INSTRUCTION MANUAL

FOR

PANORAMIC PANADAPTOR

MODEL SA-8b

TYPES T-100, T-200 & T-1000

Panoramic
INSTRUMENTS

Manufactured by

SINGER METRICS
DIVISION

THE SINGER MANUFACTURING COMPANY

915 PEMBROKE STREET • BRIDGEPORT 8, CONNECTICUT

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CHAPTER I — INTRODUCTION

I-1. GENERAL

This Instruction Manual has been prepared to assist in the installation, operation and maintenance of the following equipments:

Panadaptor, Model SA-8b, Type T-100
Panadaptor, Model SA-8b, Type T-200
Panadaptor, Model SA-8b, Type T-1000

No attempt to operate the equipment should be made until the operator is thoroughly familiar with the information contained in CHAPTER III - OPERATION.

I-2. APPLICATIONS

The uses detailed below represent but a few of the many applications of the Panadaptor. Inquiries are invited regarding the application of these instruments to particular requirements.

Panadaptor equipments are uniquely suited for monitoring communications frequencies at airports and communication centers for possible off-frequency transmissions. The immediate appearance of such signals can be detected instantaneously and tuned to quickly with absolute minimum chances of message loss. High resolution makes the equipment invaluable for detecting and analyzing interference caused by splatter, improper location of carrier frequencies, spurious modulation, parasitics, etc.

The Panadaptor is invaluable in universities and technical schools for its graphic indications of various R.F. phenomena, making them easy to understand and remember.

The Panadaptor offers visual means of examining oscillator performance, especially in the VHF regions where small changes in circuit constants, both physical and electrical, produce large frequency variations. Oscillators can be checked against standards for determining frequency and the effects of load changes, component variations, shock, and humidity and thermal changes upon frequency stability. Parasitic oscillations are easily spotted and identified.

Diathermy units, dielectric and induction heaters, and other industrial r-f equipments can be analyzed and monitored within close tolerances for off-frequency operation with the Panadaptor. Either two separate crystal-controlled oscillators or a single modulated crystal oscillator may be used as standards to produce marker pips which indicate the permissible frequency limits of operation.

I-3. EQUIPMENT SUPPLIED

Information for identification of equipments described in this Manual is contained on the front panel of the analyzer section.

The following units constitute a complete equipment:

Description	Quantity per Equipment
Analyzer Section	1
Power Supply, PS-8b	1
Constant-Voltage Transformer #T3016-1	1
Interconnecting Power Cable	1*
Prefabricated R-F Cable (Pan #W3001)	1

*Pan Part W3046 with Style A Equipments
Pan Part W3063 with Style B & Rack Mount Equipments

I-4. GENERAL DESCRIPTION

The Panadaptor is an automatic scanning receiver which permits visual analysis and identification of one or many radio-frequency signals at one time. Each signal within the band being scanned 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 the calibrated horizontal axis are indicative of signal level and frequency, respectively.

The sweep width or the extent of the band display 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 sweep width.

Type	Maximum Sweep Width
T-100	± 50 KC
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, Paragraph I-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 flatness of amplitude indication in the Panadaptor 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.

Image presentation of the Panadaptor is mainly a function of the image rejection capabilities of the receiver.

Images can be identified rapidly and simply since the image deflections move in a direction opposite to that of regular signals as the receiver is tuned.

The Panadaptor provides a visual presentation of a portion of the radio frequency spectrum on a two-dimensional surface.

Frequencies are shown on the horizontal axis of the screen (base line).

Signal Amplitudes are indicated on the vertical axis. This is illustrated in Figure - I-1.

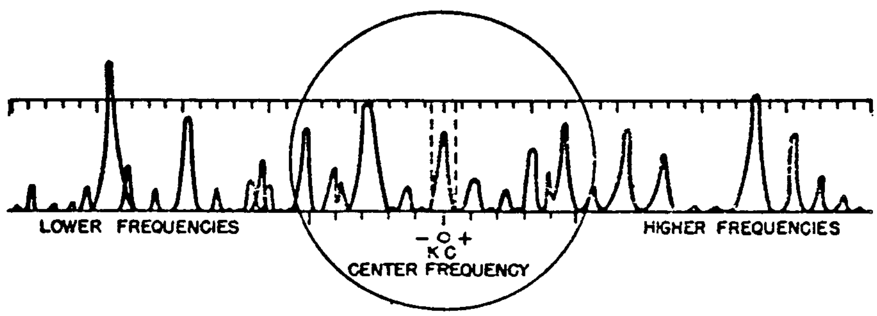


Figure I-1. Presentation of Radio Frequency Spectrum

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 the signal to which the receiver is tuned. Each signal produces its own pip or group of pips which help identify or analyze the signal.

First: The pips indicate 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 sweep width each dividing marker represents a 10 KC separation for the T-100, 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 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 linearly, logarithmically or exponentially. Amplitude scale selection is made with a front panel control. The linear amplitude range is 10:1. The log range is 40 db. The exponential range is 10 db.

Third: The deflections also reveal the character of the signal and the type of modulation, whether c-w, 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.

I-5. ELECTRICAL CHARACTERISTICS

Types	T-100	T-200	T-1000
Maximum Sweep Width	100 KC	200 KC	1000 KC
Input Center Frequency	455 or 500 KC	455 KC	5.25 MC
Bandpass Region Characteristic: Amplitude Ratio of Side Peaks to Center Valley:	15:1	30:1	5:1

Types	T-100	T-200	T-1000
Resolution:	See Fig. III-1	See Fig. III-1	See Fig. III-2
Spurious Response within the Bandpass: Input signals within the bandpass may result in spurious indications greater than 40 db below the input signals if the input signal exceeds:	.4V	.4V	.4V
Direct Sensitivity: Maximum voltage at center frequency required for full scale deflection on linear amplitude scale:	1000 uV	2000 uV	2000 uV
Peaking Frequencies:	455: 407.5-502.5 500: 452.5-547.5	365 KC-545 KC	4.83 MC-5.67 MC
Coupled to Receiver Through:	5 uuf Capacitor	51 K Resistor	24 K Resistor
I-f Transformer Tuned to:	226 KC	226 KC	1.5 MC
F-m Oscillator Mean Frequency	681/726 KC	681 KC	6.75 MC

R-F Input Cable: RG-8/U

Sweep Rate and Wave Form: 1 to 60 cps sawtooth, variable free running, line or externally synchronized.

Power Source: 115 VAC, 60 cps, single phase

Power Consumption with CV Transformer (Approx.): 135 Watts, 160 VA

I-6. PHYSICAL CHARACTERISTICS

a. Weights

Description	Weight
Analyzer Section	27 lb
Power Supply, PS-8b	33 lb
Constant-Voltage Transformer	20 lb
Cabinet, Analyzer Section	28 lb
Cabinet, Power Supply	12 lb
Cables	3 lb

b. Dimensions

See Outline Dimensional Drawings, Figure II-1 through II-5 for complete dimensional data.

I-7. OPERATING CONTROLS

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

a. CAL-SYNC SEL: This control is a three position switch. In the CAL position it provides for calibration of the sweep rate by injecting 60 cps into the vertical deflection. In the LINE position, the sweep is synchronized with the power line frequency. The EXT position permits sweep synchronism with a suitable signal fed to the EXT SYNC jack on the rear apron of the analyzer section chassis.

b. SYNC AMP: The amplitude of the sweep synchronizing signal is adjusted with this control to provide for crt beam sweep synchronism. Maximum amplitude is obtained at maximum clockwise position.

c. SWEEP WIDTH: The width of the spectrum segment being scanned by the instrument is adjusted with this control. When it is turned completely clockwise, 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 which 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 should be considered as such.

d. SWEEP RATE: This control provides for continuously adjustable scanning rates between 1 cps and 60 cps. Counterclockwise rotation results in reduced scan rate.

e. DIMMER: This control is rotated in a clockwise direction to turn on the power. When the crt is a 5ADP7, continued clockwise rotation of this control reduces the brightness of the edge lighting of the crt calibrated screen. When the crt is a 5UP7, this control dims the pilot light. The switch does not control the power line input to the constant-voltage transformer.

f. VIDEO FILTER: This three-position switch provides two degrees of video filtering to suppress such unwanted effects as noise, spurious beating between adjacent signals, hum, etc. The signal pips will be integrated and shifted slightly when the filter is in. An OUT position is provided.

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

The RESOLUTION control is used to narrow the i-f bandwidth. Counterclockwise rotation decreases the bandwidth of the second i-f section. It should be noted that as this control is adjusted, there will be some degree of change in the sensitivity of the equipment.

The frequency-scanning rate is diminished by increasing the scanning period or conversely by decreasing the spectrum width scanned within a given time.

The SWEEP WIDTH control provides the latter method. For a given setting of the SWEEP WIDTH control there is a complementary setting of the RESOLUTION control to obtain optimum resolution. (See Paragraph IV-2e for a detailed discussion of resolution.)

h. CENTER FREQ: This control serves to restore or maintain the f-m local oscillator at its specified mean frequency. In this way, the deflection corresponding to a signal at the input center frequency is centered on the crt screen.

i. AMPLITUDE SCALE: Selection of linear, logarithmic or exponential amplitude presentations is accomplished with this three-position rotary switch.

In the LOG position, signals having a 40 db (100:1) amplitude ratio can be viewed on the screen. In this switch position, the calibration dots on the left side of the screen are used. The calibration range is from -20 db to +20 db in 5 db steps.

In the LIN position, signals having a 20 db (10:1) amplitude ratio can be viewed on the screen. In this switch position, the horizontal calibration lines on the crt screen are used. The linear scale is calibrated in ten divisions.

In the EXP position, the pip height varies as the square of the signal voltage for an approximate range of 4:1.

It should be noted that because of the time constant factor, the LOG feature does not function properly with narrow pulses. Because of ac coupling in the circuit the EXP feature functions properly only with narrow pips and/or fast scan rates.

j. INTENSIFIER: To observe pulsed or noise signals, this control is turned in a clockwise direction. Noise and pulse signals will then intensity modulate the crt 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.

k. FOCUS: The sharpness of the presentation is adjusted with this control.

l. BRILLIANCE: The intensity of the screen presentation is varied with this control.

m. GAIN: The amplitude of the deflections on the crt screen are adjusted with the GAIN control. Whenever possible lower gain should be used to reduce the size of both spurious and noise deflections.

I-8. TUBE COMPLEMENT

The tubes employed are as follows:

Symbol		Type	Function
V2		12AT7	Bandpass Amplifier
V3		6BE6	Converter
V4		6AH6	Reactance Tube Modulator
V11		12AT7	a. 1st Xtal I-F Amplifier
			b. 2nd Xtal I-F Amplifier
V12		6BH6	3rd I-F Amplifier
V13		6AU6	4th I-F Amplifier (LIN-LOG)
V14		12AU7	a. Detector (LIN-LOG)
			b. First Vertical Amplifier
V15		12AU7	a. Vertical Phase Amplifier
			b. Intensifier
V16		12AT7	Sync Amplifier
V17		6U8	a. Sawtooth Generator
			b. Cathode Follower
V18		12AU7	a. Horizontal Amplifier
			b. Phase Inverter
V19	#	5UP7	Cathode-Ray Tube
V20		OC3	Voltage Regulator
V21		6U8	a. Astigmatism
			b. Blanking Amplifier
V23		12AT7	a. Exponential Detector
			b. Exponential Amplifier
V101	*	5U4GA/B	Low Voltage Full-Wave Rectifier

5ADP7 in Z modification equipments.
* In Power Supply PS-8b.

I-9. TERMS AND DEFINITIONS

a. Panoramic Reception is the simultaneous visual reception of a continuous portion of the frequency spectrum.

This definition distinguishes panoramic reception from the conventional reception which can be called "uni-signal" reception and which can be either aural or visual or both.

The main distinction between Panoramic and uni-signal reception is the following: Panoramic reception is periodic reception over a wide range of the spectrum. Each signal is received at fixed, rapid intervals for a short period of time. (These signals are received so rapidly as to appear to be continuous.) Uni-signal reception is continuous reception, of the one signal at a time, over a very narrow range of the spectrum.

b. Sweep width 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.

c. Base Line is the horizontal line produced by the electron beam sweeping across the cathode-ray tube.

d. 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.

e. 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.

f. Resolution of a given signal is the frequency difference, measured along the frequency sweep axis, 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.

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

h. Deflection Amplitude is the visual equivalent of signal input voltage. It is the height of a given signal deflection measured from the baseline to the top of the deflection.

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

j. Companion Receiver is the aural receiver with which the Panadaptor is operated.

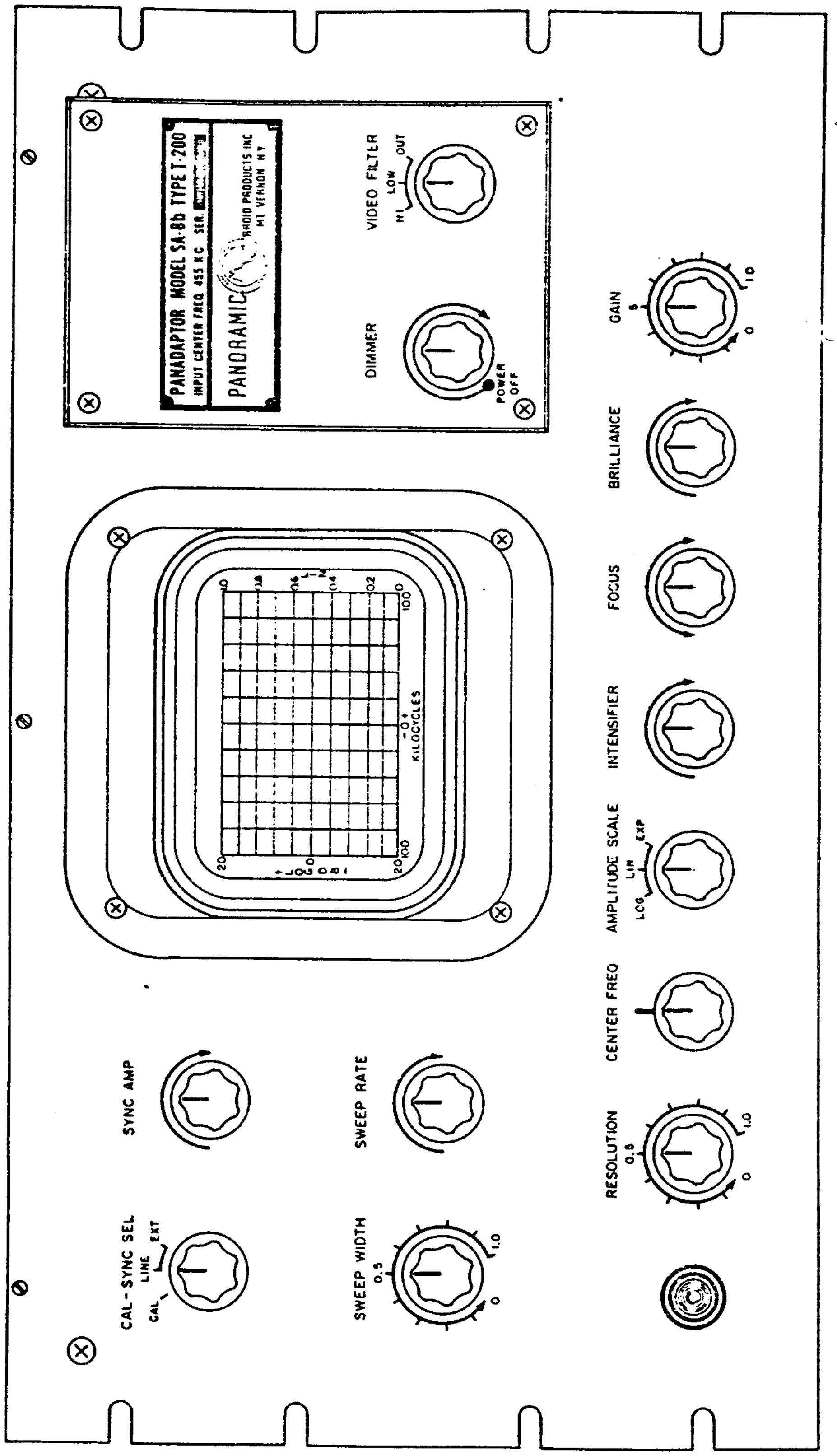


Figure I-2. Front Panel, Model SA-8bY, Type T-200.

