UNLESS OTHERWISE SPECIFIED: CAPACITANCE VALUES ARE IN UF INDUCTANCE VALUES ARE IN MH RESISTANCE VALUES ARE IN OHMS, 1/2W
2. RELAY SHOWN IN DE-ENERGIZED POSITION
3. L5024 SYMBOL DESIGNATES 5 BEADS
4. RATINGS:

| MODELS | Z5001 | Z5002 | Z5003 | L5018 | Y5003 | L5019 |
|---|---|---|---|---|---|---|
| AFC-2A | 705KC | 705KC | 705KC | 18UH | 10.705MC | 18UH |
| AFC-3 | 2MC | 2MC | 2MC | 22UH | 12.000MC | 15UH |

Automatic Frequency Control AFC-2A and AFC-3, Schematic Diagram


V5000 6DC6 CARRIER AMPLIFIER (1)
V5001 6DC6 CARRIER AMPLIFIER (2)
V5002 6AH6 CARRIER AMPLIFIER (3)
V5003 6AH6 LF AMPLIFIER (2)
LEVEL METER
M5000
T5000
T5001
T5003
L5030
L5031
L5032
S5001 RESET
S5000 CARRIER SELECTOR RCC POSITION REAR VIEW CW
THRESHOLD
SENSITIVITY
Z5000
IN OUT GND AVC
J5002
K5000
E5000
T5001 NE-2D FADE
V5007B 1/2 6U8A RELAY AMPLIFIER
DRIFT METER ZERO ADJUST
DRIFT METER
M5001
V5008B 1/2 6U8A METER AMPLIFIER
V5008A 1/2 6U8A
V5007A 1/2 6U8A DRIFT ALARM AMPLIFIER
I5000 NE-2D ALARM
ALARM ZERO ADJUST R5064 100K
PRODUCT DETECTOR OSC OVEN
CONVERTER INJECTION OSC OVEN
S5003 70°C
S5002 70°C
E5001
E5002
J5006 P5006
P5004 J5004
(SEE NOTE 3)
REF: CK-587 REV B CK-594 REV C



250KC IF CARRIER
J5000
R5000 270
R5001 47
Z5000 IN OUT GND AVC
R5003 47
R5002 8.2K
C5000 0.1
R5008 100K
C5002 0.1
C5003 0.1
R5004 1.5K
R5006 18K
C5001 0.01
L5030
1500UUF
0.001
RED
BLK
BLU
GRN
R5005 47
V5000 6DC6 CARRIER AMPLIFIER (1)
R5007 180
L5000 2.5
C5008 0.1
C5009 0.1
R5009 47
R5010 100K
R5011 1.5K
R5013 18K
C5010 0.01
L5031
R5012 47
V5001 6DC6 CARRIER AMPLIFIER (2)
R5014 180
R5015 47
R5016 100K
L5001 2.5
L5010 2.5
C5015 0.1
R5019 15K
C5016 0.01
R5017 1.5K
C5014 0.1
T5000
A1 A2 B1 B2
R5018 47
V5002 6AH6 CARRIER AMPLIFIER (3)
C5017 0.1
R5021 180
THRESHOLD
R5020 100K
R5036 100K
C5114 0.01
CR5001 IN463
L5002 2.5
C5113 0.01
R5028 12K
R5118 10K
C5032 510UUF
CR5005 IN 100
R5029 100K
R5035 4.7MEG
R5034 100K
C5079 0.1
R 5052 47
C5112 0.01
J5001
-105V REG.
AGC OUT
+200V REG.
6.3 VOLTS AC
GND
115V
H J K E F L A B
L5021 120UH
C5022 0.01
R5025 330K
C5023 0.01
R5024 100K 2W
SENSITIVITY
CR5000 IN463
C5006 1.0
R5023 220K
C5018 0.1
R5026 100K
R5022 470K
C5007 0.1
CR5004 IN463
CR5003 IN463
CR5002 IN463
C5117 0.01
C5033 0.01
L5020 120UH
C5020 0.01
C5021 0.01
(SEE NOTE 3)
L5024
L5025
C5028 0.1
V5002 V5001 V5000 V5003 V5004 V5007 V5008 V5009 V5010
C5073 0.1
L5023 120UH
C5026 0.01
C5027 0.01
C5024 0.01
C5025 0.01
L5022 120UH
J5004
P5004
C5110 0.1
R5109 100
E5002
R5110
R5111
NC
S5002 70°C
CONVERTER INJECTION OSC OVEN
V5012
V5011
J5006 P5006
P5004 J5004
C5111 0.1
R5114 100
E5001
R5112
R5113
S5003 70°C
PRODUCT DETECTOR OSC OVEN
V5006
V5005
R5066 470K
R5068 22K 1W
ALARM ZERO ADJUST R5064 100K
R5069 1K
R5067 470K
REF: CK-587 REV B CK-594 REV C


