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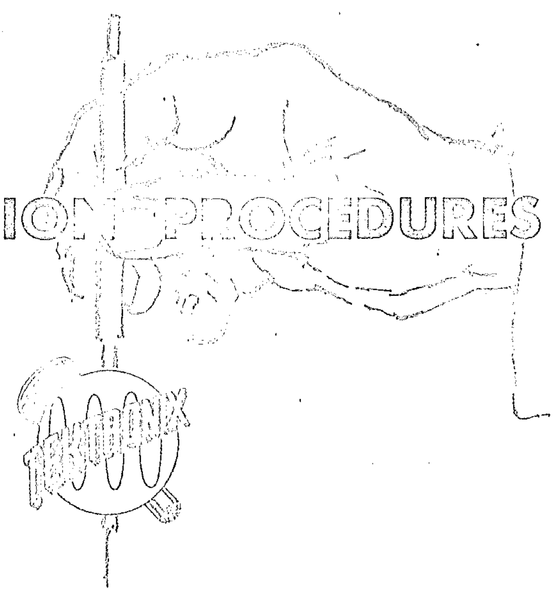
TYPE 517 RECALIBRATION PROCEDURES



OPERATIONAL CHECKS AND RECALIBRATION PROCEDURES

The following paragraphs outline the procedure which is used to check and recalibrate the Tektronix Types 517 and 517A Oscilloscopes. These instruments should not require frequent recalibration, but occasional adjustments will be necessary when tubes and other components are changed. Also, a periodic recalibration is desirable from the standpoint of preventative maintenance. The calibration of the instrument should be checked after every 500 hours of operation or after each six months period when the instrument is used intermittently.

Apparent troubles occurring in the instrument are often actually the result of improper calibration of one or more circuits. Consequently, calibration checks should be an integral part of any troubleshooting procedure. Abnormal indications which may occur during calibration checks will often aid in isolating troubles to definite circuit or stage.

In the instructions that follow, the steps are arranged in the proper sequence for a complete recalibration of the instrument. Each numbered step contains the information required to make one check, one adjustment, or a series of related adjustments or checks. The steps are arranged so that the effects of interaction between adjustments are reduced to a minimum.

In each recalibration step only the required information is given. Detailed instructions which pertain to normal operation of the instrument are not given here. If you are in doubt as to the proper operation of controls you can refer to the Operating Instructions section of the instrument manual.

Controls not mentioned in a particular recalibration step are assumed to be in the positions they were in during the previous step. In addition, all test equipment should be disconnected at the end of each step unless you are instructed otherwise.

If a single control requires adjustment, and the particular control is known, it can often be adjusted without necessitating a recalibration of the entire instrument if the control does not interact with other adjustments. In such cases the control is adjusted in the normal manner as described in the applicable step of this procedure. It will be necessary, however, that you refer to the recalibration steps immediately preceding the adjustment you wish to make to determine the proper settings for the controls not mentioned in that step.

If you find that a circuit is out of calibration, but you are not aware of which particular adjustment will correct the difficulty, it is usually best to recalibrate the entire circuit. All adjustments in a particular circuit can be determined from the schematic diagram. Adjustments made within one circuit usually do not interact with adjustments within another circuit. Adjustment of either the high or low voltage power supplies will, however, necessitate a complete recalibration of the instrument. It is important, therefore, that you do not attempt to reset power supply voltages so long as they are within the tolerances specified. All power supply voltages must be checked before any adjustments are made on the instrument.

The locations of all adjustment controls in the indicator unit are shown in the illustrations at the rear of this publication.

TEST EQUIPMENT REQUIRED

The following equipment or its equivalent is necessary for a full recalibration of the Types 517 and 517A Oscilloscopes. Differences existing in requirements for test equipment between the 517 and 517A are noted.

1. DC voltmeter with at least 20,000 ohms per volt sensitivity. To satisfy the accuracy requirements, corrected readings must be known for the following voltages: 150, 180, 225, 250, 365, 475, 750, 1950, and 4,000 volts.

2. DC milliammeter with ranges from 25 to 500 milliamperes. (Used on the 517 only.)

3. Oscilloscope with a minimum of a 10 mc bandpass such as the Tektronix Type 316 and a 10X probe.

4. AC voltmeter with a range of zero to 10 volts rms of the iron vane or dynamometer type.

5. Time-mark generator such as the Tektronix Type 180 or 180A. If neither of these instruments are available, it will be necessary to substitute a time-mark generator having 1, 5, 10, and 50

microsecond markers and sine-wave outputs of 5, 10, and 50 megacycles, with an accuracy of at least 1%.

6. Earphones with 4000 ohms or more impedance.

7. Variable autotransformer with a 1.5 KVA minimum rating.

8. Short rise time pulser such as the Tektronix Types 517 or 108. If neither of these instruments are available, it will be necessary to substitute a pulser with a rise time of 1 millimicrosecond or less.

9. AC Ammeter with a current range up to 10 amperes.

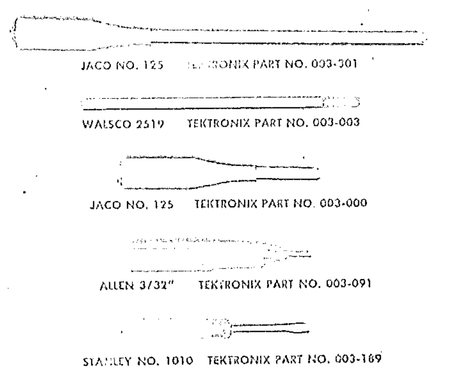


Fig. 1. Suggested alignment tools.

10. AC Voltmeter with a range of at least 105 to 125 volts.

11. Miscellaneous cables, terminating resistors, attenuators, and pads as determined by the particular requirements of the test equipment used.

12. Adjustment tools.

PRELIMINARY PROCEDURE

Place the oscilloscope face downward on a padded flat surface, remove the two screws in the bottom, and lift off the case. Repeat this procedure for the power supply. Set power supply and oscilloscope front panel controls as follows:

AC POWER	OFF
DC POWER	OFF
INTENSITY	fully ccw
SWEEP STABILITY	fully ccw
HORIZONTAL POSITIONING	fully ccw
SENSITIVITY (24KV)	NORMAL

Connect the power cord and an ac voltmeter to the output of the 1.5 KVA variable autotransformer. Adjust the autotransformer for a meter reading of 117 volts. Check this meter reading frequently during recalibration and maintain the autotransformer output at 117 volts unless instructed otherwise. If the power transformer in your instrument is connected for 234-volt operation, adjust the variable autotransformer for a meter reading of 234 volts.

1. Low Voltage Power Supply

Proper operation of your instrument is dependent upon correct power supply voltages. The negative 250-volt power supply is used as a reference voltage for regulation of the other dc power supplies and consequently must be set accurately. Any error in the output of the negative 250-volt power supply will cause corresponding errors in the outputs of all other regulated power supplies and resulting improper operation of the entire instrument. Occasionally when the negative 250-volt power supply is set at exactly 250-volts, outputs of one or more of the other regulated supplies are not within tolerances. In such a case it may be possible to bring all voltages within tolerances by readjusting the negative 250-volt supply slightly within its voltage tolerances. If it is impossible to bring all power supplies simultaneously within tolerances, this indicates trouble in the instrument and normal troubleshooting procedures should be used to locate the cause.

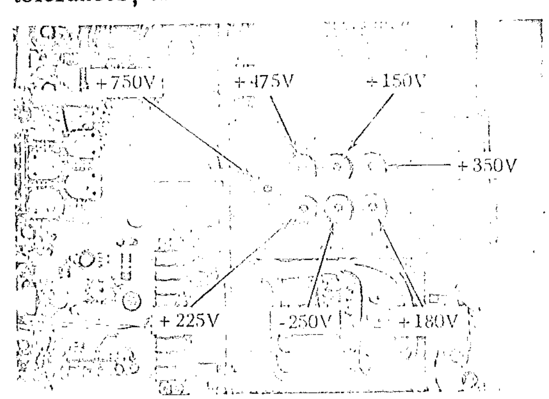


Fig. 2. Type 517 Oscilloscope power supply test points.