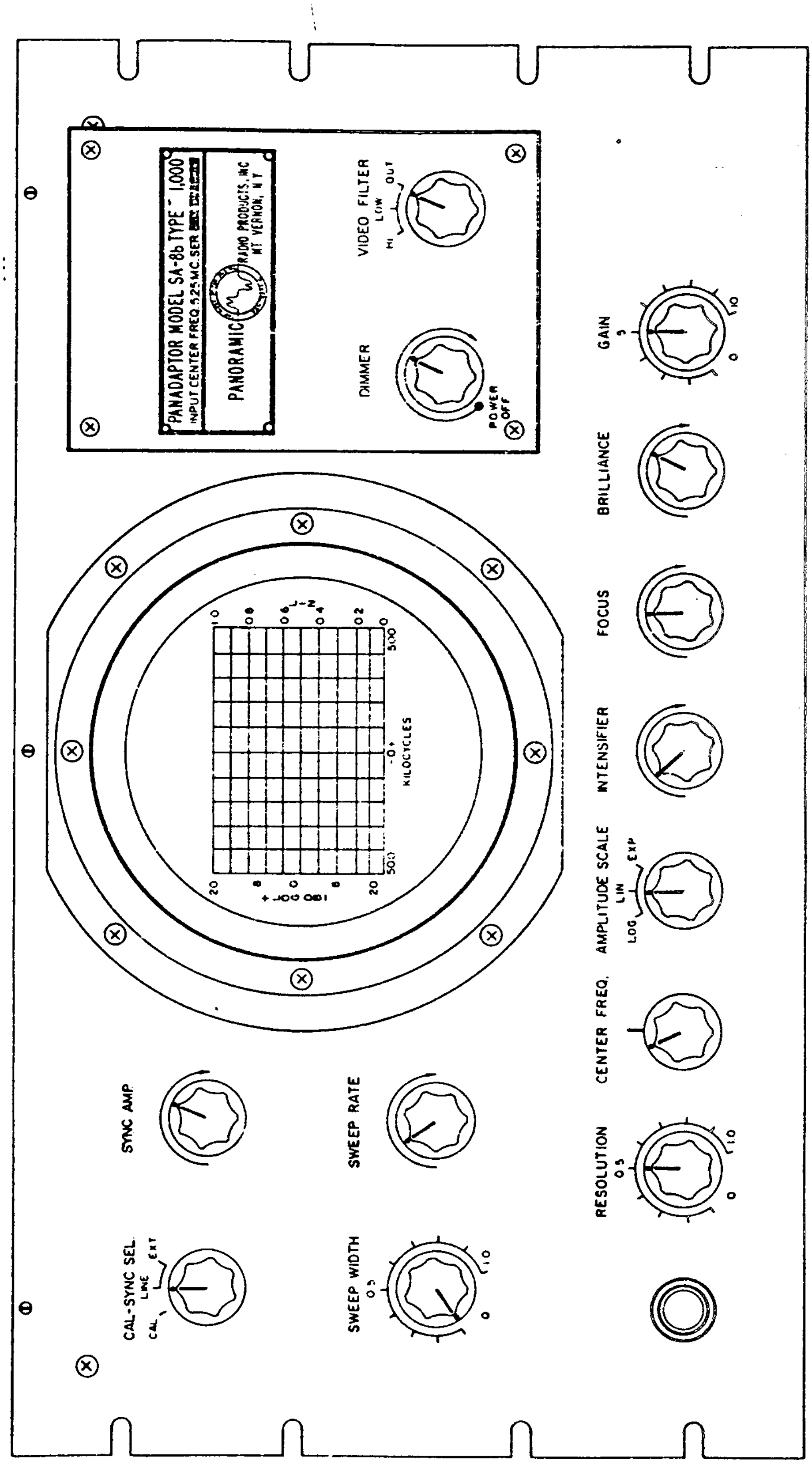


Figure I-3. Front Panel, Model SA-8bZ, Type T-1000.

CHAPTER II - INSTALLATION

II-1. INITIAL INSPECTION

This instrument has been tested and calibrated before shipment. Only minor preparations are required to put the instrument in operation.

If damage to the case is evident when delivery is made, have the person making the delivery describe the damage and sign the notation on all copies of the delivery receipt.

Most public carriers do not recognize claims for concealed damage if such damage is not reported within fifteen days after delivery. All shipping containers should be opened and the equipment inspected before fifteen days elapse.

If damage is found, whether concealed or obvious when delivered, call or write the carrier and ask that an inspection be made by their agent.

Although the carrier is liable for any damage in the shipment, Panoramic Radio Products, Inc. will assist in describing and providing for repair or replacement of damaged items.

The equipment is shipped with all tubes and crystals installed. Check that all such components are properly seated in their sockets.

II-2. INTERCONNECTING PROCEDURE

NOTE: The power supply of the Panadaptor is factory wired for 118 volt, 50-60 cps operation. In order to deliver a stable supply of this power requirement, a constant-voltage transformer is supplied. This transformer must be considered an integral part of the Panoramic equipment and must be used at all times. Do not, however, use it to supply power to auxiliary or additional equipments. For satisfactory operation of the Panoramic equipment, the c-v transformer must be used only within the input voltage range and only at the frequency specified on its name-plate. Normally, a c-v transformer with one of the following four voltage-frequency combinations is supplied, depending on the purchase order.

Input Voltage	Frequency	Output Voltage
1. 95 - 125V	60 cps	118
2. 95 - 135V	50 cps	118
3. 190 - 250V	60 cps	118
4. 190 - 250V	50 cps	118

The following table lists the cables supplied with the equipment and the connections to be made.

Cable Description	Connection From	Connection To
4 wire interconnecting power cable.	J10, rear of Analyzer Chassis	J2, rear of Power Supply Chassis
wire power cable with female plug	Constant-voltage transformer	J1, rear of Power Supply Chassis
wire power cable with male plug	Constant-voltage transformer	Suitable source of 118V AC power
Coaxial cable with type N connector	J101, rear of Analyzer Chassis	See Paragraph II-4

II-3. INSTALLATION ADJUSTMENTS AND CHECKS

a. Turn the power on with the DIMMER control. The pilot light should go on at once. When the crt is a 5ADP7, clockwise rotation of the DIMMER control will reduce the brightness of the edge lighting of the crt screen. When a 5UP7 is used, the DIMMER control dims the pilot light. Set the BRILLIANCE control between one-half and two-thirds of maximum clockwise position. Within two minutes the base-line trace should appear as a blurred or sharp line.

b. Perform the following tests:

1. 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.

2. BRILLIANCE: Turn this control 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.

3. INTENSIFIER: Set this control at its maximum counterclockwise position. Turn the GAIN, RESOLUTION and SWEEP WIDTH controls completely clockwise. Noise peaks may appear on the screen. If not, introduce noise or a signal into the equipment. Turn the BRILLIANCE control counterclockwise until the deflections almost fade out. Turn up the INTENSIFIER. The noise lines or signals will become brighter but the baseline will not be present.

4. CENTER FREQ: Feed in a signal which corresponds in frequency to the input center frequency of the equipment. Set the GAIN, RESOLUTION and SWEEP WIDTH controls completely clockwise, SWEEP RATE to about three-quarters of its maximum clockwise position and AMPLITUDE SCALE to LIN. If necessary adjust the HORIZONTAL POSITION control 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, reduce the GAIN until a single pip is present.

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

Turn the CENTER FREQ control back and forth. The deflection should shift back and forth horizontally. Return the control to the position which centers the pip on the screen.

5. GAIN: Rotation of this control should change pip height.

6. SWEEP WIDTH: Set the controls as outlined for CENTER FREQ test. With the SWEEP WIDTH control turned completely clockwise, vary the frequency of the signal generator between the limits indicated below:

Type	Input Center Freq.	Frequency Limits
T-100	455 KC	405 KC - 505 KC
	500 KC	450 KC - 550 KC
T-200	500 KC	400 KC - 600 KC
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.

7. 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 and/or the signal level to give a full scale deflection. Gradually reduce the sweep width so that the pip base covers approximately one-third of the screen. Now turn the RESOLUTION control counter-clockwise. The pip width should decrease. At the same time there may be a change in pip height. Rotation through the full range of the RESOLUTION control may result in a major change in pip height. It will also be noticed that small convolutions or "ringing" will appear on the trailing edge of the pip. Best resolution is indicated when the first convolution beyond the apex of the pip dips into the baseline. (See Paragraph III-3 b (5) for a discussion of "ringing" as an indication of best possible resolution).

8. AMPLITUDE SCALE: Set the controls as outlined for CENTER FREQ test. Feed in a signal which corresponds to the center frequency of the equipment. Adjust the pip height for full scale deflection. Switch the AMPLITUDE SCALE selector to LOG. The deflection should go down to 0 db. Switch to EXP. and vary the signal level. Full scale deflection should require about 4 times the signal for one-tenth scale.

9. SWEEP RATE: Set the CAL-SYNC SEL on CAL. At maximum clockwise rotation of the SWEEP RATE control one cycle of the line frequency should be visible. As the control is rotated in a counterclockwise direction the number of cycles visible should increase until at the end of the rotation, approximately 60 appear. The sweep rate at any position is equal to 60 cps divided by the number of cycles visible. At low rates, it is easier to count sweeps, using a stop watch for timing, than to count cycles.

10. SYNC AMP: With the CAL-SYNC SEL still in the CAL position, slowly advance this control. At one setting the sine wave display on the screen should "lock in". That is, there should be no drifting horizontally in either direction.

11. CAL-SYNC SEL: For the CAL position see steps 9 and 10. With this control in the LINE position, move the baseline to one side of the crt screen with the HOR POS control so that the end of the line is visible. The SWEEP RATE control should be set for approximately 30 or 60 cps. The SYNC AMP control should be in the maximum counterclockwise position. The end of the line will appear to move back and forth. Slowly advance the SYNC AMP control. At approximately one-quarter rotation, the baseline should remain stationary, indicating that the sweep is synchronized with the power line frequency.

    In the EXT position feed 60 cps from the secondary of a filament transformer (or from any other available low voltage supply at the line frequency) to the EXT SYNC jack. Repeat as in the LINE position.

12. VIDEO FILTER: As this filter is switched in, noise on the screen should be filtered, and signal pips will be integrated and shifted slightly. Greatest effect will be noticed in the HIGH position.

II-4. CONNECTION OF PANADAPTOR TO RECEIVER

Note: When the r-f cable supplied is attached to the Panadaptor, it becomes part of the input tuned circuit. Therefore, the length of the cable should not be varied. If, for any reason, the length of the cable must be changed, the input stage of the Panadaptor will require returning. Capacity may have to be added to or removed from the primary depending upon the nature of the change in length.

During the installation of the Panadaptor a check of the receiver gain should be made. This can be done by comparing a standard signal level (S meter reading) before and after installation of the Panadaptor. A significant loss in receiver gain will indicate the need for a slight retrimming of the receiver i-f. See the receiver manufacturer's alignment instructions.

a. Connection of Panadaptor to Receiver with Pan Receptacle

1. Make sure that the receiver has an i-f which corresponds to the input center frequency of the Panadaptor.

2. Disconnect the receiver from the power line.

3. Check the length of the cable, if any, to the receiver Pan Output receptacle. Determine the capacity of the internal cable and shorten the Panoramic r-f cable to compensate for this additional capacity. (The capacity of the RG-8/U cable supplied is 29.5 uuf per foot.)

4. Check that the appropriate isolating element listed below is in the receiver.

Panadaptor Type	Isolating Element
T-100	5 uuf capacitor
T-200	51,000 ohm, 1/2 W resistor
T-1000	24,000 ohm, 1/2 W resistor

The isolating element should be connected to the plate pin of the receiver converter tube. The lead of the isolating element should be as short as possible. The isolating itself should be located in close proximity to the pin.

The other end of the isolating element should be connected to the inner conductor of the cable which leads to the receiver Pan Receptacle.

5. Attach an appropriate connector (not furnished) to the end of the Panoramic r-f cable.

6. Connect the Panoramic r-f cable between the receiver Pan Receptacle and J101 on the rear apron of the Analyzer chassis.

7. Slight retuning of the first i-f in the receiver may be required to compensate for any stray capacity introduced by the Panoramic connection. See the receiver manufacturer's alignment instructions.

8. Interconnect the Analyzer, Power Supply and Constant-Voltage Transformer as outlined in Paragraph II-2 - INTERCONNECTING PROCEDURE.

b. Connection of Panadaptor to Receiver not provided with Pan Receptacle

1. Drill a 3/4" hole through the receiver cabinet. Locate the hole as close to the plate pin of the converter tube as possible. Put a rubber grommet in this hole.

2. Connect the isolating element specified in Paragraph II-4 a. 4. to the plate pin of the converter (or mixer) tube. The lead of the isolating element should be as short as possible. The element itself should be placed in close proximity to the pin.

3. Insert the free end of the coaxial cable through the grommeted hole.

4. Connect the inner conductor to the free end of the isolating element.

5. Clamp the cable shield to the chassis to insure a good ground connection.

6. Check for shorts between ground and either side of the isolating element.

7. Plug the free end of the cable into J101 on the rear chassis of the Panadaptor.

8. Slight retuning of the first i-f stage of the receiver may be required to adjust for any stray capacity introduced by the Panoramic connection. See the receiver manufacturer's alignment instructions.

9. Interconnect the Analyzer, Power Supply and Constant-Voltage Transformer as outlined in Paragraph II-2 - INTERCONNECTING PROCEDURE.

c. Installation of a Pan Output Connector

1. Although the type of connection described in Paragraph b above will prove satisfactory, it is not the best for permanent use. It is recommended that a Pan Output connector be installed in the receiver to provide a permanent means of connecting or disconnecting the Panadaptor.

2. An Amphenol Series N connector is recommended for use as an output receptacle. Other type connections may be used, provided that the connector used has appropriate characteristics.

3. Select a convenient location on the receiver chassis for the Pan Output connector. The point selected should be located as close as possible to the converter tube.

4. Drill the necessary mounting holes at the selected location.

5. Mount the receptacle. If the receptacle is not provided with a grounded solder lug, an appropriate lug should be installed.

6. Connect the isolating element specified in Paragraph II-4. a. 4. above to the plate pin of the converter tube. The lead of the isolating element should be as short as possible. The element itself should be placed in close proximity to the pin. The free end of the isolating element should be mounted on a tie point. If an unused tie point is not available in the receiver, one should be installed in an appropriate location.

7. The length of cable, required between the connector and the isolating element should be clipped from the free end of the r-f cable supplied.

8. Solder one end of the internal cable to the end of the isolating element which is mounted on the tie point. Solder the braided cable shield to a firm ground point as close as possible.

9. Solder the inner conductor at the other end of the internal cable to the center pin of the receptacle. Solder the braided cable shield to the receptacle grounding lug.

10. Install an appropriate plug on the free end of the Panoramic r-f cable.

11. Check both the internal cable and the Panoramic r-f cable for shorts.

12. Connect the r-f cable between the Pan Receptacle and J101 on the rear apron of the Analyzer chassis.

13. Slight retuning of the first i-f stage of the receiver may be required to adjust for any stray capacity introduced by the Panoramic connection. See the receiver manufacturer's alignment instructions.

14. Interconnect the Analyzer, Power Supply and Constant-Voltage Transformer as outlined in Paragraph II-4 - INTERCONNECTING PROCEDURE.

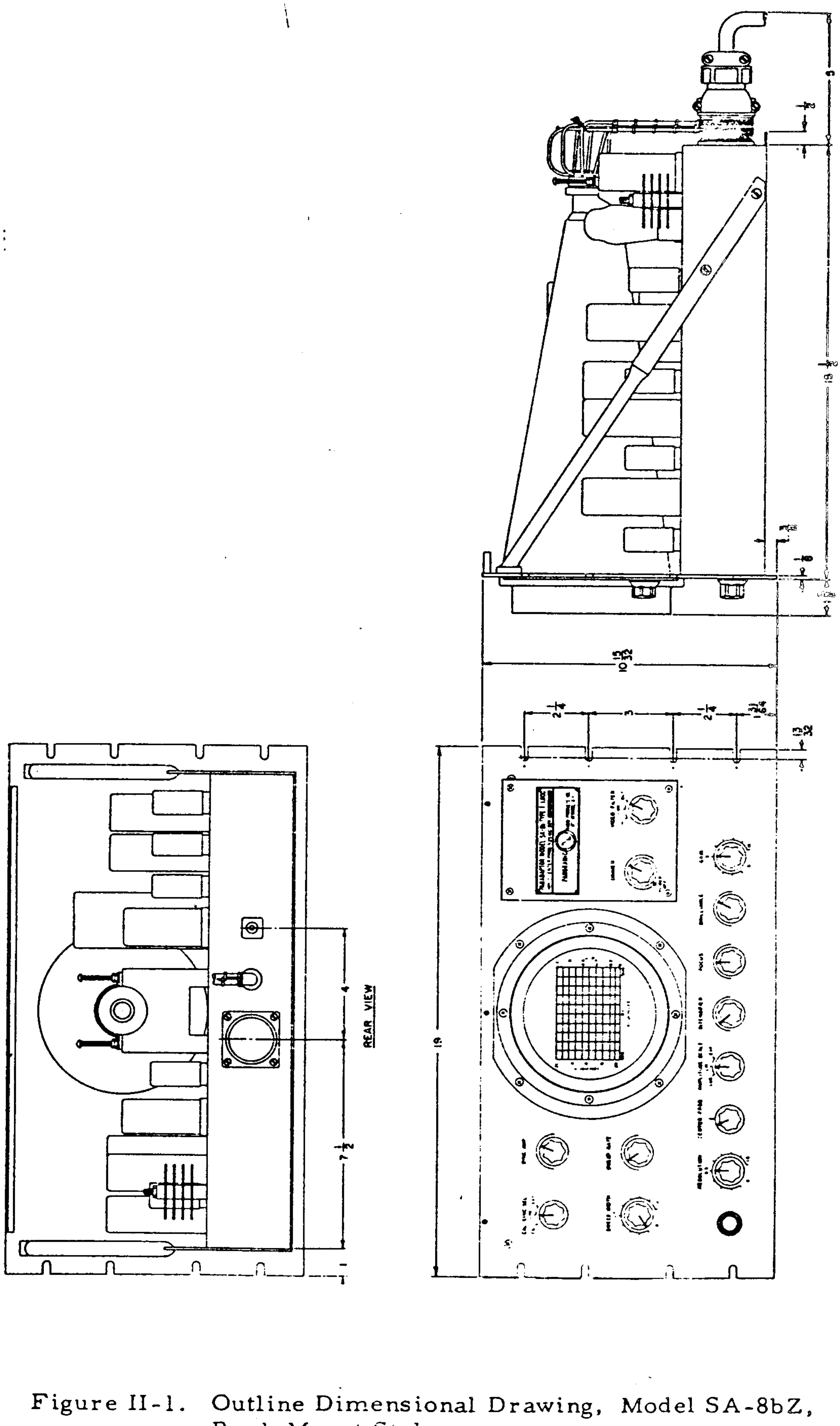


Figure II-1. Outline Dimensional Drawing, Model SA-8bZ, Rack Mount Style.