003634003B

CH-215

NC - No Connection
NA - Not Applicable

# VOLTAGE CHART SBS-1

| TUBE SYMBOL | FUNCTION | TYPE | PIN 1 VOLTS | PIN 2 VOLTS | PIN 3 VOLTS | PIN 4 VOLTS | PIN 5 VOLTS | PIN 6 VOLTS | PIN 7 VOLTS | PIN 8 VOLTS | PIN 9 VOLTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| V6200 | Mixer | 6S4 | NC | +10.5 / 0.75AC | 0 | 6.3AC | 0 | 0 | NC | NC | +190 / 0.3AC |
| V6201 | 250 KC Ampl | 6BA6 | 0 | +1.65 | 6.3AC | 0 | +185 | +58 | +1.65 | NA | NA |
| V6202A | Osc. | 1/2 6AW8 | +2.8 / 3.3AC | -1.0 / 5.0AC | +125 | 6.3AC | 0 | NA | NA | NA | NA |
| V6202B | Ampl | 1/2 6AW8 | NA | NA | NA | 6.3AC | 0 | +1.85 / 0.45AC | 0.74AC | +105 | +140 / 7.5AC |
| V6203A | 250 KC Osc | 1/2 6AW8 | +0.42 / 6.0AC | -1.0 / 6.0AC | +125 | 6.3AC | 0 | NA | NA | NA | NA |
| V6203B | 250 KC Ampl | 1/2 6AW8 | NA | NA | NA | 6.3AC | 0 | +2.1 / 0.35AC | -0.74 / 0.58AC | +80 | +125 / 10.5AC |
| V6204 | Chan A Ampl | 6BA6 | 0 | +2.7 | 6.3AC | 0 | +175 / 1.2AC | +120 | +2.7 | NA | NA |
| V6205 | Chan B Ampl | 6BA6 | 0 | +2.9 | 6.3AC | 0 | +170 / 1.0AC | +120 | +2.9 | NA | NA |
| V6206 | AGC Comparator | 12AX7 | +200 | 0 | +1.6 | 6.3AC | 6.3AC | +200 | 0 | +1.8 | 0 |
| V6000 | Product Det Chan A | 6S4 | NC | +1.75 | 0.8AC | 3.0AC* | 3.3AC* | 0.8AC | NC | NC | +60 / 1.5AC |
| V6001A | 1st Audio Ampl Ch A | 1/2 12AX7 | NA | NA | NA | 3.0AC* | 3.0AC* | +95 | -0.1 | +0.45 | 3.3AC* |
| V6001B | 2nd Audio Ampl Ch A | 1/2 12AX7 | +125 | 0 | +0.75 | 3.0AC* | 3.0AC* | NA | NA | NA | 3.3AC* |
| V6002A | 3rd Audio Ampl Ch A | 1/2 12AX7 | NA | NA | NA | 3.0AC* | 3.0AC* | +170 | 0 | +0.95 | 3.3AC* |
| V6002B | Phase Inverter Ch A | 1/2 12AX7 | +190 | +13 | +16 | 3.0AC* | 3.0AC* | NA | NA | NA | 3.3AC* |
| V6003 | Power Ampl Chan A | 6AK6 | 0 | +10 | 3.0AC* | 3.3AC* | +200 / 1.0AC | +200 | +10 | NA | NA |
| V6004 | Power Ampl Chan A | 6AK6 | 0 | +10 | 3.0AC* | 3.3AC* | +198 / 1.0AC | +200 | +10 | NA | NA |
| V6005 | Product Det Chan B | 6S4 | NC | +1.8 | 0.8AC | 3.0AC# | 3.3AC# | 0.8AC | NC | NC | +61 / 1.3AC |
| V6006A | 1st Audio Ampl Ch B | 1/2 12AX7 | NA | NA | NA | 3.3AC# | 3.3AC# | +95 | 0 | +0.55 | 3.0AC# |
| V6006B | 2nd Audio Ampl Ch B | 1/2 12AX7 | +125 | 0 | +0.68 | 3.3AC# | 3.3AC# | NA | NA | NA | 3.0AC# |
| V6007A | 3rd Audio Ampl Ch B | 1/2 12AX7 | NA | NA | NA | 3.3AC# | 3.3AC# | +170 | 0 | +1.0 | 3.0AC# |
| V6007B | Phase Inverter Ch B | 1/2 12AX7 | +190 | +15 | +17 | 3.3AC# | 3.3AC# | NA | NA | NA | 3.0AC# |
| V6008 | Power Ampl Chan B | 6AK6 | 0 | +10 | 3.3AC# | 3.0AC# | +198 / 1.3AC | +200 | +10 | NA | NA |
| V6009 | Power Ampl Chan B | 6AK6 | 0 | +10 | 3.3AC# | 3.0AC# | +198 / 1.0AC | +200 | +10 | NA | NA |

CONDITIONS:
1. Both detection switches in SSB position.
2. AFC switch in Off position.
3. Both AGC response switches in Fast position.
4. IF bandwidth KC switch (Channel A) in 7.5 KC LSB position.
5. IF bandwidth KC switch (Channel B) in 7.5 KC USB position.
6. AGC selector switch in Ch-A-B position.
7. Monitor gain control in 0 position.
8. AGC manual control fully CW.
9. Line voltage of 110@60 CPS.
10. Power switch in On position.
11. Voltage measurements taken under the above operating conditions with no audio or RF external inputs.
12. Hewlett Packard model 410 BR VTVM used for measurements.
13. All voltages taken with respect to chassis ground.

* Voltage dependent upon setting of R6036

\# Voltage dependent upon setting of R6073

| REQ. | ITEM | PART NO. | DESCRIPTION | SYMB L |
|---|---|---|---|---|

STOCK SIZE

MATERIAL

TYPE & TEMPER | HEAT TREAT. SPEC.

FINISH & SPEC. NO.

THE TECHNICAL MATERIEL CORP.
MAMARONECK, NEW YORK

VOLTAGE CHART SBS-1

DRAWN | CHECKED: RUZZO | FINAL APPROVAL

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

CH-215

| SYM | DESCRIPTION | DATE | CH. NO. | DRAFTS | CHECKER | ENG. APP. |
|---|---|---|---|---|---|---|

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 1/2°

A

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 | SECTION | ASS'Y. NO. | DATE |
|---|---|---|---|---|
| | SBS-1 | | | 2-16-62 |