With the power off, check the resistance at the output of each power supply to ground. Resistance readings obtained should be checked against the values given in Table 1. If any of these

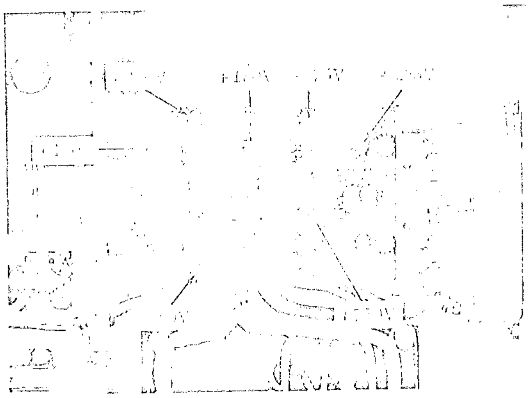


Fig. 3. Type 517A Oscilloscope power supply test points.

readings are lower than the values given in Table 1, the power must not be turned on until the cause of the abnormal resistance reading has been determined and corrected.

Place AC POWER and DC POWER switches at ON and allow several minutes for instrument warmup. Connect the dc voltmeter between the appropriate -250 volt test point (shown in Figure 2 for Type 517 Oscilloscopes and Figure 3 for Type 517A Oscilloscopes) and ground. Set the ADJ TO -250V control on the power supply chassis for a corrected meter reading of -250 volts. Measure output voltages of the other low voltage power supplies at test points shown in Figure 2 or 3 and compare voltage readings with the tolerances listed in Table 1. Using the variable autotransformer, vary the input voltage to the instrument between 105 and 125 volts while checking that all low voltage power supply output voltages remain within the tolerances listed in Table 1.

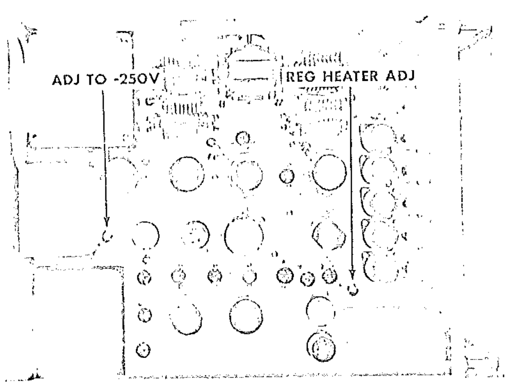


Fig. 4. Top view of the power supply unit showing the location of adjustments.

On the test oscilloscope, place the TIME/DIV control at 5 MILLISEC and the TRIGGER SELECTOR controls at +LINE and AUTO. Measure the ripple voltage at the output of each power supply. Approximate ripple voltages for each supply are given in Table 1.

TABLE 1
Power Supply Characteristics

Supply	Ripple Voltage	Output Voltage	Minimum R to Ground With load
-250	50 mv	-248 to -252	18 kilohms
+150	40 mv	+147 to +153	8 kilohms
+180	4 volts	+171 to +189	40 kilohms
+225	50 mv	+220 to +229	15 kilohms
+350	6 volts	+347 to +385	150 kilohms
+475	100 mv	+465 to +485	40 kilohms
+750	150 mv	+735 to +765	40 kilohms

For Type 517 power supply current measurements, connect the test leads of a milliammeter to a phone plug. Place the milliammeter in series with each power supply output by connecting the phone plug to appropriate phone jacks provided on the bottom of the indicator unit. (See Fig. 2). Current readings should be approximately equal to those listed in Table 2.

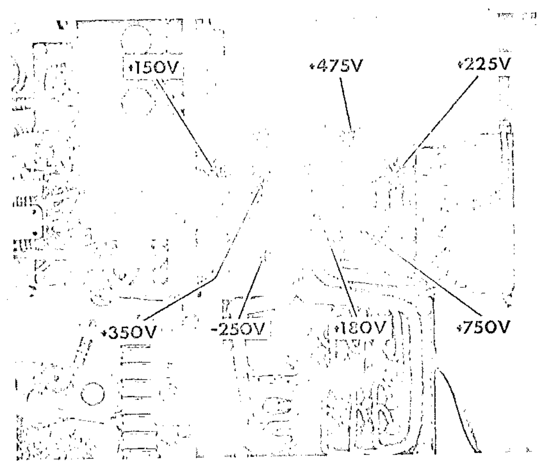


Fig. 5. Location of Type 517A Oscilloscope current measuring resistors. The voltage drops across the resistors are used to measure the load currents drawn from the power supplies.

For Type 517A power supply current measurements, connect a dc voltmeter across the current measuring resistors located on the bottom of the indicator unit. (See Fig. 5). Voltage readings should be approximately equal to those listed in Table 2.

at 150 and the TRIGGER RATE GEN MULT switch at X100. Place the test oscilloscope TIME/DIV control at 20 μSEC. Adjust C801A for the indication described previously. Set the TRIGGER RATE GENERATOR control at 15 and the test oscilloscope TIME/DIV control at .2 MILLISEC. The test oscilloscope indication should be the same as those obtained previously.

Using the test oscilloscope, check that the trigger pulses at the RATE GEN OUTPUT A receptacle have a peak amplitude of at least 20 volts. Connect the test oscilloscope input to RATE GEN OUTPUT B and check that the observed trigger pulses have a peak amplitude of at least 60 volts.

4. Trigger Amplifier

Check tubes V105, V106, and V107 for gas by measuring the voltage drop across their respective grid resistors, R116A, R116B, and R116C. If the voltage across any of the grid resistors is other than zero volts, the corresponding tube is probably gassy and should be replaced.

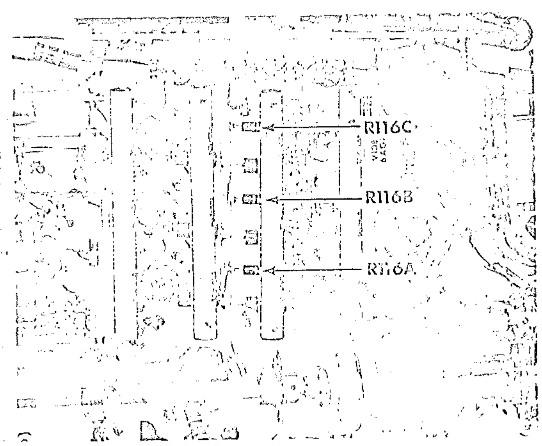


Fig. 8. Location of grid resistors R116A, R116B, and R116C for tubes V105, V106, and V107 respectively.

The gain of the Trigger Amplifier circuit can be checked by dividing down the RATE GEN OUTPUT A output spike and applying a portion of the spike to the TRIGGER INPUT receptacle. The circuit shown in Figure 9 may be used for this purpose. To check the gain of the Trigger Amplifier circuit place the TRIGGER SELECTOR switch in the +EXT position and, using the test oscilloscope, adjust the potentiometer of the circuit shown in Fig. 9 for .1 volt spikes at the TRIGGER INPUT receptacle. Then connect the input of the test oscilloscope to pin 4 of V109 through a 10X probe. With the TRIGGER AMPL. control fully cw, if the amplifier gain is correct, the spike at pin 4 of V109 should be at least 10 volts in amplitude indicating that the amplifier has a gain of at least 100. If the gain of the amplifier is less than 100, replace the tubes V101 through V108 as necessary to obtain the correct gain.

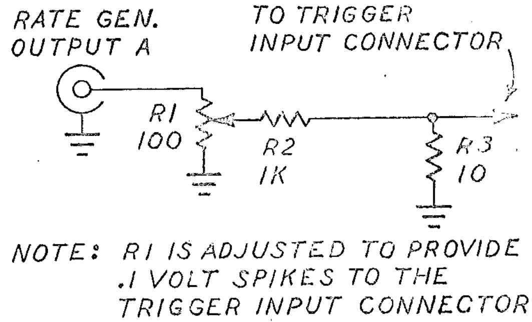


Fig. 9. Circuit used to check the gain of the Trigger Amplifier.