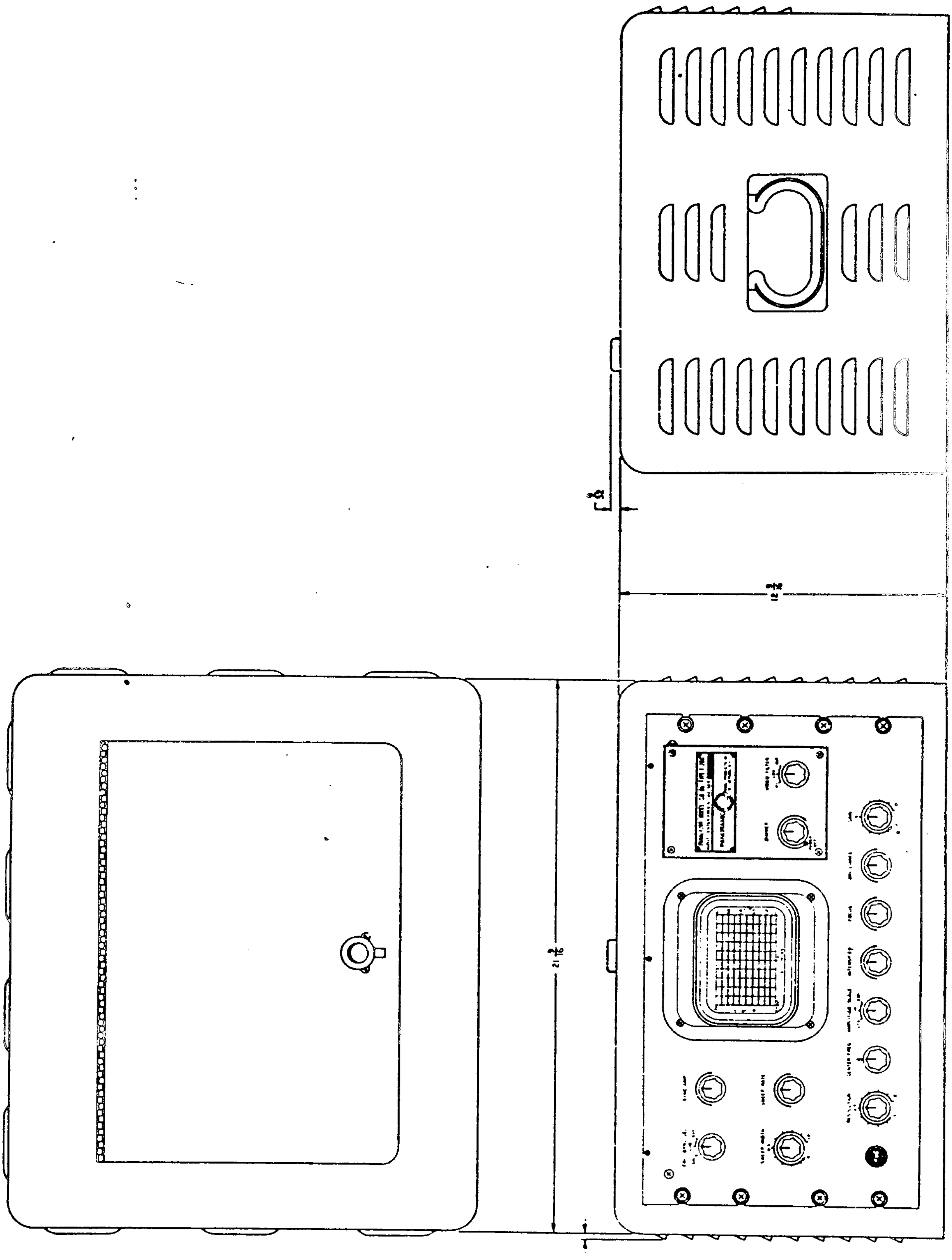


Figure II-2. Outline Dimensional Drawing, Model SA-8bY, in Cabinet.

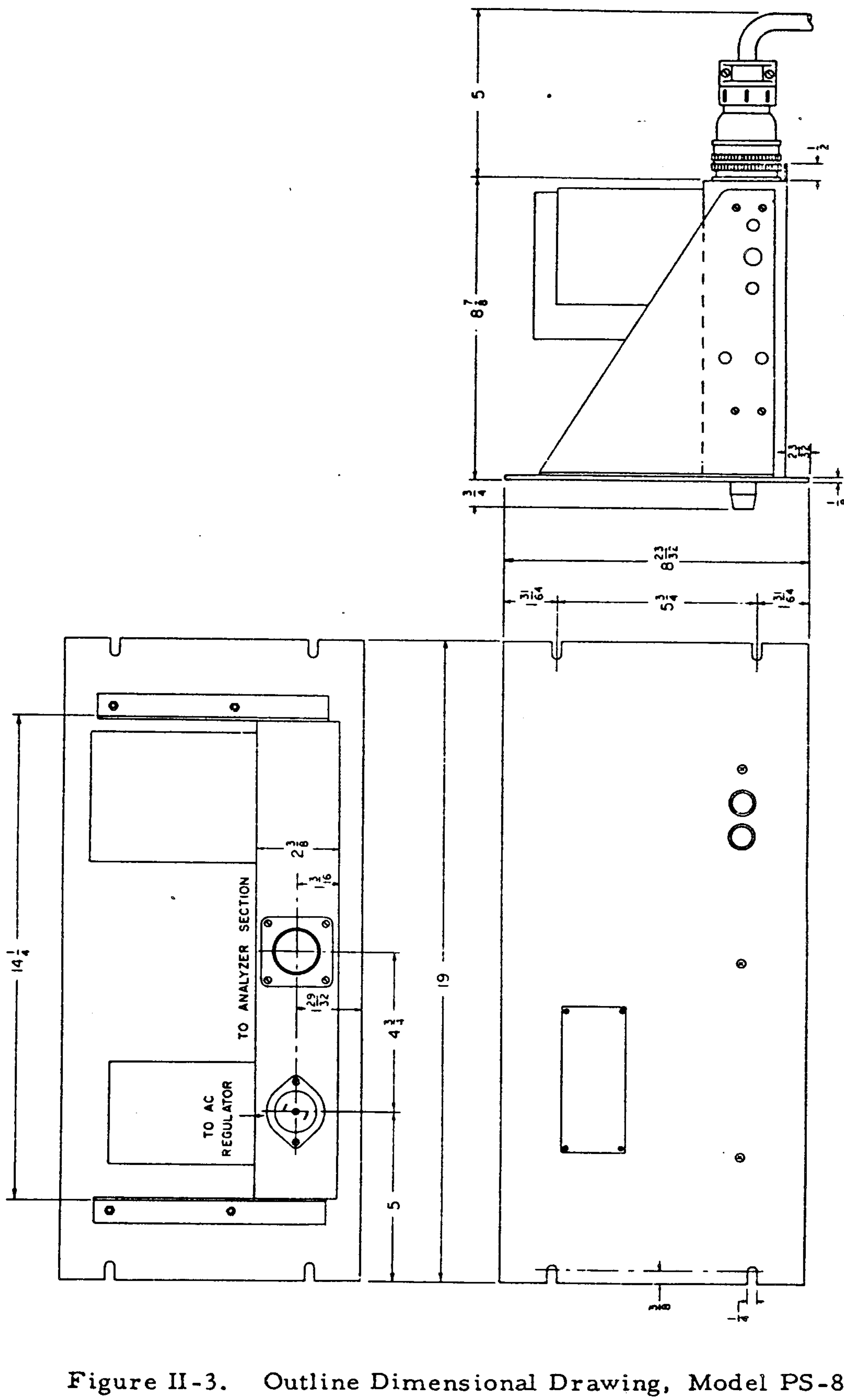


Figure II-3. Outline Dimensional Drawing, Model PS-8b, Rack Mount Style.

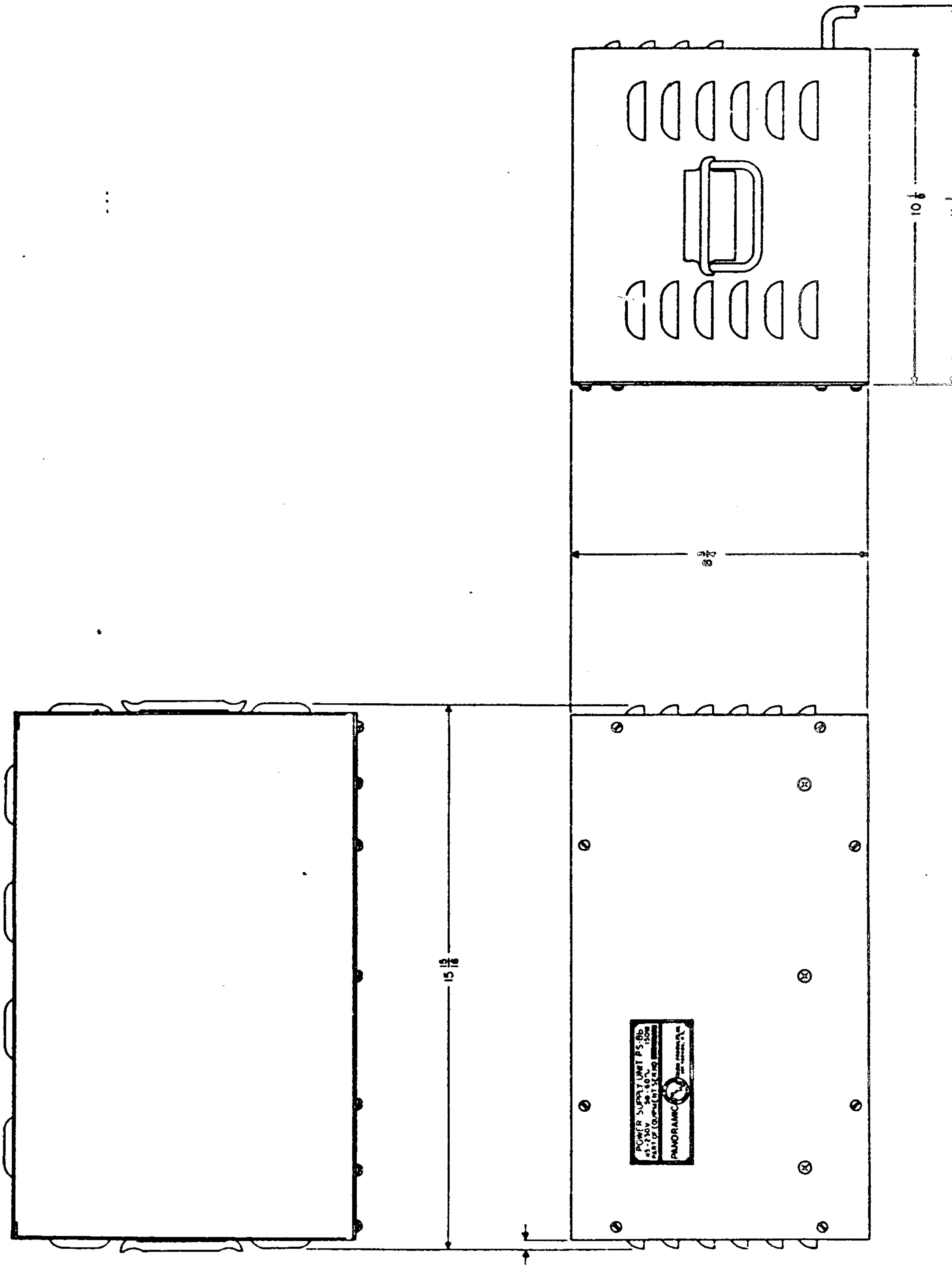


Figure II-4. Outline Dimensionai Drawing, Model PS-8b, in Cabinet.

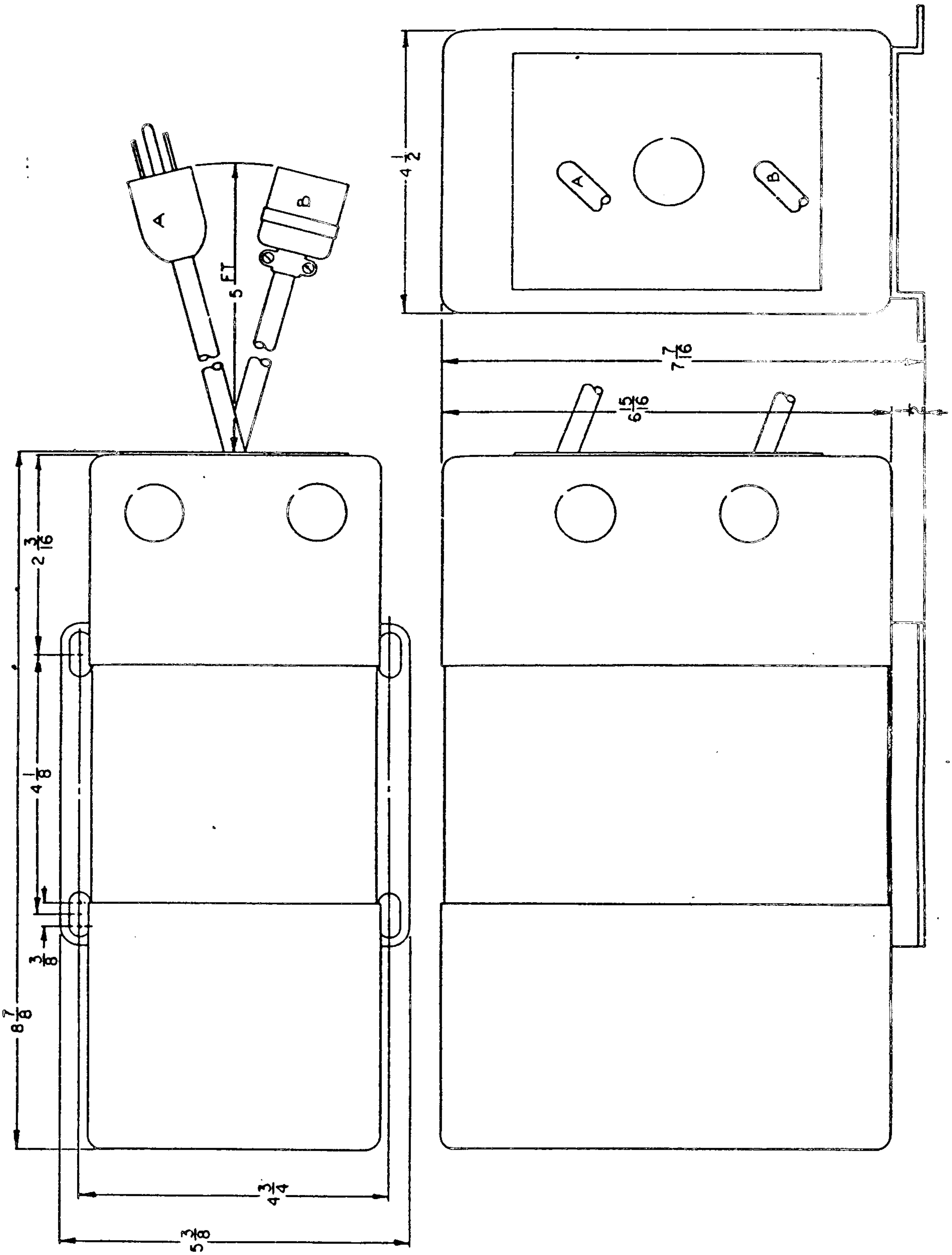


Figure II-8. Outline Dimensional Drawing, Constant-Voltage Transformer.