USED ON

CH-216

NC - No Connection
NA - Not Applicable
K - 1,000

# RESISTANCE CHART SBS-1

| TUBE SYMBOL | FUNCTION | TYPE | PIN 1 OHMS | PIN 2 OHMS | PIN 3 OHMS | PIN 4 OHMS | PIN 5 OHMS | PIN 6 OHMS | PIN 7 OHMS | PIN 8 OHMS | PIN 9 OHMS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| V6200 | Mixer | 6S4 | NC | 4K | 10K | 0 | 0 | 10K | NC | NC | 9K |
| V6201 | 250 KC Ampl | 6BA6 | 330K | 390 | 0 | 0 | 9K | 22K | 390 | NA | NA |
| V6202A | Oscillator | ½ 6AW8 | 1 to 5K | 100K | 49K | 0 | 0 | NA | NA | NA | NA |
| V6202B | Amplifier | ½ 6AW8 | NA | NA | NA | 0 | 0 | 150 | 10K | 24K | 8.5K |
| V6203A | 250 KC Oscillator | ½ 6AW8 | 1 to 5K | 100K | 30K | 0 | 0 | NA | NA | NA | NA |
| V6203B | 250 KC Amplifier | ½ 6AW8 | NA | NA | NA | 0 | 0 | 150 | 100K | 24K | 9K |
| V6204 | Chan A Amplifier | 6BA6 | 45 | 220 | 0 | 0 | 7K | 27K | 220 | NA | NA |
| V6205 | Chan B Amplifier | 6BA6 | 45 | 220 | 0 | 0 | 7K | 25K | 220 | NA | NA |
| V6206 | AGC Comparator | 12AX7 | 3.7K | 380K | 130K | 0 | 0 | 3.7K | 380K | 130K | 0 |
| V6000 | Product Detector Ch A | 6S4 | NC | 400 | 15K | 30* | 30* | NC | NC | NC | 30K |
| V6001A | 1st Audio Ampl Chan A | ½ 12AX7 | NA | NA | NA | 30* | 30* | 35K | 1 Meg | 1K | 30* |
| V6001B | 2nd Audio Ampl Chan A | ½ 12AX7 | 45K | 7 to 110K | 1K | 30* | 30* | NA | NA | NA | 30* |
| V6002A | 3rd Audio Ampl Chan A | ½ 12AX7 | NA | NA | NA | 30* | 30* | 35K | 1 Meg | 1K | 30* |
| V6002B | Phase Inverter Chan A | ½ 12AX7 | 40K | 1 Meg | 45K | 30* | 30* | NA | NA | NA | 30* |
| V6003 | Power Ampl Chan A | 6AK6 | 480K | 330 | 30* | 30* | 3K | 2.4K | 330 | NA | NA |
| V6004 | Power Ampl Chan A | 6AK6 | 500K | 330 | 30* | 30* | 3K | 2.4K | 330 | NA | NA |
| V6005 | Product Detector Ch B | 6S4 | NC | 400 | 15K | 30# | 30# | NC | NC | NC | 30K |
| V6006A | 1st Audio Ampl Chan B | ½ 12AX7 | NA | NA | NA | 30# | 30# | 35K | 1 Meg | 1K | 30# |
| V6006B | 2nd Audio Ampl Chan B | ½ 12AX7 | 45K | 7 to 110K | 1K | 30# | 30# | NA | NA | NA | 30# |
| V6007A | 3rd Audio Ampl Chan B | ½ 12AX7 | NA | NA | NA | 30# | 30# | 35K | 1 Meg | 1K | 30# |
| V6007B | Phase Inverter Chan B | ½ 12AX7 | 40K | 1 Meg | 45K | 30# | 30# | NA | NA | NA | 30# |
| V6008 | Power Ampl Chan B | 6AK6 | 450K | 330 | 30# | 30# | 3K | 2.4K | 330 | NA | NA |
| V6009 | Power Ampl Chan B | 6AK6 | 500K | 330 | 30# | 30# | 3K | 2.4K | 330 | NA | NA |

CONDITIONS:

1. Both detection switches in SSB position.
2. AFC switch in Off position.
3. Both AGC response switches in Fast position.
4. IF bandwidth KC switch (Channel A) in 7.5 KC LSB position.
5. IF bandwidth KC switch (Channel B) in 7.5 KC USB position.
6. AGC selector switch in Ch-A-B position.
7. Monitor gain control in 0 position.
8. AGC Manual control fully CW.
9. No input power.
10. Power switch in Stand by position.
11. Hewlett Packard model 410 BR VTVM used for measurements.
12. All measurements taken with respect to chassis ground.

* Value obtained with R6036 at approximately mid rang

\# Value obtained with R6073 at approximately mid rang

| REQ. | ITEM | PART NO. | DESCRIPTION | SYMBOL |
|---|---|---|---|---|
| | | | | |

STOCK SIZE

MATERIAL

TYPE & TEMPER | HEAT TREAT. SPEC.

FINISH & SPEC. NO.

THE TECHNICAL MATERIEL CORP.
MAMARONECK, NEW YORK

RESISTANCE CHART SBS-1

| DRAWN | CHECKED | FINAL APPROVAL |
|---|---|---|
| [signature] | RUZZO | [signature] |

| ELEC. DES. APP. | MECH. DES. APP. | |
|---|---|---|
| [signature] | [signature] | CH-216 |

| SYM | DESCRIPTION | DATE | CH. NO. | DRAFTS | CHECKER | ENG. APP. |
|---|---|---|---|---|---|---|
| | | | | | | |

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 1/2°
A

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 | SECTION | ASS'Y. NO. | DATE |
|---|---|---|---|---|
| | SBS-1 | | | 2-19-62 |

