

THE TYPE 545A OSCILLOSCOPE

FACTORY CALIBRATION PROCEDURE

Check for long ends, loose screws, unsoldered joints, and proper wire dress. Mechanically center all internal pots and caps (except delay line). C375 preset 1/2 turn from maximum. Tighten set screws in both TRIGGERING LEVEL knobs just snug enough so that the shafts may be turned. Check front panel knobs and jacks for proper tightness and zero. Preset front panel controls as follows: In Time Base A & B, STABILITY cw; TRIGGERING LEVEL ccw; TRIGGERING MODE AC; TRIGGER SLOPE, INT.; TIME/CM 1mSEC; VARIABLE TIME/CM cw; HORIZONTAL DISPLAY, A; MAGNIFIER, OFF; in Time Base B, LENGTH cw; DELAY TIME MULTIPLIER, 1.000; HORIZONTAL POSITION and VERNIER, ccw; AMPLITUDE CALIBRATOR, OFF; FOCUS, ccw; INTENSITY, ccw; ASTIGMATISM ccw; SCALE ILLUM., cw.

Check to see that the CRT pin connections are tight. Install TEST-LOAD UNIT, Type TU-2, with switches in LOW LOAD, NORMAL and 1:1. VERT.POS. up or down.

STEP 1. CHECK POWER SUPPLY RESISTANCES TO GROUND

All voltages, ripple and resistance should be measured on the strip adjacent to the power transformer near the fuse holder. This step must be done with scope unplugged from the line. The approximate resistances will be: -150v - 2.5K, 100v - 500Ω, 225v - 8K, 350v - 20K, 500v - 30K. Actual values may deviate considerably without harm.

STEP 2. CHECK TIME DELAY RELAY

Turn the scope on and check time delay relay. A click will be heard after 15 to 45 seconds.

STEP 3. CHECK VOLTAGES

Set line at 117v. Adjust -150v with the -150 ADJ. Check 100v, 225v, 350v, and 500v supplies ($\pm 2\%$). Check elevated heater supplies at the transformer terminals: Approx. 95v at 22, 220v at 27, 350v at 9. Adjust H.V. to -1350v measured from transformer terminal 25 to gnd. on the 5000v DC scale.

STEP 4. SET CAL. ADJ.

With the AMPLITUDE CALIBRATOR OFF, adjust CAL. ADJ. for 100v dc at CAL. TEST PT. Turn CALIBRATOR ON. Voltage at CAL. TEST PT. must read between 45v and 55v, (Calibrator symmetry $\pm 10\%$).
Turn CALIBRATOR OFF. Turn A and B STABILITY ccw but not in PRESET.

STEP 5. CHECK RIPPLE AND REGULATION

Use 2X probe with test scope vert. sens: .005v/cm., trig: auto. + line, swp: 10msec/cm. This is the only time the 2X probe is used. Set line at 125v, TEST-LOAD UNIT switched to LOW-LOAD. Measure ripple on each supply. The maximum ripple allowed is: -150v, 5mv; 100v, 10mv, with 6mv maximum high frequency ripple; 225v, 5mv; 350v, 20mv; 500v, 20mv. Set line at 105v. TEST-LOAD at HIGH-LOAD. Measure ripple on each supply. At LOW and HIGH line voltage ripple may exceed the above specifications by 100%. Return line to 117v!

STEP 6. CHECK CRT AND SET GEOMETRY

With scope turned off, install temporary shield over H.V. transformer. Check face of CRT for alignment with the front panel in the vertical, horizontal, and diagonal planes. Also check the CRT face for convexity and concavity. This is done with the graticule edge and a steel ruler. Maximum deviation from true is 1/32 inch.