CHAPTER III - OPERATION

III-1. GENERAL OPERATION

The Panadaptor 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 deflections 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 operation according to the manufacturer's instructions. The receiver controls, where applicable, should be set approximately as given below.

RF GAIN	- near maximum
AF GAIN	- normal
AVC	- off
SELECTIVITY controls	- normal
CRYSTAL	- IN or OUT
BFO	- OFF
BANDSWITCH	- to band of interest
ANL	- OFF
ANTENNA TRIMMER	- normal for the particular antenna in use.

b. Turn on the Panadaptor with the DIMMER control. The baseline trace should appear within thirty seconds. When it does, set the front panel controls as listed below.

CENTER FREQ	- on vertical marker (See Paragraph II-1. c. 4. to insure that the Panadaptor matches the receiver intermediate-frequency, the signal used for this adjustment should be derived from the receiver.)
SWEEP WIDTH	- maximum clockwise
RESOLUTION	- maximum clockwise
BRILLIANCE	- for desired trace brightness
INTENSIFIER	- maximum counterclockwise
FOCUS	- sharpest trace
AMPLITUDE SCALE	- to LIN

GAIN	- between half and maximum clockwise position
SWEEP RATE	- to approximately 3/4 maximum clockwise*
VIDEO FILTER	- to "OUT" POSITION
CAL-SYNC-SEL	- to "LINE"*
SYNC AMPLITUDE	- about 1/4 of clockwise rotation*

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 for, 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.

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

1. Tune in the station as accurately as possible.

2. Rotate the SWEEP WIDTH control almost fully counterclockwise, at the same time keeping the "spread out" peak centered on the screen with the CENTER FREQ control.

3. Return the SWEEP WIDTH 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 in the receiver. Excessively high gain may cause erratic noise deflections to appear. These will cause confusion at times 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.

* See Paragraphs II-3.b. 9, 10 and 11 for additional information concerning sweep rate and sync adjustments.

e. The relative frequencies of signals appearing on the screen may be 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 screen calibrations will apply when the local oscillator of the receiver is above the received signal.

When the local oscillator of the receiver is lower in frequency the signs are reversed.

Example: A T-200 is set for maximum scanning width. 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 above the tuned signals. If the oscillator tracks below, the signal frequency would be 4270 KC.

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

III-2. RELATIVE AMPLITUDE MEASUREMENTS

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 (see Figure IV-7). Compensation at most can only be partial since receiver selectivity will vary. Consequently, pip height will not be uniform across the screen.

To observe signals of comparative amplitude (10:1 or less), the AMPLITUDE SCALE should be set to LIN. In this position, the horizontal calibration lines on the crt screen are used. The linear scale is calibrated in ten divisions.

Examination of signals widely divergent in amplitude will require setting the AMPLITUDE SCALE switch to the LOG position. This will allow simultaneous reading of amplitude having a 40 db range. In this position of the AMPLITUDE SCALE switch, the calibration dots at the left side of the screen are used. The calibration range is from -20db to +20db in 5 db steps for a total range of 40 db.

In the EXP position, differences in amplitude are accentuated. In this position the relative deflections of discrete frequency pips are proportional to the squares of their respective amplitudes, i.e., to their respective powers. The EXP scale permits direct determination of power points, side-band energies, etc. This position also aids in distinguishing between signals and noise.

Additional separation of signal from noise can be obtained by setting the VIDEO FILTER to either LOW or HIGH.

III-3. NARROW-BAND ANALYSIS

At full sweep width, signals, or a carrier and its side-bands, having a small frequency difference tend to have their corresponding deflections merge into and mask each other. These deflections may be separated (resolved) by increasing the scanning time (reducing the sweep rate), by reducing the sweep width, or by narrowing the i-f bandwidth at the same time the sweep rate and/or the sweep width is reduced.

Figures III-1 and III-2 are graphs which indicate the relationship between resolution and sweep width at sweep rates of 30 cps, 10 cps, 3 cps and 1 cps. Figure III-1 applies to Type T-100 and Type T-200. Figure III-2 applies to Type T-1000. The graphs are used as guides for determining whether signals can be resolved. For a given setting of the SWEEP WIDTH control and for any one sweep rate, there is a setting of the RESOLUTION control which will produce the best resolution. The following example illustrates how the resolution characteristic graph for Type T-1000 (Figure III-2) is used.

Assume that a test signal with 50 side-bands, 2 KC apart, is to be observed. The overall sweep width is determined to be 100 KC (50 x 2 KC = 100 KC).

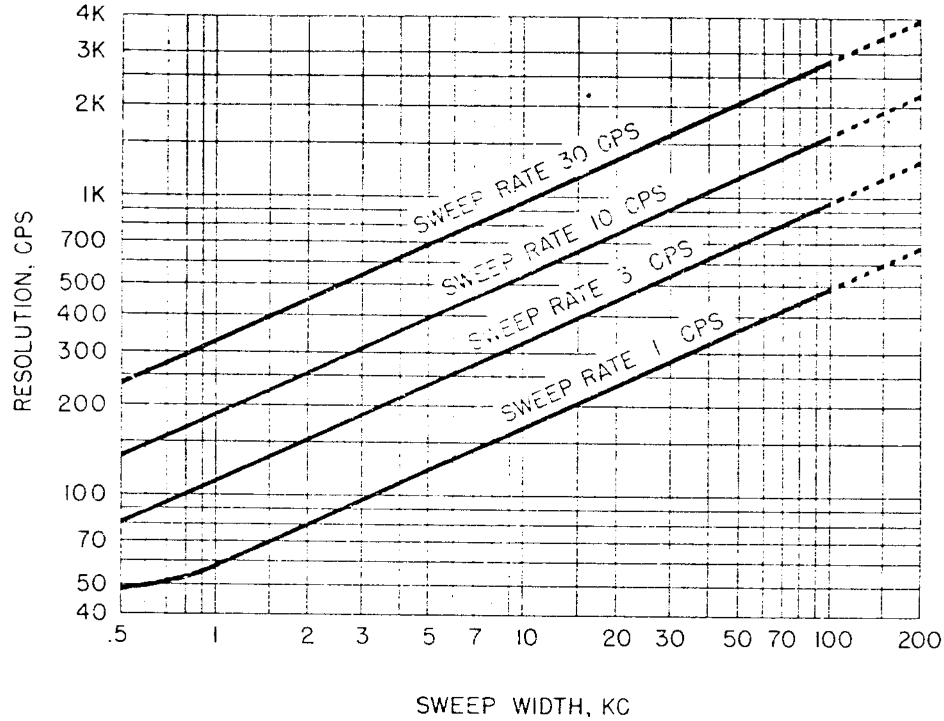


Figure III-1
Resolution (KC) vs Sweep Width (KC)
Types T-100 and T-200
(dashed portions apply to T-200 only)

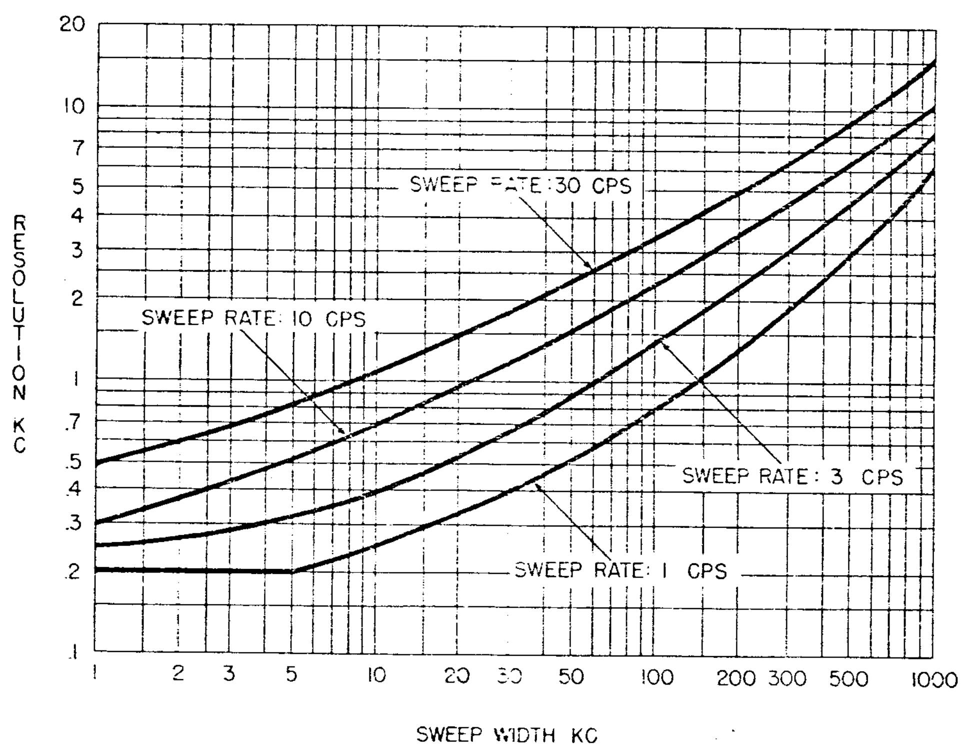


Figure III-2. Resolution (KC) vs Sweep Width (KC)
Type T-1000

With the SWEEP WIDTH control set for 100 KC and the SWEEP RATE control set for 30 cps, the best resolution is 3.3 KC. At 10 cps, the best resolution is 2.3 cps. At 3 cps, the best resolution is 1.4 KC. At 1 cps, the best resolution is 0.8 KC.

Thus to resolve the test signals involved in the example (50 side bands, 2 KC apart), a sweep rate of 3 cps or slower should be used to obtain the required resolution (2 KC)at a 100 KC sweep width.

Figures III-3 and III-4 are graphs which indicate the minimum frequency separation required to measure amplitude ratios E_2/E_1.

Figure III-3 applies to the Type T-200. Figure III-4 applies to the Type T-1000.

If a signal of small amplitude is close in frequency to a signal of large amplitude, the pip due to the small signal will be influenced by the presence of the large pip. In effect, the small pip will ride on the skirt of the large pip (the amplitude-versus-frequency response of the i-f section being bell-shaped). As the signals are separated in frequency, the error becomes less. The curves in Figures III-3 and III-4 indicate the separation required for negligible error at the given scanning velocities.

a. To obtain greater resolution by increasing the scanning time, lower the sweep rate by rotating the SWEEP RATE control counterclockwise. Readjust the SYNC AMP control to keep the sweep in synchronism.

b. To increase the resolution capabilities by reducing sweep width, narrowing the i-f bandwidth, and increasing scanning time use the following procedure:

   1. Set the RESOLUTION control on 1.0 (completely clockwise), the position for broadest i-f bandwidth.

   2. With the receiver, tune the desired band of signals to the center of the screen.

   3. Spread the band of signals across the screen by turning the SWEEP WIDTH control counterclockwise. Note that at reduced sweep width each screen frequency calibration mark represents a frequency separation equal to one-tenth of the reduced sweep width. Keep the band centered with the CENTER FREQ control.

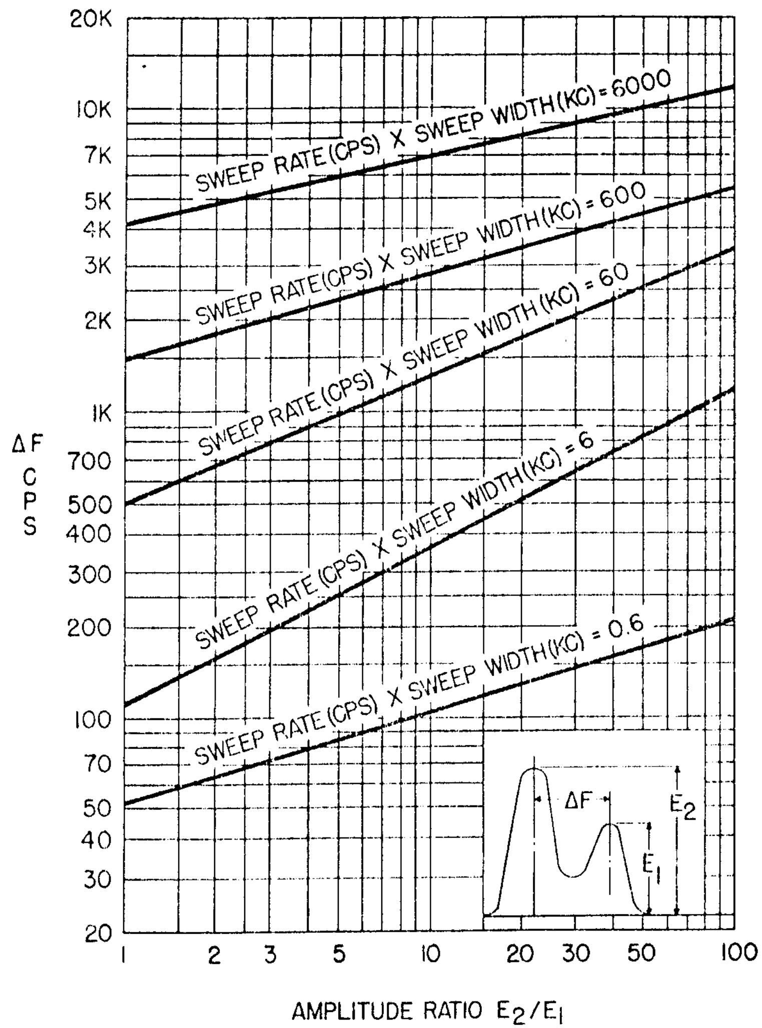


Figure III-3
Minimum Frequency Separation ΔF,
Required to Measure Amplitude Ratios E_2/E_1,
Types T-100 and T-200

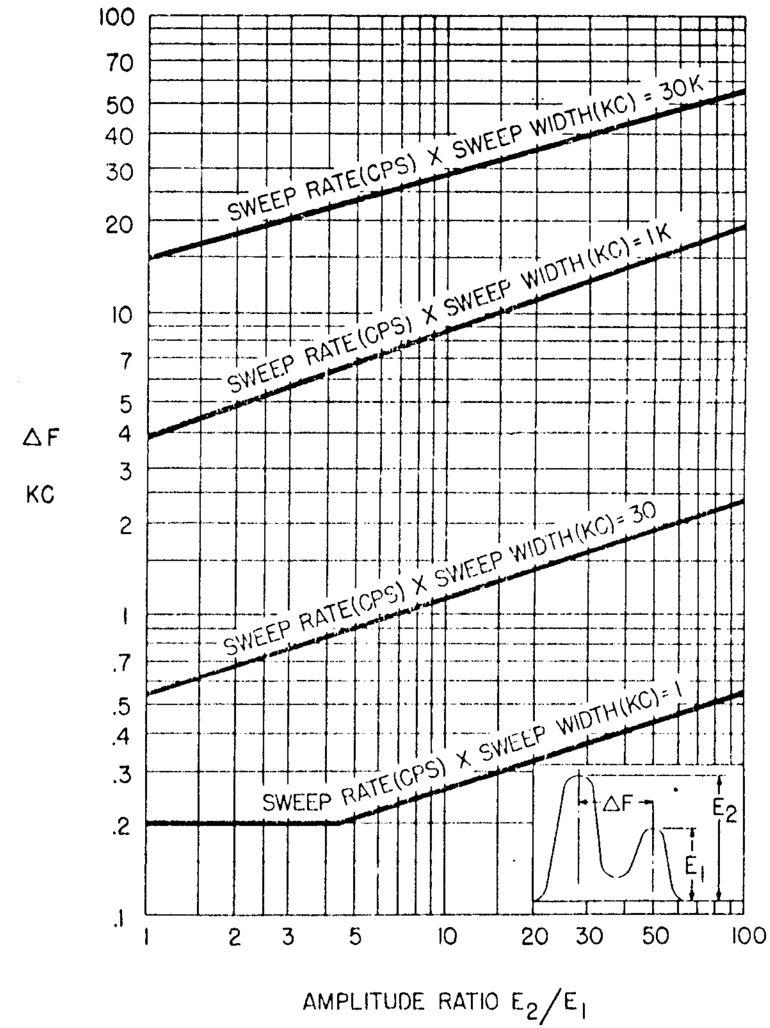


Figure III-4.
Minimum Frequency Separation ΔF,
Required to Measure Amplitude Ratios E_2/E_1.
Type T-1000

When the SWEEP WIDTH control is set close to its maximum counterclockwise position, the center signal will appear as an elevated baseline or pip with hum superimposed. This is normal. However, the sweep width need not be reduced so far in normal analysis. Note that the SWEEP WIDTH control panel markings are only approximate.