USED ON

A

CH-217

STAGE GAIN MEASUREMENTS SBS-1

| TUBE SYMBOL | FUNCTION | TYPE | INPUT AC VOLTS | OUTPUT AC VOLTS | GAIN |
|---|---|---|---|---|---|
| V6200 | Mixer | 6S4 | Grid Pins 3,6-0.012<br>Cathode Pin 2-1.1 | Plate Pin 9-0.4 | NA |
| V6201 | 250 KC Amplifier | 6BA6 | Grid Pin 1-0.01 | Plate Pin 5-0.04 | 4 |
| V6202A | Oscillator | ½ 6AW8 | Grid Pin 2-6.0 | Cathode Pin 1-3.7 | 0.61 |
| V6202B | Amplifier | ½ 6AW8 | Grid Pin 7-0.8 | Plate Pin 9-10.0 | 12.5 |
| V6203A | 250 KC Oscillator | ½ 6AW8 | Grid Pin 2-3.0 | Cathode Pin 1-5.0 | NA |
| V6203B | 250 KC Amplifier | ½ 6AW8 | Grid Pin 7-0.5 | Plate Pin 9-19.0 | 38 |
| V6204 | Chan A Amplifier | 6BA6 | Grid Pin 1-0.9 | Plate Pin 5-15.0 | 16.65 |
| V6205 | Chan B Amplifier | 6BA6 | Grid Pin 1-0.9 | Plate Pin 5-15.0 | 16.65 |
| V6206 | AGC Comparator | 12AX7 | Grid Pin 2-0.045<br>Grid Pin 2-0.045 | Cathode Pin 3-0.0015<br>Cathode Pin 3-0.0015 | NA<br>NA |
| V6000 | Product Detector Channel A | 5814A | Grid Pins 2,7-1.25<br>Cath. Pins 3,8-0.085 | Plate Pins 1,6-2.0 | NA |
| V6001A | 1st Audio Ampl Chan A | ½ 12AX7 | Grid Pin 7-0.075 | Plate Pin 6-0.4 | 5.3 |
| V6001B | 2nd Audio Ampl Chan A | ½ 12AX7 | Grid Pin 2-0.085 | Plate Pin 1-0.35 | 4.1 |
| V6002A | 3rd Audio Ampl Chan A | ½ 12AX7 | Grid Pin 7-0.35 | Plate Pin 6-6.5 | 18.6 |
| V6002B | Phase Inverter Chan A | ½ 12AX7 | Grid Pin 2-6.5 | Plate Pin 1-5.5 | 0.85 |
| V6003 | Power Ampl Chan A | 6AK6 | Grid Pin 1-5.5 | Plate Pin 5-55.0 | 10 |
| V6004 | Power Ampl Chan A | 6AK6 | Grid Pin 1-5.5 | Plate Pin 5-55.0 | 10 |
| V6005 | Product Detector Channel B | 5814A | Grid Pins 2,7-1.25<br>Cath. Pins 3,8-0.09 | Plate Pins 1,6-2.0 | NA |
| V6006A | 1st Audio Ampl Chan B | ½ 12AX7 | Grid Pin 7-0.068 | Plate Pin 6-0.4 | 5.9 |
| V6006B | 2nd Audio Ampl Chan B | ½ 12AX7 | Grid Pin 2-0.085 | Plate Pin 1-0.4 | 4.7 |
| V6007A | 3rd Audio Ampl Chan B | ½ 12AX7 | Grid Pin 7-0.4 | Plate Pin 6-6.3 | 15.7 |
| V6007B | Phase Inverter Chan B | ½ 12AX7 | Grid Pin 2-6.3 | Plate Pin 1-5.0 | 0.79 |
| V6008 | Power Ampl Chan B | 6AK6 | Grid Pin 1-5.0 | Plate Pin 5-50.0 | 10 |
| V6009 | Power Ampl Chan B | 6AK6 | Grid Pin 1-5.0 | Plate Pin 5-50.0 | 10 |

NA - Not Applicable

CONDITIONS:

1. Both detection switches in SSB position.
2. AFC switch in Off position.
3. Both AGC response switches in Fast position.
4. IF bandwidth KC (Channel A) in 7.5 KC LSB position.
5. IF bandwidth KC (Channel B) in 7.5 KC USB position.
6. AGC selector switch in Ch-A-B position.
7. Monitor gain control in 0 position.
8. AGC manual control fully CW.
9. Line voltage of 110 @ 60 CPS.
10. Power switch in On position.
11. Terminals 4 & 5 jumped on E6800.
12. Terminals 14 & 15 jumped on E6800.
13. Insert 455 KC with 1KC modulated through J6800 (low input Z).
14. AC volt meter connected in turn to R6811 (Channel A) and R6812 (Channel B).
15. Input level should be such that the level meters should indicate 0 VU and the output, metered by the VTVM should be 23 volts.
16. Ballantine, model 314 AC voltmeter and measurements, model 82 signal generator were used.

| SYM | DESCRIPTION | DATE | CH. NO. | DRAFTS | CHECKER | ENG. APP. |
|---|---|---|---|---|---|---|
| A | ON V6000 & V6005 CHART GAIN MEASUREMENTS, TYPE, INPUT & OUTPUT CLARIFIED | 1-29-63 | 8086 | 6 DL | [illegible] | [illegible] |

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± 1/64 DECIMALS ± .005 ANGLES ± 1/2° A

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 | SECTION | ASS'Y. NO. | DATE |
|---|---|---|---|---|
| | SBS-1 | | | 2-16-62 |

USED ON

| REQ. | ITEM | PART NO. | DESCRIPTION | SYMBOL |
|---|---|---|---|---|

STOCK SIZE

MATERIAL

TYPE & TEMPER | HEAT TREAT. SPEC.

