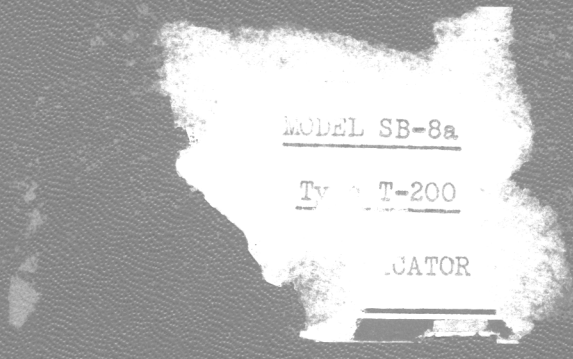
Instruction Manual

for

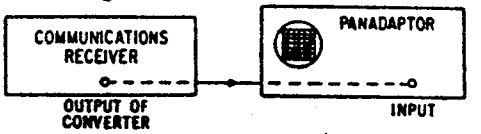


PANORAMIC RADIO PRODUCTS, INC.
10 SOUTH SECOND AVENUE
MOUNT VERNON, NEW YORK

Panoramic* RF—VHF • UHF SPECTRUM ANALYSIS

PANADAPTORS

Designed to operate with receivers having an I-F equal to the Panadaptor center frequency and show signals on either side of the frequency to which the receiver is tuned. Panadaptor response is preshaped to compensate for receiver front end selectivity to give a uniform over all response. Connection is to the output of the receiver converter stage.



Interference analysis of 3 signals with Model SA-8b Panadaptor shows interference between low-level intermittent signal (2) and AM channel (3).

PANADAPTOR equipments provide continuous monitoring for . . .

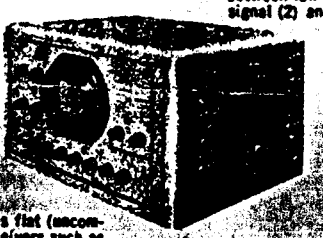
- Detecting and investigating interference caused by splatter, harmonics, rf parasitics, and multipath transmissions.
- Tuning aid for telemetry and SSB signals.
- Rapidly locating and identifying intermittent and irregular transmissions.
- Spotting inadvertent off-frequency transmissions.
- Band occupancy studies.

Panadaptors are available in 3 models and several types for use with receivers having IF's of 455 kc through 30 mc. Panadaptor responses are optimized for a particular model receiver. Please specify receiver type when ordering. Panadaptors are available to customer specifications for use with receivers with non standard IF or other unusual properties.

PANADAPTOR Model SA-8b

INDICATOR MODEL SC-8b

The SA-8b series with 3 types, and SC-8b Type T-10,000 include the performance features of laboratory grade spectrum analyzers. They are unsurpassed for use in critical, highly resolved monitoring of receiver input spectra. Model SC-8b similar to the SA-8b T-10,000, has flat (uncompensated) response for use with wide band receivers such as in radar systems. With a suitable VFO and mixer, the SC-8b, Panoramic Indicator, forms the basis of a versatile, low cost spectrum analyzer. (See Model SPA-1, Page 11.) These equipments have adjustable sweep widths, sweep rates, I-F bandwidths, Z axis intensification, and smoothing filter controls for convenience in handling CW, narrow band modulation noise, pulsed, or other types of communication signals.

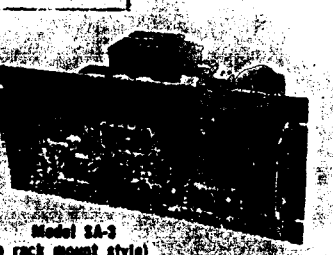


Model SA-8bZ Type T-200

PANADAPTOR Model SA-3

The rapidly scanning SA-3 Panadaptors have been proven invaluable "eyes for receivers" for 20 years in military and commercial applications. They are compact extremely rugged units with 3" CRT. Operationally they are simple, with only sweep width, gain, and center frequency as often used controls. IF bandwidth is fixed. Approximately a 20% improvement in resolution is achieved at a sweep width of 20% of maximum or less.

Rack mount and cabinet styles are available in all types.



Model SA-3 (in rack mount style)

	Model SA-8b (1)				Model SC-8b	Model SA-3									
	Type T-100	Type T-200	Type T-1000	Type T-10,000 (7)	Type T-10,000 (7)	Type T-50	Type T-100	Type T-200	Type T-1000	Type T-1000	Type T-2000TOI (2)	Type T-2000NC (3)	Type T-3000	Type T-3000CI (4)	Type T-6000
For receivers with intermediate frequency (specify)	450kc to 500kc	450kc to 500kc	5.25mc	30mc	30mc	450kc to 500kc	450kc to 500kc	450kc to 500kc	5.25mc	10.2mc or 10.7mc	30mc	30mc	30mc	21.4mc	30mc
Sweep Width	0-100kc	0-200kc	0-1mc	0-10mc	0-10mc	0-50kc	0-100kc	0-200kc	0-1mc	0-1mc	0-2mc	0-2mc	0-3mc	0-3mc	0-6mc
Direct Sensitivity (5)	1000μv	2000μv	2000μv	(8) 150μv	75μv (8)	200μv	200μv	200μv	200μv	200μv	(8) 500μv	(8) 10μv	(8) 1mv	50μv	(8) 10mv
Ratio of Side Peaks to Ctr. (Min.)	20:1	30:1	5:1	2.5:1	1:1, ±1.5 db	6:1	8:1	30:1	5:1	3:1	1.7:1	1:1	4:1	8:1	4:1
Sweep Rate	1 to 60 sweeps per sec. continuously variable. Sweep may be operated externally synchronized, synchronized to power line, or non-synchronized.				30 sweeps per second, line synchronized. (25 sweeps/sec with 50 cps power line.)										
Amplitude Scales	Linear (calibrated from 0 to 1.0). Logarithmic (from 0 db to —40 db): Power. (Square law).				Nominally linear										
Resolution Capabilities. Depends upon sweep rate and sweep width.	50cps to 4kc Variable	50cps to 4kc Variable	200cps to 10kc Variable	9kc to 80kc Variable	9kc to 80kc Variable	At maximum sweep width: 2.5kc	3.4kc	4.4kc	11kc	11kc	20kc	20kc	25kc	25kc	50kc
						Approximately 20% improvement at 20% of full sweep width.									
Cathode-ray Tube	5 inch. 5UP7, 5ADP7 (6) optionally available (add Z to model #).				3 inch. Type 3BP1A										
Power Requirements	115v (nominal), 60 cps, accurate ±0.1 cps. Provision for other power lines supplied on special order. Power line regulators supplied with all equipments.				115/230v, 50-60 cps, single phase. Equipment normally wired for 115v. Specify if 230-v wiring required.										
DIMENSIONS	Indicator Cabinet—12⅛" h x 22½" w x 20½" d. Indicator Std. Relay Rack Panel—10½" h x 19" w. Power Supply Cabinet—8⅝" h x 16¼" w x 11⅛" d. Power Supply with Std. Relay Rack Panel supplied on special order.				Cabinet - 7¼" h x 13¼" w x 13"d. 7" panel height. Std. Relay Rack Panel — 8¾" h x 19" w available on special order (with or without dust cover). Dust cover optional with rack mount style.										

1. Also available in types T-200CI, T-1000CI, T-2000CI and T-3000CI for use with special purpose receivers having an intermediate frequency of 21.4 mc. Available in type T-2000 for use with special purpose receivers having an intermediate frequency of 30 mc.
2. Designed for Tele-Dynamics Inc. receivers with 30-mc intermediate frequency.
3. Designed for Nems-Clark receivers with 30-mc intermediate frequency.
4. Designed for Nems-Clark receivers with 21.4-mc intermediate frequency.
5. Direct sensitivity, (Model SA-8b) is the maximum voltage at the center frequency required for a full scale deflection on the linear amplitude scale. Direct sensitivity (Model SA-3) is the maximum voltage at the center frequency required for ¼ inch deflection.
6. All equipments furnished with flat-faced type 5ADP7 crt are also provided with edge lit reticle and camera mount bezel.
7. Variable differential frequency calibration markers (100kc to 10mc separation) optionally available (Add letter M to Model number).
8. **Panoramic Bandpass Amplifier Model BA-1** available for increased sensitivity. Gain — 50 db +1 db from 25-35 mc. 45 db attenuation in 1 db steps. Minimum useful signal: 1μv for SC-8b. BA-1 in cabinet 5½" h x 19" w x 6" d, rack mount panel.

Condensed information is given in this catalog. For detailed data, application notes and prices . . . write . . .

INSTRUCTION MANUAL

FOR

PANORAMIC INDICATOR

IP-259/U

Panoramic Indicator IP-259/U is the same equipment as the Panalyzor Model SB-8a, Type T-200.

This is a composite Instruction Manual. Only the instructions pertaining to the Panalyzor Model SB-8a, Type T-200 should be followed when using the Panoramic Indicator IP-259/U.

Signal Corps Order Number 7521-PHILA-54-55(31)

PANORAMIC RADIO PRODUCTS, INC.

TELEPHONE:
MOUNT VERNON 4-3970

10 SOUTH SECOND AVE.
MOUNT VERNON, N. Y.

CABLE ADDRESS:
PANORAMIC
MT. VERNON (N. Y.)

XTRA COPIES TO PHILA FOR THESE P&C

P.S. — PROJECT OFFICE will be Jim Abbatiello, PAT

INSTRUCTION MANUAL

Panadapter SA-8a Type T-200
Type T-1000

Panalyzor SB-8a Type T-200
Type T-1000

PANORAMIC RADIO PRODUCTS, INC.

TELEPHONE:
MOUNT VERNON 4-3970

10 SOUTH SECOND AVE.
MOUNT VERNON, N. Y.

CABLE ADDRESS:
PANORAMIC
MT. VERNON (N. Y.)

T-200, T-1000 TABLE OF CONTENTS

SECTION I - GENERAL DESCRIPTION

1.	Introduction	1
2.	Equipment Supplied	1
3.	General	2
4.	Tube Complement	4
5.	Specs SA-8a	5
	Specs SB-8a	6
	Resolution T-200	7
	Resolution T-1000	8
6.	Operating Controls	9
7.	Semi-Adjustable Controls	10
8.	Terms & Definitions	11

SECTION II - INSTALLATION

1.	Unpacking	13
2.	Pre-Installation Tests	13
3.	Installation	15

SECTION III - OPERATION

1.	General Operation - Panadaptor	17
2.	General Operation - Panalyzor	19
3.	Narrow Band Analysis	20
4.	Pulse Operation	21
5.	Interpretation of Signals	22

SECTION IV - THEORY OF OPERATION

1.	Introduction	25
2.	Circuit Description	28

SECTION V - SERVICE & MAINTENANCE

1.	Semi-Adjustable Controls	36
2.	Alignment Procedure	37

END

SECTION I - GENERAL DESCRIPTION

1. INTRODUCTION

This instruction manual is intended for use with the following equipments:

Panadaptor, Model SA-8a, Type T-200, T-1000

Panalyzor, Model SB-8a, Type T-200, T-1000

Included within this manual is detailed information concerning installation, operation, adjustment and maintenance of the equipment.

Power source requirements for the equipments are 115 V, 60 cycles, single phase. Power consumption is approximately 80 watts. With Sola Constant Voltage Transformer #30806 the equipments will operate properly over a line voltage variation of 95 to 125 volts.

Note: For operation from other power sources, suitable constant voltage transformers can be supplied. Any C.V. transformer used must supply 115 volts output.

2. EQUIPMENT SUPPLIED

Information for identification of the aforementioned equipments is contained on the front panel of the analyzer section.

The following units constitute a complete equipment:

Quantity per Equipment	Name of Unit	Overall Dimensions	
1	Analyzer Section	Width:	22-1/2"
		Height:	12-1/8"
		/ Depth:	21-1/8"
1	PS-8, Power Supply	Width:	16-1/2"
		Height:	8-3/4"
		// Depth:	14-3/8"
1	Sola Constant Voltage Transformer		
1	Power Line Cord		
1	Interconnecting Power Cable		
*1	Prefabricated RF Cable		
**2	Prefabricated RF Cables		

* Applies to Panadaptor
** Applies to Panalyzor

/ Includes 7/8" knob projection and 3-1/2" projection of elbow power plug.

// Includes 3/4" fuse hold projection and 3-1/2" projection of elbow po plug.

3. GENERAL

Both the Panalyzor and Panadaptor are automatic scanning superheterodyne receivers which permit visual analysis and identification of one or many R.F. signals at one time. Each signal within the scanned band is displayed on a cathode-ray tube screen as a pip or a group of pips depending upon the nature of the signal. The pip amplitude and position along a calibrated horizontal axis are indicative of signal level and frequency, respectively.

The sweepwidth or the extent of the band displayed above and below a given frequency which appears at the center of the screen, is continuously adjustable from maximum to "zero". The Type designation of the equipment indicates the maximum sweepwidth.

Type	Maximum Sweepwidth
T-200	±100 KC
T-1000	±500 KC

The PANADAPTOR is designed to operate in conjunction with receivers having an I.F. equal to the Panadaptor input center frequency. (See Electrical characteristics Section I Para. 5). Interconnection is made at the output of the receiver converter. In operation, the receiver is tuned to the spectrum segment to be observed. The signal to which the receiver is tuned will appear at the center of the screen. Either locally or remotely generated signals may be observed. The Panadaptor overall frequency coverage is dependent upon the tuning range of its companion receiver.

The PANALYZOR is designed to operate with an external oscillator or signal generator to "tune in" a given spectrum segment. The signal generator is connected to one of two input RF connectors. The signal or signals to be examined are coupled directly from their source through a coaxial cable to the other input connector.

The input stage of the Panalyzor is an aperiodic mixer which in conjunction with the external oscillator is equivalent to the frequency converter of a superheterodyne receiver such as is used with the Panadaptor.

A signal will cause a deflection at the center of the screen when the generator is set at a frequency equal to the signal frequency ± the Panalyzor input center frequency. (Refer to Electrical Characteristics, Section I Para. 5).

The Panalyzor may be used as described above to examine signals up to 1000 MC. Higher frequencies may be investigated by effecting conversion with a suitable mixer attached to either of the input R.F. connectors.

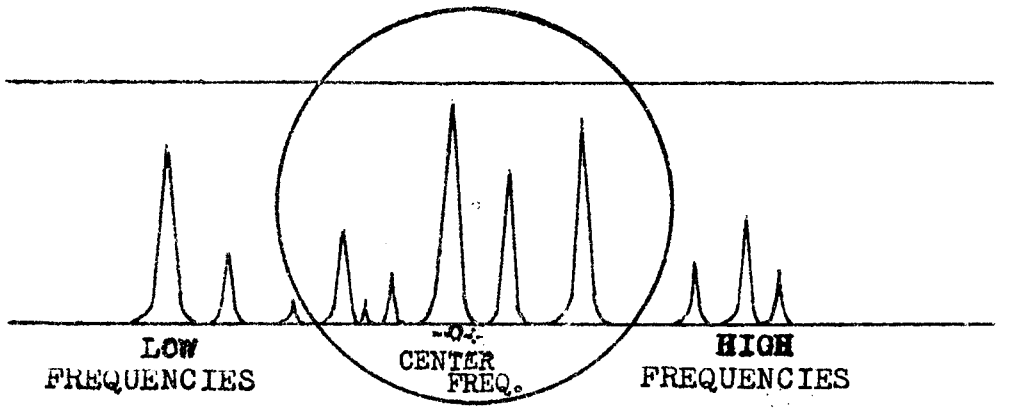
The two instruments differ in flatness of amplitude indication. The flatness of response of the Panalyzor primarily is dependent upon the bandpass characteristic of the instrument and the accuracy of the amplitude indication is therefore fixed within the limits specified. The flatness of amplitude indication in the Panadaptor, however, is the product of the receiver selectivity

as seen at the output of the converter and the bandpass characteristic of the Panadaptor. Since receiver selectivity will vary throughout the tuning range, the relative amplitudes of the signal deflections distributed across the screen may not correspond to actual relative signal levels.

The Panadaptor and Panalyzor differ also in the extent to which they present images. Image presentation of the Panadaptor is mainly a function of the image rejection capabilities of the receiver. Since the Panalyzor utilizes an aperiodic mixer (without any preselection) images are not suppressed. For example, if it is desired to examine a 100 MC signal with a Type T-1000 Panalyzor, the external oscillator would be set at 105 MC, the input center frequency being 5 MC and the bandpass from 4.5 MC to 5.5 MC. A signal of 110.1 MC which may be present would also be heterodyned down to 5.1 MC to produce an image. Both the 100 MC and 110.1 MC signals would be equally acceptable by the aperiodic mixer.

Images, however, can be identified rapidly and simply with either instrument since the image deflections move in a direction opposite to that of regular signals as the receiver or oscillator is tuned.

The Panadaptor and Panalyzor visualize the radio frequency spectrum on a two dimensional surface. On the horizontal axis of the screen (base line) frequencies are shown and on the vertical axis signal amplitudes are indicated. This is illustrated in Figure 1.



Presentation of Radio Frequency Spectrum

The entire strip represents a portion of the R.F. spectrum. The circle represents the range visible on the screen. The section directly over the zero (0) on the scale corresponds to a signal to which the receiver is tuned (for the Panadaptor) or to a signal heterodyned down to the input center frequency of the Panalyzor. Every signal produces its own pip or group of pips which help identify or analyze the signal.

First: It indicates the frequencies of signals with respect to a signal at the center of the screen. The horizontal axis of the screen is divided into ten parts. At maximum sweepwidth each dividing marker represents a 20 KC separation for the T-200 and 100 KC for the T-1000. The frequency of the centered signal may be determined from the receiver or external oscillator dial.

Second: Information on the relative levels of the signals is also given on the screen. The height of each signal peak varies proportionately with signal strength. Signal amplitudes are indicated either linearly or logarithmically. Amplitude scale selection is affected by means of a front panel control. The linear amplitude range is 10:1 while the log range is 40 db.

Third: The deflections also reveal the character of the signal and the type of modulation, whether CW, phone or pulse, etc. The feature of Variable Resolution enables examination of signals so closely adjacent in frequency that their corresponding deflections normally tend to merge together or even completely mask one another in wide scan displays. This is of particular value in observing sidebands caused by low frequency audio modulation, e.g. 200 c.p.s.