5. Check +GATE Waveform

Set the TRIGGER RATE GENERATOR for 1 kc, place the TRIGGER SELECTOR switch in the RATE GEN position, and set the SWEEP TIME/CM switch in the 20 μSEC/CM position. Adjust the SWEEP STABILITY and TRIGGER AMPL. controls until the sweep triggers. Using the test oscilloscope and a 10X probe, check the waveform at the +GATE connector. The +GATE waveform should have a peak amplitude of more than 40 volts and a duration of from 250 to 300 μseconds (See Fig. 10). As the SWEEP TIME/CM switch is rotated position by position from the 20 μSEC/CM position to the 50 MμSEC/CM position, the duration of the +GATE waveform in each position should be approximately halved from the previous position.

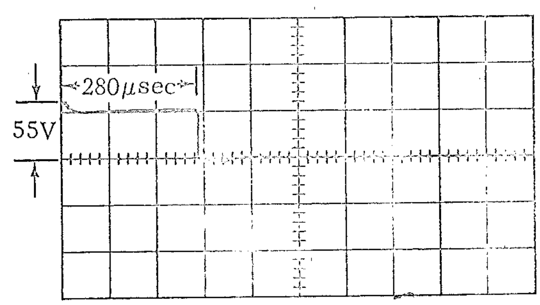


Fig. 10. Typical +GATE waveform obtained when the SWEEP TIME/CM switch is in the 20 μSEC/CM position.

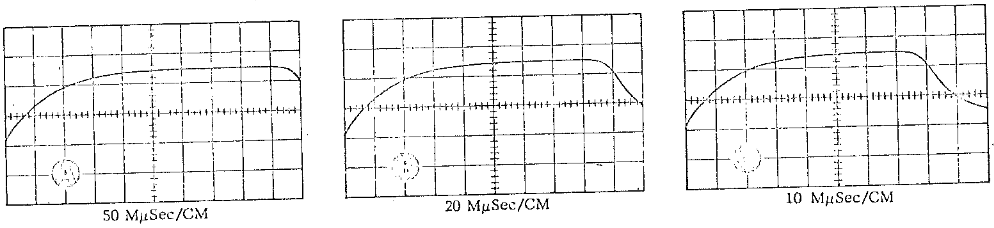


Fig. 11. Waveforms obtained when the + GATE is adjusted properly for the respective sweep rates.

With the SWEEP TIME/CM switch in the 50 MμSEC/CM position, set the TRIGGER RATE GENERATOR for 10 kc. Adjust the test oscilloscope so that the +GATE covers 10 divisions horizontally (See Fig. 11A). Then place the SWEEP TIME/CM switch in the 20 MμSEC/CM position and adjust C128J so that the +GATE waveform covers 9 divisions horizontally (See Fig. 11B). Place the SWEEP TIME/CM switch in the 10 MμSEC/CM position and adjust C128K so that the +GATE waveform covers 8 divisions horizontally (See Fig. 11C).

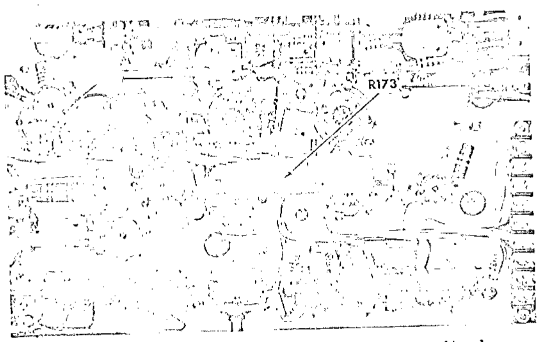


Fig. 12. Bottom view of the indicator unit showing the location of R173.
The UNBLANK control is adjusted to provide 100 volts drop across R173.

6. UNBLANK

Set the SENSITIVITY switch at NORMAL (24KV), the SWEEP TIME/CM switch at 200 MμSEC/CM, and the SWEEP STABILITY and TRIGGER AMPL controls fully counterclockwise. Adjust the UNBLANK control for a 100-volt drop across R173, the plate load resistor for tubes V120 and V121. (See Fig. 12).

7. Check Probe Power

To check the probe power, it is necessary to place a load at the PROBE POWER receptacle. A suitable load can be obtained by using the circuit shown in Fig. 13. With this load applied, the lamp should be at normal brilliance and the voltage at pin 3 of the PROBE POWER receptacle should measure 120 +or-3 volts.

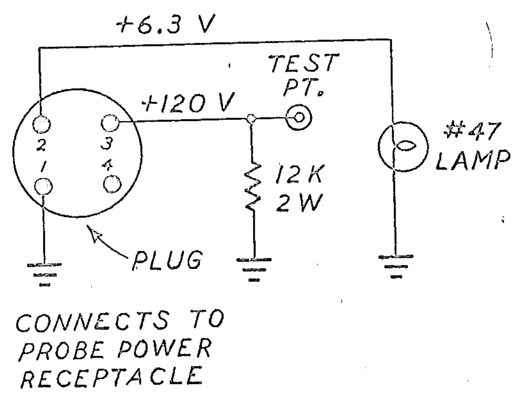


Fig. 13. Circuit used to check Probe Power.

8. Check the Calibrator Waveform

After making sure that the test oscilloscope attenuator and probe are properly compensated, connect the input of the test oscilloscope to

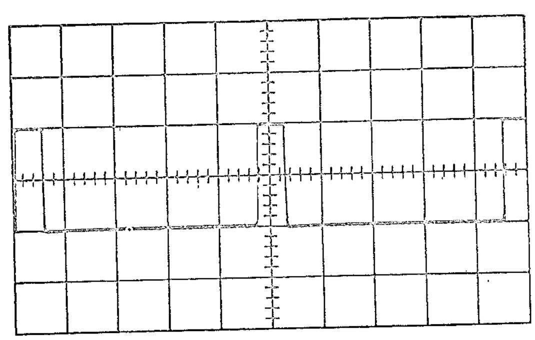


Fig. 14. Normal Calibrator waveform.

the CAL OUTPUT connector through a 10X probe. Adjust the calibrator voltage to about 40 volts with the CAL VOLTAGE control and check the Calibrator waveform for distortion and for peaks or overshoot on the baseline of the waveform. The normal Calibrator waveform is shown in Fig. 14. If the waveform has more overshoot on the baseline than is shown in the illustration, check the IN34 diode in the grid circuit of V132.

9. CAL VOLTAGE Dial

Set the test oscilloscope for automatic triggering and place the VOLTS/DIV control in the .01 position. Connect the test oscilloscope to the CAL OUTPUT connector and place the CAL RANGE switch in the 50 position. The setting of the CAL VOLTAGE dial can be checked by observing the test oscilloscope when the dial is set at zero. With the dial set at zero, no output from the calibrator should be displayed on the test scope. However the calibrator voltage should increase rapidly as the dial is moved off zero. If the dial is incorrectly set, loosen the knob and rotate the dial to the proper setting.

10. CAL ADJ.

Set the test oscilloscope for 10 volts per division and connect the test oscilloscope input to the CAL OUTPUT connector. Set the CAL VOLTAGE control for 40 volts of calibrator signal and adjust the CAL ADJ control for 4 divisions of vertical deflection on the test oscilloscope. Then spot check the calibration voltage displayed on the test oscilloscope against the setting of the CAL VOLTAGE dial from various settings on each of the ranges of the CAL RANGE switch.

11. CRT Alignment

NOTE

The first portion of the instructions for this adjustment pertain only to the Type 517A and modified Type 517 instruments. The remainder of the instructions apply to both Type 517A and Type 517 instruments.

For Type 517A and modified Type 517 instruments only, preset the VET SCAN ADJ and GEOM ADJ controls so that the voltage at the center arms of the two controls is -30 volts. For all instruments, trigger the sweep with the Trigger Rate Generator and loosen the crt clamp. Press the crt forward against the graticule and align the crt so that the trace is parallel to the graticule lines. Retighten the crt clamp.