4. Turn the RESOLUTION control counterclockwise until individual signals are most clearly resolved. If the signal is not resolved, a slower sweep rate must be used. Best resolution can be recognized by the nature of the ringing pulses which will appear on the trailing edge of the signal pip as the best possible resolution is approached. See Figure III-5 and Subparagraph 5 below. Ringing can be seen more easily with the VIDEO FILTER control in the OUT position.

NOTE: Rotation of the RESOLUTION control may result in increased or decreased pip height. Pip amplitude may be returned to a suitable level with the GAIN control. Turning the RESOLUTION control counterclockwise after best resolution is reached will <u>decrease</u> the resolving power and result in greatly reduced sensitivity.

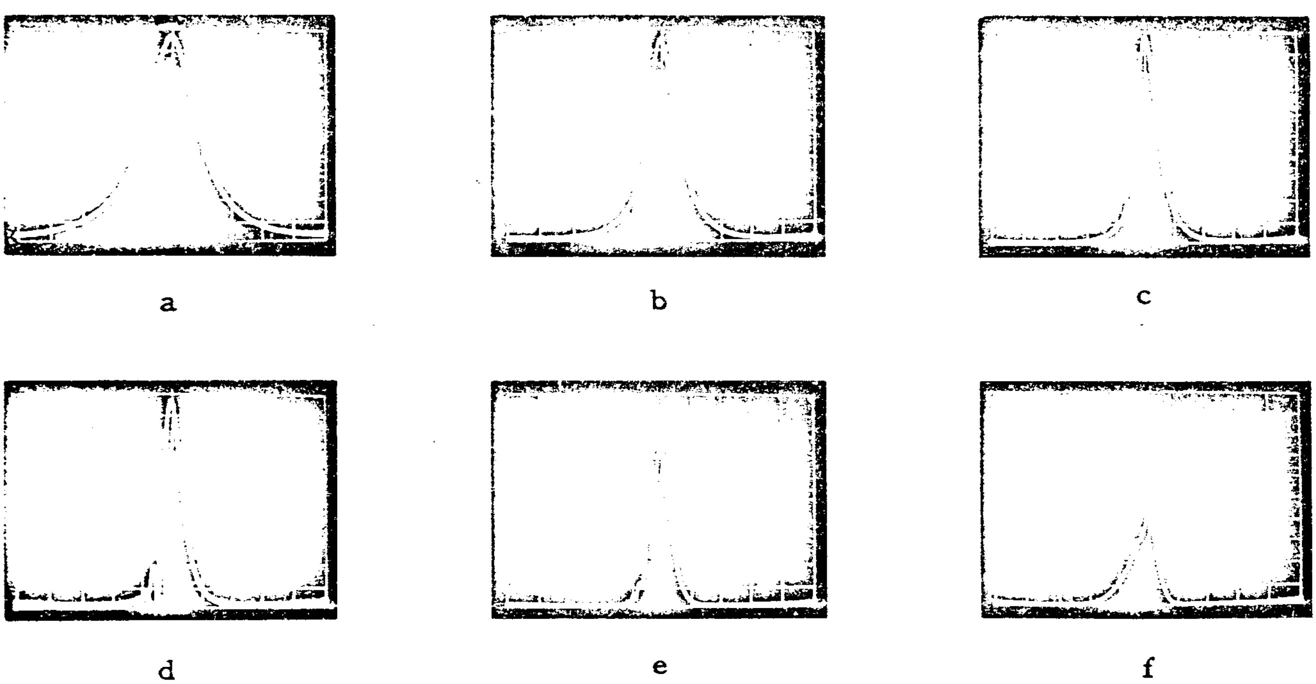


Figure III-5. Ringing as an Indication of Optimum Resolution.

5. If the resolution adjustment results in practically complete separation of signal pips, best resolution can be recognized by the presence of ringing pulses on the trailing edge of the pip.

   Waveforms (a) through (f) of Figure III-6 indicate the progressive variations in pip shape caused by counterclockwise rotation of RESOLUTION control. In (a) and (b) the i-f bandwidth is broad for a given scanning velocity (product of sweep rate and sweep width). Waveform (c) shows beginning of ringing. Extent of ringing in (d) shows best possible resolution. Note that at best resolution the notch between the signal pip and the ringing pip nearest the signal pip extends into the baseline. As the i-f bandwidth is made narrower, excessive ringing widens the signal pip and decreases the pip amplitude thus reducing the resolving power. Further counterclockwise rotation of the RESOLUTION control causes a reduction in amplitude and re-merging of the pips. This is shown in waveforms (e) and (f).

6. To better separate the signals, the SWEEP WIDTH and RESOLUTION CONTROLS can be backed off further counterclockwise and the SWEEP RATE control set to give a slower rate.

   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, best possible resolution is recognized by the appearance of the clearest picture. After this point has been reached, further counterclockwise rotation of the RESOLUTION control will result in lessened resolution and a bobbing presentation.

   Better resolution can be obtained by looking at narrow segments of the bandwidth of interest, and shifting the center frequency to cover the entire band.

III-4 OPERATING PROCEDURE FOR PULSED SIGNALS

Pulsed 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 that the crt screen is not sufficiently 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 should be used.

a. Set up the equipment as outlined in Paragraph III-1, GENERAL OPERATION.

b. Using the BRILLIANCE control, reduce the brightness 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, adjust the FOCUS control for the sharpest presentation.

NOTE: The LOG position of AMPLITUDE SCALE selector does not function properly when narrow pulses are involved.

III-5 INTERPRETATION OF SCREEN PRESENTATIONS (See Fig. III-6)

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

a. A constant carrier (Fig. III-6, a & b) appears as a deflection of fixed height.

b. An amplitude-modulated carrier (Fig. III-6, c & d) 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 sweep width of the analyzer. Operation of the RESOLUTION control will effect further separation. The higher the frequency of modulation, the farther away these side bands will move from the center deflections, representing the carrier. Due to possible non-linear amplification of the receiver or of the analyzer, or both, over a wide band, the side bands may appear unequal in height, even though they are of equal strength. The relative heights of the side bands may vary as the receiver is tuned and as the deflection moves from one end of the screen to the other.

c. Single side-band modulation (Fig. III-6, g & h) appears as two carriers of slightly different frequency (See "Signal Interference" below).

d. A carrier frequency-modulated at low rate appears as a carrier which wobbles sideways.

e. 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.

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

g. Signal Interference (Fig. III-6, g & h). 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 to be modulated on one side only. Further increase of frequency will cause a "break" in the apex of the deflection. By reducing the sweep width of the analyzer, the respective deflections will gradually separate. Further separation can be made with the RESOLUTION control and by setting the SWEEP RATE control to give a lower rate.

h. Transient disturbances, generally examined, are of two types: periodic and aperiodic transients.

Periodic transients, such as produced by motors, vibrators, buzzers, etc., appear as signals moving along the frequency sweep baseline 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 cps 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 carrier. Aperiodic transients, such as "static" appear as irregular deflections and flash along the whole frequency sweep axis.

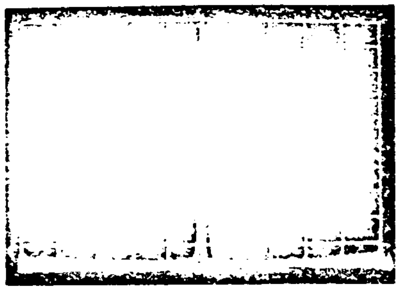
i. Images. Images will be distinguishable from normal signals by the fact that they move in an opposite direction with respect to normal signals on the screen of the analyzer when the external oscillator is being tuned. Such images are most likely to appear on the higher frequency ranges of the receiver.

j. Harmonics produced in the analyzer by the beating of very strong signals with harmonics of the oscillator, will be distinguishable from other signals by the fact that they move across 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 analyzer will eliminate this type of spurious signal.

k. 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 the 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 receive those periodic pulses.

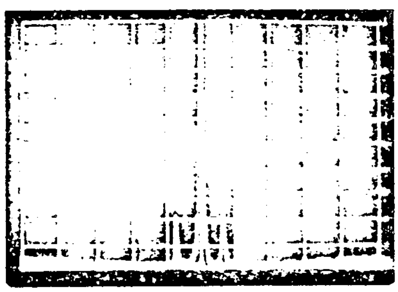
In order to examine signals which are synchronized to the line frequency, set the CAL-SYNC SEL to LINE, SYNC AMP to maximum counterclockwise and adjust the RATE control for the best presentation across the entire screen. This provides the asynchronous operation necessary to see the entire signal. The SYNC AMP control can be used to provide synchronism in order to "capture" an interesting portion of the display.

l. 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 sidebands. These spurious signals can take place in either the analyzer or the receiver on extremely strong signals. Attenuation of signal input level will remedy this.



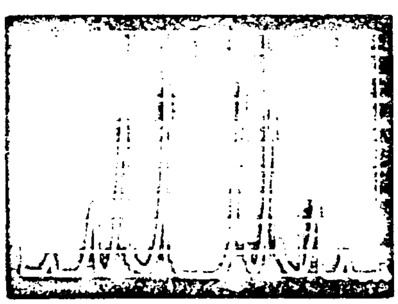
a. Constant carrier signal at approximately maximum sweep width.

b. Appearance of constant carrier at reduced sweep width.

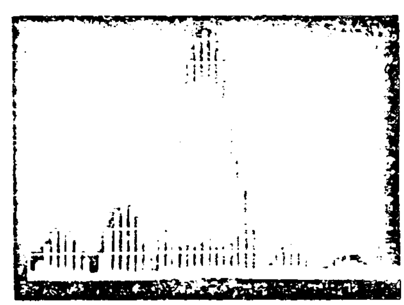


c. Amplitude-modulated signal, showing carrier and two sidebands.

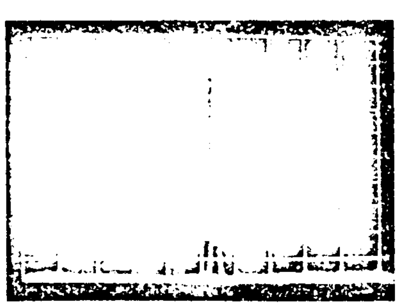
d. Same am signal as "c" at reduced sweep width, carrier remains at center of screen.



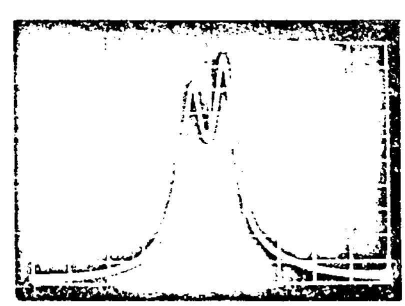
e. Frequency distribution of an fm signal.



f. Spikes indicating distribution of a pulsed rf signal.



g. Two interfering carriers at maximum sweep width.



h. Same signals as "g" at reduced sweep width, resulting in improved separation or resolution.

Figure III-6. Appearance of Typical Panoramic Indictions.

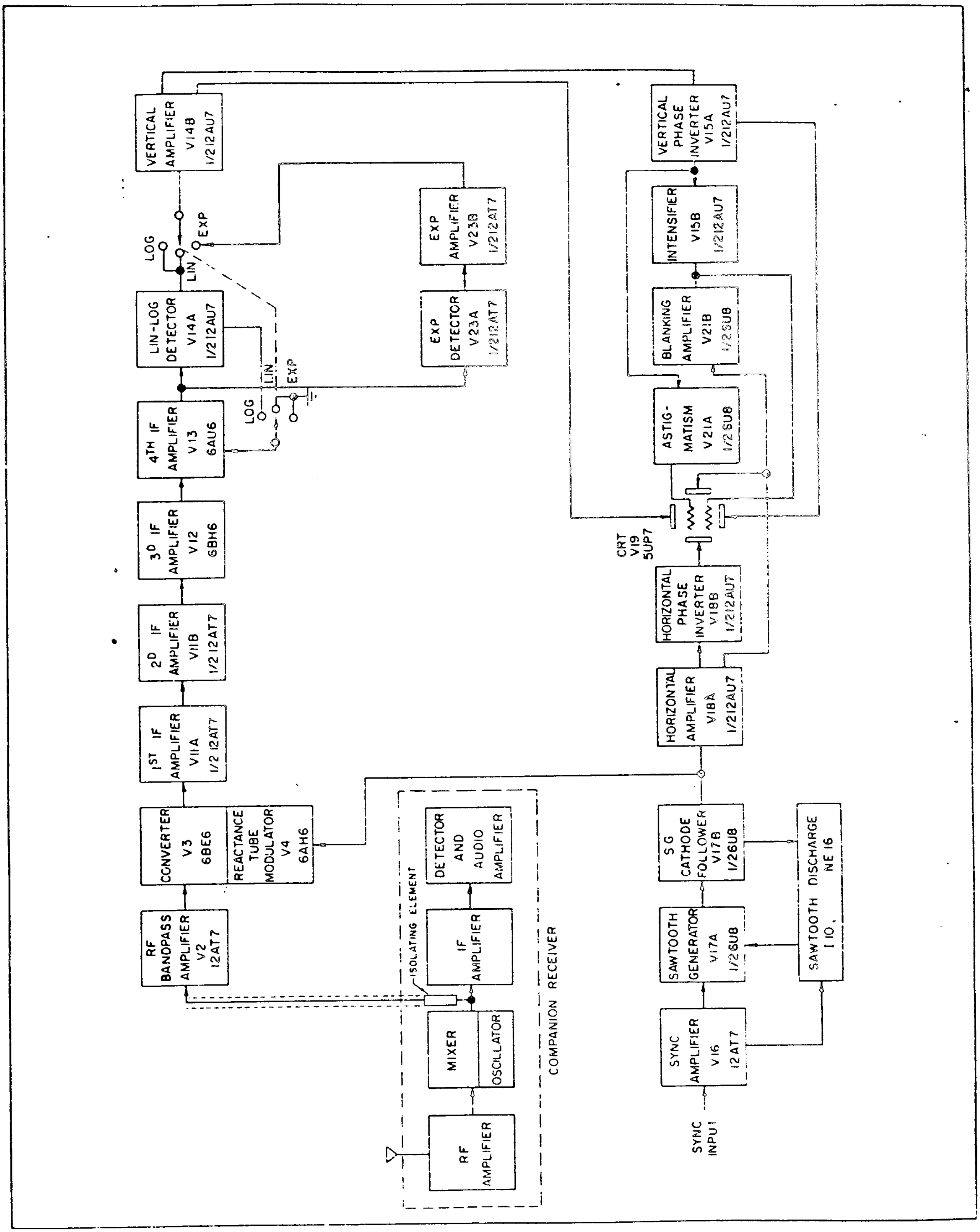


Figure IV-1. Block Diagram, Model SA-6b.

CHAPTER IV - THEORY OF OPERATION

IV-1 INTRODUCTION

The Panadaptor is essentially an automatic-scanning heterodyne receiver which provides a visual display of signals present within a given band.

The Panadaptor is operated with a companion heterodyne 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 intermediate-frequency of the receiver. The width of the band is determined by the selectivity of the receiver front end. 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 Panadaptor consists basically of a broad band r-f amplifier, swept local oscillator and converter, variable selectivity intermediate-frequency 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 intermediate-frequency section. The output voltage of the i-f section 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 cathode-ray tube.

Oscillator sweep is obtained from a sawtooth modulated reactance tube circuit. A sawtooth generator supplies the necessary modulating voltage and also provides for horizontal sweep of the crt beam. For each discrete point on the horizontal axis of the crt there is a corresponding local oscillator frequency and consequently a corresponding signal frequency.

The intermediate-frequency 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. A detector, with circuit parameters which provide exponential amplification of signals is also provided. The output of the video section is applied to an intensifier tube as well as to the vertical deflection plates of the crt. An adjustable amount of a positive voltage output from the intensifier is impressed upon the intensity grid of the crt enabling signals to intensity modulate the crt beam.

IV-2 CIRCUIT DESCRIPTION

a. R-f Bandpass Amplifier, V2 (12AT7): The function of this stage is to compensate for the selectivity of the r-f amplifier and mixer stages of the receiver to enable presentation of a broad band of signals i.e. 100KC, 200 KC or 1000 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 IV-2.

The signal input is passed from the output of the convertor in the receiver through an isolating element and r-f cable to the input r-f transformer. The capacity of the cable is part of the shunt capacity across the primary of the transformer. The isolating element prevents undesirable interaction.

The input transformer is overcoupled to produce a pronounced double-peaked response. The output transformer is similarly overcoupled and peaked.