With scope turned on, obtain trace in A swp., TIME/CM 1 mSEC by advancing STABILITY and INTENSITY controls cw. Push CRT face against graticule, align trace with Horz. graticule lines, and secure CRT clamp. Use vernier adjustment for fine setting. Insert 1mSEC and 100 μ SEC markers from the time mark generator, with Vert. Sens. 1:1. Obtain a stable display by adjusting STABILITY and TRIGGER LEVEL controls with 1mSec applied to TRIGGER INPUT on A.C. + EXT. Adjust VARIABLE TIME/CM or MAG. GAIN pot on pot bracket for one 1mSEC marker/cm. Set GEOMETRY for minimum bowing of the vertical traces. Check edge focus for no overlapping of the vertical traces in the center 8.8 cm with center of display properly focused. Vertically center graticule in useable area of CRT and tighten cam screw. Vary line voltage from 103v to 125v and watch for trace blooming (HV regulation check). Remove markers. Obtain trace (STABILITY full cw), return line to 117v, and switch vertical sensitivity to 250:1. Check for bowing of the horizontal trace at the upper and lower limits of the graticule. (Refer to Spec. Sheet.) Obtain 1mm of vertical deflection from the CALIBRATOR by adjusting the VERTICAL GAIN control if necessary. Position the trace vertically over the entire graticule and watch for no overlapping of the traces (vertical focus).

Obtain 2cm of vertical deflection from the CALIBRATOR by the method mentioned above. Position the 2cm of deflection at the upper and lower graticule limits and check for compression and/or expansion. Refer to spec. sheet for limits.

STEP 7. CHECK DISTRIBUTED AMPLIFIER BIAS

Connect the grid lines of the DA together with a short clip lead and check for min. 1v, max. 2v bias on each pair of tubes in the DA. Check the suppressor grids for 165v to 180v from gnd.

STEP 8. CHECK VERTICAL AMPLIFIER BALANCE

With grid lines shorted as above, short vert. deflection plates of the CRT together with a small screwdriver. (This is electrical center of the CRT.) Do not short to ground. The deviation of the trace noted is the over-all unbalance of the DA and must not exceed 2mm. Apply 225v from the front panel of the TEST LOAD, by pushing the button marked 225v, with a lead in the appropriate jack, to each pair of cathodes in the DA. This cuts each pair off in turn and shows how much unbalance each pair is contributing (max. 2mm) to the over-all DA unbalance. If tubes are switched or changed, recheck over-all balance and bias (Step 7) of the DA. Remove short and position trace to this point. Then, short grids (Pin 2) of the 6DJ8's together with a small screwdriver and note unbalance (max. .5cm). Do not short to ground. Position trace to this point and push ZERO REFERENCE button on front of TEST LOAD. This shows deviation contributed by the 12BY7's (max. 1cm). Position trace at electrical center of CRT and push ZERO REFERENCE button. This determines over-all unbalance of the vert. amp., and must not exceed 1.0cm. All tubes in the DA must be of the same manufacture. The 12BY7's must also have the same reference number.

STEP 9. SET VERTICAL GAIN ADJUST

The vertical amplifier must have 10% more gain than necessary. With test load unit switched to 250:1, apply 100v from the CALIBRATOR and adjust the GAIN ADJ. POT in the vertical amplifier for 4cm of vertical deflection. Remove CALIBRATOR signal from vertical.

STEP 10. CHECK DUAL TRACE AND CHOPPED BLANKING

This step must be done for both A and B sweeps. Switch TEST LOAD to 1:1, DUAL TRACE, TIME/CM 5 μ SEC and check for two traces on CRT. Push button marked +225v on TEST LOAD, and with CRT. CATHODE SELECTOR switch on the rear of the scope in the CHOPPED BLANKING position look for blanking of the leading and trailing edges of the multi waveform at normal intensity. If in doubt, move the switch at the rear of the scope back and forth several times for comparison. Remove TEST LOAD and install a K unit or other Plug-in.

STEP 11. ADJUST D.C. SHIFT COMPENSATION

With the sweep free running at 1mSEC/CM, VOLTS/CM of the Plug-in at 5v/CM, DC, adjust the VARIABLE gain control of the Plug-in for 4cm of deflection on the CRT with the test leads from the ohmmeter, set at the 100K range, applied to the vertical input. Adjust the DC SHIFT control at the rear of the vertical chassis for no vertical drift when alternately deflecting and releasing the trace.