4. TUBE COMPLEMENT

The tubes employed are as follows:

Symbol	Type	Function
V1	* 6BE6	Signal Mixer
V2	6BH6	Bandpass Amplifier
V3	6BE6	Converter
V4	6AH6	Reactance Tube Modulator
V11	12AT7	1st Xtal I.F. Amplifier 2nd Xtal I.F. Amplifier
V12	6BH6	3rd I.F. Amplifier
V13	6AU6	4th I.F. Amplifier (Lin or Log)
V14	12AU7	Detector, First Vertical Amplifier
V15	12AU7	Vertical Phase Inverter, Intensifier
V16	12AU7	Multi-Vibrator
V17	12AU7	Blocking Tube Oscillator, Horizontal Amplifier
V18	12AU7	Horizontal Output, Phase Inverter
V19	5UP7	Cathode-Ray Tube
V20	0C3	Voltage Regulator

* Used in Panalyzor only

5. ELECTRICAL CHARACTERISTICS

P A N A D A P T O R

MODEL SA-8a

Types	T-200	T-1000
Max. Sweepwidth	200 KC	1 MC
Input Center Freq. Range Factory Aligned to	450-470 KC 455 KC	5.25 MC
Sensitivity for full Scale linear	2000 uV	2000 uV
Spurious Response within the Bandpass: Input signals within the bandpass may result in spurious indications greater than 40 db below the input signal if the input signal exceeds	.4V	.4V
Resolution:	Fig. 2	Fig. 3
Bandpass Characteristic: Amplitude Ratio of Side Peaks to Center Valley	30:1	5:1
Peaking Frequencies	365 KC 545 KC	4.83 MC 5.67 MC
Coupled to Receiver through	50,000 ohm resistor	25,000 ohm resistor
Oscillator Mean Frequency	681 KC	6.75 MC
R. F. Input Cable	RG-11/U	
I. F. Transformer Tuned to	226 KC	1.5 MC
Power Source Req.	single phase, 115 V, 60 cycle	
Power Consumption	80 Watts	80 Watts

P A N A L Y Z O R

MODEL SB-8a

Types	T-200	T-1000
Maximum Sweepwidth	200 KC	1000 KC
Input Center Frequency	500 KC	5 MC
Bandpass Region	400 KC to 600 KC	4.5 MC to 5.5 MC
Bandpass Region Characteristic: Flat to	±5%	±7%
Resolution:	Fig. 2	Fig. 3
Image Rejection Ratio at input center frequency: Better than	250:1	150:1
Spurious Response above the Bandpass: No signal exclusive of images, of a frequency above the bandpass and less than .1V will produce a deflection greater than	40 db below input signal	40 db below input signal
Spurious Response within the Bandpass: Input signals within the bandpass may result in spurious indications greater than 40 db below the input signal if the input signal exceeds	20,000 uV	.1V
Direct Sensitivity: Maximum voltage at center frequency required for full scale deflection on linear amplitude scale	100 uV	500 uV
Product Sensitivity: Maximum product voltage of external oscillator and test signal required for full scale deflection on log amplitude scale	10^{-3} V.-V.	$5x10^{-3}$ V.-V.
I.F. Transformer Tuned to	226 KC	1.5 MC
F.M. Oscillator Mean Frequency	726 KC	6.5 MC
Input Impedance	50 ohms	50 ohms
Sweep Rate and Wave Form	1 cps (non-synchronized) 5 cps, 30 cps Synchronized, 25-35 cps Variable, Sawtooth	
Power Source	115 V, 60 cycle, single phase	
Power Consumption (Approx.)	80 Watts	80 Watts

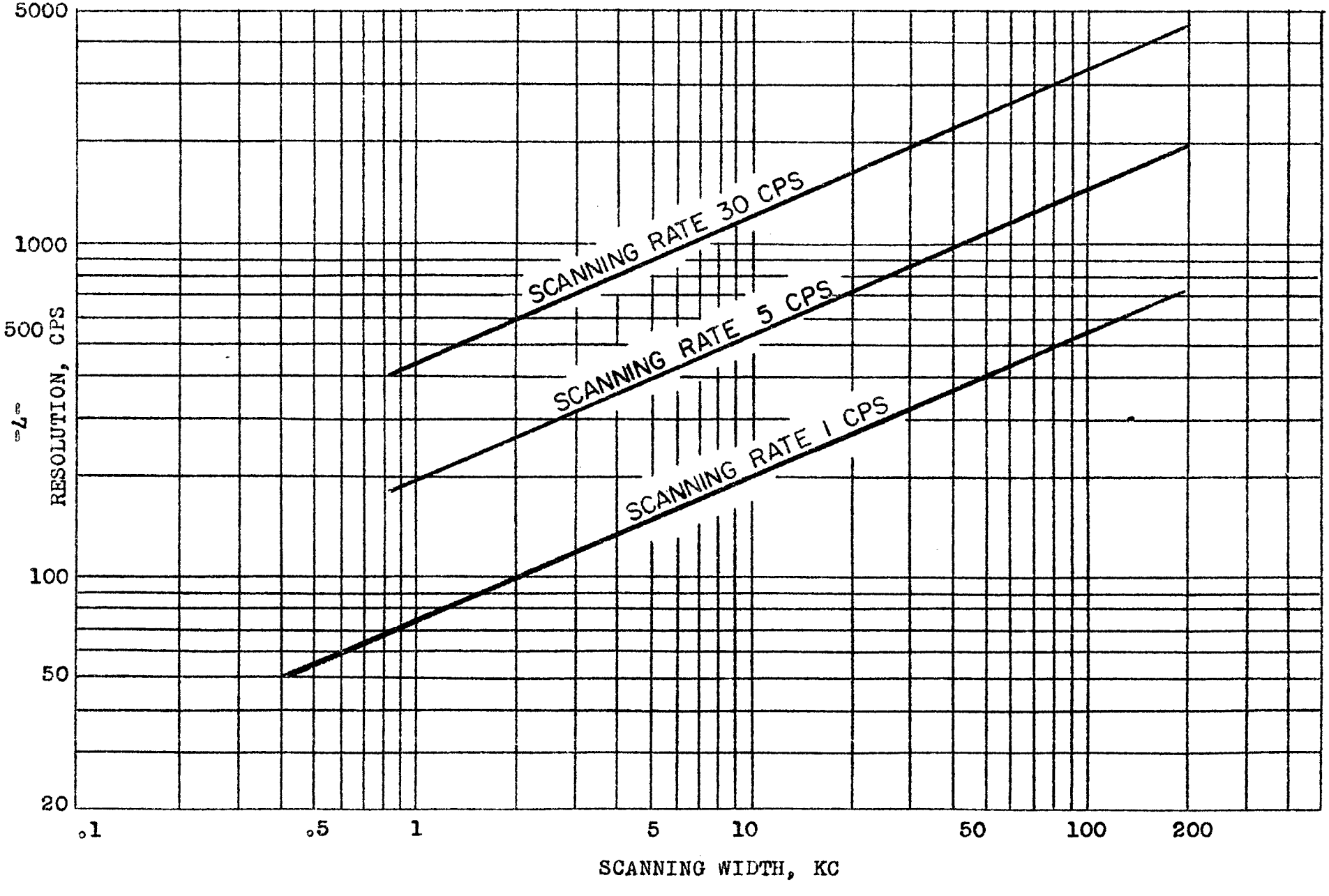


Fig. 2. Resolution Characteristics of Models SB-8a, SA-8a Type T-200

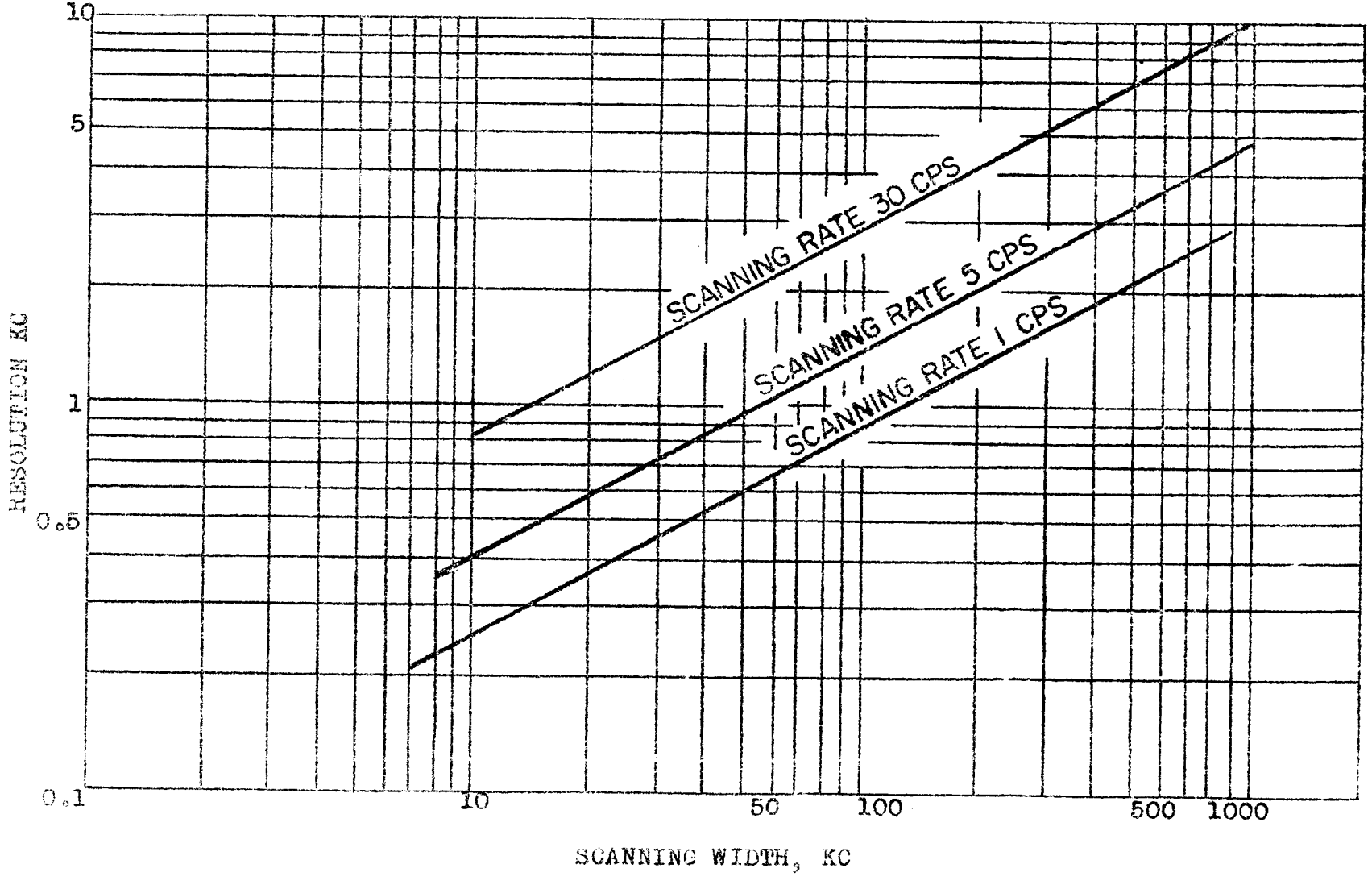


Fig. 3. Resolution Characteristics of Models SA-8a, SB-8a Types T-1000

6. OPERATING CONTROLS

The following operating controls are at the disposal of the operator. These are mounted on the front panel.

a. SWEEPWIDTH: The scanning width of the instrument is governed by this control. When it is turned completely to the right, the maximum spectrum width for which the instrument is designed can be seen on the screen. As the control is backed off in a counterclockwise direction, the bandwidth viewed becomes narrower. The part that can be seen, however, is expanded across the screen and hence is virtually magnified.

This control, in conjunction with the Resolution control, is useful for separating two or more signal deflections which are so close as to merge into each other.

The panel calibration markings below maximum are only approximations and are to be considered as such.

b. RESOLUTION: Resolution or the ability to separate individual signals, is dependent upon two factors: the rate of frequency scan and the I.F. bandwidth of the instrument. Optimum resolution requires a definite relationship between the two. Resolution sharpens as both the scanning rate and I.F. bandwidth are decreased.

The RESOLUTION control is utilized to narrow the I.F. bandwidth. Counterclockwise rotation of this control sharpens the I.F. width.

The scanning rate is diminished by increasing the scanning period or conversely by decreasing the spectrum width scanned within a given time. The sweepwidth control provides the latter method.

For a given setting of the Sweepwidth control there is a complementary setting of the Resolution control to obtain maximum resolution. Refer to Figures 2 and 3.

c. SWEEP RATE SELECTOR: This is a four position switch which enables selection of the following scanning rates:

1 c.p.s., 5 c.p.s., 30 c.p.s. and a variable range of 25 to 35 c.p.s. The 5 c.p.s. and 30 c.p.s. rates are power line synchronized. The variable range is useful for observing signals which are modulated by multiples or sub-multiples of the line frequency.

Information on Resolution vs. Scanning Rage vs. Sweepwidth is given in Figures 2 and 3.

d. VARIABLE SWEEP RATE: This provides for continuously adjustable scanning rates between 25 and 35 c.p.s. Counterclockwise rotation results in reduced scan rate.

e. CENTER FREQ. This control serves to restore or maintain the FM local oscillator at its specified mean frequency. Thus, a deflection corresponding to the input center frequency appears at the center of the screen. Flatness of response in the Panalyzor and proper peak location on the screen in the Panadaptor are dependent upon this control.

f. HORIZONTAL POSITION: This controls the position of the baseline trace along the horizontal axis.

g. GAIN: The amplitude of the indications on the crt screen is adjusted with this control. Maximum gain obtains at maximum clockwise position. Lower gain is to be used whenever possible so as to reduce the size of both spurious and noise deflections provided that the maximum allowable signal input within the pass-band for spurious indications below 40 db is not exceeded. (See Section I-5 - ELECTRICAL CHARACTERISTICS.) For applications in which spurious indications that may be introduced by the Panoramic equipment are objectionable, the point on the GAIN control at which spurious indications increase should be determined. The GAIN control range may be divided approximately as follows. The clockwise 2/3 of the range should be used to obtain spurious free presentations. The use of the counter-clockwise 1/3 of the control range may result in spurious indications. To determine with precision the point on the control beyond which spurious indications become objectionable, feed in the maximum signal for spurious free presentation (at a frequency within the pass-band) and adjust the GAIN control for full scale LOG presentation. This is the desired point. If the spurious indications are not objectionable and larger input signals are of interest, the signal amplitude may be increased while at the same time maintaining the signal pip height at full scale, until spurious indications become objectionable. Any position of the GAIN control clockwise of this position will not have objectionable spurious indications providing the signal level used to determine this point is not exceeded. It is necessary to check for spurious indications introduced by the Panoramic equipments throughout its bandpass region.

h. SCALE SELECTOR: Selection of linear or log amplitude presentations is accomplished with this two position rotary switch. On the LIN position signals having an amplitude ratio of 10:1 may be observed at one time. In the LOG position a 40 db amplitude range may be viewed on the screen.

i. POWER: For equipment this toggle switch is snapped to the ON position. It does not control the power to any auxiliary equipment.

j. BRILLIANCE: The intensity of the screen presentation is controlled by this.

k. FOCUS: The sharpness of the presentation is varied through this control.

l. INTENSIFIER: To observe pulsed or noise signals this control is turned in a clockwise direction. Signals will then intensity modulate the scope beam. Normally, in using this control the BRILLIANCE control is adjusted so that the baseline just disappears. Intensity modulation then causes only the signals to appear on the screen in greater contrast.

7. SEMI-ADJUSTABLE CONTROLS: These controls are in circuits which seldom require adjustment, and for this reason they are located on top of the chassis.

a. VERTICAL POSITION: This adjusts the vertical position of the baseline trace on the c-r tube screen.

b. LINE SIZE: The horizontal length of the trace is adjusted with this control.

c. LOG ADJUST: The accuracy of the log amplitude scale is governed by this control. It will require adjustment when the detector tube is replaced.

d. I.F. GAIN: Reserve gain is provided in the IF section. When the sensitivity of the instrument falls below that specified, this control will require adjustment.

e. SWEEP LIMIT: The upper limit of sweepwidth obtainable with the SWEEPWIDTH control is set by this control.

f. CF PAD: This is a coarse adjustment for the mean center frequency of the local FM oscillator.

g. 20 CYCLE SYNCH, 5 CYCLE SYNCH, 30 CYCLE SYNCH: Synchronization of the 5 c.p.s. and 30 c.p.s. scanning rates to be line frequency is accomplished through the use of a multivibrator which applies a synchronization pulse to a sawtooth oscillator.

For the 5 c.p.s. scan rate, the multivibrator is synchronized to 1/3 the line frequency or 20 c.p.s. 20 CYCLE SYNCH is used to make this adjustment. The multivibrator circuit is automatically modified when the SWEEP RATE SELECTOR is set to 30 c.p.s. scanning rate and thus it is synchronized to one-half the line frequency.

The sawtooth oscillator, which is of the blocking tube variety, is synchronized to one-fourth the multivibrator frequency when the 5 c.p.s. rate is selected. The 5 CYCLE SYNCH control accomplishes this.

The 30 CYCLE SYNCH adjusts the sweep oscillator circuit for "synching" to the 30 c.p.s. frequency produced by the multivibrator.

h. 1 cycle sweep rate adjusts the sweep oscillator circuit for a 1 cycle sweep rate.

i. ASTIGMATISM ADJUST: This adjusts the horizontal and vertical traces for relative focus. It will require adjustment if V18 or V19 is replaced. The astigmatism may also be readjusted slightly to compensate for the defocusing effect that occurs when the intensifier is operated.

j. BANDWIDTH LIMIT: This is adjusted to make the pip height at maximum sweep equal approximately the height of the signal at zero sweep. The pip will be single peaked and approximately symmetrical.

k. LOG ZERO ADJUST: This is aligned in conjunction with the log scale adjust to provide accurate calibration over the entire log scale, according to the procedure in section V, para. 2.

8. TERMS AND DEFINITIONS

a. Sweepwidth is the band, measured in cycles, kilocycles, or megacycles, which can be observed by Panoramic Reception and which corresponds to the range of oscillator sweep in the Panoramic Equipment.

b. Frequency Sweep Axis is the line along which the signal deflections are produced and which can be calibrated in frequency according to a given frequency scale.

c. Center Frequency is the frequency of the signal received on that part of the frequency sweep axis corresponding to zero sweep voltage applied to the reactance modulator.

d. Resolution of a given signal is the frequency difference measured along the sweepwidth scale between the points where its deflection is 30% down from the peak value. This characteristic corresponds to "selectivity" in ordinary receivers. The smaller this frequency difference, the better the resolution is.

e. Sweep Frequency is the number of times per second the electron beam sweeps across the cathode-ray tube.

f. Deflection Amplitude is the visual equivalent of signal output strength and is represented by the height of a given signal deflection measured from the base line to the top of the deflection.

g. Screen Scale is the scale adjacent to the base line which is calibrated in frequency units above and below center frequency for a maximum sweepwidth setting.

h. External Oscillator is the associated unit which is used with the PANALYZOR to produce a heterodyne frequency with a test signal equal to the specified input frequency of the PANALYZOR.