Peaking frequencies are:

T-100 (455 KC)	407.5 KC and 502.5 KC
T-100 (500 KC)	452.5 KC and 547.5 KC
T-200	365 KC and 545 KC
T-1000	4.83 MC and 5.67 MC

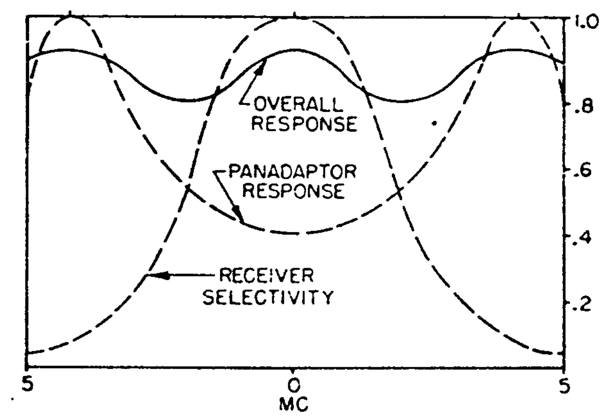


Figure IV-2. Overall Response of Panadaptor and Receiver.

The GAIN control is incorporated in the cathode circuit of V2. This control 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+. This insures that plate current variations will not cause undesirable reactions in other circuits as the GAIN control is manipulated.

b. Converter, V3 (6BE6): This tube serves as a local oscillator and also acts as a mixer to combine the output of the local oscillator with the output of the r-f bandpass amplifier. Oscillator and input signals are hetrodyned in the mixer to produce sum and difference terms of the input and oscillator frequencies. The difference frequency is selected and amplified by the i-f section. The difference frequency is the intermediate-frequency.

The oscillator is a grounded plate Hartley type. Grid #1 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 the converter tube is affected not only by grid #1 but also by grid #3 which is connected to T102, the r-f amplifier output transformer.

To eliminate the possibility of hum modulation, the heater of the converter V3, and reactance tube modulator V4, are operated on dc. Two 6.3V power transformer windings are connected in series. Their output is full wave rectified and filtered. The resultant dc is applied to the two tubes connected in series. (V12, an i-f amplifier is wired in parallel with V3).

The oscillator is periodically tuned through a given range by the reactance tube modulator.

c. Reactance Tube Modulator V4 (6AH6): 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, the reactive current of the tube changes to swing the frequency of the oscillator. The controlling voltage variation, which is derived from a sawtooth voltage is zero, the oscillator is at its mean frequency.

The sawtooth on the reactor grid rises linearly from zero to a maximum positive voltage and then falls to a maximum negative value. From there it rises linearly to zero, completing one cycle. In coincidence with this the oscillator sweeps upward in frequency, then suddenly snaps back past the mean frequency to the minimum frequency and then sweeps back to the mean frequency. The extent of frequency excursion is determined by the amplitude of the applied sawtooth voltage. The SWEEP WIDTH control governs this amplitude and consequently controls the scanning width. The chassis mounted SWEEP LIMIT semi-adjustable control 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 chassis mounted CF PAD is a coarse bias adjustment.

d. I-f Section: The primary function of the intermediate-frequency section is the 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, logarithmic or exponential amplification.

To examine the general operation of the i-f section, the operation of the Type T-200 may be considered. The intermediate-frequency 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 r-f bandpass amplifier passes signal frequencies between 335 KC and 555 KC, the center being 455 KC. Figure IV -3 below illustrates these facts in relation to the calibrated indicator screen.

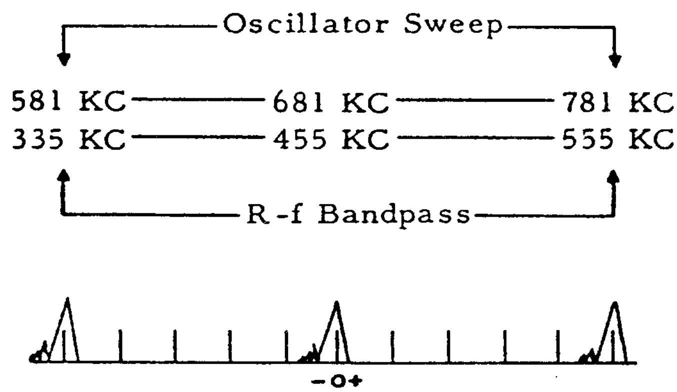


Figure IV - 3. Relationship of r-f bandpass and oscillator sweep frequencies to input signals.

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

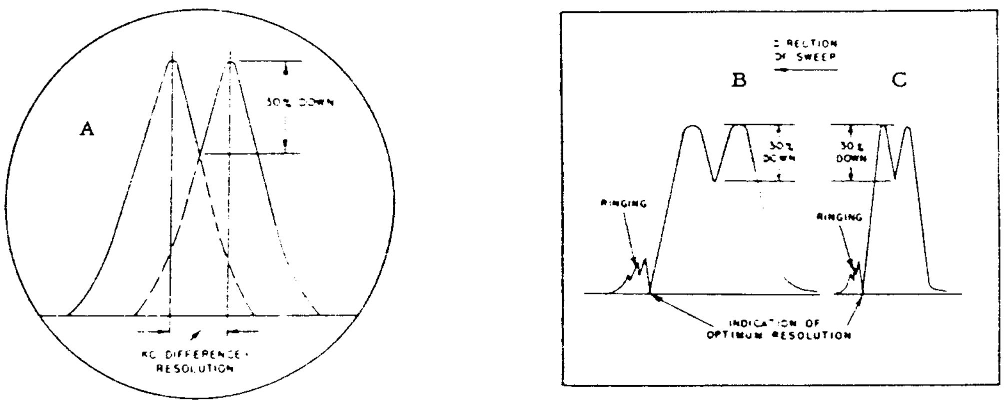
slightly below 226 KC for the 355 KC signal
slightly below 126 KC for the 455 KC signal
slightly below 26 KC for the 555 KC signal

But since the i-f section is sharply tuned to 226 KC, only the 355 KC signal will appear as a significant voltage. The other difference products are so far removed from the 226 KC 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 shape of the pip on the crt screen represents, to a degree, the response characteristic of the i-f section. At times, the test signals are so close in frequency (especially signals with many side bands) that these signals tend to merge on the screen of the crt. Merging of the signals is undesirable; thus it is necessary to separate, or resolve, the signals to simplify interpretation.

Resolution is defined as the frequency difference between the peaks of two signals when their curves merge at a point approximately 30 per cent below their maximum amplitudes. (See A, Figure IV -4).



A. Representation of Resolution.

B. Ringing effect indicating Optimum Resolution

Figure IV - 4

Resolution is dependent upon three factors: the i-f bandwidth of the unit, the sweep rate, and the sweep width. These three factors are controlled by the front panel RESOLUTION control, the SWEEP RATE selector, and the SWEEP WIDTH control, respectively. It is possible to obtain resolution at various combinations of settings of these controls. One particular combination of settings of these controls will give best possible (optimum) resolution.

Both B and C, Figure IV-4, indicate best resolution with the two signals merging at 30 per cent below their maximum amplitudes. B, Figure IV-4, represents best resolution at a narrow sweep width, and C represents best resolution at a wide sweep width.

Best possible resolution is indicated when the first ringing pulse (that pulse nearest the signal) reaches the baseline of the trace. Ringing will appear only on the trailing edge of the signal. To see the ringing effect on the screen of the crt, set the VIDEO FILTER switch on the front panel to the OUT position.

To achieve maximum resolution for given sweep widths and rates, two variable selectivity i-f stages are incorporated. A twin triode V11 (12AT7) is common to both stages.

One section of V11 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. A variable capacitor is connected to the junction of the crystal and load coil. The other side of the capacitor 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 highly resistive impedance in series with the crystal, thus causing a broad response. To vary 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 crystal holder capacity effects the variable capacitor mentioned above applies a voltage to the crystal load coil which is equal and in phase opposition to the voltage 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, V11. 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 forms the RESOLUTION control.

A potentiometer shunted across the second load coil of Z103 and the second half of the RESOLUTION control is the chassis mounted BANDWIDTH LIMIT control. It is used to set the overall limit of the i-f bandwidth.

The output of the second load coil is applied to the grid of the third i-f amplifier, a 6BH6, V12. A potentiometer in the cathode circuit varies the bias and transconductance of this tube. B+ is bled into the control to provid greater range. This is the chassis mounted I-F GAIN control. The output of this stage is Z104, a double tuned transformer which drives the fourth i-f amplifier stage.

The fourth i-f amplifier, V13, is a 6AU6. Circuit parameters provide linear, logarithmic or exponential amplification, selection being made through the AMPLITUDE SCALE selector switch. When the selector is set to LIN or EXP, the bottom end of the secondary in Z104 is grounded. Cathode bias is applied to the control grid. Amplification is linear. In the LOG setting of the AMPLITUDE SCALE SELECTOR, the bottom end of Z104 is grounded 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.

e. Exponential Detector and Amplifier (V23) and Log-Lin Detector and First Vertical Amplifier (V14):

The output of the i-f section is coupled to the Exponential Detector and to the Log-Lin 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.

1. Expontial Detector and Amplifier (V23):

Z105 is capacity coupled to the grid of the Exponential Detector, one section of a 12AT7 twin triode, V23. The cathode of this section is direct coupled to the grid of the Exponential Amplifier, the second triode section of the 12AT7. In the EXP position of the AMPLITUDE SCALE switch, the plate of the Exponential Amplifier is coupled through a capacity and a dc restorer to the first Vertical Deflection Amplifier.

2. Lin-Log Detector and First Vertical Amplifier (V14):
The plate and grid of one section of a 12AU7 twin triode, V14, are connected together to form a diode detector. In the LIN or LOG position of the AMPLITUDE SCALE switch, 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 low pass filters which cut off about 260 cps in the LOW position and 30 cps in the HIGH position. Grid bias for the triode is obtained from 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 crt, and to the Vertical Phase Inverter.

f. Vertical Phase Inverter and Intensifier (V15):
The phase inverter, one half of a twin triode 12AU7, V15, drives the second or opposing vertical deflection plate of the crt. 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 the second vertical deflection plate is direct. Hence, the same dc voltage appears on the plate of the inverter and on the deflection plate. In the LINE and EXT position of the CAL-SYNC SEL(ECTOR) switch, a variable cathode bias resistor in the cathode circuit of the inverter governs the inverter plate voltage and consequently the vertical position of the crt indication. This is the chassis mounted VERTICAL POSITION control.

In the CAL position of the CAL-SYNC SEL switch, a 6.3 V, 60 cps ac voltage is applied to the cathode. This results in a sinusoidal vertical deflection of the horizontal trace.

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 of V15 is capacitively coupled to the intensity grid of the crt. The magnitude of the output 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 counteracts the bias, allowing passage of the crt beam. Operation of the INTENSIFIER control is described in Chapter III.

g. Astigmatism and Blanking Amplifiers (V21):
The output of the triode section of the 6U8, V21, sets the operating level of the second anode of the crt. A variable cathode bias resistor governs the output voltage. This is the ASTIGMATISM control. It is set to reduce de-focusing of the beam at different points within the limits of the face of the crt.

The input to the grid of the intensifier, V15, is also connected to the grid of the triode section of V21. The resultant output voltage reduces de-focusing when the INTENSIFIER is operated.

Sawtooth voltage from the plate of the First Horizontal Amplifier is connected to the grid of the pentode section of V21 through a differentiating network. The output of the blanking amplifier supplies a negative-going voltage pulse to the control grid of the crt. The duration of the pulse is approximately the same as that of the horizontal sawtooth retrace. This blanking of the brilliance of the crt beam suppresses visable traces during flyback time.

h. Sweep Circuits: The sawtooth sweep voltage is derived from the sweep generator V17, a 6U8 and I10, a NE16 neon lamp with a conductive coating. The pentode section of the 6U8 acts as a Miller type sweep generator. A resistor and capacitor in the grid circuit provide a time constant which controls the negative-going voltage on the grid. This change in grid voltage is amplified in the pentode section and is fed back 180° out of phase through the triode cathode follower section of the same tube. This amplified positive-going voltage tends to slow down the time constant, or rate of negative change, in the grid of the pentode section. This results in a linear, positive sawtooth voltage in the output of the cathode follower. When this voltage reaches a pre-determined amplitude, I10 conducts, restoring the grid of the pentode section of the 6U8 to its beginning condition. (The conduction time for I10 is the flyback time of the sawtooth).

One section of a dual potentiometer in the crt negative voltage bleeder string governs the negative-going voltage applied to the grid of the pentode section of V17. This negative-going voltage determines the amplification of the time constant. The other section of the dual potentiometer determines the resistive portion of the grid time constant of V17. These two sections of the dual potentiometer make up the SWEEP RATE control.

When the negative grid voltage of the pentode section of V17 is at a minimum, the amplification of the time constant will be the greatest. At the same time the second section of the dual potentiometer is at highest resistance or highest time constant. Rotation of the SWEEP RATE control in a clockwise direction results in a higher sweep rate. Fully clockwise = 60 cps. Fully counterclockwise = 1 cps.

In the CAL or LINE position of the CAL-SYNC SEL switch, 6.3 volt 60 cps ac from the filament system is fed to the grid of the Sync Amplifier-Limiter, a dual triode 12AT7, V16.

The differentiated output of the Sync Amplifier is fed through the SYNC AMP(LITUDE) potentiometer to the conductive coating of I10. Voltage pulses appearing on this coating will electrostatically cause variations in the firing voltage of I10, the sweep discharge, or flyback tube. A pilot lamp, I2, is located adjacent to I10. The function of I2 is to maintain a constant ionization level in I10 by photoelectric effect, thereby maintaining a constant striking or firing voltage. (Note: If I2 is not lit, erratic operation of the sweep circuit may occur).

The EXT position of the CAL-SYNC SEL permits synchronization with external voltage, which can be fed in through the EXT SYNC jack J103.

The sawtooth sweep voltage from the output of the sweep generator cathode follower is capacitively coupled to both the Horizontal Amplifier and the Reactance Tube Modulator. The LINE SIZE control is located in the input of the Horizontal Amplifier. The SWEEP WIDTH and SWEEP LIMIT controls are couples after the LINE SIZE control to prevent changes in horizontal location of pips with line voltage fluctuations.

The horizontal amplifier, V18, one section of a 12AU7 twin triode, is direct coupled to one horizontal deflection plate of the crt indicator, to the horizontal phase inverter and to the blanking amplifier.

Coupling between the output of the horizontal amplifier and the first horizontal deflection plate is direct. Hence, the same dc voltage appears on the plate of the amplifier and on the deflection plate. A variable cathode bias and resistor governs the plate voltage of the amplifiers and consequently the horizontal position of the crt indication. This is the HORIZONTAL POSITION control.

The second section of the 12AU7 twin triode, V18 is the horizontal phase inverter. The output of the inverter, which is 180° out of phase with the input voltage, is direct coupled to the second or opposing horizontal deflection plate of the crt.

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

CHAPTER V - SERVICE AND MAINTENANCE

If trouble develops which cannot be corrected by following the procedures outlined in the following paragraphs, it is recommended that the instrument be returned to Panoramic Radio Products, Inc. for servicing. Before returning the instrument, fill out the Repair and Maintenance form bound in the rear of this Manual and send it to us. Upon receipt of this information our Service Department will send you service data or shipping instructions.

Upon receipt of shipping instructions, forward the instrument prepaid to the factory. If requested, an estimate of charges will be made before work begins.

This chapter is divided into five sections to facilitate its use in connection with adjustment, repair or alignment of the equipments.

Section V-1 contains a discussion of the semi-adjustable controls found on the chassis of the equipments.

Section V-2 is a guide to trouble shooting. The principal types of troubles that may be encountered are listed. For each trouble, the likely causes are indicated.

Section V-3 contains voltage and resistance charts.

Section V-4 is a complete factory alignment procedure.

Section V-5 is a list of replaceable parts.

V-1 SEMI-ADJUSTABLE CONTROLS

These controls are in circuits which seldom require adjustment. They are 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 coincidence. If the baseline is not parallel with the grid line, the crt should be rotated. This requires loosening of the clamp around the crt socket and relaxation of the crt 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 crt.

The crt socket can then be rotated as required. In equipments supplied with a 5UP7 crt, 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. 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 from 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, AMPLITUDE SCALE selector to 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 by feeding in a signal which causes a full scale deflection for LIN setting of the AMPLITUDE SCALE selector. 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 the LOG SCALE ADJUSTMENT potentiometer until full scale deflection is obtained.

e. LOG ZERO ADJUST: This adjustment may be checked by feeding in a signal which causes a full scale deflection for LIN setting of the AMPLITUDE SCALE selector. Turn the selector to LOG. The deflection should go down to 0 db. If it does not rotate the LOG ZERO ADJUST potentiometer until the deflection is at 0 db. 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. BANDWIDTH LIMIT: See step 18, I-F Alignment Procedure, Paragraph V-4b.

h. ASTIGMATISM: This adjustment may be checked by feeding in a signal which causes a full scale deflection. The BRILLIANCE control should be set to give a moderate trace on the screen.

The INTENSIFIER should be set fully counterclockwise. Adjust the ASTIGMATISM and FOCUS controls simultaneously while traversing the pip across the screen. The ASTIGMATISM control is at the correct setting when both the baseline and the pip are in sharp focus on all points of the screen. (Or best over-all focus is obtained).