12. L. F. COMP.

Connect a 50 mc sine wave signal to the SIGNAL INPUT connector and trigger the sweep at a 1 kc rate with the Trigger Rate Generator. Adjust the signal amplitude and VERT AMPL. ATTEN control to obtain 4 centimeters (2 cm for 5XP CRT) of vertical deflection Adjust the L.F. COMP. control to eliminate any wedge-shaped appearance of the brightened portion of the screen. When the L. F. COMP. control is adjusted properly, the vertical amplitude of the brightened portion of the screen should be the same at each point across the screen.

13. DUTY CYCLE LIMITER ADJ. (Types 517A and Modified 517 only).

Place the SWEEP TIME/CM switch in the 20 μSEC/CM position, set the TRIGGER RATE GENERATOR control for 1.25 kc, and place the TRIGGER SELECTOR switch in the RATE GEN position. Rotate the TRIGGER AMPL control fully counterclockwise and adjust the SWEEP STABILITY control to a setting just below the point where the sweep free-runs. Then rotate the TRIGGER AMPL and DUTY CYCLE LIMITER ADJ controls fully clockwise. Under these conditions, there should be no sweep.

Turn up the intensity slightly and rotate the DUTY CYCLE LIMITER ADJ control until the sweep is 7.5 centimeters long and is unstable at the right end. As an additional check on the control setting, increase and decrease the triggering rate. The sweep length should decrease as you increase the triggering rate and increase as you decrease the triggering rate. Check that the sweep will free-run in all sweep speeds when the SWEEP STABILITY control is fully clockwise and the TRIGGER AMPL control is fully counterclockwise.

14. VERT SCAN ADJ and GEOM ADJ. (Types 517A and Modified 517 only.)

Rotate the ASTIGMATISM, SWEEP STABILITY, and TRIGGER AMPL controls fully counterclockwise and the FOCUS control fully clockwise. Connect a 5 mc sine wave signal to the SIGNAL INPUT connector and rotate the INTENSITY control clockwise until a vertical trace appears. Adjust the signal amplitude and the VERT AMPL ATTEN control to obtain 3 centimeters of vertical deflection. Using the HORIZONTAL POSITIONING controls, move the display under the center vertical line of the graticule. Adjust the VERT SCAN ADJ to obtain a vertical rectangular trace of constant width. (See Fig. 15).

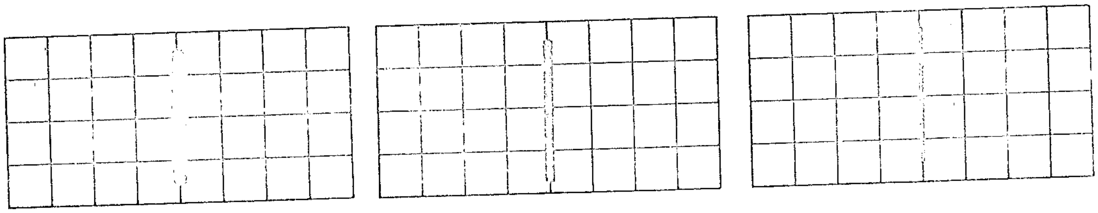


Fig. 15. Typical displays obtained with different settings of the VERT SCAN ADJ control. The VERT SCAN ADJ control should be set to obtain the display shown in the center illustration.

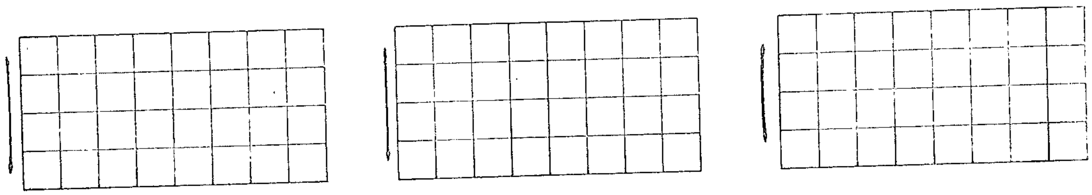


Fig. 16. Typical displays obtained with different settings of the GEOM ADJ control. The GEOM ADJ control should be set to obtain the display shown in the center illustration.

Using the HORIZONTAL POSITIONING controls, move the display to the left side of the screen. Adjust the GEOM ADJ control for minimum bowing of the vertical trace. Position the trace to the center of the screen and recheck the setting of the VERT SCAN ADJ control.

WARNING

Because of the high voltages involved, the DC POWER switch should be placed in the OFF position when the leads of the dc voltmeter are connected or disconnected during the high voltage adjustments of steps 15 and 16.

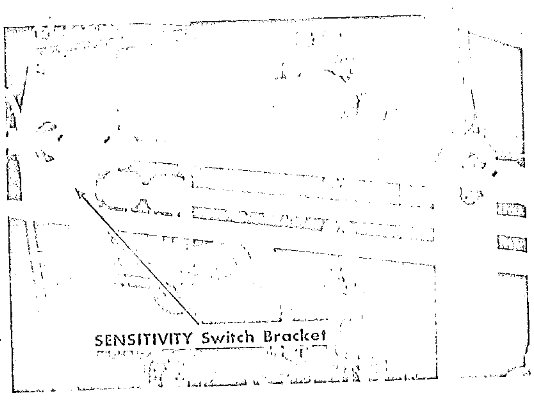


Fig. 17. Left side view of the indicator unit showing the location of the SENSITIVITY switch bracket.

15. HOR POS VERN ADJ, 2 KV ADJ, and 4 KV ADJ. (Type 517 only).

Place the DC POWER switch in the OFF position and connect the dc voltmeter from the SENSITIVITY switch bracket to ground. Place the SENSITIVITY switch in the X2 (12 KV) position and return the DC POWER switch to the ON position. Adjust the 2 KV ADJ control for a reading of -1950 volts on the dc voltmeter. Adjust the HOR POS VERN ADJ control so that the HORIZONTAL POSITIONING Vernier control will move the trace exactly 2 centimeters when it is turned from 0 to 1.0.

Place the SENSITIVITY switch in the NORMAL (24 KV) position. Adjust the 4 KV ADJ control so that the HORIZONTAL POSITIONING Vernier control will move the trace exactly 1 centimeter when the control is rotated from 0 to 1.0.

16. HOR POS VERN ADJ, 2 KV ADJ, and 4 KV ADJ. (Types 517A and Modified 517 only.)

Place the DC POWER switch in the OFF position and connect the dc voltmeter from the SENSITIVITY switch bracket to ground. Place the SENSITIVITY switch in the NORMAL (24 kv) position and return the DC POWER switch to the ON position. Adjust the 4 KV ADJ control for a reading of -4000 volts on the dc voltmeter. Adjust the HOR POS VERN ADJ control so that the HORIZONTAL POSITIONING Vernier control will move the trace exactly 1 centimeter when it is rotated from 0 to 1.0.

Place the SENSITIVITY switch in the X2 (12 KV) position. Adjust the 2 KV ADJ control so that the HORIZONTAL POSITIONING Vernier will move the trace exactly 2 centimeters when it is rotated from 0 to 1.0.

17. MAX INTENSITY ADJ.

With the SWEEP STABILITY and TRIGGER AMPL controls fully counterclockwise and the SENSITIVITY switch in the NORMAL (24 KV) position, slowly rotate the INTENSITY control until a low intensity spot appears on the screen. Use the FOCUS and ASTIGMATISM controls to bring the spot into sharp focus. Rotate first the MAX INTENSITY ADJ control then the INTENSITY control to their fully clockwise positions. Slowly turn the MAX INTENSITY ADJ control counterclockwise until the spot reappears and a halo forms around it. Then turn the MAX INTENSITY ADJ control clockwise until the halo just disappears.