NOTE: The heterodyne frequency should be the difference frequency between the two. If the sum frequency were used, spurious harmonics of the test signal and oscillator output might appear on the screen.

SECTION II - INSTALLATION

1. UNPACKING

With the shipping containers set right side up, remove the lids from the boxes. Carefully unpack the analyzer, power supply, and constant voltage transformer. Remove all accessories from the case. Check contents against information in Section I para. 2.

2. PRE-INSTALLATION TESTS

a. The Panadaptor and Panalyzor are factory wired for 115 V, 60 cycle operation. Be sure that the proper power source is available. See note on page 1.

Connect the power supply to the analyzor section with the interconnecting power cable furnished. Plug the line cord into the receptacle at the rear of the power supply chassis. The other end of the line cord is attached to the constant voltage transformer. Plug the constant voltage transformer into the power source.

Turn the POWER switch to on. The pilot light should go on at once. Set the BRILLIANCE control between one half and two thirds of maximum clockwise position. In approximately one half minute the baseline trace should appear as a blurred or sharp line.

Now perform the following tests:

b. FOCUS: Turn this control through its range. The trace should become sharp or blurred. At some setting of the FOCUS control the baseline will be sharp. Leave the control at this position.

c. BRILLIANCE can be checked quickly by turning it through its range. The intensity should vary. Focus may also vary. This is normal. Return the control to a position giving a sharp bright trace.

d. INTENSIFIER: Set this control to its maximum counterclockwise position. Turn the GAIN RESOLUTION and SWEEPWIDTH controls completely clockwise. Noise peaks may appear on the screen. If not, introduce noise or a signal into the equipment. Now turn the BRILLIANCE control counter-clockwise until the deflection almost fade out. Turn up the INTENSIFIER. The noise lines of signals will become brighter but the baseline will not be present.

e. CENTER FREQ.: Feed a signal which corresponds in frequency to the input center frequency of the equipment. Set the GAIN, RESOLUTION and SWEEPWIDTH controls completely clockwise. Set SWEEP RATE SELECTOR to 30 and SCALE SELECTOR to LIN. Adjust HORIZONTAL POSITION so that the trace is centered on the screen. A pip corresponding to the signal should appear on or near the center of the screen. If the deflection consists of many vertical lines, lower the GAIN of the set until a single pip is present.

Turn the SWEEPWIDTH control counterclockwise. The pip will broaden and should remain on or near center. If it moves off the screen, trim CENTER FREQ. to maintain the centered condition. When the base of the pip occupies the entire screen, return the SWEEPWIDTH control to maximum clockwise position. The pip may now be off-center. If so, adjust HORIZONTAL POSITION to obtain center position.

Turn the CENTER FREQ. control back and forth. The deflection should shift back and forth horizontally. Return the control to the pip center position.

f. GAIN: Rotation of this should change pip height.

g. SWEEPWIDTH: Set the controls as outlined for CENTER FREQ. test. With the SWEEPWIDTH control completely clockwise, vary the frequency of the signal generator between the limits indicated below for the following equipments:

Equipment		Input Center Freq.	Frequency Limits
Panadaptor Model SA-8a	Type T-200	455 KC	355 KC-555 KC
	Type T-1000	5.25 MC	4.75 MC-5.75 MC
Panalyzor Model SB-8a	Type T-200	500 KC	400 KC-600 KC
	Type T-1000	5 MC	4.5 MC-5.5 MC

When the limit frequencies are applied, corresponding deflections should appear within one-half division of the horizontal calibration extremities. This will indicate that the scanning width is within specifications.

h. RESOLUTION: Set the controls as outlined for CENTER FREQ. test. Feed in a signal which corresponds to the input center frequency of the equipment. Adjust the GAIN control or signal level to cause a full scale deflection. Gradually reduce the scanning width so that the pip base covers approximately one third of the screen. Now turn the RESOLUTION control counterclockwise. The pip width should decrease. At the same time there may be a reduction in pip height. It will also be noticed that small convolutions or "ringing" will appear on the trailing edge of the pip. Optimum resolution occurs when the first convolution beyond the apex of the pip dips into the baseline.

i. SCALE SELECTOR: Set the controls as outlined for CENTER FREQ. test. Feed in a signal at center frequency which is modulated by 60 c.p.s. (Modulation by the line frequency is preferable). Reduce the scanning width to zero with the SWEEPWIDTH control at the same time maintaining a centered condition. Set the SWEEP RATE SELECTOR to 5. Twelve cycles of the modulation waveform should appear from one end of the trace to the other. On the 30 setting there should be 2 cycles of the modulating waveform.

j. VARIABLE SWEEP RATE: Set the SWEEP RATE SELECTOR to VAR. Change the modulation frequency, used in para. i on preceding page, to approximately 50 c.p.s. When the VARIABLE SWEEP RATE control is advanced completely in the direction of 25, two cycles of modulation should appear. Change the Modulation to approximately 70 c.p.s.

Turn variable rate control completely to 35. Again two cycles of modulation should appear.

k. HORIZONTAL POSITION: As this control is turned, the baseline trace should move horizontally.

Additional information on service or adjustments affecting the foregoing controls is contained in the Maintenance Section of this handbook.

3. INSTALLATION

a. CONNECTION OF PANADAPTOR TO RECEIVER

Find a suitable place to locate the Panadaptor near the companion receiver. If possible do not mount the Panadaptor over ventilation holes of the receiver. Place the Panadaptor in such a position that direct sun light or other strong light does not shine on the screen.

(1) Be sure that the receiver has an I.F. which corresponds to the input frequency of the instrument.

(2) Disconnect the receiver from the power line.

(3) Attach the inner conductor of the R.F. coaxial cable furnished to the plate of the converter tube in the receiver with the specified isolating element in series. The male plug at the other end of the cable is fitted into the input R.F. connector on the rear of the Panadaptor.

IF THE COMPANION RECEIVER IS NOT PROVIDED WITH A RECEPTACLE FOR OPERATION WITH A PANADAPTOR, PROCEED AS FOLLOWS:

Drill a 3/4" hole through the receiver cabinet somewhere near the plate prong of the converter tube. Put a rubber grommet into this hole.

Connect the isolating element as closely as possible to the plate prong of the mixer tube.

Insert the free end of the coax cable through the grommet hole. Connect the inner conductor to the other end of the isolating element. Clamp the cable shield to the chassis to assure a good ground connection. Check for any shorts between ground and either side of the isolating element.

SECTION III - OPERATION

1. GENERAL OPERATION, PANADAPTOR

The Panadapter provides continuous automatic visual presentation of signals present within a given band. Signals appear on the screen as inverted "V" deflections. The signal or station to which the receiver is tuned is seen as a deflection at or very near the center of the screen, while others which are not heard at the time appear to the left or right of center depending upon their frequencies. As the receiver is tuned the deflection will move across the screen. As a deflection approaches the center of the screen, its corresponding signal will be heard through the receiver.

a. Check the receiver for proper alignment and functioning of all controls. Turn on the receiver in the normal manner. Its controls, where applicable, should be set approximately is given below:

(1) R.F. Gain - near maximum
(2) A.F. Gain - normal
(3) AVC - off
(4) Selectivity controls - normal
(5) Crystal - In or Out
(6) BFO - Off
(7) Bandswitch - to band of interest or where traffic is heavy
(8) ANL - Off
(9) Antenna trimmer - normal for the particular antenna in use

b. Turn on the Panadaptor. Wait about 30 seconds for the baseline trace to appear. Set the front panel controls as given below:

(1) CENTER FREQ - on vertical marker
(2) SWEEPWIDTH - maximum clockwise
(3) RESOLUTION - maximum clockwise
(4) BRILLIANCE - for desired trace brightness
(5) INTENSIFIER - maximum counterclockwise
(6) FOCUS - sharpest trace
(7) SCALE SELECTOR - to LIN
(8) GAIN - between half and maximum clockwise position
(9) SWEEP RATE SELECTOR - to 30
(10) HORIZONTAL POSITION - for centered position of baseline trace
(11) VIDEO FILTER - to "out" position

If the band to which the receiver is tuned is well "populated", signal deflections of various amplitudes should be visible on the screen. If not or if a particular signal is being searched, rotate the receiver tuning dial until the signals or signal come into view.

Tune in the signal so that it is heard through the receiver.

Plug the other end of the cable into the rear RF receptacle on the Panadaptor.

NOTE: WHEN THE RF CABLE SUPPLIED IS ATTACHED TO THE PANADAPTOR, IT BECOMES PART OF THE INPUT TUNED CIRCUIT OF THE PANADAPTOR. THEREFORE, THE LENGTH OF THE CABLE SHOULD NOT BE VARIED. IF FOR ANY REASON THE LENGTH MUST BE CHANGED, THE INPUT STAGE OF THE PANADAPTOR WILL HAVE TO BE RETUNED. CAPACITY MAY HAVE TO BE ADDED OR REMOVED FROM THE PRIMARY DEPENDING UPON THE NATURE OF THE LENGTH CHANGE.

If the Panadaptor is operated with a receiver which has a PAN output connector, check whether there is an internal cable to this. If so, determine its capacity and shorten the Panoramic RF cable as required to compensate for this additional capacity.

Slight retuning of the first I.F. in the receiver may be required to adjust for any stray capacity introduced by the Panoramic connection.

(4) Connect the PS-8 power supply and Analyzer as outlined in Par. 2 above, Pre-installation Tests. Plug in the power supply to the constant voltage transformer. Plug the constant voltage transformer into the power source.

(5) Turn on the Panadaptor and receiver. Check the operation by following the operating procedure in Section III.

b. CONNECTION OF PANALYZOR: Installation of the Panalyzor is simple. Find a suitable location for the Panalyzor. Avoid locations which will allow strong light to shine on the screen.

Connect the power supply to the analyzer. Plug the line cord female connector into the male receptacle on the rear of the power supply chassis. Attach the other end of the line cord to the constant voltage transformer. Plug the constant voltage transformer into the power source.

To one of the two input RF connectors on the front panel connect the external oscillator or signal generator. Use either the cable supplied or the generator cable.

NOTE: If the signal generator frequency is not varied during examination of the test signal, the connecting cable does not have to match the 50 ohm input impedance of the Panalyzor. This also applies when flatness of response is not critical. Otherwise the generator cable must be 50 ohms and non-terminated or a suitable pad may be used to prevent reflections due to mismatch.

To the other RF connector attach the cable supplied. The other end of the cable may be coupled to the test signal capacitively or inductively as may be required. (A small loop may be attached to the end of the cable.) If the test signal has a DC component and the Panoramic cable is to be connected directly to the signal source, a .01 mfd DC blocking capacitor should be used at the free end of the cable. (26 ohms to 40 ohms AC Impedance at 400 KC to 600 KC.)

The deflection corresponding to the signal should be directly over the zero mark on the panoramic screen. If it is not, center it by the following procedure:

(1) Tune in the station as accurately as possible.

(2) Rotate the SWEEPWIDTH control almost fully counterclockwise at the same time keep the "spread out" peak centered with the CENTER FREQ control.

(3) Return the SWEEPWIDTH control to maximum clockwise position.

(4) If the peak is now off center, carefully rotate the HORIZONTAL POSITION control until the deflection is centered.

c. Always use as low a gain setting on the Panadaptor as possible while still being able to see weak stations heard on the receiver. Excessively high gain may cause jumpy noise deflections to appear. These will at times cause confusion since it is sometimes difficult to differentiate between noise and signals.

d. When AVC is used in the receiver, the signal appearing at the center of the screen will control the heights of other deflections. Therefore if a strong signal is tuned in, weaker adjacent signals may be so reduced that they do not appear. It will be found expedient, in most applications, to operate the receiver with AVC off.

e. The relative frequencies of signals appearing on the screen may be quickly determined from the screen calibrations and the receiver tuning dial. The frequency of the signal appearing at the center of the screen may be read off the receiver dial. The frequency of other signals is obtained by adding or subtracting the screen calibration for the given signal to the frequency reading on the receiver dial.

NOTE: The polarity (- or +) of the calibration will apply when the local oscillator of the receiver is below the received signal.

When the local oscillator is higher in frequency, the signs are reversed.

For example; at maximum scanning width each frequency calibration mark for the T-200 is equivalent to a 20 KC separation. If the deflection appears at + 40 and the receiver is tuned to 4310 KC, the pip corresponds to a signal of 4350 KC provided that the local oscillator tracks below the tuned signals. If the oscillator tracks above, the signal frequency would be 4270 KC.

When the local oscillator tracks below the signals, the deflections will move from right to left as the receiver is tuned upward in frequency.

f. The relative strengths of the received signals are roughly determined by the respective height of each pip. As the receiver is tuned it will be noted that the pip height will vary as the pip traverses the screen. The Panadaptor is designed to compensate for receiver selectivity through the use of a double peaked input stage.

To observe simultaneously signals which cause pips having an amplitude ratio no greater than 10:1 keep the SCALE SELECTOR on LIN. For observation of pips having a greater amplitude ratio switch the SCALE SELECTOR to LOG. This will allow simultaneous viewing of signals which may differ as much as 100:1 in height.

g. Interpretation of screen presentations will be found in paragraph 5 of this section. Operating procedure for pulses is contained in paragraph 4. Information on Narrow Band Analysis is given in paragraph 3.

2. GENERAL OPERATION, PANALYZOR

a. Turn on the power and wait for the baseline to appear. Allow the analyzor to warm up.

Set up the controls as follows:

(1) CENTER FREQ - on vertical marker (See Section II, par. 2e).
(2) SWEEPWIDTH - maximum clockwise
(3) RESOLUTION - maximum clockwise
(4) BRILLIANCE - for desired trace brightness
(5) INTENSIFIER - maximum counterclockwise
(6) FOCUS - sharpest trace
(7) SCALE SELECTOR - to LIN
(8) GAIN - between half and maximum clockwise
(9) SWEEP RATE SELECTOR - to 30
(10) HORIZONTAL POSITION - for centered position of center frequency pip (See Section II, par. 2c).
(11) VIDEO FILTER - set to "OUT"

Adjust the external heterodyne oscillator or signal generator which is connected to one of the input RF connectors at approximately 500 KC below the test signal for the T-200. (5 MC for the T-1000).

NOTE: The signal generator frequency can be recognized as being below the test signal frequency is increased. When the frequency of the external oscillator is below the test signals, the plus and minus signs on the screen apply: that is signals on the (+) side are higher in frequency than the center signal while those on the (-) side are lower. If the oscillator frequency is above the test signals, the signs are reversed.

Slowly search the spectrum with the external oscillator until the signal appears at the center of the screen.

To locate the signal, it may be found convenient to operate the analyzer at maximum gain and the signal generator for high output. Once the signal is located, the GAIN control may be backed off counterclockwise and the generator output lowered to obtain a signal which falls below full scale.

b. Frequencies of signals appearing on the screen may be quickly determined by adding or subtracting the screen calibration for a given signal to the frequency to which the signal generator is

adjusted and then subtracting or adding the input center frequency. See NOTE in para. 2a on the foregoing page.

Example: A T-1000 is set for maximum scanning width. A pip appears at -300 KC. The heterodyne oscillator is set to 107.400 MC.

The input center frequency of the T-1000 is 5 MC.

Signal Freq = Oscillator Freq $\mp$ Screen Calib. $\mp$ Input Center Freq.

Signal Freq = 107.400 MC - 0.300 MC + 5 MC = 112.100 MC

The screen calibration was subtracted in this example since it was determined, by following the procedure indicated in NOTE of par. a on the foregoing page, that the oscillator was below the test signal. Therefore, the (-) sign applied.

c. The relative amplitudes of presented signals are proportional to the relative heights of the corresponding deflections, within the limits specified for flatness of response.

To observe signals of comparative amplitude the SCALE SELECTOR should be set to LIN. On the other hand, examination of signals widely divergent in amplitude will require LOG setting of this control. This will allow simultaneous reading of amplitudes having a 40 db range.

3. NARROW BAND ANALYSIS: When signals or a carrier and its sidebands are so closely spaced in frequency that at full sweepwidth their corresponding deflections tend to merge into each other or mask one another, it may be possible to separate or resolve them by sharpening the I.F. bandwidth, and concurrently reducing the scanning width or by reducing the scanning rate or by doing both of the foregoing. Figures 2 and 3 indicate resolution versus scanning width for a 30 c.p.s., a 5 c.p.s. and a 1 c.p.s. scan rate.

a. To obtain greater resolution by increasing the scanning time, switch the SWEEPRATE SELECTOR from 30 to 5, 30 to 1, or from 5 to 1.

b. To increase the resolution capabilities by diminishing scanning width, narrowing the I.F. bandwidth and increasing scanning time use the following procedure:

(1) Keep the RESOLUTION control on 1.0 (broad).

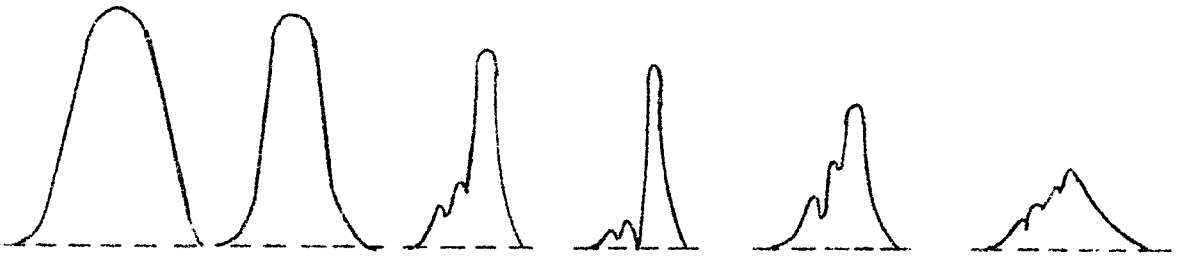
(2) With the receiver or external oscillator tune in the particular band of signals to the center of the screen.

(3) Spread the band of signals across the screen by turning the SWEEPWIDTH knob counterclockwise. Note that at reduced scanning width each frequency calibration mark represents a frequency separation equal to one tenth of the reduced sweepwidth. Keep the band centered with the CENTER FREQ. control.

(4) Turn the RESOLUTION control counterclockwise until individual signals are most clearly resolved.