V-2 TROUBLE SHOOTING

WARNING: When servicing the Analyzer or the power supply, be extremely careful of the exposed high voltages. Always disconnect the interconnecting cable between the Analyzer and the power supply and discharge capacitors C2 and C3 before doing any testing. With the high voltage off, potentials as great as 2,000 volts are still present in the Analyzer and the power supply.

a. Most of the parts in the Panadaptor are readily accessible and are replaced easily if found to be faulty. If the SWEEP RATE SELECTOR switch requires replacement, mark the wires connected to the switch with tags to avoid misconnection when the new switch is installed. Follow this practice whenever replacement requires the disconnection of numerous wires.

b. When a part is replaced in any r-f or i-f circuit, it must be placed exactly in the same position as the original part. A part which has the same electrical value but different physical size may cause trouble in high-frequency circuits. Give particular attention to proper grounding when replacing a part. Failure to observe these precautions may result in decreased gain or the possibility of oscillation in the circuit.

c. The following chart is supplied as an aid in locating trouble in the Analyzer and power supply. The chart lists the symptoms which the repairman observes, either visually or audibly, while making a few simple tests. The chart also indicates how to localize trouble quickly to a circuit stage or circuit element. Once the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of this stage or circuit should be ordinarily sufficient to isolate the defective part or parts. Normal voltage and resistance measurements are given in V-3, Voltage and Resistance Charts.

SYMPTOM	PROBABLE TROUBLE	CORRECTION
1. No illumination on the screen when POWER switch is turned to the ON position. Pilot lamp does not light.	AC power is not being supplied the power supply or the indicator.	Check interconnecting cables. Check for input voltage.
	Open fuse F1 or F2 in power supply.	Replace fuse. If it blows again, check filter capacitors C1 through C6 in power supply. Check all filter and bypass capacitors in analyzer.
	Transformer T1 defective.	Check transformer output voltages.
2. Indicator operates normally but pilot lamp does not light.	Pilot lamp or pilot lamp socket defective.	Replace pilot lamp. Check pilot lamp socket.
3. No illumination is observed on the screen of crt. Pilot lamp lights.	Improper adjustment of BRILLIANCE or FOCUS controls. Improper adjustment or HORIZONTAL POSITION or VERT. POSITION controls.	Adjust these controls. (Use the procedures given in Paragraphs II-3 and V-1.
	Failure of B+ or high-voltage supply.	Remove the power supply from its case and compare voltages measured between each terminal and the chassis with values shown in Paragraph V-3 (Voltage and Resistance Chart).
	Defective crt V19.	If no voltage or low or high B+ voltage is present check tube V101 and capacitors C1 through C6.
4. With the GAIN control turned completely counterclockwise, a dot or short line is observed on the screen but a horizontal baseline (horizontal sweep) is not obtained.	Faulty sweep stage.	Check tubes V17, V18, V101, and their tube socket resistances and voltages.
	Improper adjustment or LINE SIZE control	Adjust this control; use the procedure given in Paragraph V-1 b.

SYMPTOM	PROBABLE TROUBLE	CORRECTION
5. GAIN control turned completely counterclockwise, the horizontal baseline is obtained, but it is unstable in CAL and SYNC positions of the CAL SYNC SEL switch.	Horizontal oscillator circuit not synchronized. Faulty sweep stage.	Adjust the SYNC AMP control: use the procedure given in Paragraph II-3b. 11.
6. Horizontal baseline trace appears normal, but no vertical deflection signal is observed when the GAIN control is tuned in a clockwise direction.	No input signals; amplitude of input signal is low; input signals are at an incorrect frequency.	Check r-f cables from the companion receiver. Check isolating element and connections.
7. With the SWEEP WIDTH control turned completely clockwise, the vertical deflection representing a 5 MC signal does not appear on the horizontal baseline at the zero line of the calibrated scale.	Improper adjustment of the CF PAD control, the CENTER FREQ. control, or the HORIZONTAL POSITION control.	Adjust these controls; use the procedures given in Paragraphs II-3 and V-1.
8. The frequencies of signals, as determined by their position on the horizontal baseline in reference to the calibrated scale, are not indicated accurately.	Improper alignment of the bandpass amplifier. Tube V2, V3, V4 and V20 defective.	Perform the alignment procedures given in Paragraphs V-4d. Check and replace if necessary.
9. With the SWEEP WIDTH control set at its maximum clockwise position, the vertical deflection (representing a signal) does not appear as a peak, but rather as a shift in the baseline.	Defective reactance tube modulator stage.	Check tube V-4. Check the tube socket voltages and resistances. Check the resistances of network Z101.
10. The length of the horizontal baseline does not cover the diameter of the screen with controls adjusted properly.	Defective stage in the horizontal sweep circuits.	Check tubes V17, V18, and V101. Check tube socket voltages and resistances of the above tubes.

SYMPTOM	PROBABLE TROUBLE	CORRECTION
11. The amplitude of the signals on the screen is low with the GAIN control of the indicator turned completely clockwise.	Input signals of very low magnitude, or improper connections of the r-f signals.	Check the input signal, the r-f cable and isolating element.
	Improper alignment of the indicator.	Realign the indicator; use the procedure given in Paragraphs V-4 a, b, c, and d.
	Defective i-f stage	Check tubes V2, V3, V11, V12, V13, V14 and V15. Check the tube socket voltages and resistances.
	Improper adjustment of the I-F GAIN control.	Adjust this control; use the procedure given in Paragraph V-1c.
12. The screen of the crt contains burned spots.	Defective crt.	Slight adjustment of the VERT. POSITION control may allow the illumination to be observed in a screen area free from burned spots. If this is not possible or practical the crt must be replaced.
13. The indicator operates normally except that some vertical peaks are present along the baseline which do not move as the frequency of the external signal generator is varied.	Electrical interference, the frequency of which is synchronized with the sweep frequency of the indicator.	In many cases, the trouble may be traced to a nearby electrical appliance connected to the same power source as the indicator, or the trouble may be in the power source. Corrective power filters may be used in the event that the interference is caused by appliances. If the power source is the cause and a motor generator set is being used, corrective filters should be used.
14. Rotation of the GAIN control has no effect on the amplitude of the pip on the screen.	Capacitor C401 (T1K)C102 (T100 & T200) or resistor R403 (T1K)R102 (T100 & T200) or R402 (T1K) R103 (T100 & T200) defective.	Check and replace if necessary.

SYMPTOM	PROBABLE TROUBLE	CORRECTION
15. No signals appear on the screen. Application of signals within the r-f band-pass to r-f input connector causes no pip or vertical elevation of the baseline. A strong input center frequency signal input causes a baseline elevation.	F-M oscillator stage inoperative.	Check tubes V3 and V4 and their tube socket voltages and resistances. Check capacitor C405 (T1K) C106 (T100 & T200) and replace if necessary. Check the dc resistance of network Z101.
	Tube V3 or V4 heater voltage is low.	Check capacitor C28, resistors R634(T1K) R334 (T100 & T200), R635 (T1K) R335 (T100 & T200) and rectifier CR1. Replace if necessary.
16. The signal image disappears from the screen at certain frequencies.	Tubes V3 or V4 or network Z101 defective.	Check tubes and the dc resistance of network Z101. Replace if necessary.
17. An input signal causes a vertical rise of the entire baseline rather than a pip.	SWEEP WIDTH control R33 misadjusted or defective.	Rotate control to its maximum clockwise position. Check this control for open or shorts and replace if necessary.
	Capacitor C619 (T1K) C319 (T100 & T200) is shorted.	Check and replace if necessary.
	Reactance tube modulator stage is defective.	Check tube V4, and network Z101, replace if necessary.
18. The CENTER FREQ. control does not center an input center frequency when the scanning width is reduced.	Network Z101 is misaligned.	Realign this network; use the procedure given in Paragraph V-4c.
	Tubes V3 or V4 resistors R629 (T1K) R329 (T100 & T200) R631 (T1K) Reel (T100 & T200) R632 (T1K) R332 (T100 & T200) defective.	Check and replace if necessary.
	CF PAD potentiometer R630 (T1K) R330 (T100 & T200) misaligned or defective.	Realign this control; use the procedure of Paragraph V-4c. Check this control for shorts and replace if necessary.

SYMPTOM	PROBABLE TROUBLE	CORRECTION
19. Resolution is unsatisfactory with the RESOLUTION control set for a broad pip as evidenced by an asymmetrical pip, the appearance of a rejection slot, or more than 20-percent fall of amplitude in changing the SWEEP WIDTH control from maximum counterclockwise position to maximum clockwise position.	I-F GAIN control improperly adjusted.	Check by reducing the setting of the I-F GAIN control to see if this corrects the difficulty. If not, restore the control to its original setting.
	Tube V11 is defective	Check and replace if necessary.
	Transformer Z103 or capacitor C604 (T1K) C304 (T100 & T200) or C607 (T1K) C307 (T100 & T200) misaligned or defective.	Relign transformer and capacitor; use the procedure given in Paragraph V-4b.
	Resistors R608A (T1K) R308A (T100 & T200) or R608B (T1K) R308B (T100 & T200) or crystal Y1 or Y2 defective.	Check and replace if necessary.
20. Resolution is unsatisfactory with the RESOLUTION control set for narrow i-f.	Defective Y1 or Y2.	Check by substitution and replace if necessary.
21. The log scale calibration is inaccurate (Paragraph V-1 d and e)	Tube V13 is defective	Check tube and the tube socket voltages and resistances.
	LOG SCALE ADJUST and LOG ZERO ADJUST controls are misaligned.	Realign controls; use the procedure given in Paragraph V-1.
22. The VERT. POSITION control does not line up the baseline with the frequency scale.	Tube V14 or V15 is defective.	Check tube and the tube socket voltages and resistances.
	Resistor R11, R12, R47, R48, or R639(T1K) R340 (T100 & T200) is defective.	Check for open or short and replace if necessary.
23. The tops of the pips on the screen of the crt flatten off below full-scale deflection	Tube V14 or V15 is defective.	Check tubes and the tube socket voltages and resistances.
	Capacitor C6C is defective.	Check for leakage and replace if necessary.

SYMPTOM	PROBABLE TROUBLE	CORRECTION
24. Baseline not present but a dot appears on the screen at all sweep rates.	LINE SIZE control improperly adjusted.	Adjust this control; use the procedure given in Paragraph V-1.
	Tube V17 or V18 is defective.	Check tubes and the tube socket voltages and resistances.
	Resistor R24 or R35 is defective.	Check these parts and replace if necessary.
	Capacitor C11 or C12 is defective.	Check capacitors and replace if necessary.
	Tube V101 defective.	Check this tube and replace if necessary.
	No B+.	Check B+ output of power supply.
25. HORIZONTAL POSITION control does not center the baseline trace.	Tube V18 is defective.	Check tube and the tube socket voltages and resistances.
	Resistor R36, R37, R38 R39, R40, R42, R43, R44 R45 or R46 is defective.	Check and replace if necessary.
	Capacitor C13 is defective.	Check and replace if necessary.
26. The frequency scanning is nonlinear.	Capacitor C13 is defective.	Check and replace if necessary.
27. The screen of crt has low brilliance.	The BRILLIANCE control is misadjusted.	Turn control to its maximum clockwise position.
	CRT V19 is weak.	Replace V19.
	CR1, CR2 (in Power Supply) defective.	Check and replace if necessary.
	Capacitor C2, C3 or C6 (in PS) is defective.	Check and replace if necessary.
	Resistor R2, R3, R4, R5 R6 (in PS) R52, R54, R56, R71 is defective.	Check and replace if necessary.
	Faulty connections between power supply and indicator.	Check the cable and plug connections between the power supply and indicator.

SYMPTOM	PROBABLE TROUBLE	CORRECTION
28. The screen of the crt has high brilliance at all positions of the BRILLIANCE control.	CRT faulty. R53 or C18 defective.	Replace CRT V19. Check and replace if necessary.

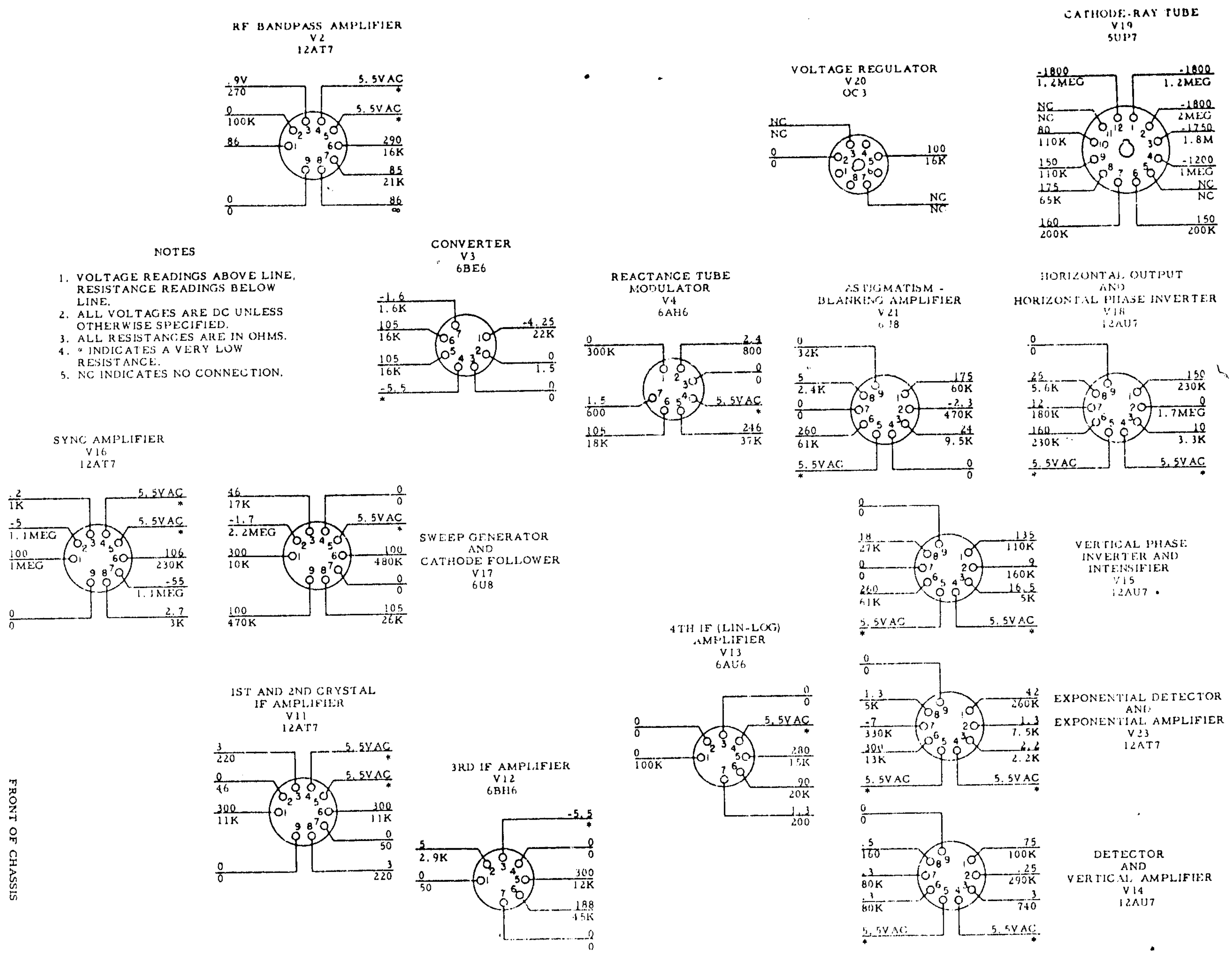
V-3 VOLTAGE AND RESISTANCE CHARTS

The voltage and resistance charts were made with analyzer section and power supply interconnected for normal operation.

All readings taken between point specified and chassis ground using an RCA VTVM Model WV-77A.