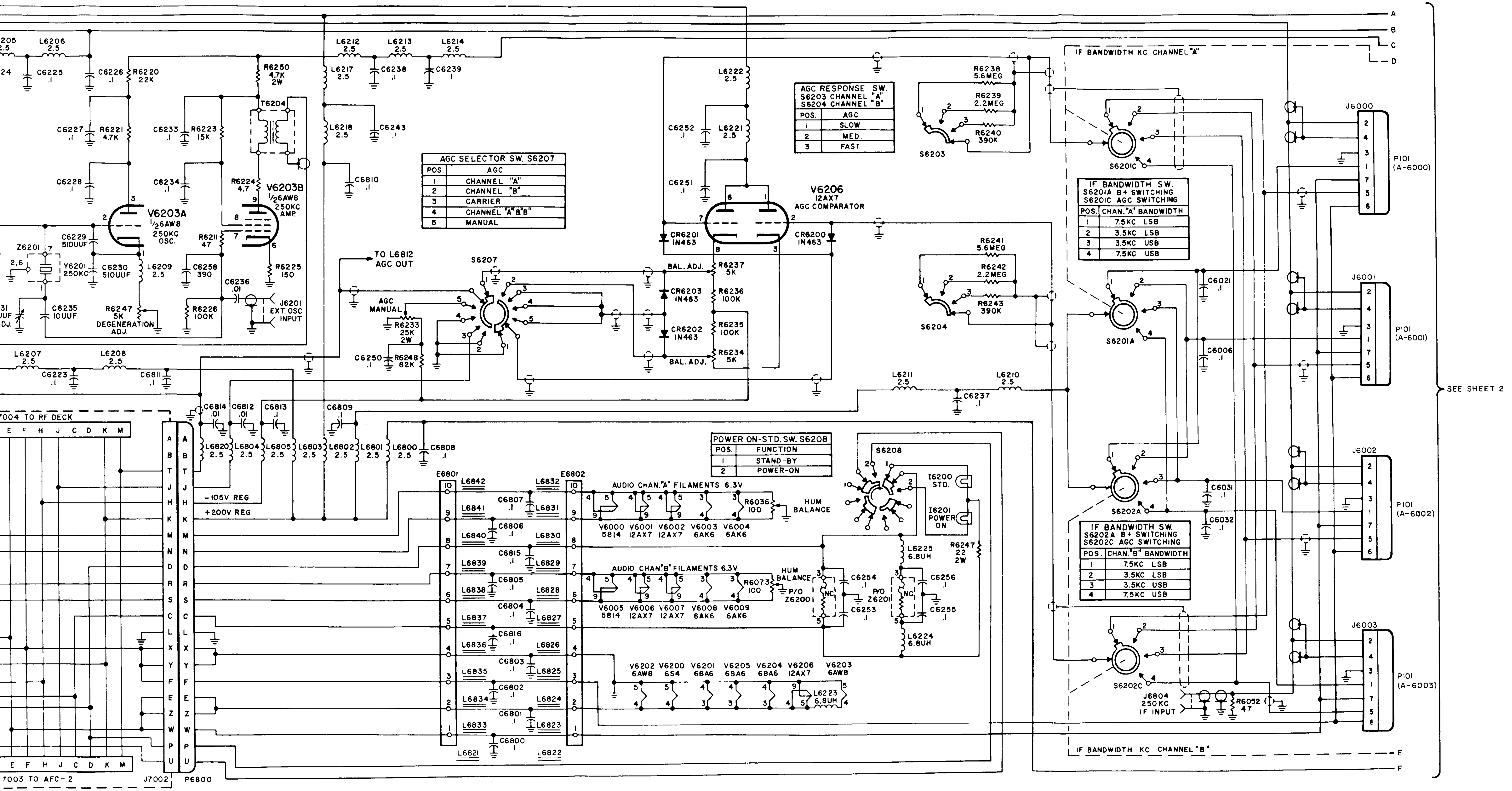
FINISH & SPEC. NO.