NOTE: Rotation of the Resolution control may result in increased or decreased pip height. Pip amplitude may be returned to suitable level with the GAIN control. Turning the Resolution Control counterclockwise after optimum resolution is reached will decrease the resolving power and result in greatly reduced sensitivity.

If the resolution adjustment results in pratically complete separation of signal pips maximum resolution can be recognized by the presence of "ringing" on one side of the pip. The illustration below depicts this. "Ringing" can be seen more easily with the video filter in the "out" position.



Illustrations (a) to (f) indicate progressive variations in pip width effected by counterclockwise rotation of RESOLUTION control. In (a) and (b) I.F. width is broad for particular scanning velocity. (c) shows beginning of "ringing". Extent of "ringing" in (d) shows optimum resolution. As I.F. is made narrower, excessive "ringing" widens pip, amplitude decreases.

Further counterclockwise rotation of the Resolution control causes a reduction in amplitude and a tendency of remerging of the pips.

(5) To better separate the signals the SWEEPWIDTH and RESOLUTION controls can be further backed off counterclockwise and the SWEEP RATE SELECTOR set to 5 or to 1.

If it is mandatory to observe a given bandwidth at one time and the signals contained therein are so closely spaced that they cannot be completely resolved, maximum resolution is recognized by the appearance of the clearest picture. Further counterclockwise rotation of the resolution will result in lessened resolution and a "bobbing" presentation.

4. OPERATING PROCEDURE FOR PULSES SIGNALS

Pulse signals are composed of a series of pulses which are of relatively short duration. Therefore, a peak produced by one of these pulses traverses the screen vertically for so short a period of time that the c-r tube screen is insufficiently excited to produce a visible trace. Merely turning up the BRILLIANCE control does not help because the increased brightness of the baseline tends to "wash out" the pulse pattern. Therefore, the following procedure is used:

a. Follow the regular operating procedure but
b. Reduce the intensity of the baseline trace so that it is barely visible.
c. Turn the INTENSIFIER control clockwise. The pulse peaks should come into view while the baseline is not equally apparent. If necessary use the FOCUS control.

5. INTERPRETATION OF SIGNALS

With a little experience, the operator will be able to recognize visually the character of the various types of signals.

(1) A constant carrier appears as a deflection of fixed height.

(2) An amplitude modulated carrier appears as a deflection of variable height. Non-constant tone modulation of low frequency will produce a series of convolutions varying in height, their number being determined by the modulation frequency. The nature of the presentation will depend upon the scanning width.

As the modulation frequency increases the convolutions move toward the two sides of the deflection, as the side bands tend to become visible. When the modulation frequency is increased, it becomes possible to separate the side bands by reducing the sweepwidth of the analyzer. The resolution control will enable further separation. The higher the frequency of modulation, the farther away these sidebands will move from the center deflection, representing the carrier. One should remember that due to possible non-linear amplification of the receiver or of the analyzer, or both, over a wide band, the sidebands may appear unequal in height, even though they are of equal strength. Their relative heights may vary as the receiver is tuned and as the deflection moves from one end of the screen to the other.

(3) Single side-band modulation appears as two carriers of slightly different frequency (see below "Signal Interference").

(4) A carrier, frequency modulated at low rate appears as a carrier which wobbles sideways.

(5) A CW signal appears and disappears in step with the keying of the transmitter. During the moments when the signal is off, the frequency sweep axis is closed at the base of the signal. In very rapidly keyed signals the deflection and the baseline are seen simultaneously.

(6) A MCW signal appears like a CW signal of periodically varying height. If the modulation rate is high, sidebands will appear as explained above.

(7) Signal Interference. Two signals which are so close in frequency as to cause aural interference (beats), may appear on the screen as a single deflection, varying in height as with a modulated signal. As the frequency separation is increased, the deflection appears as if modulated on one side only. Further increase of frequency will cause a "break" in the apex of the deflection. By reducing the sweepwidth of the analyzer, the respective deflection will gradually separate. Further separation is effected with the Resolution Control and by setting the SWEEP RATE SELECTOR to 5 or 1.

(8) Transient disturbances, generally examined, are of two types: periodic and aperiodic transients.

Periodic transients, such is produced by motors, vibrators, buzzers, etc. appear as signals moving along the frequency sweep base line in one direction or another. Thus an engine which is accelerating will produce a set of deflections which may move first in one direction, slow down, stop, and then move in an opposite direction. This is caused by the fact that the analyzer is sweeping at a fixed rate, whereas the transient occurs at a variable rate. The images stand still on the screen when there is synchronism between the two. If the transient disturbance is synchronized with the 60 cycle line the "noise" appears as a fixed signal which, however, does not move on the screen when the receiver is tuned, but only varies in height. Such deflections may appear like amplitude modulated signals or like steady transients, such as "static" appear as irregular deflections and flashes along the whole frequency sweep axis.

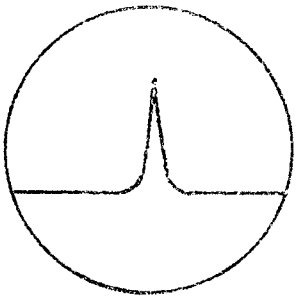
(9) Images. If the receiver or converter allows "images" to pass (due to poor image rejection of the RF circuit) these will be distinguishable from normal signals by the fact that they move in an opposite direction with respect to normal signals on the screen of the analyzer when the companion receiver or external oscillator is being tuned. Such images are most likely to appear on the higher frequency ranges of the receiver.

(10) Harmonics produced in the converter or receiver by the beat of very strong signals with harmonics of the oscillator, will be distinguishable from other signals by the fact that they move on the screen more rapidly (with tuning) than the normal signals. (Twice as fast for second harmonic spurious signals.) Generally a reduction in the gain of the receiver will eliminate this type of spurious signal.

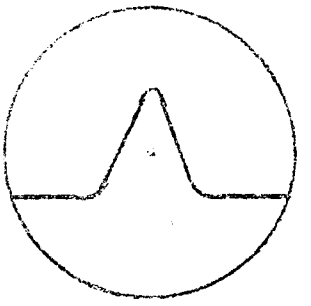
(11) Diathermy or other apparatus using an unfiltered or AC power supply will produce a periodic disturbance which will cause a deflection to appear on certain portions of the screen and disappear on other portions. This is due to the fact that such equipment emits a signal pulsating in synchronism with power line. On the other hand, the analyzer too, is sweeping the spectrum in synchronism with the line, but at a lower frequency and only when a certain phase relationship exists is it possible for the analyzer to receiver these periodic pulses.

In order to examine signals which are synchronized to the line frequency set the SWEEP RATE SELECTOR TO VAR and adjust the VARIABLE SWEEP control for the best presentation across the entire screen.

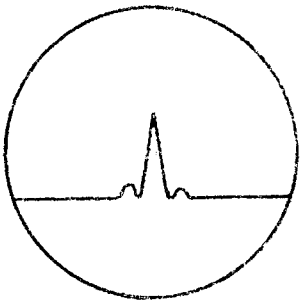
(12) Spurious Signals. If the signal strength exceeds a certain value, the deflection caused by any signal breaks up into a series of parallel deflections, somewhat similar to side-bands. These spurious signals take place either in the receiver or analyzer on extremely strong signals. Attenuation of signal input level will remedy this.



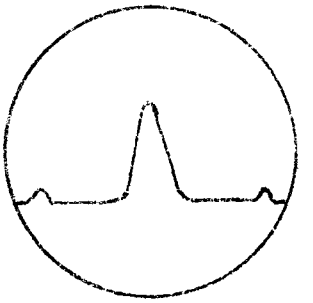
1. Constant carrier signal. Sweepwidth control adjusted for approximately maximum sweepwidth.



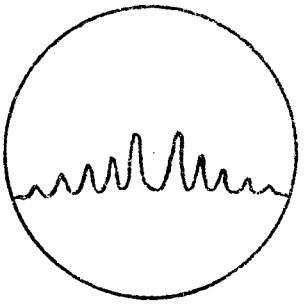
2. Appearance of constant carrier at reduced sweep-width.



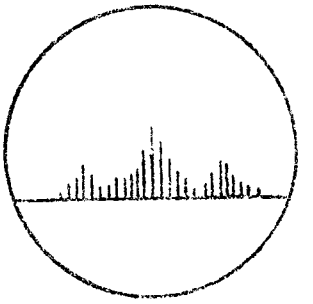
3. Illustration of an ampli-tude modulated signal showing carrier at 0 on screen and two side bands.



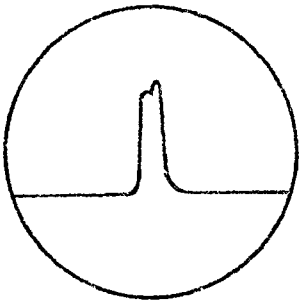
4. Same AM signal as in 3 except sweepwidth is reduced, carrier remains at center of screen.



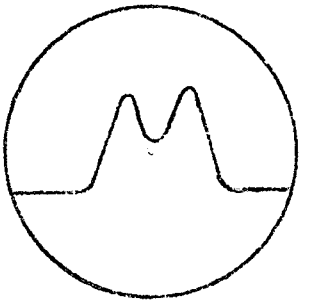
5. Frequency distribution of an FM signal.



6. Spikes indicating distri-bution of a pulsed RF signal.



7. Two interfering carriers depicted at maximum scanning width.



8. Same signals as in 7, sweep width reduced resulting in improved separation or resolution of signals.

Figure 2-2. APPEARANCE OF TYPICAL PANORAMIC INDICATIONS

SECTION IV - THEORY OF OPERATION

1. INTRODUCTION

The Panadaptor and Panalyzor are essentially automatic scanning superheterodyne receivers which provide a visual display of signals present within a given band.

The Panadaptor is operated with a companion superheterodyne receiver which is used to tune in the portion of the spectrum to be observed. The Panadaptor is attached to the receiver at the output of the mixer or converter. Appearing at this point is a broad band of signals which centers about the I.F. of the receiver. The width of the band is determined by the receiver front end selectivity. Since the receiver I.F. is sharply tuned only one of the signals is normally passed and subsequently heard. The input amplifier of the Panadaptor, however, is double peaked to compensate for the selectivity introduced by the receiver front end. Thus, it becomes possible to examine signals within a relatively broad band. The relative amplitudes of the signal indications will be determined by the product of the Panadaptor response and the preselection of the receiver. Inasmuch as receiver front end selectivity will differ among receivers and from band to band, the relative amplitudes of the indications may not coincide with actual relative signal levels.

The Panalyzor is operated with an external signal generator or oscillator which "tunes in" the band to be observed. The first stage of this panoramic unit is an aperodic mixer. The combination of external oscillator and mixer, in effect, is similar to the converter in the companion receiver described in the paragraph above. Since there is no preselection in this case and since a flat broad band amplifier follows the mixer, the relative heights of the signal indications will, within limits, coincide with the actual signal levels.

Both panoramic instruments basically consist of a broad band R.F. amplifier (discussed above), a swept local oscillator and converter, variable selectivity I.F. amplifiers, detector, video amplifier, cathode-ray tube indicator, associated sweep circuits and an intensifier.

The swept oscillator progressively heterodynes in order of frequency with those signals appearing across the output of the broad band amplifier to produce a difference frequency which is passed and amplified by the I.F. section. The output voltage of the I.F. which is proportional to the amplitude of the scanned signal is detected, amplified by the video section and applied to the vertical deflection plates of the c-r tube.

Oscillator sweep is obtained with a sawtooth modulated reactance tube circuit. A sawtooth generator supplies the necessary modulating voltage and also provides for horizontal sweep of the 'scope beam. Thus, for each discrete point on the horizontal axis of the c-r tube there is a corresponding local oscillator frequency and consequently a corresponding signal frequency.

The I.F. section includes two variable selectivity stages. A ganged control is used to vary the bandwidth of these two stages. Also included is an I.F. stage with circuit parameters which allow logarithmic amplification of signals. The output of the video section is applied to an intensifier tube as well as to the vertical deflection plates of the c-r tube. An adjustable amount of a positive voltage output, from the intensifier is impressed upon the intensity grid of the c-r tube enabling signals to intensity modulate the 'scope beam.

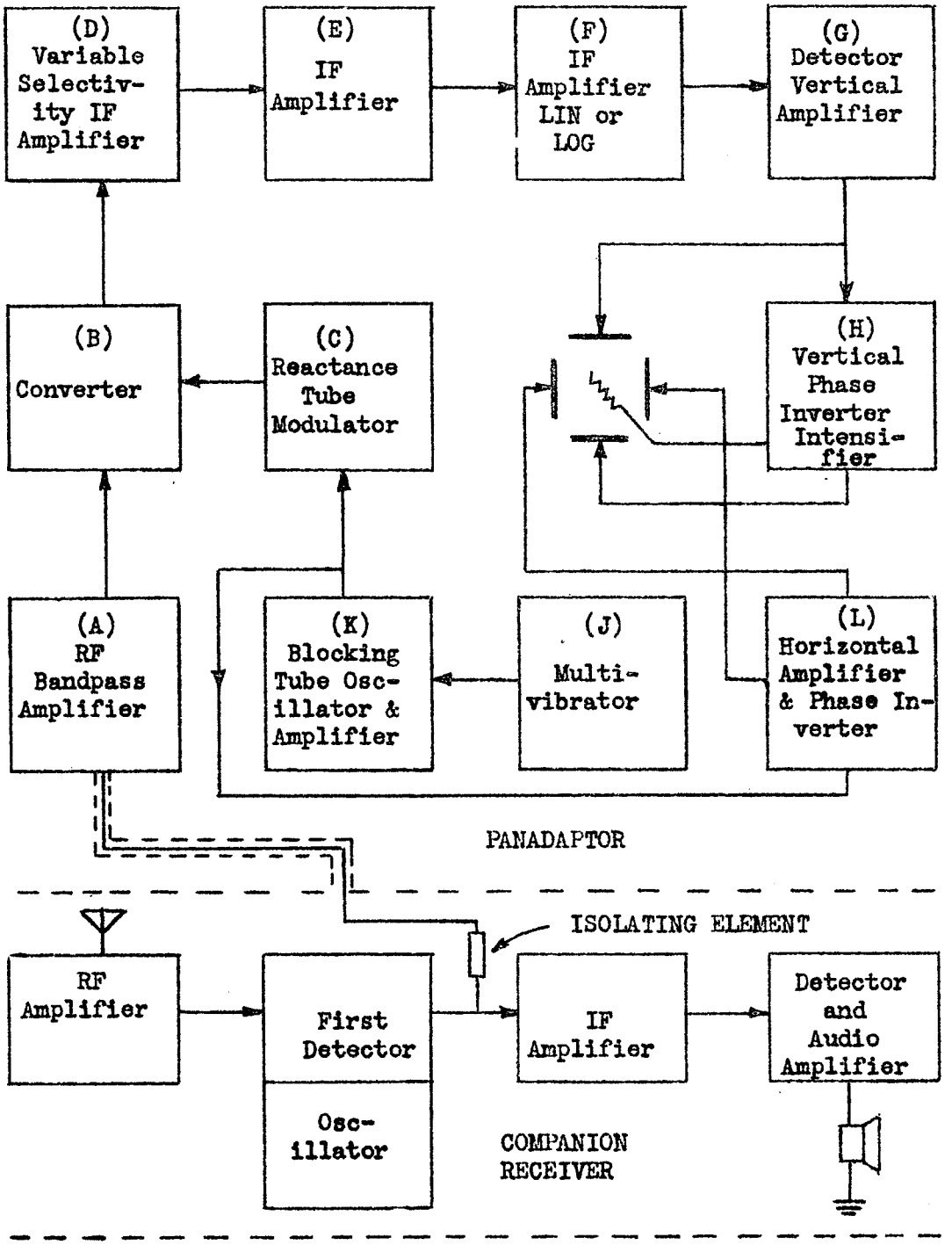


Figure 4 - Block Diagram, Panadaptor and Companion Receiver.

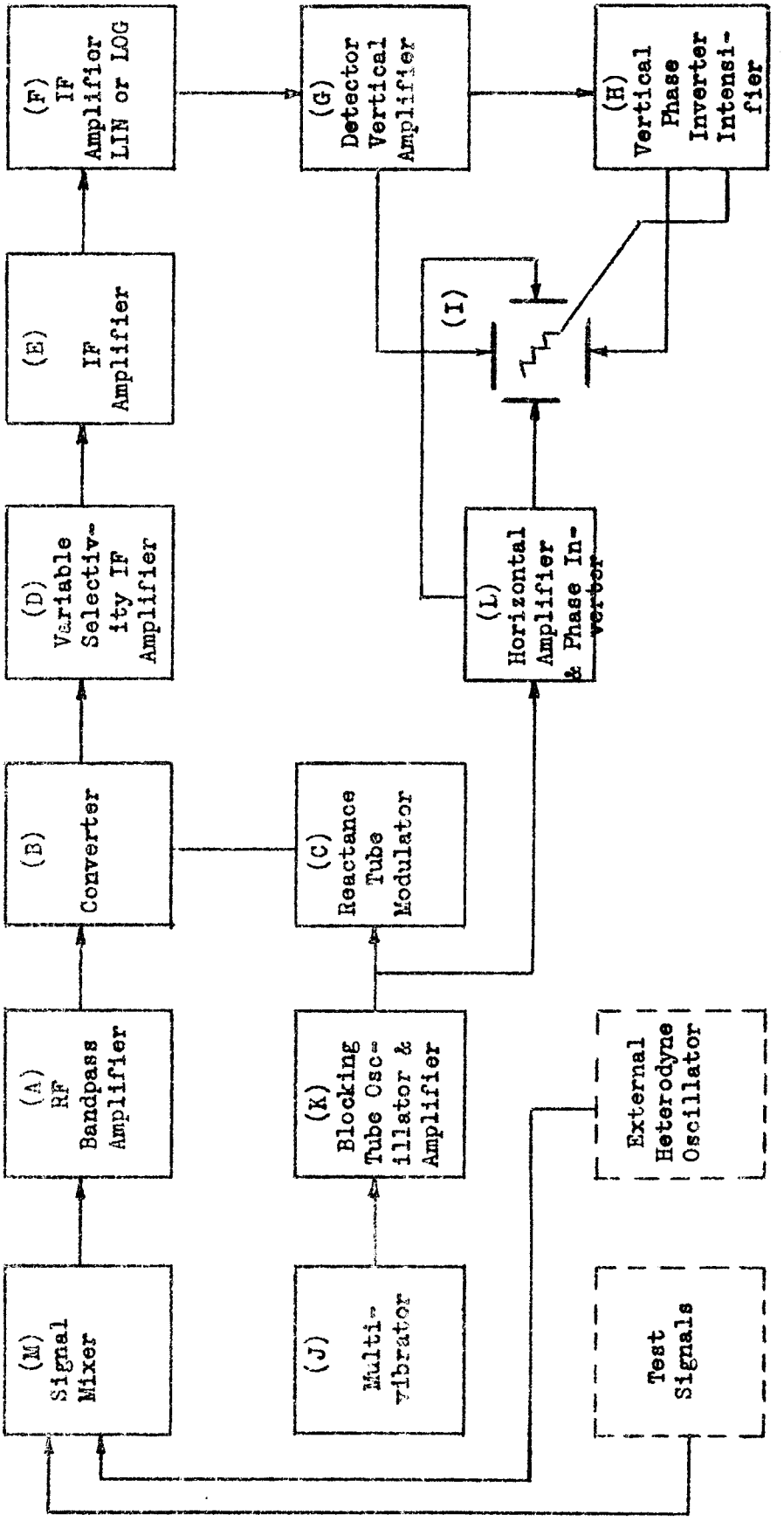


Figure 5 - BLOCK DIAGRAM, PANALYZOR

2. CIRCUIT DESCRIPTION

a. Signal Mixer: This stage, which employs a 6BE6 pentagrid mixer, is incorporated only in the Panalyzor. The test signals are applied to one of the control grids while the output of the external oscillator is applied to the other control grid. The function of the stage is purely to heterodyne the test signals with the external oscillator to produce a difference frequency which is equal to the input center frequency at the particular Panalyzor. Whatever gain is derived from the stage is incidental. The block marked II in Figure 5 represents the signal mixer.

b. R.F. Bandpass Amplifier: The function of this stage in the Panalyzor is to obtain to flat response across the scanned spectrum, and to provide image rejection. Refer to Block A Figure 5. The output load of the signal mixer consists of a double tuned transformer which is highly overcoupled and loaded resulting in a broad double peaked response. Peaking frequencies are as follows:

SB-8a	T-200	T-101-19B	400 KC and 600 KC
	T-1000	T-101-18B	4.7 MC and 5.3 MC

The voltage appearing across T101 is applied to the control grid of V2, a 6BH6 pentode amplifier. The output load of V2 is also an overcoupled double tuned transformer which has a double peaked response. The approximate locations of the peaks are given below:

SB-8a	T-200	T-102-19B	470 KC and 530 KC
	T-1000	T-102-18B	4.4 MC and 5.6 MC

The overall response of T-101 and T-102 combination is relatively flat over the specified bandpass region. This is illustrated in Figure 7.