18. Check Horizontal and Vertical Deflection Sensitivity.

Position the spot approximately at the center of the screen and connect the dc voltmeter from the junction of R182 and R184 to the junction of R185 and R186. (See Fig. 18) Record the voltage reading obtained. Using the HORIZONTAL POSITIONING controls, move the spot exactly 2 centimeters in either direction and again record the voltage reading obtained. The

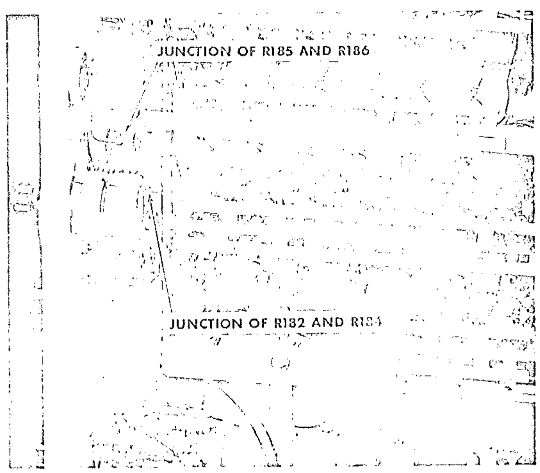


Fig. 18. Right side view of the indicator unit showing the location of the test points used to check the horizontal sensitivity of the instrument.

difference between the two voltage readings should be between 184 and 204 volts for Type 517 Oscilloscopes and between 100 and 140 volts for Type 517A or Modified Type 517 Oscilloscopes.

Again position the spot approximately to the center of the screen. Connect the dc voltmeter from the junction of R706 and the wiper arm of R716A to the junction of R713 and the wiper arm of R716B (See Fig. 19) and record the voltage reading obtained. Using the VERT POSITION control, move the spot exactly 2 centimeters in either direction and again record the voltage reading obtained. The difference between the two voltage readings should be between 62 and 72 volts for Type 517 Oscilloscopes and between 26 and 36 volts for Type 517A and Modified Type 517 Oscilloscopes.

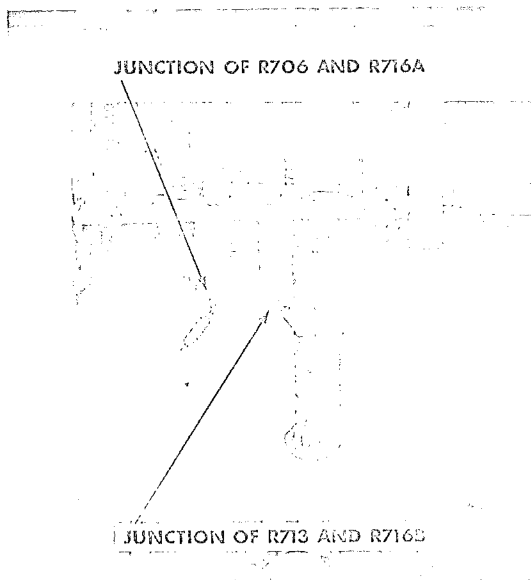


Fig. 19. Left side view of the indicator unit showing the location of the test points used to check the vertical sensitivity of the instrument.

WARNING

In checking the crt cutoff voltage, the meter leads are connected to points where the potential is approximately -4000 volts. The entire meter is consequently also at approximately -4000 volts. Therefore it is essential that you shut off the high voltage when connecting or disconnecting the meter leads and that you refrain from touching the meter when the high voltage is on.

19. Check CRT Cutoff Voltage.

Using the HV SW, turn off the high voltage. Rotate the INTENSITY control fully counterclockwise and connect the dc voltmeter between the grid and cathode of the crt at the test points shown in Fig. 20. Return the HV SW to the ON position and slowly advance the INTENSITY control until a spot is visible on the screen. Then turn the INTENSITY control counterclockwise until the spot just disappears. The meter reading is the cutoff voltage of the crt. This voltage should be between 93 and 115 volts for Type 517 Oscilloscopes and between 120 and 135 volts for Type 517A and Modified Type 517 Oscilloscopes.

Turn off the HV SW and allow the high voltage power supply to discharge before removing the meter leads.

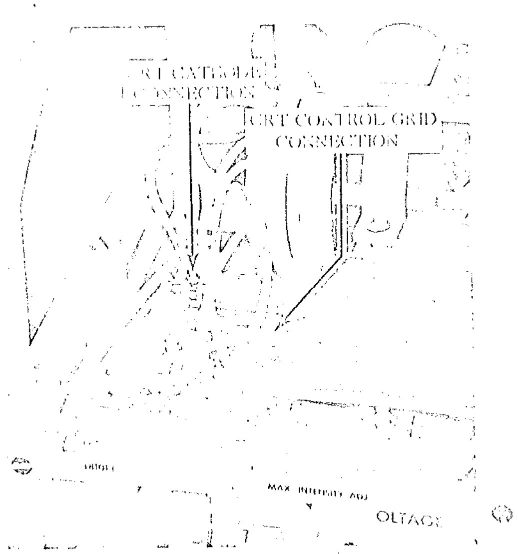


Fig. 20. Location of test points used to check the crt cutoff voltage.

20. Check Vertical and Horizontal Positioning Limits.

Place the SENSITIVITY switch in the NORMAL (24 KV) position and turn on the high voltage. Position the spot to the center of the screen and then check the movement of the spot while rotating the POSITIONING controls between their limits. From the center of the screen, the minimum spot movement should be the amounts and directions listed in Table 3. Modified Type 517 Oscilloscopes should have the same positioning limits as the Type 517A Oscilloscopes.

TABLE 3
Positioning Limits

	517	517A
Left	4 centimeters	5 centimeters
Right	1 centimeter	1.5 centimeters
Up	1.5 centimeters	2.1 centimeters
Down	1.5 centimeters	2.1 centimeters

21. Adjust Unblanking Compensation.

Place the SWEEP TIME/CM switch in the 2 μSEC/CM position. Connect a 50 mc sine wave signal to the SIGNAL INPUT connector and trigger the sweep at a 1 kc rate using the Trigger Rate Generator. Adjust the signal amplitude and the VERT AMPL ATTEN control to obtain approximately 4 centimeters of vertical deflection. Rotate the SCALE ILLUM control fully counterclockwise and turn down the intensity until the trace is just visible. Adjust L110 until the intensity at the start of the trace is the same as the intensity of the remainder of the sweep.

22. Check the Sweep Inverter.

Rotate the SWEEP STABILITY and TRIGGER AMPL controls fully counterclockwise. Measure the voltage dropped across R163. (See Fig. 21) This voltage should be between 25 and 35 volts. If the voltage is incorrect, it will be necessary that you select tubes for use as V118 and V137 which will produce the proper voltage drop across R163.

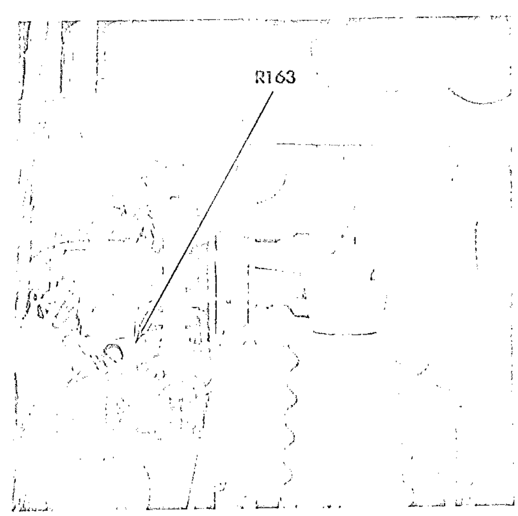


Fig. 21. Right side view of the indicator unit showing the location of R163.

23. Check the DC Restorer.

Slowly turn up the intensity until a spot appears on the screen. Remove tube V133 and note any change in the position of the spot. If the spot moves more than 1 millimeter, tube V133 is defective and must be replaced.

24. Check Clamp Tubes.

Place the SWEEP TIME/CM switch in the 20 μSEC/CM position and trigger the sweep at a 1 kc rate with the marker generator. Connect 10 μsecond markers to the SIGNAL INPUT connector and observe the spacing between markers on the display. Change the triggering rate to 100 cycles and again observe the spacing between markers. If the sweep timing is changed, as is evident if the spacing between markers is different, clamp tubes V112 and V113 should be replaced.

NOTE

In each sweep timing step place the second time marker or sine wave under the second vertical line of the graticule and time the sweep between the second and ninth vertical lines.

25. 2 μSEC/CM Sweep Timing.