STEP 12. ADJUST TIME BASE A TRIGGER SENSITIVITY AND LEVEL CENTERING

Ground the switch or grid end of the 470K resistor (R19) from the center arm of the TRIGGERING LEVEL pot. Connect test scope, set for AUTO, + INT, 0.5 msec/cm, 0.5 v/cm, through a 10X probe to V45B, Pin 6. On the scope under calibration, set V/CM to 1.0v DC coupled. Adjust TRIGGER LEVEL CENTERING and TRIGGER SENSITIVITY controls with the following calibrator voltages applied to the vertical INPUT jack while turning TRIGGER SLOPE switch from + INT to - INT.

CALIBRATOR	TRIG. MODE	TEST SCOPE PRESENTATION
0.1v	AC	Stable square wave of about 15v
50 mv	AC	Stable square wave
20 mv	AC	A somewhat jumpy square wave
10 mv	A.C.L.F. REJECT	A somewhat jumpy square wave
20 mv	A.C.L.F. REJECT	Check for stable square wave
50 mv	AC	Check for stable square wave
0.1v	DC	Adjust <u>INT. TRIG. DC LEVEL ADJ</u> for stable square wave on + and - <u>INT</u> while moving <u>VERT POSITION</u> . Trace must be within 2 mm of center of CRT of scope under calibration.
0.2v	DC	Check for stable square wave on + and - <u>INT</u> without moving <u>VERT POSITION</u> .

NOTE: The correct setting of the STABILITY and TRIGGERING LEVEL controls during normal operating conditions in any mode except AUTO or PRESET is with the STABILITY control just slightly ccw from the point of free-running and with the TRIGGERING LEVEL control adjusted for a stable display.

STEP 13. ADJUST TIME BASE A TRIGGERING LEVEL CONTROL

Remove ground from 470K resistor. Obtain 1mm of vert. deflection on scope under calibration with trigger in AC + INT. Without changing test scope settings or connections, adjust TRIGGERING LEVEL knob on scope under calibration for stable display on the test scope. Loosen the set screw, physically center the knob and tighten the set screw without moving the shaft. Remove test scope connection.

STEP 14. ADJUST TIME BASE A PRESET ADJUST

Set trigger to AUTO + LINE; TIME/CM, 100 μ SEC. Turn the PRESET ADJUST screw on the front panel fully ccw. Connect a voltmeter set for -250v DC to the center arm of the PRESET ADJUST pot or left end of R114 located near V125. Slowly turn the pot cw until a trace appears on the CRT. Note the voltage. Continue turning the pot until the trace brightens. Note the voltage again. Back the pot ccw until the meter reads 1/2 way between the two readings. The two readings should be at least 15v apart.

STEP 15. ADJUST TIME BASE B TRIGGER CONTROLS

Steps 12 through 14 above apply to the B trigger with the following exceptions: Ground grid (rear) end of 470K Ω resistor from center arm of B TRIGGERING LEVEL pot. Test scope connected to Pin 6 V95. No SENSITIVITY adjust. No AC LF REJECT position. For PRESET adjust, voltmeter is connected between center arm of the preset pot or bottom of R 214 (near V233) and ground. The two readings obtained during PRESET adjust must be 15 or more volts apart.

STEP 16. CHECK A AND B TRIGGER CIRCUITS FOR PROPER OPERATION

Check for EXT trigger operation with .1v CALIBRATOR signal applied to the TRIGGER INPUT jack and vertical INPUT, VOLTS/CM 1. Check + and - LINE triggering by applying 60 cps from the fuse holder through a 10X probe connected to the Plug-in INPUT of scope under calibration and observing correct phasing on the CRT. Check STABILITY PRESET switch by turning the STABILITY pot fully ccw and obtaining stable display by adjusting the TRIGGERING LEVEL control.

STEP 17. CHECK AMPLITUDE CALIBRATOR

With vertical sensitivity at 20v/CM DC and CALIBRATOR at 100v/CM (5 cm deflection, base line off screen, will not move) run through CALIBRATOR steps to .1v/CM switching vertical sensitivity simultaneously to check accuracy of the CALIBRATOR steps. The ratios will be 5, 5, 4, 5, 5, 4, 5, 5, 4, 2 cm.