The primary function of the RF Amplifier in the Panadaptor is to compensate for the selectivity of the RF amplifier and mixer stages of the receiver to enable presentation of a broad band of signals i.e. 200 KC or 1,000 KC. To do this it must provide greater gain in the outer portions of the displayed band. Compensation at most can only be partial since receiver selectivity will vary throughout the tuning range of the receiver. At the high end of the range there may be over-compensation. At the low end compensation may be insufficient, thus limiting the observable bandwidth. At some receiver frequency the compensation will be optimum. This is illustrated in Figure 6.

The signal input is passed from the output of the converter in the receiver through an isolating element and RF cable to the input RF transformer. Refer to Block A of Figure 4. The capacity of the cable is part of shunt capacity across the primary of the transformer. The isolating element prevents undesirable interaction.

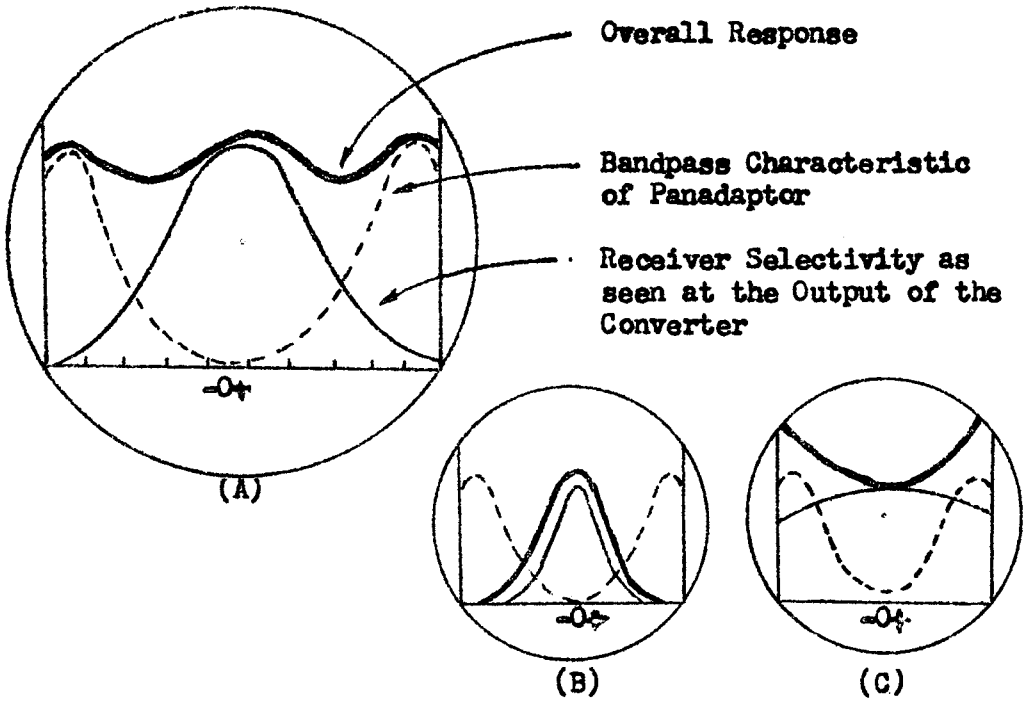


Figure 6.- Frame (A) indicates the resultant overall response of the Panadaptor and receiver when the receiver is tuned to a frequency at which front end receiver selectivity is compensated by the double peaked characteristic of the Panadaptor. (B) shows undercompensation and (C) overcompensation.

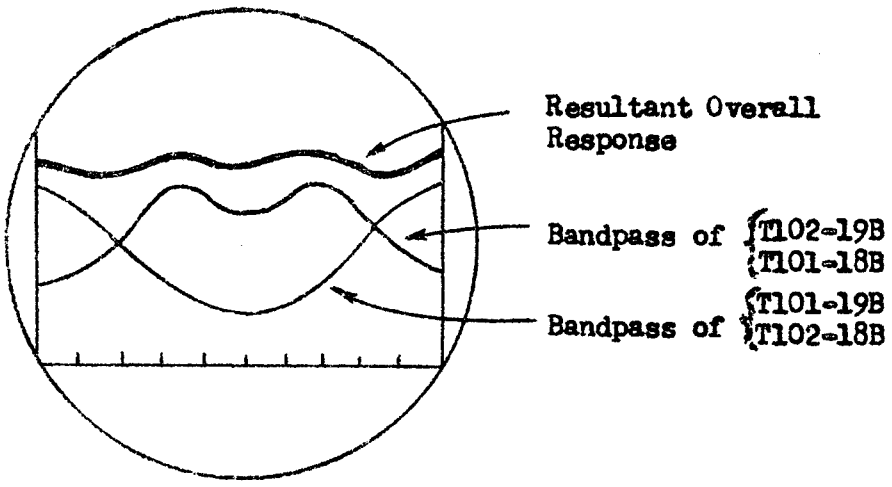


Figure 7. - Overall Response of Panalyzor as determined by the Bandpass Characteristics of the Input (T101) and Output (T102) Transformers.

3.3

The input transformer is overcoupled to produce a pronounced double peaked response. The output transformer is similarly overcoupled and peaked. Peaking frequencies are indicated below:

SA-8a T-200	365 KC and 545 KC
T-1000	4.83 MC and 5.67 MC

In both the Panalyzer and Panadaptor T101 and T102 are permeability tuned.

The GAIN control is incorporated in the cathode circuit of V2. This varies the grid bias on the tube thus governing transconductance. Current from the B+ supply is bled through the GAIN control to provide a greater range of gain variation and permit cutting off plate current in V2. The plate circuit of V2 is connected to regulated B+ so that as the GAIN control is manipulated plate current variations will not cause undesirable reactions in other circuits.

c. Converter: The block marked B in Figures 4 and 5 represent the converter. The stage employs a 6BE6 pentagrid converter tube, V3, which serves as an oscillator tube and also acts as a mixer to combine the output of the oscillator with the output of the RF Bandpass Amplifier. A difference frequency results. This is the I.F.

The oscillator is a grounded plate Hartley. Grid one of the 6BE6 acts as the oscillator grid and Z101 constitutes the oscillator tank circuit.

The electron stream traveling from the cathode to plate of converter tube is not only affected by grid one but also by grid three which is connected to T102, the RF Amplifier output transformer.

To eliminate the possibility of hum modulation, the heater of the converter and reactance tube modulator are operated on D.C. Two 6.3 V power transformer windings are connected in series. Their output is full wave rectified and filtered. The resultant D.C. is applied to the two tubes connected in series.

The oscillator is periodically tuned through a given range by purely electronic means.

d. Reactance Tube Modulator: The block marked C in Figures 4 and 5 is the reactance tube modulator. This tube is connected to the oscillator through a phase shifting network in such a manner that it becomes part of the oscillator tuned circuit. By varying the control grid voltage of this tube, a 6AH6 (V4), the reactive current of the tube changes in such a manner as to swing the frequency of the oscillator. Such a controlling voltage variation is applied to the grid periodically. The voltage is derived from a sawtooth voltage generator. When the sawtooth voltage is zero, the oscillator

3.3

is at its mean frequency.

The sawtooth on the reactor grid falls linearly from zero to a maximum negative voltage and then rapidly rises to a maximum positive value. From there it falls linearly to zero, completing one cycle. In coincidence with this the oscillator sweeps downward in frequency, then suddenly snaps back past the mean frequency to the maximum frequency and then sweeps back to the mean frequency. The extent of frequency excursion is determined by the amplitude of the applied sawtooth. The SWEEP WIDTH control governs this amplitude and consequently controls the scanning width. The SWEEP LIMIT control on the chassis limits the sawtooth voltage between the SWEEP WIDTH control and the sawtooth source.

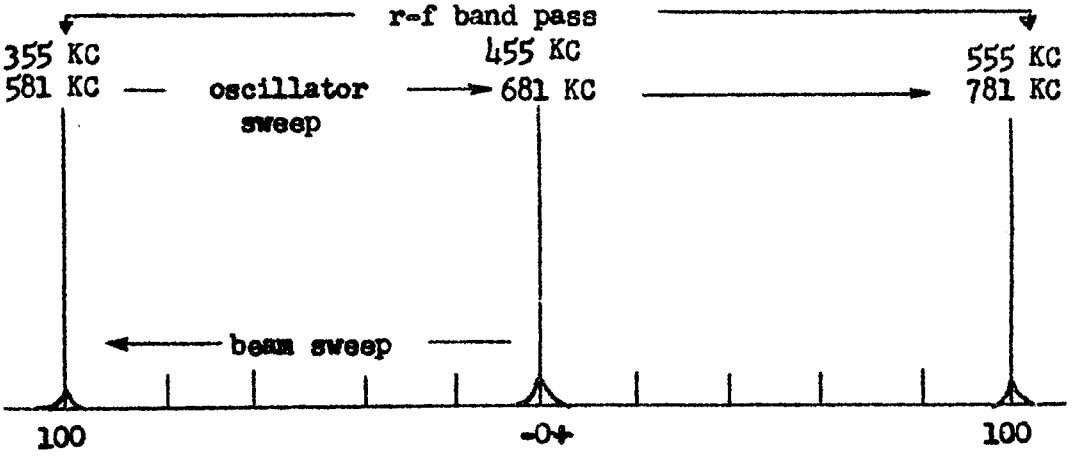
By controlling the bias on the reactance tube modulator the mean frequency of the oscillator becomes adjustable. The CENTER FREQ. control is actually a fine cathode bias control on the reactor tube. The C.F. PAD is a coarse bias adjustment.

As previously mentioned the heater of the reactor tube is operated on D.C. to prevent either FM or AM by 60 cycle A.C.

e. I.F. Section: The blocks marked D, E and F in Figures 4 and 5 illustrate the I.F. section.

The primary function of the section is selection and amplification of a given difference frequency which appears at the output of the Converter. The design features include variable selectivity and selectable linear or logarithmic amplification.

To examine the general behavior of the I.F. Section, the operation of the SA-8a, T-200 may be considered. The I.F. of this instrument is 226 KC, the oscillator excursion extends slightly on either side of the region between 581 KC and 781 KC while the RF Bandpass Amplifier passes signal frequencies between 355 KC and 555 KC, the center being 455 KC. The Chart below illustrates these facts in relation to the calibrated indicator screen.



3.3

If it is assumed that there are signals at 355 KC, 455 KC and 555 KC, then as the oscillator starts its upward frequency sweep from slightly below 581 KC, it will heterodyne with each of the three signals to produce the following difference frequencies.

slightly	below	226 KC for the 355 KC signal
slightly	below	326 KC for the 455 KC signal
slightly	below	426 KC for the 555 KC signal

But since the I.F. Section is sharply tuned to 226 KC, only the 355 KC signal will appear as a significant voltage in the section. The other difference products are so far removed from the 226 resonance frequency that they are greatly attenuated by the I.F. selective circuits. As the oscillator approaches 581 KC the I.F. voltage for the 355 KC signal will rise and will for all practical purposes become a maximum when the oscillator is at 581 KC. The voltage then decreases as the oscillator swings upward from 581 KC.

Thus, only the 355 KC signal will produce an indication when the oscillator sweeps through 581 KC. By the same reasoning it can be seen that only the 455 KC signal will produce a pip when the oscillator passes through 681 KC.

The form of the indication represents, to a degree, the response characteristic of the I.F. Section. For maximum resolution there is a definite relationship between I.F. bandwidth and scanning velocity, that is the number of cycles scanned in a given time. The SWEEPWIDTH and SWEEP RATE SELECTOR controls permit variations in scanning velocity. Therefore, to achieve maximum resolution for given scanning widths and rates two variable selectivity I.F. stages are incorporated. These are represented in Figures 4 and 5 by block D, the first section of the I.F. strip.

A 12AT7 twin triode, V11, is common to both variable selectivity stages.

One section of the tube is coupled to the output of the Converter through transformer Z102. The secondary coil of Z102 is tuned in part by the capacitance of the cable which connects Z102 to the 12AT7 grid. Both the plate and cathode circuits contain load resistors. The cathode load is shunted by a crystal in series with load coil Z103. Connected to the junction of the crystal and load coil there is variable capacitor, the other side of which is attached to the plate load.

The inductance of the crystal load coil is adjusted so that in conjunction with various shunt capacities its parallel resonant frequency is equivalent to the crystal series resonant frequency. The load coil at parallel resonance acts as a high resistive impedance in series with the crystal, thus causing a broad response. To very the response width, a potentiometer is shunted across part of the load coil.

As this shunt resistance is made smaller, the response width becomes narrower. The potentiometer is one section of the RESOLUTION control.

To neutralize the effects of the crystal holder capacity, the variable capacitor, mentioned above applies to the crystal load coil, a voltage which is equal and in phase opposition to that applied through the holder capacity. The neutralizing capacitor is used to eliminate the rejection slot.

The I.F. voltage appearing across the crystal load coil is applied to the second triode grid of the 12AT7. The circuitry of this second section is similar to that of the first. Another load coil, also contained in Z103 is used for the second crystal filter. The potentiometer across this coil, in conjunction with the potentiometer across the first load coil form the RESOLUTION control.

The output of the second load coil is applied to the grid of the third I.F. Amplifier, a 6BH6, V12. Refer to block E. A potentiometer in the cathode circuit of this tube varies the bias and transconductance of the tube. B+ current is bled into the control to provide greater range. This is the I.F. GAIN control. It is mounted on the chassis. The output of this stage is Z104, a double tuned transformer which drives the fourth I.F. Amplifier stage.

The fourth I.F. utilizes a 6AU6 pentode. See block F. It is designed to provide either linear or logarithmic amplification, selection being made through the SCALE SELECTOR switch. When the selector is set to LIN, the bottom end of the secondary in Z104 is grounded and cathode bias is applied to the control grid of the 6AU6. Amplification is linear. On the LOG setting of the selector switch, the bottom end of Z104 is ungrounded and connected through a decoupling filter to the Detector load resistor. The DC return of the 6AU6 control grid therefore, consists of the secondary of Z104, the decoupling resistor and the detector load.

In addition to cathode bias, detected signal voltages, across the load resistor, are fed back to the fourth I.F. stage as grid bias. The feedback bias voltage is proportional to signal level. As this bias increases, the gain of the stage decreases. Therefore, signals of high level will be amplified to a lesser degree than low level signals and consequently they will appear compressed. The extent of compression is determined by the amount of voltage feedback. The LOG ADJUST control governs the magnitude of the feedback.

f. Detector and First Vertical Amplifier: Refer to block G. The output of the I.F. Section is coupled to the detector through Z105, a single tuned coil. The primary and secondary of Z105 are top coupled through a large capacitor so that the two coils are effectively in parallel. Hence, a single capacitor is used to tune both coils.

The plate and grid of one section of a 12AU7 twin triode, V14, are connected together to form a diode detector. The rectified voltage appearing across the diode load resistor is direct coupled through a filter to the control grid of the second triode section.

The filter is designed to pass video frequencies. In addition the "video filter" switch switches in a low-pass filter that cuts off about 260 cps. Grid bias for the triode is obtained in the cathode circuit. A portion of the cathode bias is applied to the diode plate.

The output of the vertical amplifier is direct coupled to one vertical deflection plate of the c-r tube indicator and also to the Vertical Phase Inverter.

g. Vertical Phase Inverter and Intensifier: The purpose of the Phase Inverter, one half of V15, a 12AU7, is to drive the second or opposing vertical deflection plate of the c-r tube. The output voltage of the inverter is 180° out of phase with the input voltage. Thus, the combined output voltage of the First Vertical Amplifier and Phase Inverter is approximately twice that of either stage.

The coupling system between the two vertical amplifiers contains high frequency compensation for video output.

Coupling between the output of the Phase Inverter and second vertical deflection plate is direct. Hence the same DC voltage appears on the plate of the inverter and on the deflection plate. A variable cathode bias resistor in the cathode circuit of the inverter governs the inverter plate voltage and consequently the vertical position of the c-r tube indication. This is the VERTICAL POSITION control.