THE TECHNICAL MATERIEL CORP.
MAMARONECK, NEW YORK

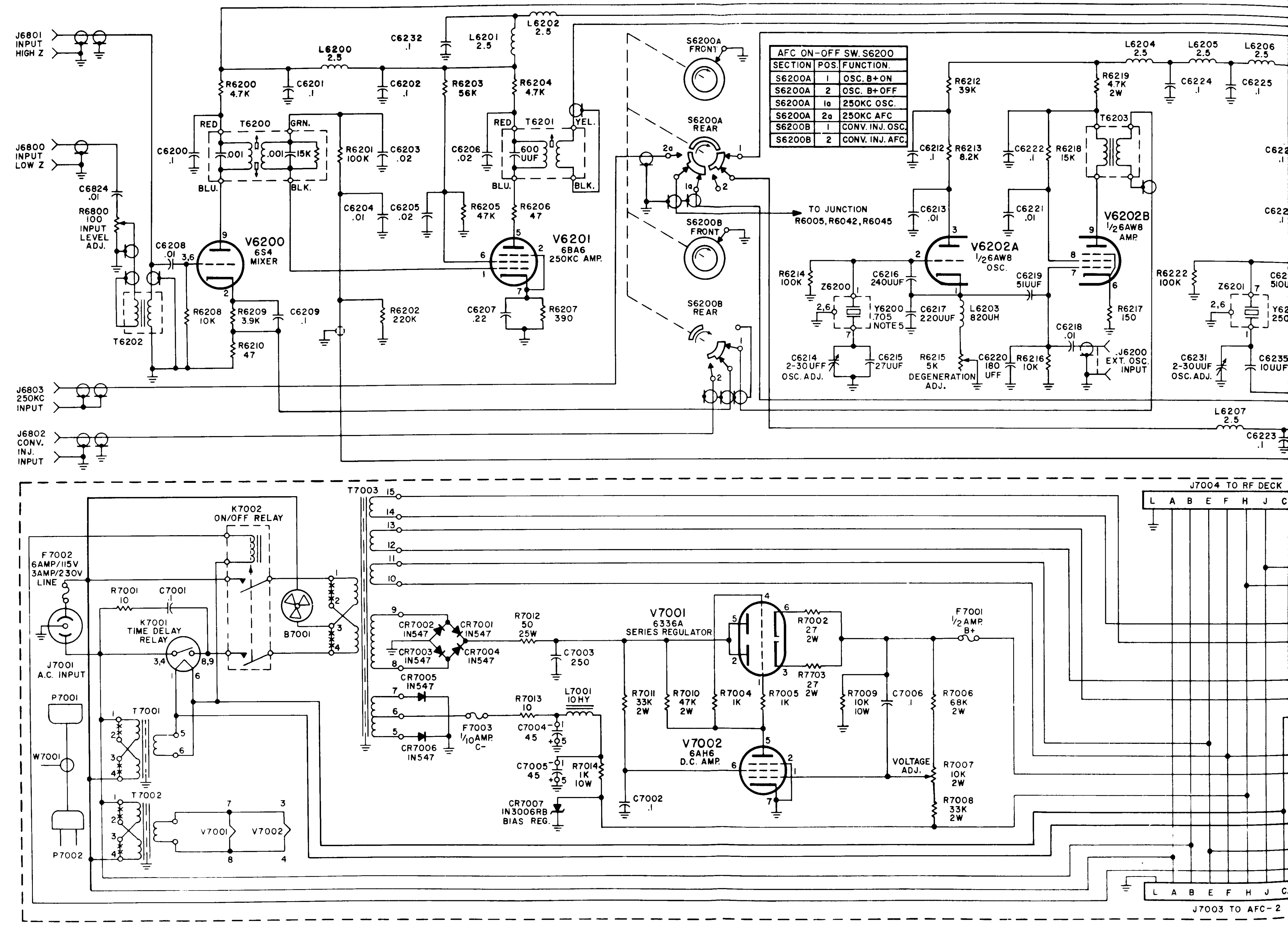
STAGE GAIN MEASUREMENTS

| DRAWN | CHECKED | FINAL APPROVAL |
|---|---|---|
| [illegible] | RUZZO | [illegible] |

| ELEC. DES. APP. | MECH. DES. APP. | | |
|---|---|---|---|
| [illegible] | [illegible] | CH-217 | A |

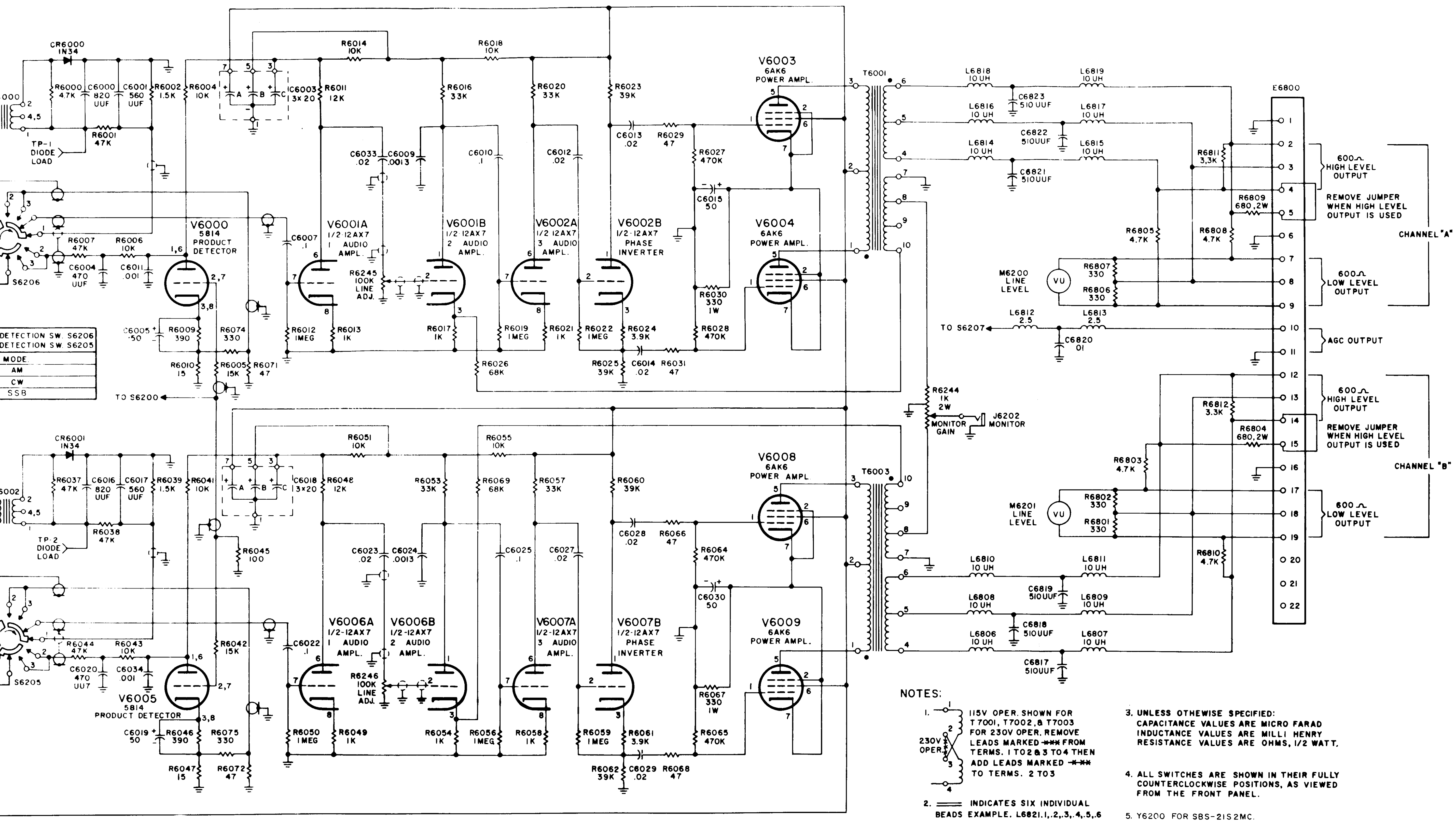



SBS-1 Schematic Diagram (Sheet 1 of 2)




AFC ON-OFF SW. S6200

| SECTION | POS. | FUNCTION. |
|---|---|---|
| S6200A | 1 | OSC. B+ON |
| S6200A | 2 | OSC. B+OFF |
| S6200A | 1a | 250KC OSC. |
| S6200A | 2a | 250KC AFC |
| S6200B | 1 | CONV. INJ. OSC. |
| S6200B | 2 | CONV. INJ. AFC. |




NOTES:

1. 115V OPER. SHOWN FOR T7001, T7002, & T7003 FOR 230V OPER. REMOVE LEADS MARKED ⊣⊢ FROM TERMS. 1 TO 2 & 3 TO 4 THEN ADD LEADS MARKED ⊣⊢ TO TERMS. 2 TO 3

2. ═══ INDICATES SIX INDIVIDUAL BEADS EXAMPLE. L6821.1,.2,.3,.4,.5,.6

3. UNLESS OTHEWISE SPECIFIED: CAPACITANCE VALUES ARE MICRO FARAD INDUCTANCE VALUES ARE MILLI HENRY RESISTANCE VALUES ARE OHMS, 1/2 WATT.