ADJ. DELAY LINE \neq HF COMPENSATIONS

MEASURE VERTICAL RESPONSE

STEP 18. CHECK HIGH FREQUENCY SYNC.

Apply 30mc to the vertical input, TIME/CM .1μSEC, MAG ON, TRIGGERING SLOPE + INT, TRIGGER MODE HF SYNC. A stable display should be obtained with 2cm of vertical deflection by adjusting the A sweep STABILITY control. Strike the top of the front panel with the palm of the hand. Sync may be lost momentarily, but should return immediately without changing the setting of the STABILITY. Maximum trace width allowed is 1mm.

STEP 19. SET LOCKOUT LEVEL ADJUST

On scope under calibration set HORIZONTAL DISPLAY to B INTENSIFIED BY A with B STABILITY and TRIGGERING LEVEL controls fully cw, both A and B TRIGGER in AC + INT., A STABILITY ccw, A TRIGGERING LEVEL cw. With Time Base A and B TIME/CM switches at 100μSEC, test scope connected to Pin 2 V125 turn A STABILITY cw until a sawtooth-gate waveform first appears on the test scope. Make sure the B SWEEP LENGTH control is fully cw and that the DELAY-TIME MULTIPLIER dial is 1/2 or more turns from full ccw. Adjust the LOCKOUT LEVEL ADJ. on the pot bracket, until the ratio of the sawtooth to gate portion of the waveform is 1/2 way between 1 to 1 and 2 to 3. (With 5cm of deflection the sawtooth portion should be 2.25cm and the gate 2.75cm.)

Check the gate portion of the waveform for at least 9V amplitude. Time Base A STABILITY must be set just at the point of triggering for correct adjustment of the LOCKOUT LEVEL ADJ.

STEP 20. CHECK SINGLE SWEEP OPERATION

Trigger the scope in Time Base A AC + INT, with 1mm of vertical deflection from the CALIBRATOR. Remove the jumper from the input to the Plug-in, and switch the HORIZONTAL DISPLAY to A SINGLE SWEEP. If the READY neon is on, apply CALIBRATOR signal to the vertical input and watch the CRT for one trace only. The READY neon should extinguish. By removing the signal from the vertical and pushing the RESET button the READY neon should light, and the above be repeated. If the READY neon will not remain lighted until the signal is reapplied to the vertical, readjust the STABILITY or TRIGGERING LEVEL pots slightly.

STEP 21. ADJUST MAG GAIN

Turn the Time Base B TIME/CM switch to 1mSEC and insert 1mSEC and 100μSEC markers into the vertical. Trigger the sweep in AC + INT. Turn the MAG ON and adjust the MAG GAIN for 1 large mark every 5 cm and 2 small marks every cm. Check magnifier linearity over the entire sweep. Check MAG NEON for operation in MAG ON position. Use the same time marks through Step 25. Do not use the AUTO or HF SYNC mode positions for timing adjustments.

STEP 22. ADJUST SWEEP CAL

Turn MAG OFF. Adjust SWP CAL, R 348, for one large time mark per cm. (Timing adjustments are always made from the 1cm line to the 9cm line on the graticule.)

STEP 23. ADJUST TIME BASE A TO TIME BASE B

Set A TRIGGER MODE in any position but AUTO or HF SYNC. Set A TRIGGERING LEVEL and STABILITY pots fully cw. With both sweep speeds at the 1mSEC positions, HORIZONTAL DISPLAY in B INTENSIFIED BY A, B sweep triggered properly as above, position the trace so that the second time mark coincides with the second graticule mark. Then switch to A DEL'D BY B and with the DELAY-TIME MULTIPLIER adjust A sweep so that its second time mark corresponds with the second time mark of B sweep. By rapidly switching from A DEL'D BY B to B INTENSIFIED BY A the second and 10th time marks on the two sweeps may be compared, and R 160Z is adjusted for identical sweep speeds. Refer to spec. sheet for tolerance.

STEP 24. ADJUST TIME BASE A SWEEP LENGTH

Switch HORIZONTAL DISPLAY to Time Base A position. Adjust Time Base A SWEEP LENGTH control on the pot bracket for approximately 10.5 cm of sweep.