The output voltage of the Phase Inverter is also coupled to the second triode section of V15 where it is amplified. Coupling is capacitive. The output of the second section is capacitively coupled to the intensity grid of the c-r tube. Its magnitude is governed by the INTENSIFIER control. A positive output voltage pulse is obtained from the Intensifier whenever a signal is scanned through. When the BRILLIANCE control is adjusted so that the bias voltage on the intensity grid is at cut-off, application of the positive signal voltage pulse counter-acts the bias, allowing passage of the C-R beam. Operation of the INTENSIFIER is further described in Section III.

h. Sweep Circuits: Refer to block J, K and L. The sawtooth sweep voltage is derived from a blocking tube oscillator. A multivibrator is used to obtain line synchronized pulses for 5 c.p.s. and 30 c.p.s. sweep rates. The grid of one section of the multivibrator is fed with a 6.3 V heater voltage. The grid time constant of the second section is made variable through a 20 CYCLE SYNCH control, to obtain either a 20 c.p.s. or 30 c.p.s. pulse in a common cathode circuit. The pulse is introduced into the grid of the B.T.O. circuit.

When the SWEEP RATE SELECTOR is set to 5 c.p.s., the multivibrator produces a 20 c.p.s. synchronizing pulse which triggers the B.T.O. The B.T.O. is adjusted with the 5 CYCLE SYNCH control so that at this setting of the SWEEP RATE SELECTOR the sweep rate is 5 c.p.s. The 5 CYCLE SYNCH control is in the grid of the blocking tube oscillator (B.T.O.) circuit and governs the time constant of the grid.

3.3

On the 30 c.p.s. setting of the SWEEP RATE SELECTOR, the time constant of the 20 CYCLE SYNCH control in the multivibrator is automatically changed so that 30 c.p.s. synch pulses are produced. Simultaneously, the time constant of the BTO grid is changed with the 30 CYCLE SYNCH control so that the BTO can be triggered by the multivibrator 30 times per second.

The multivibrator is inoperative when the SWEEP RATE SELECTOR is on VAR and on 1 cps sweep rates. The BTO is free running. The 30 CYCLE SYNCH control is retained in the BTO and adjusts for proper range of the VARIABLE SWEEP RATE control.

The sawtooth voltage is produced across the charging capacitor in the plate circuit of the BTO. The sawtooth so developed is fed to an amplifier to permit low impedance coupling of sawtooth voltage to the reactor grid. A frequency compensating network in the grid circuit of this amplifier insures equal sweep velocities at all points of the screen. The LINE SIZE Control is located in the input of this amplifier. The SWEEP LIMIT PAD and SWEEPWIDTH controls are coupled after the LINE SIZE control to prevent changes in horizontal location of pips with line voltage fluctuations.

The sawtooth voltage is applied from this amplifier to a Horizontal Amplifier and Horizontal Phase Inverter. Both stages supply an amplified sawtooth voltage to the horizontal deflection system of the c-r tube. The HORIZONTAL POSITION control governs the relative DC potentials on the horizontal deflection plates and hence the horizontal position of the sweeping beam.

The FOCUS and BRILLIANCE control are in the high voltage bleeder chain.

The ASTIGMATISM control adjusts the voltage to the 2nd anode of the CRT.

SECTION V - SERVICE AND MAINTENANCE

1. SEMI-ADJUSTABLE CONTROLS

These controls seldom require adjustment and they are therefore located on top of the chassis.

a. VERTICAL POSITION: If the baseline trace is not in line with the lowest horizontal grid line on the screen, adjust this control to obtain incidence. If the baseline is not parallel with the grid line, the c-r tube should be rotated. This requires loosening of the clamp around the c-r tube socket and relaxation of the c-r tube bezel screws so that pressure on the tube by the bezel is removed. Be sure that the power is off when adjusting the physical position of the c-r tube. The c-r tube socket can then be rotated as required. The screen is held in place by detents in the bezel grommet. There is slight amount of play in this fit so that if exact lining up of the trace and grid is difficult through tube rotation the screen position may be changed a trifle.

b. LINE SIZE: The horizontal length of the trace is adjusted with this control. If the trace is excessively long, resolution will be adversely affected, and if the trace is too short, the scanning width will be reduced. If adjustment is required, the LINE SIZE control should be set for a baseline length which extends three quarters to one division on either side of the frequency scale extremities.

c. I.F. GAIN: Reserve gain is provided in the I.F. Section. When the overall gain is below that specified, set the front panel GAIN control to maximum, RESOLUTION completely clockwise, SCALE SELECTOR ON LIN. Apply the specified sensitivity voltage to the equipment through the input cables (and isolating elements where applicable). Adjust the I.F. GAIN control for full scale deflection.

d. LOG SCALE ADJUSTMENT: This adjustment may be checked quickly by feeding in a signal which causes a full scale deflection for LIN setting of the SCALE SELECTOR switch. Turn the selector to LOG. Increase the amplitude of the input signal by ten times. If this does not give a full scale deflection, rotate LOG SCALE ADJUSTMENT potentiometer until full scale deflection is attained.

e. LOG ZERO ADJUST: This adjustment may be checked quickly by feeding in a signal which causes a full scale deflection for LIN setting of the SCALE SELECTOR switch. Turn the selector to LOG. The deflection should go down to 0 db. If this does not occur, rotate LOG ZERO ADJUST potentiometer until the point is reached. It is important to note that procedures (d) and (e) must be repeated until the LOG SCALE is correct.

f. SWEEP LIMIT and C.F. PAD: See Alignment Procedure.

g. 20 CYCLE SYNCH, 5 CYCLE SYNCH and 30 CYCLE SYNCH: If the Pre-Installation Tests outlined in Section II, paragraphs i and j indicate improper sweep rates, one or more of the above controls will require adjustment.

Adjustment of the multivibrator for 20 C.P.S. line synchronized pulses is given below.

(1) Set the SWEEP RATE Selector on 5.

(2) Connect an oscilloscope to jack on the rear labeled "multivibrator." Adjust the oscilloscope sweep rate for 20 c.p.s.

This will be recognized by the appearance on the screen of the oscilloscope of 3 cycles of the 60 cycle hum present on these pins.

(3) Adjust the 20 CYCLE SYNCH for one multivibrator pulse. Rotate this control through the range in which only I pulse appears, then set the control midway in this range.

(4) Change the sweep rate of the oscilloscope to 30 c.p.s. Two cycles of 60 cycle hum should appear. Set the SWEEP RATE SELECTOR to 30. Again one multivibrator pulse should appear for every two cycles of hum.

The BTO is set for 5 c.p.s. sweep in the following manner:

(1) Set the SWEEP RATE SELECTOR to 5.

(2) Apply approximately 1 volt of AC heater voltage to the grid of the video amplifier, pin 2 of V14.

(3) Adjust 5 CYCLE SYNCH so that twelve stationary cycles of 60 cycle hum appears on the screen.

30 CYCLE SYNCH is adjusted as follows:

(1) Set the SWEEP RATE SELECTOR to VAR.

(2) To pin #2 of V14 apply a 24 c.p.s. voltage from a well calibrated audio oscillator. Keep this voltage low so that the stage is not overloaded.

(3) Turn the VARIABLE SWEEP RATE to 25.

(4) Adjust 30 CYCLE SYNCH so that one cycle of 24 c.p.s. appears on the screen. 30 cycle synch is now aligned.

(5) Turn variable sweep rate to 35 c.p.s. Adjust the audio oscillator for one cycle on screen. The oscillator will read from 35-37 c.p.s. if the 30 cycle synch is properly aligned. As a check the SWEEP RATE SELECTOR can be set to 30 and 60 cycle hum fed in on pin #2 of V14. Two cycles of hum should appear on the 30 c.p.s. position.

1 Cycle Sweep is adjusted as follows:

Adjust the 1 c.p.s. sweep control until 20 sweeps are counted in 20 seconds. Use a watch with a sweep second hand for timing.

2. ALIGNMENT PROCEDURE

A. Tuning the R.F., FM oscillator and I.F. Coils: Transformers T101, T102, Z101, Z102, Z103, Z104 and Z105 are tuned by means of movable iron cores. Windings at the top of the coil are tuned with a hollow iron core which may be turned with the pin end of the aligning tool supplied.

3.3

The bottom windings may be tuned from either the top or bottom of the transformer. In either case the screwdriver tip of the aligning tool is used. When the bottom core is approached from the top, the tool is inserted through the top hollow core and finally engaged in a slot at the top of the lower core. Allow the panoramic equipment and necessary signal generator to "warm up" for at least one-half hour before alignment is attempted.

B. I.F. Amplifier Alignment

The frequencies involved in I.F. alignment are listed below.

Model	Type	Input Center Freq.	I.F.
SA-8a	T-200	455 KC	226 KC
	T-1000	5.25 MC	1.5 MC
SB-8a	T-200	500 KC	226 KC
	T-1000	5 MC	1.5 MC

Set the front panel controls as follows:

RESOLUTION - completely clockwise

INTENSIFIER - completely counterclockwise

GAIN - maximum

SCALE SELECTOR - LIN

SWEEP RATE SELECTOR - 30

BRILLIANCE - bright trace as desired

FOCUS - sharp trace

CENTER FREQUENCY - to marker

HORIZONTAL ADJUSTMENT -

1. Turn SWEEPWIDTH control to zero
2. Center input signal with CENTER FREQ. control
3. SWEEPWIDTH to maximum clockwise
4. Adjust HORIZONTAL POSITION to place pip in center

VIDEO FILTER - "out"

SWEEPWIDTH - completely clockwise

Connect an 0.01 mfd capacitor in series with the output of the signal generator and proceed as outlined on the next page.

Sig. Gen. Output	Sweepwidth Control at	Signal Fed To	Procedure
I.F. spec. above (about 50,000 uv)	Min.	Pin #1	Tune the top and bottom windings of Z105 for maximum horizontal deflection. Once either Core is tuned for maximum deflection, no further tuning is required, since the windings are in parallel.
Same as above (1,000 uv)	Same as above	Pin #1 V12 6BH6	Tune top and bottom cores of Z104 for maximum vertical deflection possible with each.
Same as above (2,500 uv)	Same as above	Pin #7 V3 6BE6	Tune top and bottom core of Z102 for maximum vertical deflection possible with each.
Input Center Freq. Spec. above	Max.	Pin #7 V3 6BE6	(1) Adjust the CENTER FREQ. and if necessary the C.F. PAD to center the pip on the screen. Gradually reduce the scanning width at the same time continuously readjusting the CENTER FREQ. control to keep the pip on the screen until the base of the pip occupies the entire frequency scale.
	Adjust continuously as required to keep the entire pip within screen limits.		(2) Remove crystal Y1 and short the pins of the crystal Y1 socket. Since holder capacity varies with position, it will be important, when replacing the crystal, to preserve the orientation of the crystal with respect to the crystal socket.
			(3) A crystal neutralizing condenser is mounted near each crystal on the underside of the I.F. strip. These condensers are to be tuned with the screwdriver end of the aligning tool furnished. Access holes will be found about half way between the crystal sockets. Each condenser tunes the crystal nearest to it. Tune the trimmer capacitor nearest crystal Y2 for a minimum height of the envelope formed by the pips.
			(4) Tune the top core of Z103 for maximum envelope height.

Sig Gen. Output	Sweepwidth Control at	Signal Fed To	Procedure
			(5) Repeat (3) of the foregoing (6) Tune the top of Z103 for minimum envelope height. Readjust the signal input level and sweepwidth so that the pip fills the screen. (7) If neutralization is improper, a deep rejection slot will be seen in the pip. Tune the neutralizing capacitor until the slot moves towards one edge of the pip and then enters the opposite side of the pip from the other side of the screen. (Tuning the trimmer in a clockwise direction will cause the pip to move to the right.) Reverse the tuning direction until the slot again moves out of the pip. Leave the adjustment approximately half way between the two positions at which the slot enters the pip from either side. (8) Repeat 6 above. (9) Retune the neutralizing condenser and the top core of Z103 together until the pip is symmetrical about a vertical axis. (10) Remove the short from the crystal Y1 socket. Replace crystal Y1 in the same orientation as it had prior to removal. Remove crystal Y2 and short together the pins of crystal Y2 socket. (11) Tune the nearest trimmer capacitor to crystal Y1 and the bottom core of Z103 as described in steps (3) to (9) of the foregoing. (12) Remove the short from the empty socket and replace the crystal in the same orientation as it had prior to removal.

Sig. Gen. Output	Sweepwidth Control at	Signal Fed to	Procedure
			(13) Retune the top core of Z103 for a minimum symmetrical response curve of the pip.
			(14) Turn the RESOLUTION control counter-clockwise until the pip height is reduced 30%. Retune the top and bottom cores of Z105, Z104 and Z102 for maximum pip height.
			(15) Set the RESOLUTION control fully clockwise and repeat step 13. Adjust BANDWIDTH LIMIT for broadest single symmetrical peak.

C. FM Oscillator Alignment.

The following adjustments are a series of approximations, which are narrowed down until the desired results are obtained. During the entire procedure the signals are applied through the R.F. cable and where applicable the proper isolating element at the end of the cable.

The frequencies involved are indicated in the following.

Model	Type	Input Center Frequency	High Freq. Alignment	Low Freq. Alignment
SA-8a	T-200	455 KC	555 KC	355 KC
	T-1000	5.25 MC	5.75 MC	4.75 MC
SB-8a	T-200	500 KC	600 KC	400 KC
	T-1000	5 MC	5.5 MC	4.5 MC

(1) Low Frequency Alignment. -

(a) Feed in a signal as shown under Low Frequency Alignment in the chart above.

(b) With SWEEP LIMIT and SWEEPWIDTH set for maximum, tune Z101 so that the deflection on the C-R screen appears at the extreme left calibration.

(2) Center Frequency Alignment. -

(a) Feed in a signal as shown under Center Frequency Alignment in the chart above.

(b) With the SWEEPWIDTH control at maximum, set the CENTER FREQ. control on the marker.

(c) Keeping the pip on center by adjusting Center Frequency C.F. PAD, reduce the SWEEPWIDTH until this control is almost at minimum.

(d) Return the SWEEPWIDTH control to full clockwise position. Center the pip with the Horizontal Position Control.

(3) High Frequency Alignment.-

(a) Feed in a signal as shown under High Frequency Alignment in the chart on page 41.

(b) Reduce the SWEEP LIMIT Pad until the deflection on the C-R screen appears at the extreme right calibration.

(4) Check on Overall Alignment.-

(a) Feed in a signal as shown under Low Frequency Alignment in the chart; if the deflection appears at the extreme left calibration, then the F.M. oscillator is aligned.

(b) However if this does not occur, repeat the low Frequency Alignment, Center Frequency Alignment and High Frequency Alignment.

Suggestion: In repeating the Low Frequency Alignment if the deflection occurs to the right or left of the extreme right calibration, it should be moved the same distance to the other side of the calibration by tuning Z101.

D. R.F. Alignment, Panadaptor

For this alignment a "cut and try" method is required. To determine the response characteristics of the R.F. stages, the frequency of the signal generator is varied while the amplitude is kept constant. The deflection peak on the screen moves from one side of the screen to the other, thereby defining the response characteristic.

The SCALE SELECTOR should be on LIN and the SWEEPWIDTH at maximum.

The peaking frequencies involved are given below:

Type	Input Center Freq	High Peak Freq	Low Peak Freq
T-200	455 KC	545 KC	365 KC
T-1000	5.25 MC	5.67 MC	4.83 MC

The chart below shows the cores that tune the primary and secondary windings in the input and output R.F. transformers.

Type	Transformer	Primary	Secondary
T-200	T101-19A	top core	bottom core
	T102-19A	top core	bottom core
T-1000	T101-18A	top core	bottom core
	T102-18A	top core	bottom core

3.8

D 1. Type T-200

Note: The R.F. transformers used in this equipment have sliders. This makes it possible to adjust the spacing between the primary and secondary so as to obtain the proper frequency separation between the peak frequencies. If the frequency separation is correct, then it is only necessary to trim the cores of two R.F. transformers until the desired peak deflection is obtained. If the frequency separation is not correct, the full alignment procedure must be used.*

a. First align the interstage transformer T102

(1) Make the spacing between the primary and secondary windings approximately 1/16".

(2) Using a .01 mfd coupling capacitor, feed a signal equal to the input center frequency to the plate of V2 (pin #5). Tune the secondary for a peak deflection at the center of the screen.

(3) Apply a signal equal to the high peak frequency to the grid of V2 (pin #1). Tune the primary for a peak deflection.

(4) Applying the signal to grid of V2, vary the signal generator frequency over the R.F. band of the equipment noting the frequency separation between the high and low frequency peaks as read on the screen of the equipment.

If the frequency separation is greater than specified, increase the coil spacing.

If the frequency separation is less than specified, decrease the coil spacing.

(5) Repeat steps (2), (3) and (4) until peak deflections and the proper frequency separation are obtained.

b. Then align the input transformer T101.

(1) In order to see the response characteristic of T101, it is first necessary to load down the primary and secondary of T102. For this purpose use resistors of approximately 10 K ohms clipped across both the primary and secondary of T102.

(2) Make the spacing between the primary and secondary windings approximately 1/16".

(3) Connect the signal generator to lug 1 of T101 and set the generator to the input center frequency. Tune the secondary for a peak deflection at the center of the screen.

(4) Now apply to the input connector through the input cable and specified isolating element, a signal equal to the high peak frequency. Adjust the primary for maximum deflection.

---

* The sliders have been waxed down to prevent movement. If it is necessary to change the position of the sliders, the waxing must be removed. Upon completion of the alignment procedure re-wax the coils to prevent movement.

3.8

(5) Applying the signal to the input connector using the input cable and isolating element, vary the signal generator frequency over the R.F. band of the equipment noting the frequency separation between the high and low frequency peaks as read on the screen of the equipment.

If the frequency separation is greater than specified, increase the coil spacing.

If the frequency separation is less than specified, decrease the coil spacing.

(6) Repeat Steps (3), (4) and (5) until peak deflections and the proper frequency separation are obtained.

(7) Remove the loading resistors across T102 used in Steps (1) to (6).

(8) Examine the overall response characteristic and trim the primary and secondary of both R.F. transformers until the two peak deflections are of nearly equal amplitude and properly placed. A position between the edge of the screen and one half of a division from the edge of the screen is considered proper. See page 29.

Note: Other things being equal, the peak to valley ratio is a function of how closely in frequency are the corresponding peaks of T101 and T102. Therefore some degree of change can be made by changing the frequency separation of the peaks of one of the coils.

D 2. Type T-1,000

a. First align the interstage transformer T102

(1) Through an .01 mfd coupling capacitor feed a signal equal to the input center frequency to the plate pin #5 of V2.