Preset capacitor C136 up one-third from minimum capacitance and connect 1 μsecond markers from the time-mark generator to the SIGNAL INPUT connector. Place the SWEEP TIME/CM switch in the 2 μSEC/CM position. Trigger the sweep and adjust the L.F. COMP control and C129D for 2 markers per centimeter. Capacitor C129D is used to time the sweep while the L.F. COMP control is used to adjust the sweep for best linearity. It is necessary to adjust C129D and the L.F. COMP control simultaneously to obtain the proper settings for both adjustments. The L.F. COMP control was adjusted previously in step 12 to approximately the correct setting and should require only a slight additional adjustment at this point.

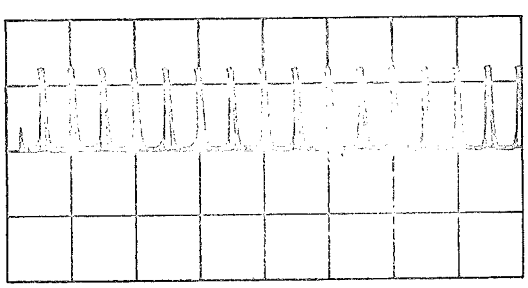


Fig. 22. Typical waveform obtained with correct 2 μSEC/CM sweep timing and linearity.

26. 10 MμSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 10 MμSEC/CM position. Connect a 50 mc sine wave signal from the time-mark generator to the SIGNAL INPUT connector and trigger the sweep at a 10 kc rate from the time-mark generator. Adjust C136 for one cycle per 2 centimeters.

NOTE

It may be necessary to repeat steps 25 and 26 several times to obtain the best sweep linearity due to the interaction between the L.F. COMP control and C136.

27. 20 MμSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 20 MμSEC/CM position. Leave the input and triggering signal connections as they were in step 26. Adjust C129J for 1 cycle per centimeter.

28. 50 MμSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 50 MμSEC/CM position. Leave the input and triggering signal connections as they were in step 27. Adjust C129I for 5 cycles per 2 centimeters.

29. 100 MμSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 100 MμSEC/CM position. Connect a 10 mc sine wave signal from the time-mark generator to the SIGNAL INPUT connector and trigger the sweep at a 1 kc rate from the time-mark generator. Adjust C129H for 1 cycle per centimeter.

30. 200 MμSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 200 MμSEC/CM position. Connect a 5 mc sine wave signal from the time-mark generator to the SIGNAL INPUT connector and trigger the sweep at a 1 kc rate from the time-mark generator. Adjust C129G for 1 cycle per centimeter.

31. 500 MμSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 500 MμSEC/CM position. Leave the input and triggering signal connections as they were in step 30. Adjust C129F for 5 cycles per 2 centimeters.

32. 1 μSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 1 μSEC/CM position. Connect 1 μsecond markers to the SIGNAL INPUT connector and trigger the sweep at a 1 kc rate from the time-mark generator. Adjust C129E for 1 marker per centimeter.

33. Check 2 μSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 2 μSEC/CM position and check the setting of C129D. (C129D was set in step 25.) If the sweep timing is incorrect, reset C129D as necessary to obtain the proper sweep timing.

34. 5 μSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 5 μSEC/CM position. Connect 5 μsecond markers to the SIGNAL INPUT receptacle and trigger the sweep at a 1 kc rate from the time-mark generator. Adjust R181E for 1 marker per centimeter.

35. 10 μSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 10 μSEC/CM position. Connect 10 μsecond markers to the SIGNAL INPUT receptacle and trigger the sweep at a 1 kc rate from the time-mark generator. Adjust R181C for 1 marker per centimeter.

36. 20 μSEC/CM Sweep Timing.

Place the SWEEP TIME/CM switch in the 20 μSEC/CM position. Leave the marker and triggering signal connections as they were in step 35. Adjust R181A for 2 markers per centimeter.

37. Check Vertical Amplifier for Microphonic or Noisy Tubes.

Disconnect any input signals to the oscilloscope being checked. Place the VERT AMPL ATTEN control fully clockwise and connect high impedance earphones directly between the vertical deflection plates at the neck of the crt. Using the rubber tip of a pencil, tap the vertical preamplifier chassis and listen for excessive hum or noise. Either excessive hum or noise can indicate microphonic tubes. The defective tubes can be detected by tapping each tube individually.

38. Check Vertical Preamplifier Bias Voltage.

Rotate the VERT AMPL ATTEN control fully clockwise. Measure the voltage at the wiper arm of the VERT AMPL ATTEN potentiometer to ground. This voltage should be between -1.9 and -2.1 volts.

39. Check Vertical Deflection Factor.

Rotate the VERT AMPL ATTEN control fully clockwise, and using the Calibrator voltage, check the vertical deflection factor of the oscilloscope. If the instrument is a Type 517, the deflection factor should be between 60 and 100 millivolts per centimeter. The vertical deflection factor for Type 517A and Modified Type 517 Oscilloscopes should be between 25 and 50 millivolts per centimeter.

40. Preset Trimmer Slugs.

Trimmer slugs in the vertical preamplifier and driver amplifier should be preset as follows and as shown in Fig. 24 if the vertical amplifier is to be tuned.

Top row on preamplifier chassis...slugs in 3/8"
Second row on preamplifier chassis . . . . .slugs in 5/16"
Third and Fourth rows on preamplifier chassis . . . . slugs in 1/4"
Driver amplifier . . . . . .Adjustment shaft protruding 1/2"

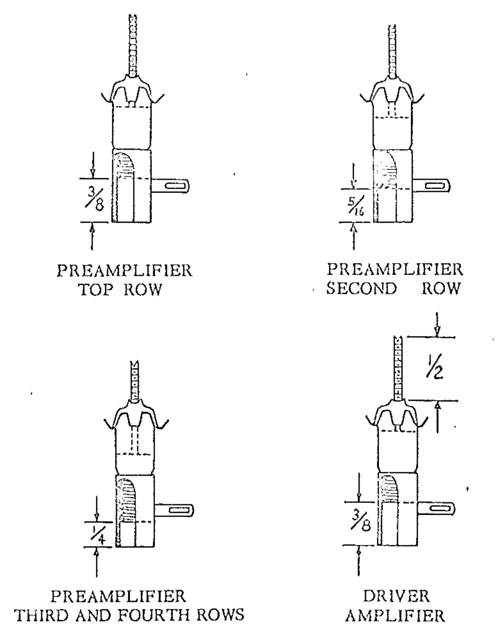


Fig. 23. Vertical amplifier trimmer settings.

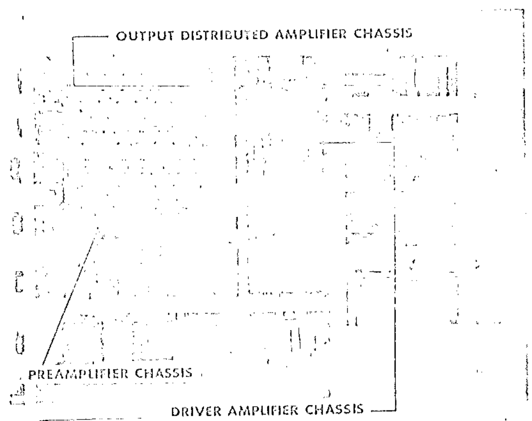


Fig. 24. Location of the various portions of the vertical amplifier.

41. Tune Output Distributed Amplifier.

Connect the properly terminated positive output of the short rise-time pulser to the SIGNAL INPUT connector. Set the VERT AMPL ATTEN control approximately at mid range and adjust the pulser output to provide 1 centimeter of vertical deflection for Type 517 Oscilloscopes and 2 centimeters for Type 517A and Modified Type 517 oscilloscopes. Place the TRIGGER SELECTOR switch in the +SIG position and trigger the sweep.

Adjust the forward row of trimmers on the output distributed amplifier chassis for the best square-wave response. These trimmers affect the leading edge of the pulser waveform for about 1 centimeter at this sweep speed. Start with the trimmers at the extreme right side of the chassis and work toward the left. Because of the interaction between the front and back rows of trimmers, only a rough adjustment of the front row trimmers should be made at first.