STEP 25. ADJUST NORM MAG REGIS

In Time Base A, with MAG ON, position the trace so that the first time mark falls on the center line of the graticule. Turn the MAG OFF and adjust the NORM MAG REGIS pot on the pot bracket so that the first time mark again falls on the center line of the graticule. Check to see that the MAG ON and MAG OFF positions register properly at the middle and end of the sweep.

STEP 26. ADJUST C 330

With 10μSEC markers properly triggered in A sweep, MAG ON, switch A TIME CM switch from 50 to 100μSEC and adjust C 330 so that the first time marks coincide.

STEP 27. ADJUST EXTERNAL HORIZONTAL DC BALANCE

Connect A SAWTOOTH OUT to vertical input set for 20v/CM AC and switch HORIZONTAL DISPLAY to X10. Free run A sweep set at .2mSEC. Adjust EXT. HORZ. DC. BAL. pot on the B sweep chassis for no horizontal shift of the vertical trace when turning the VARIABLE 10-1 from stop to stop. This adjustment will change. Leave these connections for the next step.

STEP 28. CHECK EXTERNAL HORIZONTAL INPUT DEFLECTION FACTOR

With 0.2v of CALIBRATOR signal fed into the HORZ. INPUT jack, VARIABLE 10-1 fully cw, HORIZONTAL DISPLAY EXT X1 at least 1.2cm of horizontal deflection must be observed. The scope should be triggered by feeding the CALIBRATOR signal into the TRIGGER INPUT jack on A time base and adjusting the trigger controls, set in AC + EXT, for proper triggering. Increase CALIBRATOR signal to 2.0v, set HORIZONTAL DISPLAY to EXT X10 and check attenuator accuracy ($\pm 2\%$). Return to X1 attenuation and rotate VARIABLE 10-1 fully ccw. There must be at least 10X attenuation.

STEP 29. ADJUST EXTERNAL HORIZONTAL INPUT COMPENSATION

With X10 attenuation in the external horizontal, increase CALIBRATOR to 10v, VARIABLE 10-1 fully cw, scope triggered as above, adjust C301C on the HORIZONTAL DISPLAY switch for optimum flat top on the square wave.

STEP 30. CHECK POSITIONING NEONS

Remove all front panel connections. With front panel set as above, position the spot in the graticule and check the positioning neons. The appropriate neon must be on and the other off before the spot leaves the graticule. Also check the A and B neons. The B neon should ignite in all positions of the HORIZONTAL DISPLAY switch except A and A SINGLE SWEEP.

STEP 31. CHECK TIME BASE A SWEEP RATES

MAG OFF and scope triggered in A sweep on AC + INT. Refer to spec. sheet for tolerances.

<u>TIME CM SWITCH</u>	<u>MARKERS</u>	<u>OBSERVE</u>
<u>1mSEC</u>	1mSEC	1 marker / cm
<u>2mSEC</u>	1mSEC	2 markers/ cm
<u>5mSEC</u>	5mSEC	1 marker / cm
<u>10mSEC</u>	10mSEC	1 marker / cm
<u>20mSEC</u>	10mSEC	2 markers/ cm
<u>50mSEC</u>	50mSEC	1 marker / cm
<u>.1 SEC</u>	100mSEC	1 marker / cm
<u>.2 SEC</u>	100mSEC	2 markers/ cm
<u>.5 SEC</u>	500mSEC	1 marker / cm
<u>1 SEC</u>	1 SEC	1 marker / cm
<u>2 SEC</u>	1 SEC	2 markers/ cm
<u>5 SEC</u>	5 SEC	1 marker / cm

STEP 32. CHECK VARIABLE TIME CM CONTROL AND UNCALIBRATED NEON

Feed to the vertical 10mSEC markers with A sweep rate at 1mSEC, scope triggered properly, MAG OFF. Adjust HORIZONTAL POSITION so that 2 markers are visible. Turn the VARIABLE TIME CM control, slowly, fully ccw. There should be at least 4 markers visible at the full ccw position of the control. The control must be smooth. The UNCALIBRATED neon must light whenever the VARIABLE TIME CM control is moved away from the full cw position.