Tune the secondary for a peak deflection at the center of the screen.

(2) Now apply a signal equal to the high peaking frequency to the grid pin #1 of V2. Tune the primary for a peak deflection.

b. Second align the input transformer T101.

(1) Connect the generator to lug 1 of T101 and set the generator to the input center frequency. Tune the secondary for a peak deflection at the center of the screen.

(2) Now feed the high peaking frequency through the input cable and specified isolating element. Adjust the primary for maximum deflection.

(3) Examine the overall response characteristic and trim the primary and secondary of both R.F. transformers until the two peak deflections are of nearly equal amplitude and properly placed. A position between the edge of the screen and one half of a division from the edge of the screen is considered proper. See page 29.

E. R.F. Alignment, Panalyzor, SB-8a, T-200

Note: The R.F. transformers used in this equipment have sliders. This makes it possible to adjust the spacing between the primary and secondary so as to obtain the proper frequency separation between the peak frequencies. If the frequency separation is correct, then it is only necessary to trim the cores of two R.F. transformers until the desired flatness is obtained. See sub-paragraph c, page 46. If the frequency separation is not correct, the full alignment procedure must be used.*

Set the SCALE SELECTOR on LIN., CENTER FREQ. for centered 500 KC pip and SWEEPWIDTH at maximum. This alignment requires a "cut and try" method. The frequency response of the section is determined by feeding in signals constant in amplitude at various frequencies over the R.F. band of the equipment.

a. First align the interstage transformer T102

(1) Make the spacing between the primary and secondary windings approximately 1/4".

(2) Using a .01 mfd coupling capacitor, feed a 500 KC signal to the plate of V2 (pin #5). Tune the secondary for a peak deflection at the center of the screen.

(3) Apply a 530 K signal to the grid of V2 (pin #1). Tune the primary for a peak deflection.

(4) Applying the signal to grid of V2, vary the signal generator frequency over the R.F. band of the equipment noting the frequency separation between the high and low frequency peaks as read on the screen of the equipment. The peaks should appear at 530 KC and at 470 KC.

If the frequency separation is greater than specified, increase the coil spacing.

If the frequency separation is less than specified, decrease the coil spacing.

(5) Repeat steps (2), (3) and (4) until peak deflections and the proper frequency separation are obtained.

b. Then align the input transformer T101

(1) In order to see the response characteristic of T101, it is first necessary to load down the primary and secondary of T102. For this purpose use resistors of approximately 10 K ohms clipped across both the primary and secondary of T102.

(2) Make the spacing between the primary and secondary windings approximately 1/16".

(3) Connect the signal generator to lug 1 of T101 and set the generator to 500 KC . Tune the secondary for a peak deflection at the center of the screen.

(4) Now apply to one of the input connecters, through one of the input cables, a 600 KC signal. Adjust the primary for maximum deflection.

*The sliders have been waxed down to prevent movement. If it is necessary to change the position of the sliders, the waxing must be removed. Upon completion of the alignment procedure re-wax the coils to prevent movement.

(5) Applying the signal to the input connector using the input cable, vary the signal generator frequency over the R.F. band of the equipment noting the frequency separation between the high and low frequency peaks as read on the screen of the equipment. The peaks should appear at 600 KC and at 400 KC.

If the frequency separation is greater than specified, increase the coil spacing.

If the frequency separation is less than specified, decrease the coil spacing.

(6) Repeat Steps (3), (4) and (5) until peak deflections and the proper frequency separation are obtained.

(7) Remove the loading resistors across T102 used in Steps (1) to (6).

c. Then adjust the cores of the two R.F. transformers for proper flatness as follows.

Note: When performing a complete R.F. alignment, i.e., including "a" and "b", steps (5) to (7) only need be followed. If the frequency separation of the peaks is correct and only an adjustment of the cores to obtain proper flatness is being made, then steps (1) to (7) must be followed.

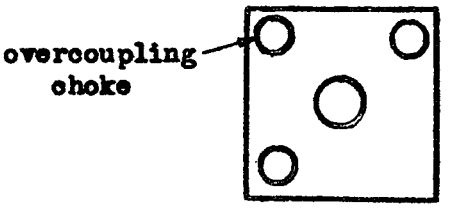
	Signal Generator Output	Signal Fed To	Transformer Tuned	Procedure
(1)	470 KC	Pin #1 of V2, 6BH6	T102-19B	Tune bottom core (secondary) for a maximum pip deflection.
(2)	530 KC	Pin #1 of V2, 6BH6	T102-19B	Tune top core (primary) for a maximum pip deflection.
(3)	400 KC	Input Jack	T101-19B	Tune bottom core (secondary) for a maximum pip deflection.
(4)	600 KC	Input Jack	T101-19B	Tune top core (primary) for a maximum pip deflection.
(5)	400 KC then 600 KC	Input Jack	T102-19B	If the 400 KC pip is taller than the 600 KC pip, adjust for equal amplitude by trimming the bottom core clockwise and the top core counter-clockwise. On the other hand if the 600 KC pip is the tall of the two, trim the bottom core counter-clockwise and the top core clockwise.
(6)	400 KC 500 KC 600 KC	Input Jack	T102-19B	If the 400 KC and 600 KC pips are taller than the 500 KC pi trim the top and bottom cores clockwise. If they are lower trim both cores counter-clock
(7)				Repeat (5) and (6) until response flatness is within

F. R.F. Alignment, Panalyzor, SB-8a, T-1000

Set the SCALE SELECTOR on LIN, SWEEPWIDTH at maximum and CENTER FREQ. for a centered 5 MC pip.

All adjustments on the next page are made from the top of the can.

	Signal Gen. Output	Signal Fed To	Transformer Tuned	Procedure
1)	5.6 MC	Pin #1 of V2 6BH6	T102-18B	Turn the core of the overcoupling choke so that no threads appear outside the can. Tune top core (primary) and bottom core (secondary) for a maximum vertical pip.
2)	4.4 MC	"	"	Tune overcoupling choke for a maximum vertical pip. Do not turn the core so far in a clockwise position that it cannot be turned in a counter clockwise direction.
3)	5.6 MC	"	"	Repeat (1)
4)	4.4 MC	"	"	Repeat (2)
5)	5.3 MC	Input Jack	T101-18B	Turn the core of the overcoupling choke so that no threads appear outside the can. Tune top core (primary) and bottom core (secondary) for a maximum vertical pip.
6)	4.7 MC	"	"	Tune overcoupling choke for a maximum vertical pip.
7)	5.0 MC	"	———	Vary GAIN control until a deflection 1.0 is reached on the LIN scale on the screen.
8)	5.3 MC	"	T101-18B	Tune the bottom core (secondary) until a deflection of 1.0 is reached on the LIN scale. Use top core if necessary.
9)	5.0 MC	"		Repeat (7)
10)	5.3 MC	"	T101-18B	Repeat (8), if the bottom core (secondary) does not give the necessary results, use the top core (primary) until a deflection of 1.0 is reached on the LIN scale.
11)	5.0 MC	"		Repeat (7)
12)	4.7 MC	"	T101-18B	Tune overcoupling choke until a deflection of 1.0 is reached on LIN scale.
13)	5.0 MC	"	T101-18B	Repeat (7)
14)	5.3 MC	"	T101-18B	Repeat (10)
15)	5.0 MC	"		Repeat (7)
16)	4.7 MC	"	T101-18B	Repeat (12)
17)	5.0 MC	"	———	Repeat (7)
18)			———	Repeat steps (14)-(17) until a flatness of approximately ±7% is reached.



Top of can applies for both
T101-18B
T102-18B

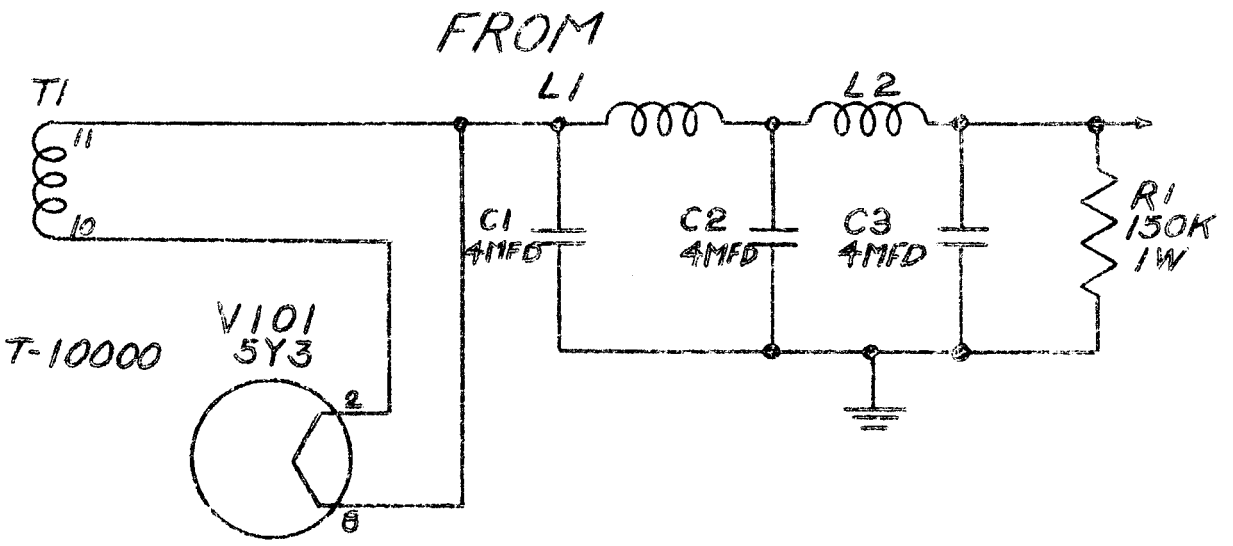
Note: Signal input should be kept constant throughout procedures (7)-(18).

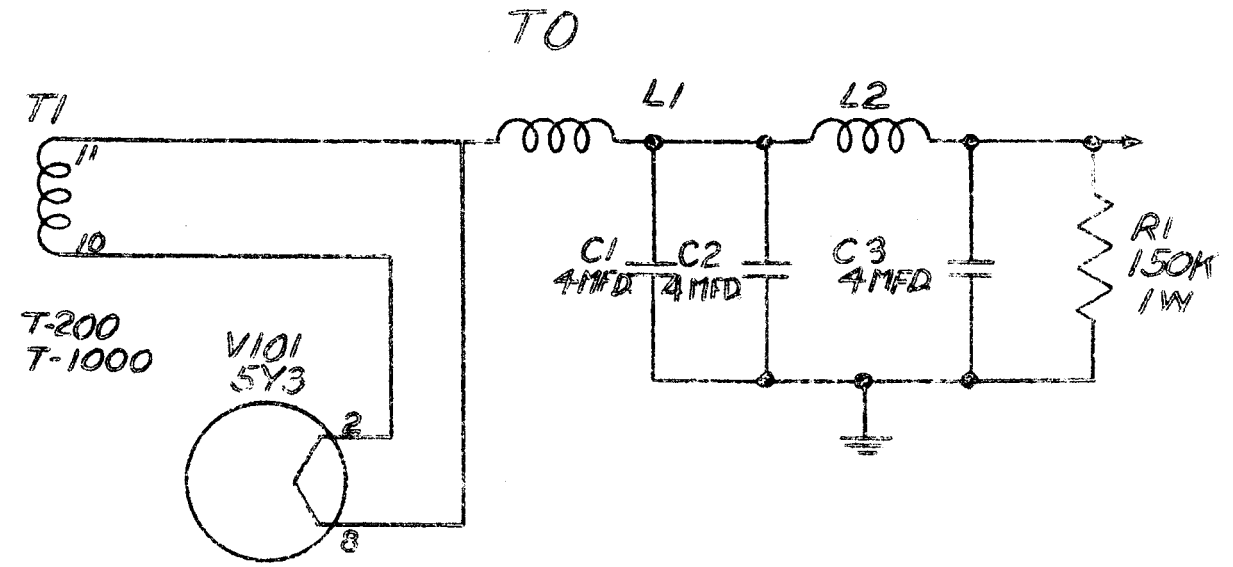
Sensitivity: Set the controls of the equipment as indicated on Page 38. Feed in a signal of amplitude as listed on Pages 5 and 6 for the direct sensitivity of the equipment and of frequency as listed on Page 5 and 6 for input Center Frequency of the equipment. This signal is fed in at the input jack for the Panadaptor and at the upper input jack for the Panalyzor. Set the I.F. GAIN control for full scale pip deflection.

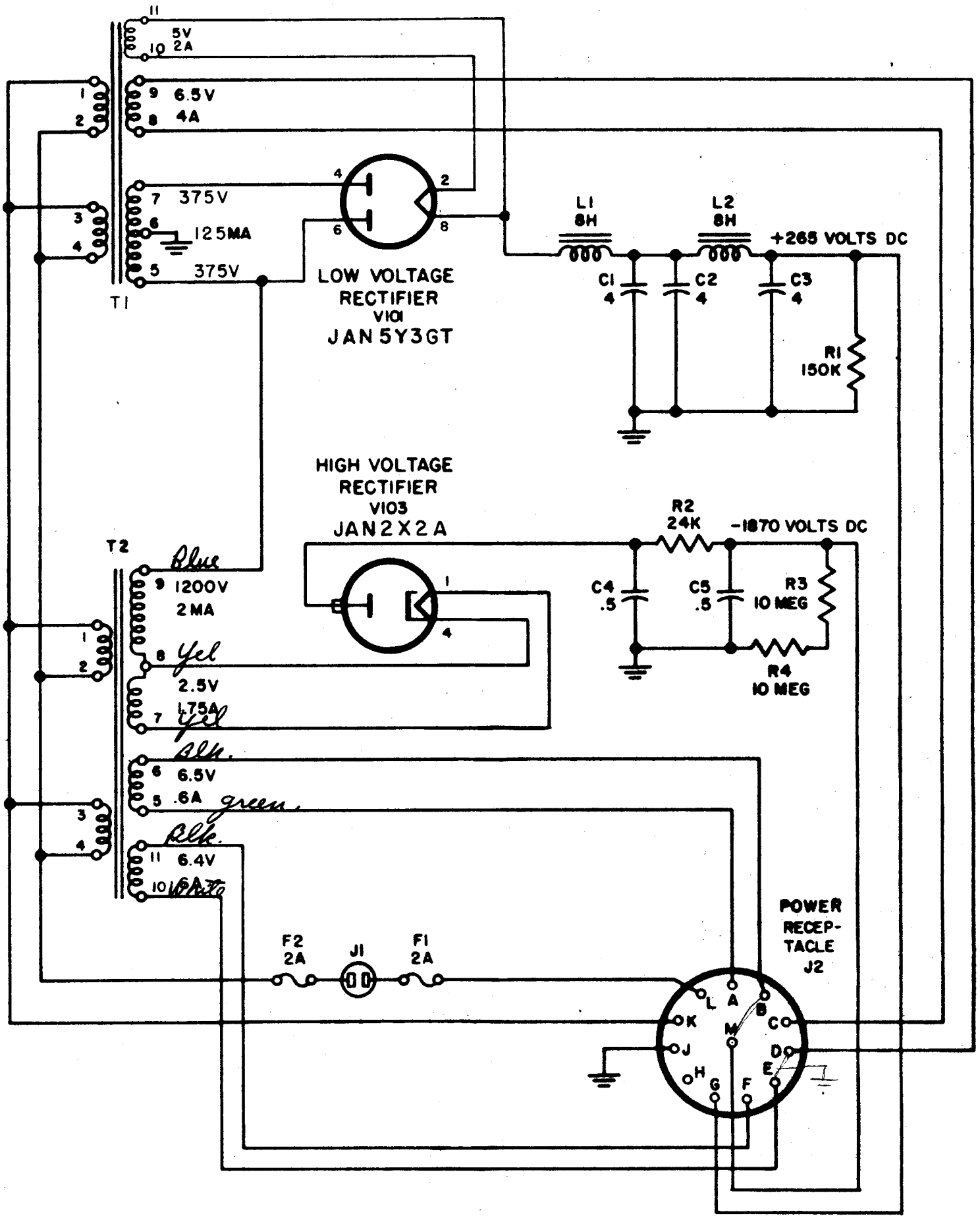
Note Concerning Model PS-8

Power Supply

The low voltage filter in the SA-8a and SB-8a, Types T-200 and T-1,000 power supply is different than the low voltage filter in the SA-8a, Type T-10,000 and SB-8a, Type T-10,000 power supply. If a Model PS-8 Power Supply from a Type T-10,000 is used with a Type T-200 or T-1,000, it should be changed as follows. Note that the difference is only in the position of C1 in the circuit.