Place the TRIGGER SELECTOR switch in the -SIG position and set the pulser controls to obtain negative pulses. Adjust the back row of trimmers on the output distributed amplifier chassis for the best square-wave response. The same procedure in adjusting the back row of trimmers should be used as was used to adjust the front row. When the back row of trimmers has been adjusted approximately, apply positive pulses and repeat the adjustment of the front row. Continue to adjust the forward row of trimmers with positive pulses and the back row of trimmers with negative pulses until all trimmers are set at their best positions. While adjusting the trimmers, occasionally reduce the sweep speed momentarily so that you may obtain a better perspective of any tilt or slope of the waveform.

The neutralizing capacitors affect the portion of the pulse waveform just to the right of the portion adjusted by the last trimmer capacitors on the output distributed amplifier chassis. The neutralizing capacitors are located on the extreme right end of the driver amplifier chassis and are accessible from below. The front capacitor is adjusted using a positive going pulse and the back one is adjusted with a negative going pulse.

The leading edge of the pulses can be adjusted to a limited extent by L509 and L510 in the preamplifier circuit. If you shunt these coils one at a time, you can observe the portion of the waveform which is affected by each coil. It is possible that different shunt resistors across the coils will produce a better waveform and in such cases the resistors should be changed. In extreme cases, either or both coils may be shorted completely.

42. Check Delay Time.

Place the SWEEP TIME/CM switch in the 10 MμSEC/CM position. Connect appropriate properly terminated outputs from the short rise-time pulser to the SIGNAL INPUT and TRIGGER INPUT connectors. When the sweep is triggered externally by the pulser, the applied pulses should appear approximately 2 centimeters from the start of the trace. When the sweep is triggered internally from the input signal, the applied pulse should appear approximately 1 centimeter from the start of the trace. If the delay observed is much shorter than indicated, tubes V108 and V109 should be replaced. If the delay time is not the same for both positive and negative pulses, change V101.

43. Check Risetime.

Connect the properly terminated outputs of the pulser to appropriate oscilloscope input connectors and adjust the pulser output for 2 centimeters of vertical deflection. Under these conditions the time required for the pulse to rise from .2 to 1.8 centimeters should be less than 7 Mμseconds. This can be checked using the HORIZONTAL POSITIONING Vernier control.

Set the HORIZONTAL POSITIONING Vernier control at zero and use the coarse HORIZONTAL POSITIONING control to position the display

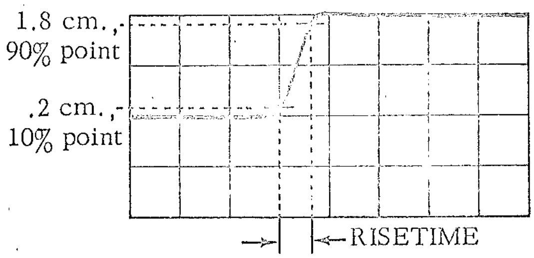
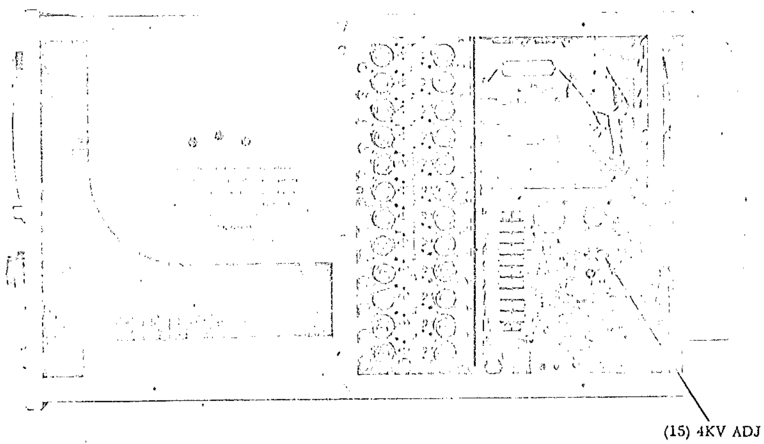


Fig. 25. Measurement of vertical risetime.

so that the center vertical line of the graticule passes through the rising portion of the waveform .2 centimeters from the bottom of the rise. Use the HORIZONTAL POSITIONING Vernier control to position the display so that the vertical centerline of the graticule passes through the rising portion of the waveform 1.8 centimeters up from the bottom of the rise. The reading of the HORIZONTAL POSITIONING Vernier control multiplied by 10 is the rise-time in Mμseconds.



NOTE
Numbers in parenthesis refer to the particular step(s) where the control is adjusted.

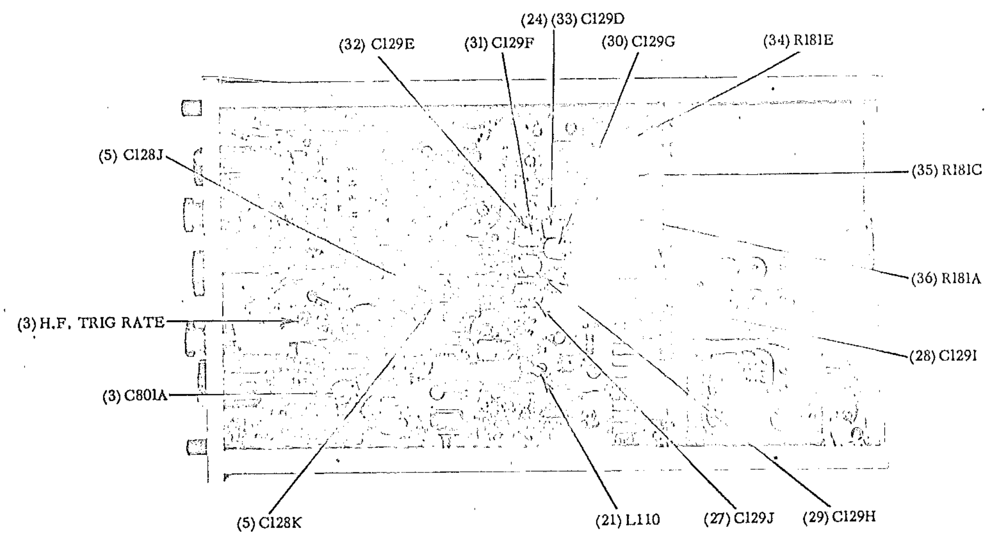
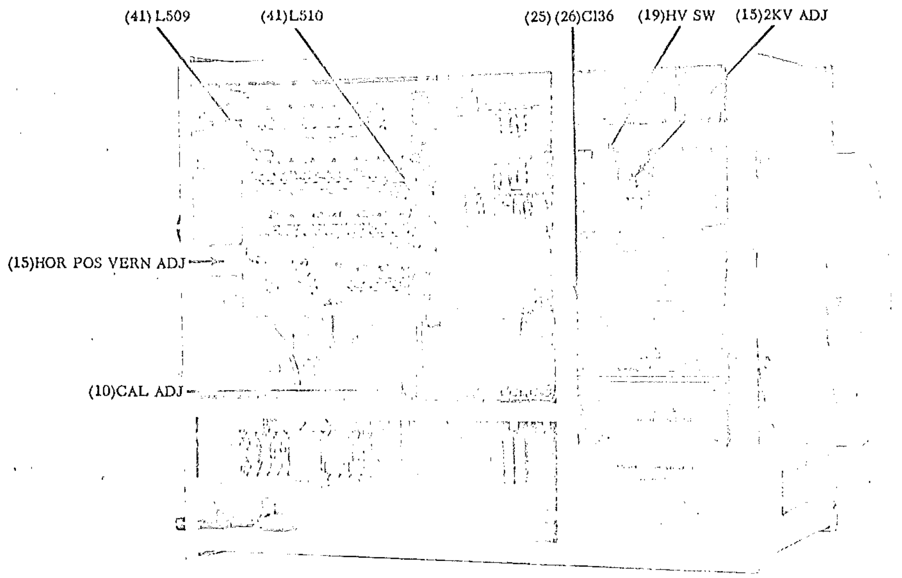


Fig. 26. Type 517 Oscilloscope top and bottom views showing the location of adjustment controls.



NOTE
Numbers in parenthesis refer to the particular step(s) where the control is adjusted.