STEP 33. ADJUST TIME BASE A SWEEP RATES

Preset C375 on the pot bracket 1/4 turn from maximum capacity. This setting will be changed to improve timing and linearity at the start of the sweep in Step 5. In Step 5, "at the center of sweep" means the center of the sweep before Magnification. There will be considerable interaction in Steps 3, 4, and 5. These must be repeated until proper timing is achieved. Make sure the VARIABLE TIME/CM control is in the CALIBRATED position. The scope should be triggered in AC + EXT by feeding the appropriate triggers from the time mark generator to the TRIGGER INPUT jack. Refer to Spec. Sheet.

<u>TIME/CM SWITCH</u>	<u>MARKERS</u>	<u>ADJUSTMENT</u>	<u>OBSERVE</u>
1. 10μsec.	10μsec.	C160E	1 marker/cm
2. 1 μsec	1μsec	C160C	1 marker/cm
3. .5μsec. <u>MAG. ON</u>	10 mc	C160A	1 cycle /cm
4. .1μsec. <u>MAG.OFF</u>	10 mc	C348	1 cycle /cm
5. .1μsec. <u>MAG. ON</u>	50 mc	C364 and C384 (at center of sweep) C375 (at left end of sweep)	1 cycle /cm
6. .2μsec	5 mc	Check timing range	1 cycle /cm
7. 2μsec	1 μsec	Check timing range	2 markers/cm
8. 5μsec	5 μsec	Check timing range	1 marker/cm
9. 20μsec	10μsec	Check timing range	2 markers/cm
10. 50μsec	50μsec	Check timing range	1 marker/cm

STEP 34. SET TIME BASE B SWEEP LENGTH

In time base B with .5mSEC sweep speed, MAG OFF, sweep free running, select the proper values of resistance, using an ohms picker, to set the limits of the B LENGTH control from 3.2cm to 3.8cm minimum to 10.2 to 10.8 cm maximum sweep length. R277 shunts the LENGTH control. R278 shunts the 12 K resistor between the LENGTH control and -150v. Replace the ohms picker with the proper value of 10%, 1/2-w resistor, soldered in neatly with the color coding facing in the right direction.

STEP 35. CHECK TIME DELAY JITTER

Set the B sweep rate to 1mSEC and the A sweep rate to 1μSEC. Display 1mSEC markers with the HORIZONTAL DISPLAY switch in B INTENSIFIED BY A, triggered in B sweep on AC + INT, A sweep STABILITY fully cw or free running position. Set the MULTIPLIER dial so that the brightened portion of the sweep coincides with the 2nd time mark. Switch to A DEL'D BY B and observe the horizontal jitter (2mm max.). Repeat this process at the 10th time mark for max. jitter 4mm. V414 and V424 are usually at fault if jitter exceeds the above specs.

STEP 36. SET DELAY START AND STOP ADJUST

Switch HORIZONTAL DISPLAY to B INTENSIFIED BY A, B sweep speed .5mSEC, A sweep speed 10μSEC. Feed 500μSEC markers to the vertical input. Adjust B trigger in AC + INT for a stable display. Turn A STABILITY control fully cw to free run sweep. Check DELAY TIME MULTIPLIER dial for mechanical zero. By turning the DELAY TIME MULTIPLIER with low INTENSITY a brightened portion of the sweep should move along the trace. Turn the DELAY TIME MULTIPLIER to 1.00 and adjust the DELAY START on the swing-out chassis until the bright portion just passes to the right of the 2nd marker. Turn the MULTIPLIER to 9.00 and adjust the DELAY STOP so that the bright spot just passes to the right of the 10th marker. There will be interaction between these adjustments, so it will be necessary to go back and forth several times. Switch HORIZONTAL DISPLAY to A DEL'D BY B and make final adjustments viewing the start of the magnified time marker, and setting the start of the marker to correspond with the start of A sweep in A DEL'D BY B. Check linearity of the DELAY TIME MULTIPLIER at all major divisions from 1 to 9. Refer to spec. sheet for tolerances.