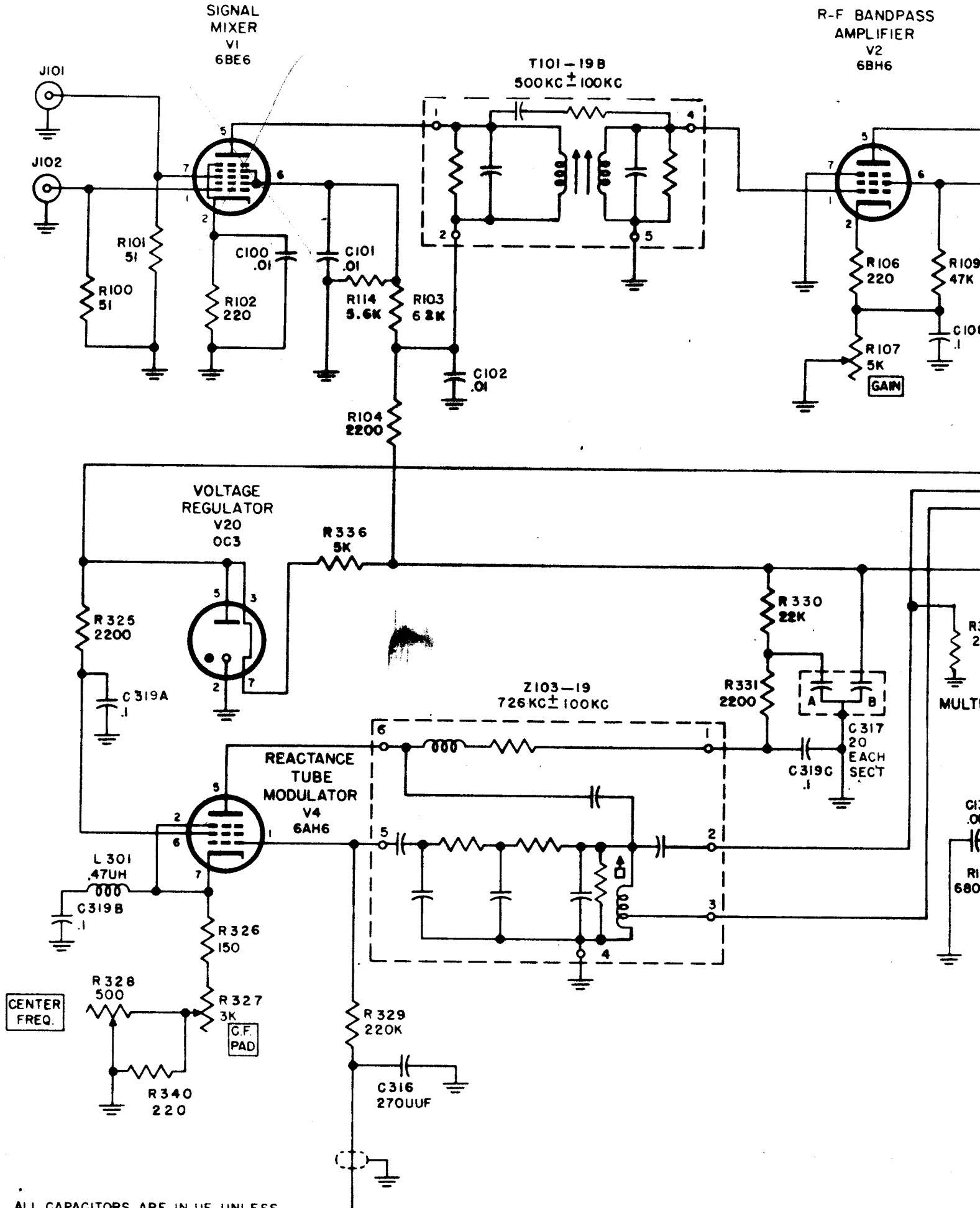


NOTE:
ALL CAPACITOR VALUES ARE IN UF.
ALL RESISTOR VALUES ARE IN OHMS
UNLESS OTHERWISE SPECIFIED.

9/27/11

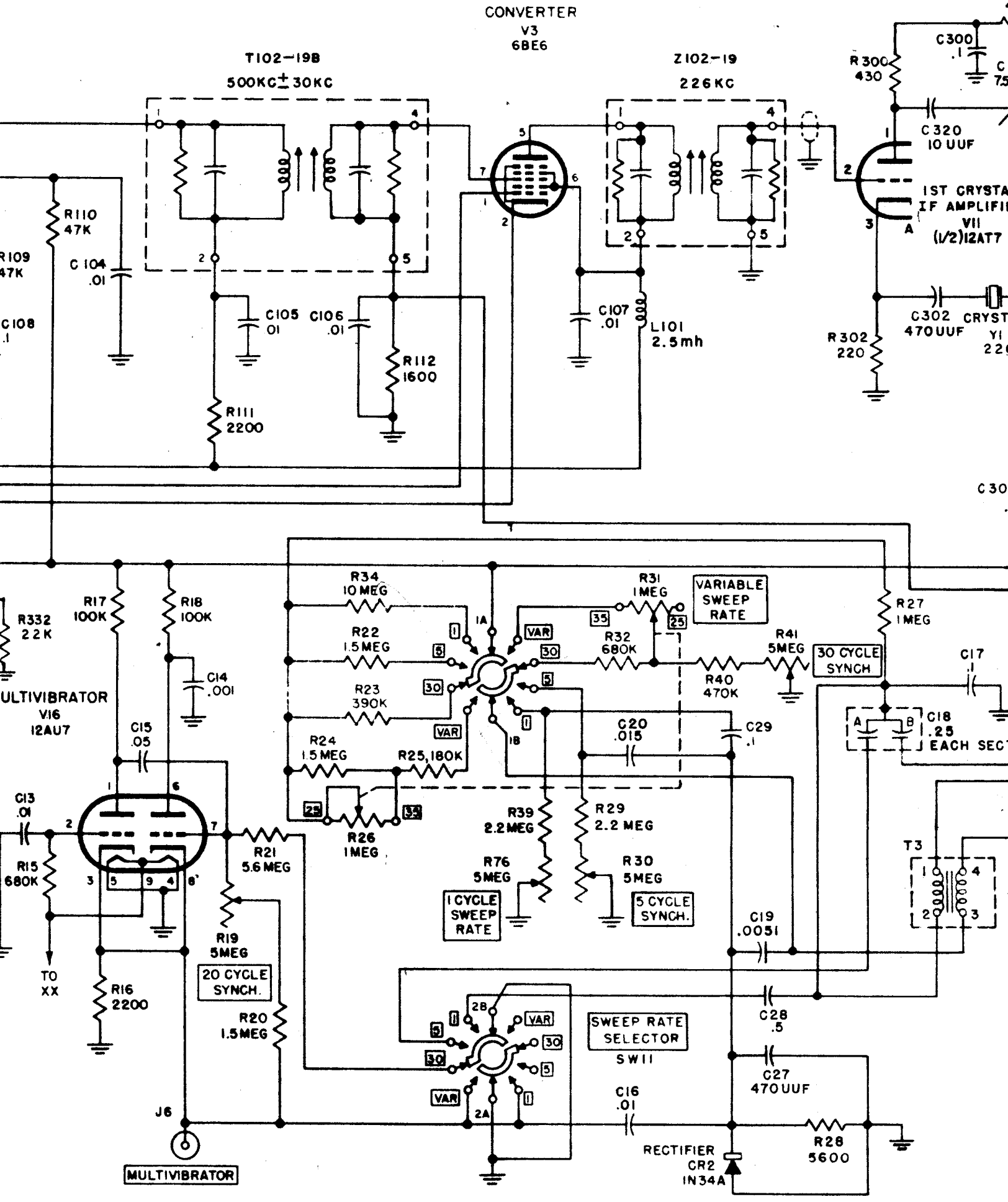
Abby - If we are running these at
R-3rs If of 500 ea why are we
buying this model? can we get one
with out VI 1st mixer? Should drop
cost - call Sing and see if they
will run @ 500 ea without VI -
I can change CLIN .001 to reflect
new order for 500 more if
cost is 5% less or more.

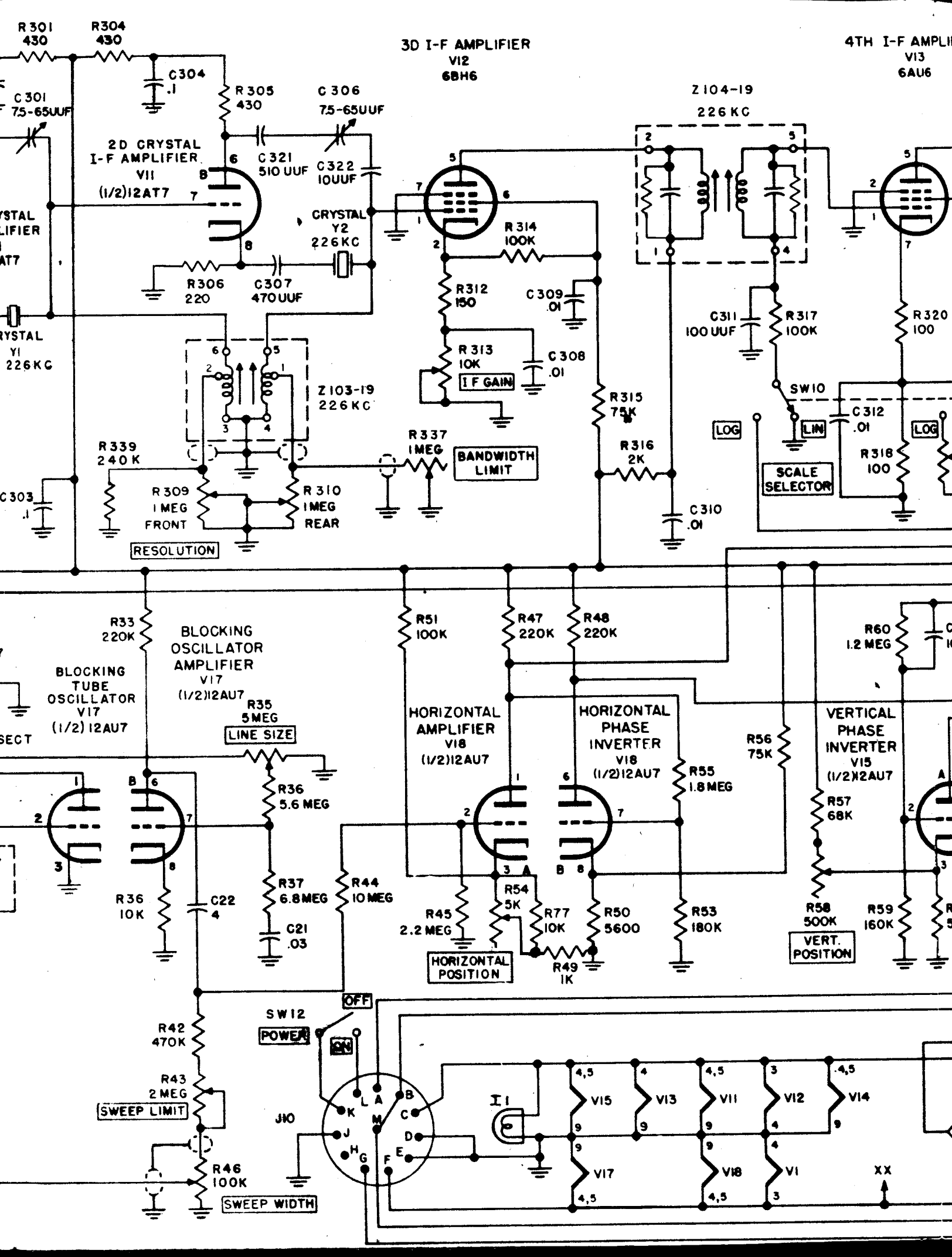
Chuck

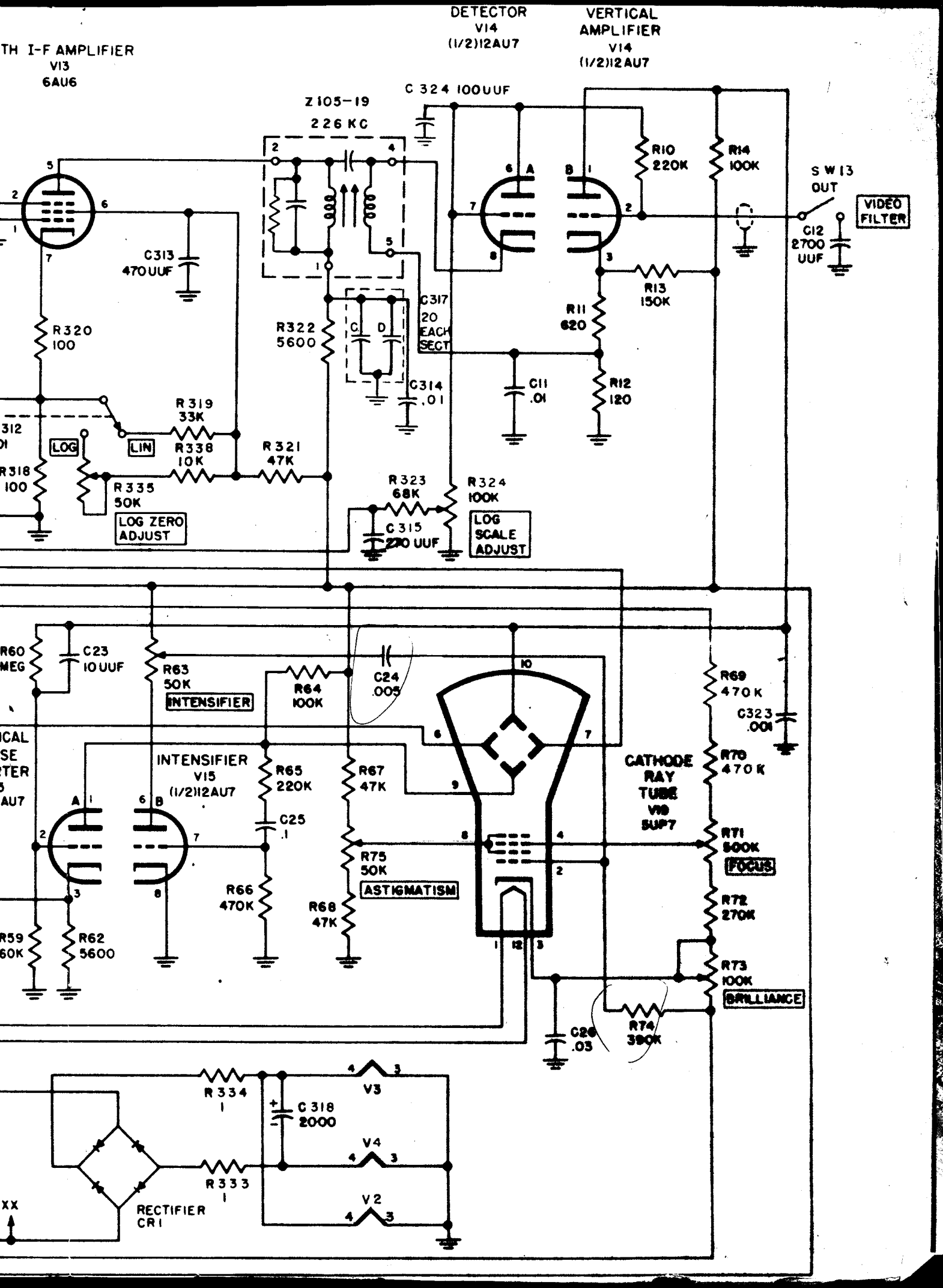


ALL CAPACITORS ARE IN UF UNLESS OTHERWISE SPECIFIED

ALL RESISTORS ARE IN OHMS UNLESS OTHERWISE SPECIFIED.


CONVERTER
V3
6BE6
T102-19B
500KC ± 30KC
Z102-19
226KC
R110
47K
C 104
.01
C105
01
C106
.01
R112
1600
R111
2200
C107
.01
L101
2.5mh
C300
.1
R300
430
C320
10 UUF
1ST CRYSTA
IF AMPLIFI
VII
(1/2)12AT7
C302
470UUF
R302
220
R332
2.2K
R17
100K
R18
100K
C14
.001
ULTIVIBRATOR
V16
12AU7
C15
.05
C13
.01
R15
680K
TO
XX
R16
2200
R21
5.6 MEG
R19
5MEG
20 CYCLE
SYNCH.
R20
1.5MEG
J6
MULTIVIBRATOR
R34
10 MEG
R22
1.5MEG
R23
390K
R24
1.5 MEG
R25, 180K
R26
1MEG
R31
1MEG
VARIABLE
SWEEP
RATE
R32
680K
R40
470K
R41
5MEG
30 CYCLE
SYNCH
R27
1MEG
C17
.1
C18
.25
EACH SEC
C20
.015
C29
.1
R39
2.2MEG
R29
2.2 MEG
R76
5MEG
R30
5MEG
1 CYCLE
SWEEP
RATE
5 CYCLE
SYNCH.
C19
.0051
T3
SWEEP RATE
SELECTOR
SW11
C28
.5
C27
470UUF
C16
.01
RECTIFIER
CR2
IN34A
R28
5600
VAR


R301 430
R304 430
C304 .1
R305 430
C306 7.5-65UUF
C301 7.5-65UUF
2D CRYSTAL I-F AMPLIFIER VII (1/2)12AT7
C321 510 UUF
C322 10UUF
CRYSTAL Y2 226KC
R306 220
C307 470UUF
3D I-F AMPLIFIER VI2 6BH6
Z104-19 226 KC
R314 100K
R312 150
C309 .01
R313 10K
I F GAIN
C308 .01
Z103-19 226KC
R339 240K
R337 1MEG
BANDWIDTH LIMIT
R309 1MEG FRONT
R310 1MEG REAR
RESOLUTION
R315 75K
R316 2K
C310 .01
C311 100 UUF
R317 100K
SW10
LOG
LIN
C312 .01
SCALE SELECTOR
4TH I-F AMPLI VI3 6AU6
R320 100
R318 100
C303 .1
R33 220K
BLOCKING TUBE OSCILLATOR VI7 (1/2) 12AU7
BLOCKING OSCILLATOR AMPLIFIER VI7 (1/2)12AU7
R35 5MEG
LINE SIZE
R36 5.6 MEG
R36 10K
C22 .4
R37 6.8MEG
C21 .03
R44 10 MEG
R51 100K
R47 220K
R48 220K
HORIZONTAL AMPLIFIER VI8 (1/2)12AU7
HORIZONTAL PHASE INVERTER VI8 (1/2)12AU7
R55 1.8MEG
R56 75K
R45 2.2 MEG
R54 5K
R77 10K
R50 5600
R53 180K
R49 1K
HORIZONTAL POSITION
VERTICAL PHASE INVERTER VI5 (1/2)12AU7
R57 68K
R58 500K
VERT. POSITION
R59 160K
R60 1.2 MEG
SW12
POWER
OFF
ON
R42 470K
R43 2MEG
SWEEP LIMIT
R46 100K
SWEEP WIDTH
J10
I1
VI5
VI3
VI1
VI2
VI4
VI7
VI8
VI
XX


TH I-F AMPLIFIER
V13
6AU6
DETECTOR
V14
(1/2)12AU7
VERTICAL
AMPLIFIER
V14
(1/2)12AU7
Z105-19
226 KC
C 324 100UUF
R10
220K
R14
100K
SW 13
OUT
VIDEO
FILTER
C12
2700
UUF
C313
470UUF
R320
100
R322
5600
C317
20
EACH
SECT
C
D
C314
.01
R11
620
R13
150K
C11
.01
R12
120
R319
33K
LOG
LIN
R338
10K
R321
47K
R335
50K
LOG ZERO
ADJUST
R323
68K
R324
100K
C315
220 UUF
LOG
SCALE
ADJUST
R60
MEG
C23
10UUF
R63
50K
INTENSIFIER
R64
100K
C24
.005
R69
470K
C323
.001
INTENSIFIER
V15
(1/2)12AU7
R65
220K
C25
.1
R67
47K
R66
470K
R68
47K
R75
50K
ASTIGMATISM
CATHODE
RAY
TUBE
V16
5UP7
R70
470K
R71
500K
FOCUS
R72
270K
R73
100K
BRILLIANCE
R74
390K
C26
.03
R59
60K
R62
5600
R334
1
C318
2000
V3
V4
V2
R333
1
RECTIFIER
CR1