The following control positions were used:

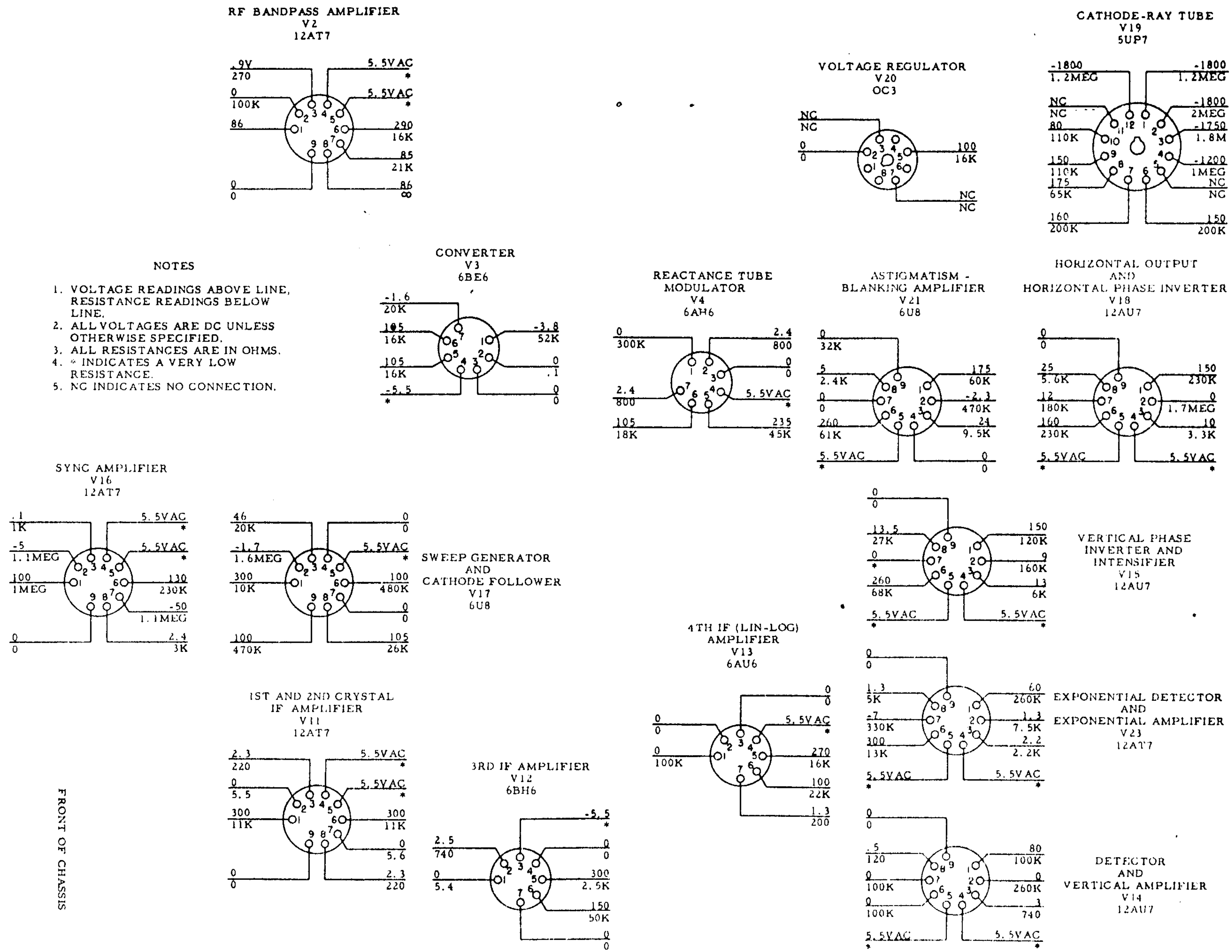
BRILLIANCE	Normal
FOCUS	Normal
CAL-SYNC SEL	LINE
SYNC AMP	Set for correct sync
SWEEP WIDTH	1.0
SWEEP RATE	30 cps
RESOLUTION	1.0
CENTER FREQ	to center marker
AMPLITUDE SCALE	LIN
INTENSIFIER	Counterclockwise
GAIN	10
DIMMER	Clockwise
VIDEO FILTER	OUT



NOTES

1. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.
2. ALL VOLTAGES ARE DC UNLESS OTHERWISE SPECIFIED.
3. ALL RESISTANCES ARE IN OHMS.
4. * INDICATES A VERY LOW RESISTANCE.
5. NC INDICATES NO CONNECTION.

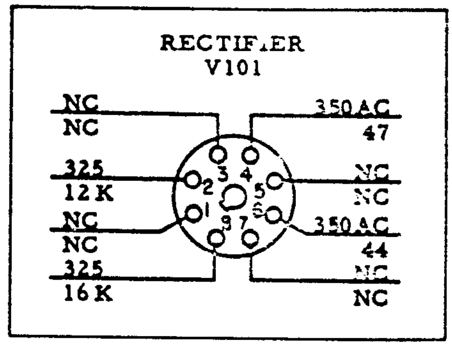
Voltage and Resistance Chart, Model SA-85Y
Types T-100 and T-200



NOTES

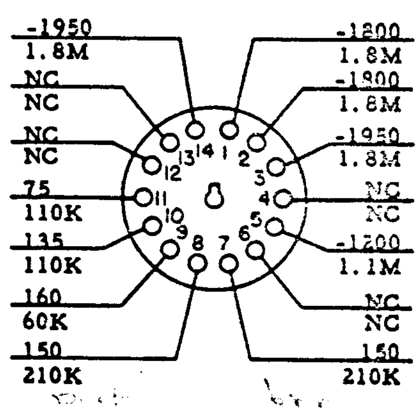
1. VOLTAGE READINGS ABOVE LINE, RESISTANCE READINGS BELOW LINE.
2. ALL VOLTAGES ARE DC UNLESS OTHERWISE SPECIFIED.
3. ALL RESISTANCES ARE IN OHMS.
4. * INDICATES A VERY LOW RESISTANCE.
5. NC INDICATES NO CONNECTION.

Voltage and Resistance Chart, Model SA-85Y
Type T-1000



Power Supply, Model PS-8b

CATHODE-RAY TUBE
V19
5ADP7



V19 Voltages and Resistances
Z Modification

V-4. ALIGNMENT PROCEDURE

The following is a complete factory alignment procedure. It should be used only after touch-up alignment techniques have been tried and have failed to yield satisfactory results.

a. General

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 furnished.

The bottom windings may be tuned from either the top or the 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 hollow top core and finally engaged in a slot in 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

1. The frequencies involved in i-f alignment are:

TYPE	INPUT CENTER FREQ.	I-F
T-100	455 or 500 KC	226 KC
T-200	455KC	226 KC
T-1000	5.25 MC	1.5 MC

(a) Set the front panel controls as follows:

RESOLUTION ------------- completely clockwise
INTENSIFIER ------------- completely counterclockwise
GAIN -------------------- maximum
AMPLITUDE SCALE ------- LIN
SWEEP RATE ------------ 30 cps
CAL-SYNC SEL ------------ LINE
BRILLIANCE -------------- bright trace as desired
FOCUS ------------------- sharp trace
CENTER FREQ ------------ to marker
VIDEO FILTER ------------ OUT
SWEEP WIDTH ------------ completely clockwise

(b) Horizontal Adjustment

(1) Feed in a signal corresponding to the input center frequency specified above.

(2) Turn the SWEEP WIDTH control counterclockwise until base of the pip occupies 50 percent of the screen.

(3) Center the pip with the CENTER FREQ control.

(4) Turn the SWEEP WIDTH control to the maximum clockwise position.

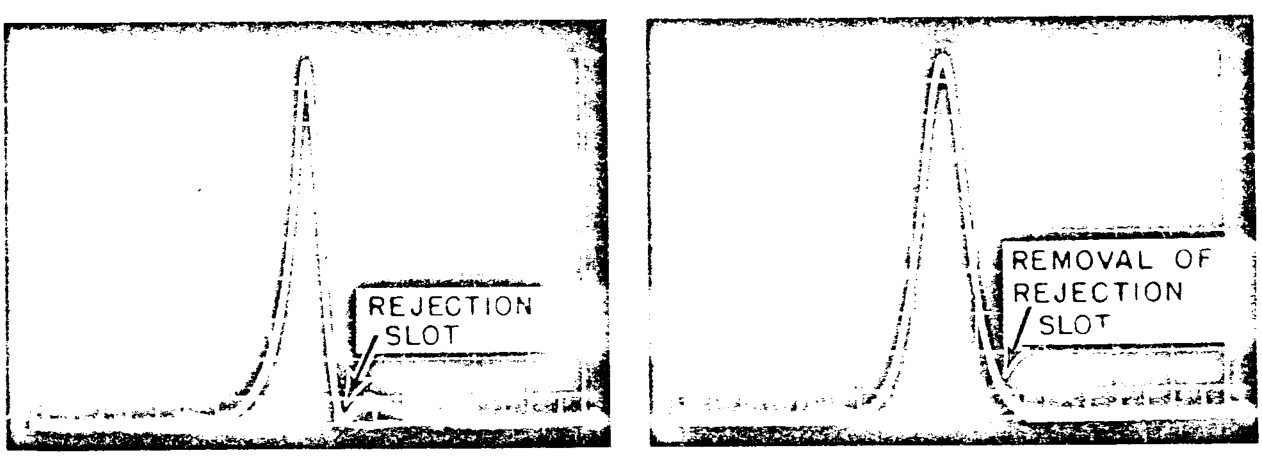
(5) Adjust the HORIZONTAL POSITION control to center the pip on the screen.

2. Connect an .01 mfd capacitor in series with the output of the signal generator and proceed as follows:

Step	Sig. Gen. Output	Sweep Width Control at	Signal Fed to	Procedure
1	I-f spec above (about 50,000 uv)	Minimum	Pin #1 V13 6AU6	Tune top and bottom cores of Z105 for maximum baseline rise. When either core is tuned for maximum deflection, no further tuning is required because windings are in parallel.
2	Same as above (1,000 uv)	Same as above	Pin #1 V12 6BH6	Tune top and bottom cores of Z104 for maximum baseline rise possible with each.
3	Same as above (2,500 uv)	Same as above	Pin #7 V3 6BE6	Tune top and bottom cores of Z102 for maximum baseline rise possible with each.
4	Input Center Freq spec above (2,500 uv)	Maximum	Pin #7 V3 6BE6	Adjust the CENTER FREQ. control and, if necessary, the CF PAD control to center the pip on the screen. Gradually reduce the sweep 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 approximately 25 percent of the frequency scale.

Step	Sig. Gen. Output	Sweep Width Control at	Signal Fed to	Procedure
5	———	Adjust continuously as required to keep the entire pip within screen limits.	———	Mark the position of crystal Y1 in its socket. Holder capacity varies with position; therefore, it will be important, when replacing the crystal, to preserve its orientation with respect to the socket. Remove crystal Y1 and place a 0.1 uf capacitor across the socket.
6	———	———	———	A neutralizing capacitor is mounted near each crystal on the underside of the i-f strip. These capacitors are to be tuned with the screw driver end of the aligning tool furnished. Access holes will be found about halfway between the crystal sockets. Each capacitor tunes the crystal nearest to it. Turn the adjusting screw of the capacitor nearest crystal Y2 clockwise until it is just tight. Do not force.
7	———	———	———	Reduce the sweep rate to approximately 1 cps by turning the SWEEP RATE control counterclockwise. Turn the RESOLUTION control counterclockwise until it is set as follows: Type T-200, at the 0.5 marker. Type T-1000, at the second marker from the fully counterclockwise end of the control rotation. Adjust amplitude of the input signal, if necessary, to maintain full scale deflection. At this point pip should approximate the shape shown in Figure V-1 or its mirror image.

Step	Sig. Gen. Output	Sweep Width Control at	Signal Fed to	Procedure
8	———	———	———	Gradually rotate the trimmer screw of the capacitor nearest Y2 counterclockwise approximately 2 turns, and note the change in pip shape. The rejection slot should sharpen and disappear on one side of the pip and approach from the other side.
9	———	———	———	Reverse the rotation and choose a point where best pip symmetry is obtained and a rejection slot is not present. (Approximately halfway between the two positions at which the slot enters the pip from either side. (See Figure V-1).



A. Illustration of Rejection Slot

B. Illustration of Complete Rejection Slot Removal

Figure V-1. Crystal Rejection Slot Removal

tep	Sig. Gen. Output	Sweep Width Control at	Signal Fed to	Procedure
.0	______	____ ______	______	Reset the SWEEP RATE control to 30 cps. Turn RESOLUTION control fully clockwise. Adjust amplitude of input signal, if necessary, to maintain full scale deflection. Tune the top core of Z103 for a minimum height <u>and</u> a broadest pip. Note that as the core is moved from one end of its range to the other, the pip will broaden and decrease in amplitude until a condition of minimum height and broadest pip is reached. Continued rotation will cause the pip to sharpen and increase in amplitude. (As the pip decreases in amplitude it may be necessary to increase the amplitude of the input signal to maintain a readable deflection on the screen.)
.1	______	______	______	Check for correct rejection slot removal by adjusting sweep width until pip base occupies approximately 25 percent of the screen baseline. Set the input amplitude for a full-scale deflection. Increase input amplitude by ten times. Set SCALE SELECTOR to LOG. If the pip is not full-scale, set the LOG SCALE ADJ. for a full-scale pip. Pip should remain approximately symmetrical and no rejection slot should appear. If it does appear, readjust trimmer slightly to remove it and retune as in step 10. Reduce the input amplitude 10 times and set SCALE SELECTOR to LIN.

Step	Sig. Gen. Output	Sweep Width Control at	Signal Fed to	Procedure
12	______	______	______	Remove the 0.1 uf capacitor placed across the crystal socket and replace crystal Yl in its socket in the same orientation it has prior to removal.
13	______	______	______	Mark the position of Y2 in its socket. Remove crystal Y2 and place a 0.1 uf capacitor across the socket. Repeat the procedure given in steps 6 through 11 using capacitor the nearest crystal Y1 and the bottom core of Z103.
14	______	______	______	Remove the 0.1 uf capacitor from empty socket and replace crystal Y2 in the same orientation it has prior to removal. Repeat step 11 with both crystals installed but omit reference to step 10. If trimmer adjustment is required, make small gradual changes in the trimmer settings. If there is no change when adjusting one of the trimmers, restore it to its original setting and adjust the other trimmer.
15	______	______	______	Retune the top core of Z103 for a minimum symmetrical response curve of the pip. Refer to step 10 for the results of tuning the core.
16	______	______	______	Turn the RESOLUTION control counterclockwise until the pip is reduced 30 percent. Retune the top and bottom cores of Z105, Z104, and Z102 for maximum pip height.

Step	Sig. Gen. Output	Sweep Width Control at	Signal Fed to	Procedure
17	______	______	______	Set the RESOLUTION control fully clockwise and repeat step 15.
18	______	______	______	Adjust BANDWIDTH LIMIT control for the broadest (without double peak) symmetrical peak possible without more than a 20 percent drop in amplitude as the SWEEP WIDTH control is changed from a maximum counter-clockwise position to a maximum clockwise position.

c. F-M Oscillator Alighment

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 with the proper isolating element at the end of the cable.

The frequencies involved are:

Type	Input Center Frequency	High Freq. Alignment	Low Freq. Alignment
T-100	455 KC	505 KC	405 KC
T-100	500 KC	550 KC	450 KC
T-200	455 KC	555 KC	355 KC
T-1000	5. 25 MC	5. 75 MC	4. 75 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 SWEEP WIDTH set for maximum, tune Z101 so that the deflection on the crt 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 SWEEP WIDTH control at maximum, set the CENTER FREQ. control on the marker.

(c) Keeping the pip on center by adjusting Center Frequency CF PAD, reduce the SWEEP WIDTH until this control is almost at minimum.

(d) Return the SWEEP WIDTH 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 above.

(b) Reduce the SWEEP LIMIT until the deflection on the crt 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 above; 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. Continue to narrow down by repeating these steps until the desired results are obtained.

SUGGESTION: In repeating the Low Frequency Alignment, if the deflection appears 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 Alighment

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. If the frequency separation is not correct, the full alignment procedure must be used.*

Peaking frequencies are:

Type	Input Center Frequency	High Peak Frequency	Low Peak Frequency
T-100	455 KC	502.5 KC	407.5 KC
T-100	500 KC	547.5 KC	452.5 KC
T-200	455 KC	545 KC	365 KC
T-1000	5.25 MC	5.25 MC	4.83 MC

1. R-F Alignment, Type T-100 and T-200

Set the AMPLITUDE SCALE Selector to LIN, CENTER FREQ for a centered input center frequency pip and SWEEP WIDTH at maximum. This alignment requires a "cut and try" method.

The frequency response of the section is determined by feeding in constant amplitude signals, at various frequencies, over the r-f band of the equipment.

(a) First adjust neutralizing capacitor C101.

(1) Set the GAIN control approximately between 0 and the first division from the counterclockwise end of rotation.

(2) Feed an input center frequency signal to J101, the input connector. Adjust signal generator amplitude to give an approximately 1/4" scale deflection at the center of the screen.

(3) Adjust C101 for a minimum pip height.

* 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.

(b) Next 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 an Input Center Frequency signal to the plate of V2 (pin #5). Tune the secondary (bottom core) for a peak deflection at the center of the screen.

(3) Apply a High Peak Frequency signal to the grid of V2 (pin #1). Tune the primary (top core) 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.

(c) 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 1/4".

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

(4) Now apply High Peak Frequency signal to the input connector, through the input cables and specified isolating element. Adjust the primary (top core) for maximum deflection.

(5) Vary the signal generator frequency over the r-f band of the equipment. Note the frequency separation between the high and low frequency peaks as read on the screen.

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 (a) through (f).

(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.

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

2. R-F Alignment, Type T-1000

Set the SCALE SELECTOR on LIN, SWEEP WIDTH at maximum and CENTER FREQ for a centered 5.25 MC pip.

All adjustments are made from the top of the can.