STEP 37. CHECK TIME BASE B SWEEP RATES

The following procedure must be done for all sweep rates in the B sweep from .2mSEC to 1 SEC. With B sweep triggered properly as in last step, turn the DELAY TIME MULTIPLIER to 1.00 and notice the error in delay start. Then turn the MULTIPLIER to 9.00 plus or minus the error noted at 1.00. The difference between the MULTIPLIER setting with the error at 1.00 and 9.00 must be 5 or less minor divisions (.5%) except the three slowest sweep speeds which may vary 8 or less minor divisions (.8%). These figures just mentioned are not the error in delay start on any range, but the difference between the 2nd and 10th time marks on the B sweep as read on the MULTIPLIER dial. Check the sweep rates starting with B at .2mSEC and A at 5μSEC. Feed markers corresponding to B sweep rates into vertical. Start with the HORIZONTAL DISPLAY in B INTENSIFIED BY A and make

(Step 37 Continued)

rough settings with the bright portion of the sweep. Then switch to A DEL'D BY B and make fine setting to the start of the A sweep and appropriate time mark. Reduce the A TIME CM switch settings ccw one step at a time to correspond with the step by step reduction in sweep speed settings on the B sweep.

STEP 38. ADJUST TIME BASE B SWEEP RATES

The procedure for this step is the same as above except the ranges are adjustable. Set B sweep at $50\mu\text{SEC}$, A sweep speed $1\mu\text{SEC}$, $50\mu\text{SEC}$ markers to vertical, rough adjustment of C260C in B INTENSIFIED BY A, and fine adjustments in A DEL'D BY B. Adjust C260A by setting B sweep speed at $5\mu\text{SEC}$, A sweep speed $.1\mu\text{SEC}$, $5\mu\text{SEC}$ markers to vertical and rough and fine adjustments as above. Check the $2\mu\text{SEC}$, $10\mu\text{SEC}$, $20\mu\text{SEC}$, and $100\mu\text{SEC}$ B rates for tolerance by using 1, 10, 10, and $100\mu\text{SEC}$ markers in this order. If B trigger will not operate properly at the faster speeds feed $50\mu\text{SEC}$ markers simultaneously with the proper markers for the range being checked. Refer to spec. sheet for tolerances.

STEP 39. CHECK TIME BASE A HOLD-OFF

Connect a 10X probe from the test scope to the GATE A jack. Trigger the test scope on AC - INT, set the A sweep on the scope under calibration free running with trigger in any position but AUTO. Check all ranges on the Time Base A TIME/CM switch for correct hold off. At speeds from $10\mu\text{s}$ up, hold off should be checked at input to Horizontal Amplifier, outboard end of C 330. Refer to spec. sheet.

STEP 40. CHECK TIME BASE B HOLD-OFF

Repeat the above step in B sweep position. Use the correct hold-off specs. for B sweep. Connect 10X probe to GATE B jack.

STEP 41. CHECK CRT CATHODE INPUT

Remove the CRT CATHODE GND. STRAP on the rear of the scope. The strap should hinge on the ground post. Insert 20v of CALIBRATOR signal into the post marked CRT CATHODE. With normal intensity the trace should be modulated. Replace the ground strap.

STEP 42. CHECK FRONT PANEL WAVEFORMS

Both A and B STABILITY pots on the scope under calibration set in the free running position (cw) and the TRIGGERING MODE switch in any position but AUTO. Using a 10X probe, test scope set for DC input, triggered on auto + int, check SAWTOOTH A jack for a 150v \pm 10% (more on the faster speeds) sawtooth waveform. GATE A jack should have a 20v to 35v square wave with no rounding at the start of the rise. GATE B jack 20v square wave. DEL'D TRIGGER jack 5v or more spike from either A or B sweep depending upon the setting of the HORIZONTAL DISPLAY switch.

(NOTE: The A and B neons indicate which sweep is driving the delay pickoff circuit.)

The test scope should be triggered on ac + int. to see the delayed trigger spikes at the slower sweep speeds. The VERT. SIG. OUT jack should have 2v for every cm of vertical deflection (25% tolerance).

STEP 43. RECORD CRT SERIAL NUMBER AND FILL OUT IBM CARD