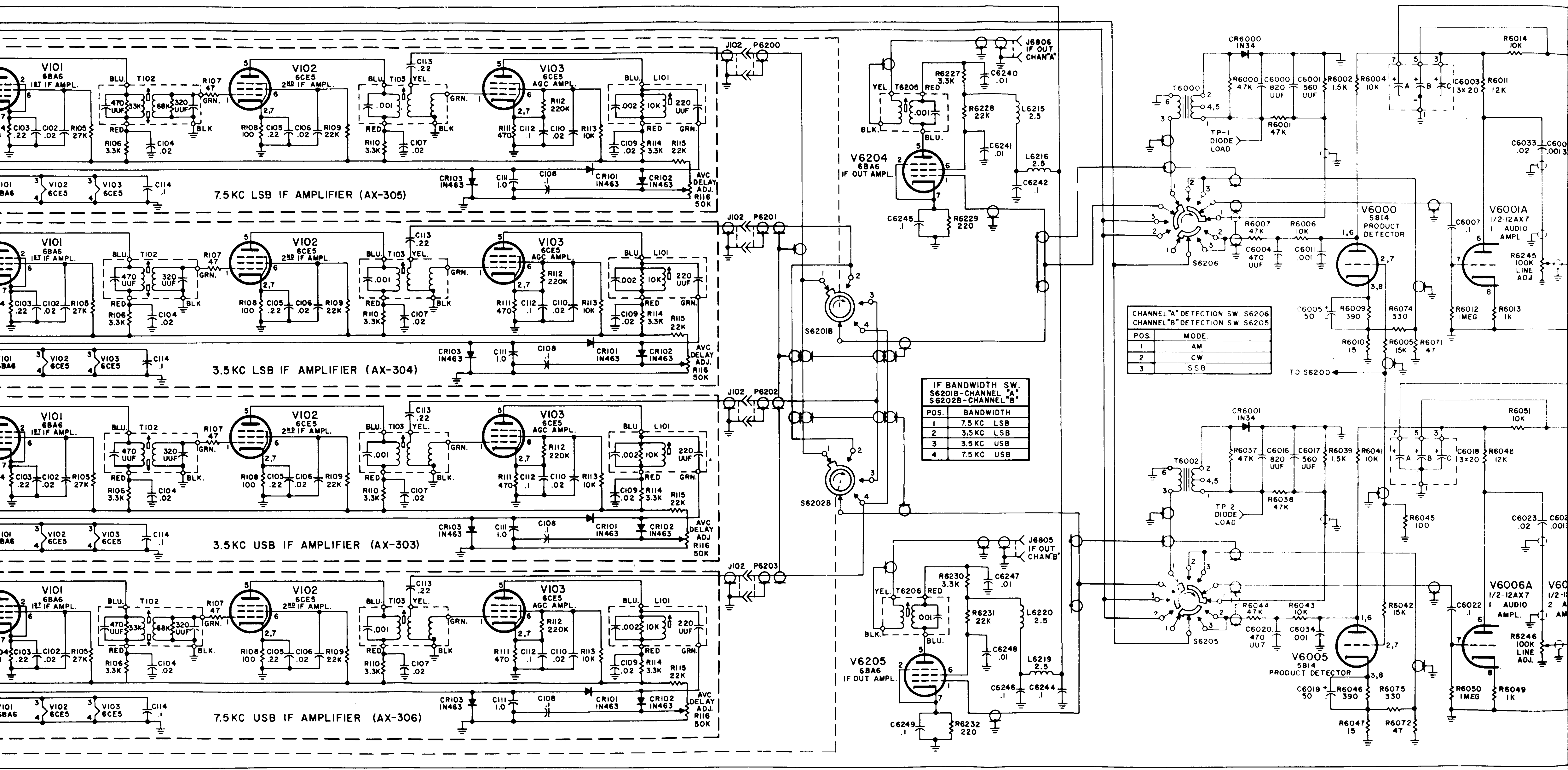
4. ALL SWITCHES ARE SHOWN IN THEIR FULLY COUNTERCLOCKWISE POSITIONS, AS VIEWED FROM THE FRONT PANEL.