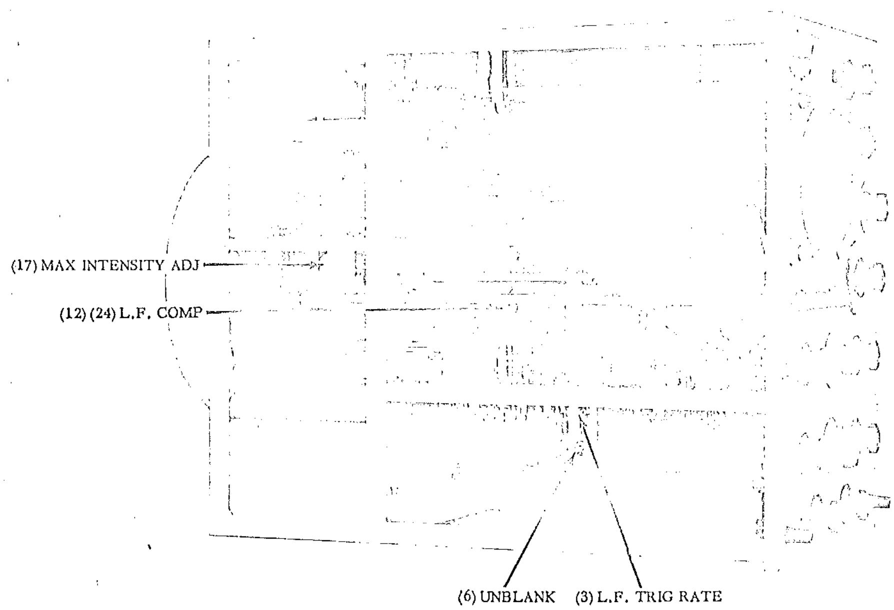
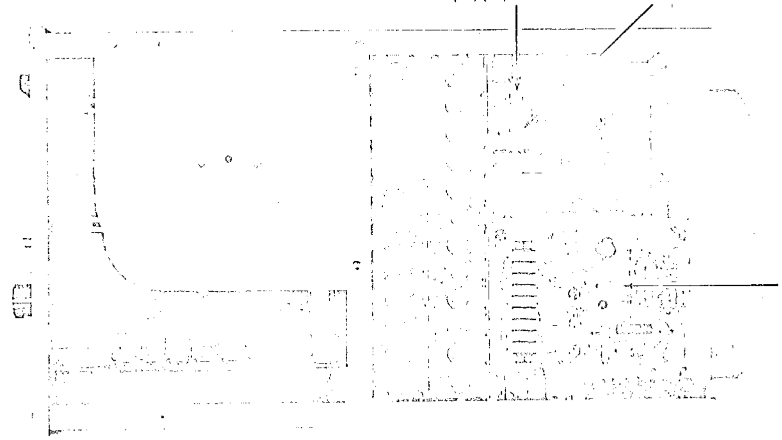


Fig. 27. Type 517 Oscilloscope left and right side views showing the location of adjustment controls.



NOTE
Numbers in parenthesis refer to the particular step(s) where the control is adjusted.

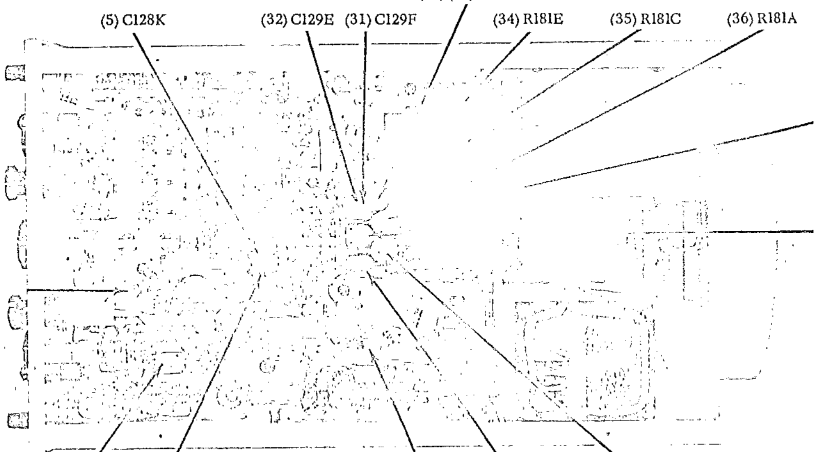
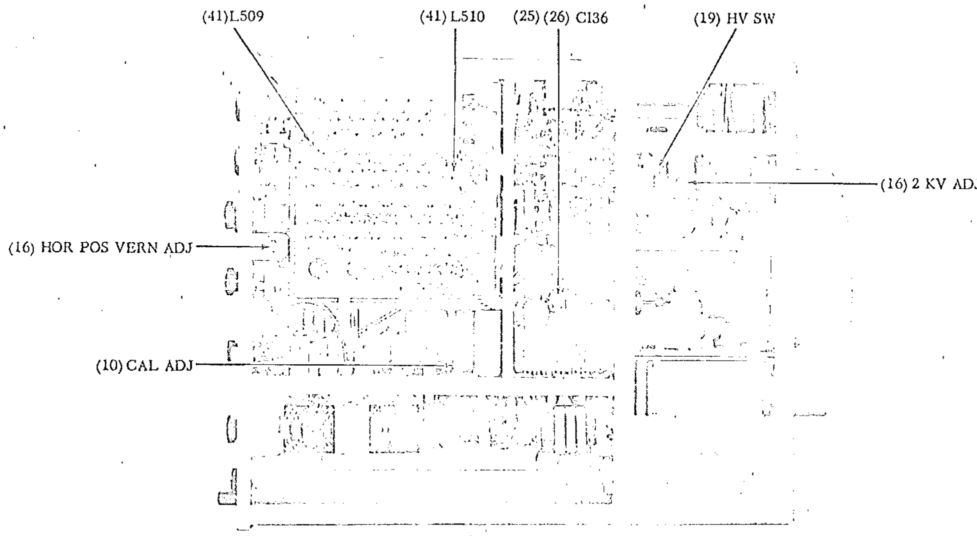


Fig. 28. Type 517A Oscilloscope top and bottom views showing the location of adjustment controls.



NOTE
Numbers in parenthesis refer to the particular step(s) where the control is adjusted.

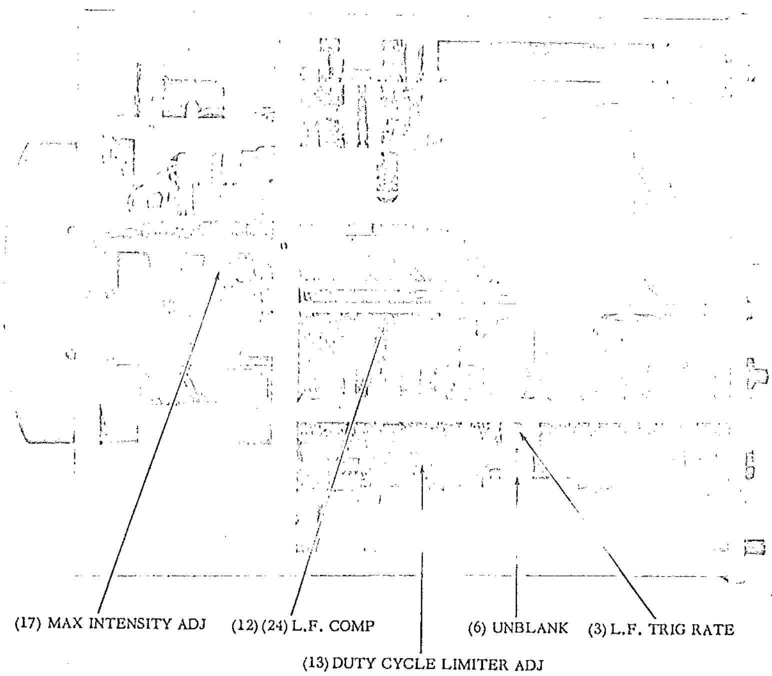


Fig. 29. Type 517A Oscilloscope left and right side views showing the location of adjustment controls.