5. Y6200 FOR SBS-2IS2MC.

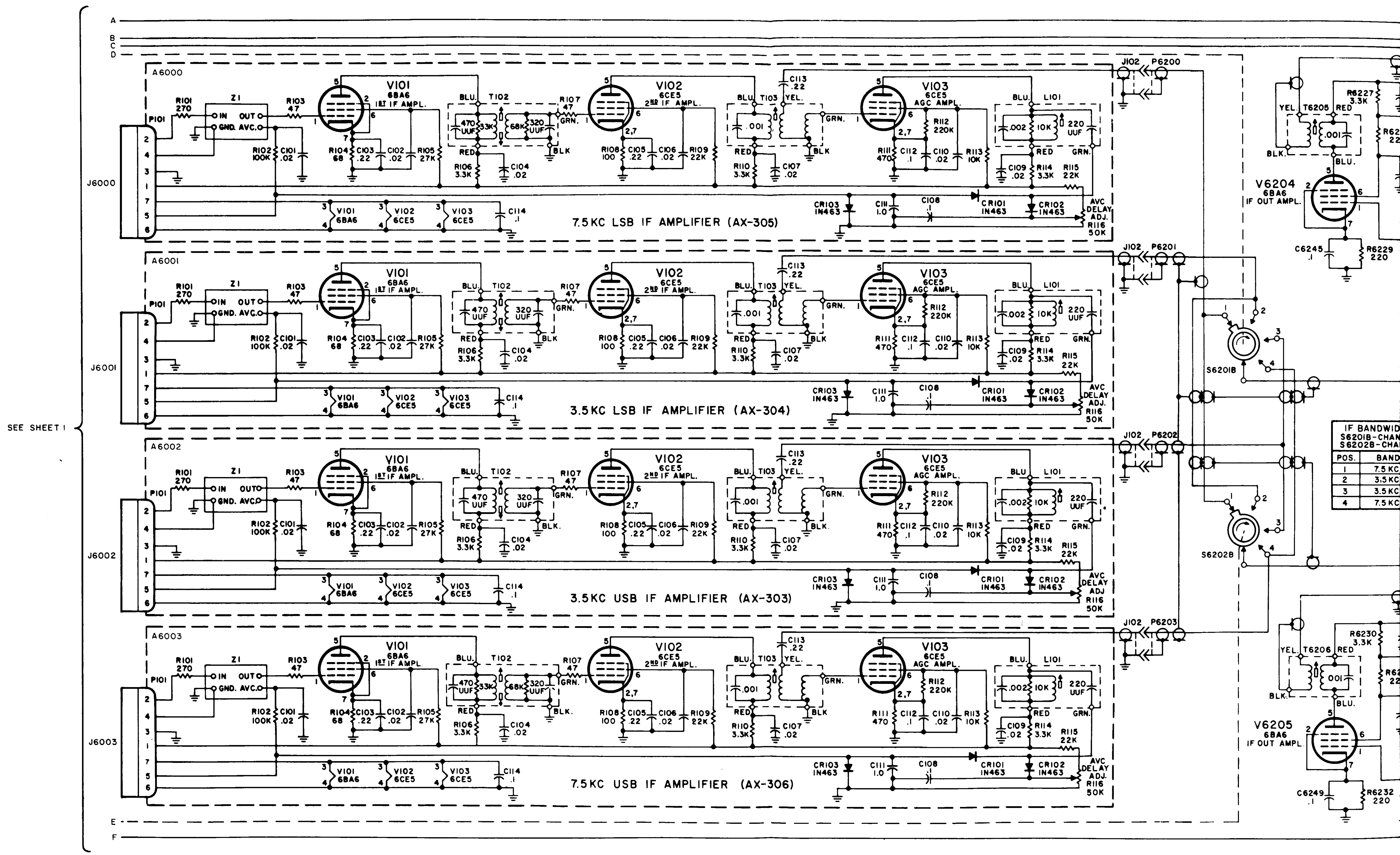
| LAST SYMBOLS | |
|---|---|
| C6034 | C6824 |
| CR6001 | E6802 |
| J6003 | J6806 |
| R6075 | L6842 |
| T6003 | P6800 |
| V6009 | R6812 |
| A6003 | W7001 |
| V6206 | P7002 |
| C6258 | V7002 |
| CR6203 | B7001 |
| I6201 | C7006 |
| J6202 | CR7007 |
| L6225 | F7003 |
| M6201 | J7004 |
| P6203 | K7002 |
| R6250 | L7001 |
| S6208 | R7014 |
| T6206 | T7003 |
| Z6201 | J102 |
| Y6201 | L101 |
| C114 | P101 |
| CR103 | R116 |
| TP-2 | T103 |
| Z1 | V103 |

| MISSING SYMBOLS | |
|---|---|
| C6002 | C6210 |
| C6008 | C6211 |
| C6026 | C6257 |
| R6003 | |
| R6008 | |
| R6015 | |
| R6032 | |
| R6033 | |
| R6034 | J101 |
| R6035 | T101 |
| R6040 | |
| R6063 | |
| R6070 | |
| R6071 | |
| R6072 | |

SBS-1 Schematic Diagram (Sheet 2 of 2)



7.5KC LSB IF AMPLIFIER (AX-305)
3.5KC LSB IF AMPLIFIER (AX-304)
3.5KC USB IF AMPLIFIER (AX-303)
7.5KC USB IF AMPLIFIER (AX-306)
V6204 6BA6 IF OUT AMPL.
V6205 6BA6 IF OUT AMPL.
J6806 IF OUT CHAN "A"
J6805 IF OUT CHAN "B"
V6000 5814 PRODUCT DETECTOR
V6005 5814 PRODUCT DETECTOR
V6001A 1/2 12AX7 1 AUDIO AMPL.
V6006A 1/2-12AX7 1 AUDIO AMPL.
TP-1 DIODE LOAD
TP-2 DIODE LOAD
TO S6200
IF BANDWIDTH SW.
S6201B-CHANNEL "A"
S6202B-CHANNEL "B"
POS. | BANDWIDTH
1 | 7.5KC LSB
2 | 3.5KC LSB
3 | 3.5KC USB
4 | 7.5KC USB
CHANNEL "A" DETECTION SW. S6206
CHANNEL "B" DETECTION SW. S6205
POS. | MODE
1 | AM
2 | CW
3 | SSB


SEE SHEET 1
J6000
J6001
J6002
J6003
A6000
A6001
A6002
A6003
7.5KC LSB IF AMPLIFIER (AX-305)
3.5KC LSB IF AMPLIFIER (AX-304)
3.5KC USB IF AMPLIFIER (AX-303)
7.5KC USB IF AMPLIFIER (AX-306)
V101 6BA6 1ST IF AMPL.
V102 6CE5 2ND IF AMPL.
V103 6CE5 AGC AMPL.
AVC DELAY ADJ. R116 50K
V6204 6BA6 IF OUT AMPL.
V6205 6BA6 IF OUT AMPL.
S6201B
S6202B
J102
P6200
P6201
P6202
P6203