TEKTRONIX TYPE 536 OSCILLOSCOPE

F A C T O R Y
C A L I B R A T I O N P R O C E D U R E

Check for long ends, unsoldered joints, rosin joints, poor wire dress, misaligned or loose knobs, etc. Check to see that the CRT pin connections are tight. Preset all pots to mid-range. Preset the INTENSITY and SCALE ILLUM. controls full left (ccw). Set the INTENSITY MODULATION mode switch to INT. UNBLANK.

1. PRESET CAPACITORS AND INDUCTORS.

   Set C292, C392, and C254 to near minimum capacity.
   Set L250 and L256 so 1/4" of shaft projects from the chassis.
   Set L350 and L356 so 1/2" of shaft projects from the cahssis.
   Set L304, L324, L204, and L224 slug 80% in the winding from the outside.
   Set L323 and L223 slug 50% in the winding from the outside.

2. CHECK PHASING CONTROL.

   With the phasing control set at "0", the front capacitor should be set at minimum capacity and the rear should be set at maximum capacity. The two stops should be set so the knob rotation is only from 0 - 100. The tension spring connections should not hit either chain sprocket.

3. CHECK POWER SUPPLY RESISTANCE TO GROUND.

   The power transformer primary must have infinite resistance to ground. Typical power supply resistances are as follows:

Power Supply	Resistance to Ground
-150	15kΩ
+100	500Ω
+100	2.5kΩ with underload relay hand actuated.
+225	15kΩ
+350	20kΩ

4. CHECK TIME-DELAY RELAY.

   Install 2 TEST LOAD UNITS and turn scope on. Check for a delay of from 15 to 45 seconds before the B+ relay energizes.

5. SET -150 ADJ, CHECK RIPPLE, REGULATION, AND ELEVATED FILAMENTS.

   Set -150 v supply with the -150 ADJ. Check all regulated supplies for voltages within 2% of their rated value.

   Advance the INTENSITY control slowly until a spot is observed. Check the operation of the HORIZONTAL and VERTICAL positioning controls.

   With the test scope, measure the ripple of all the power supplies. At 117 line volts, the ripple should not exceed 30 millivolts on any supply. Typical ripples are:

-150	5 mv	
+100	10 mv	
+225	5 mv	
+350	20 mv	350 volt ripple may reach 50 mv at lo line hi load.

5. Cont.

Check regulation at low line (105 vac) with both load units switched to HI LOAD. Check regulation at high line (125 vac) with both load units switched to LOW LOAD.

Check terminals 26, 17, 16 and 9 for +150 v.
Check terminals 27, 28, 12, and 13 for +100 v.
Check terminals 22 and 23 for +225 v.
Check terminals 24 and 25 for - hv (800v.)

6. SET CAL ADJ.

With line voltage at 117, turn the SQUARE WAVE CALIBRATOR OFF. Set CAL ADJ. for 100 v at the CAL VOLT CHECK pin jack located towards the front of the power chassis. Turn the SQUARE WAVE CALIBRATOR ON. The voltage at the pin jack should drop to between 45 and 55 volts.

7. SET HV ADJ. AND CHECK REGULATION

Set the H.V. ADJ. for -800 v measured at the forward end of the 10k resistor which returns to the plate of V822. Position the spot off the screen. While measuring the 800 v, rotate the INTENSITY control and check supply regulation. (approximately a 10 v change.)
Apply 2 v of CALIBRATOR signal to the HORIZONTAL test load unit. Advance the INTENSITY control until the trace is visible. Align the trace with the horizontal graticule lines and push the crt forward against the graticule. Clamp the crt in this position.

8. CHECK SCALE ILLUM. CONTROL

Check the SCALE ILLUM.control to see that there are no open spots in the pot and that it is wired so the graticule lights are brightest when the control is full right. (cw)

9. SET GEOM. ADJ.

From the CALIBRATOR, apply 2 v of signal to the VERTICAL TEST LOAD UNIT input. Set the GEOM. ADJ. for minimum curvature of the vertical trace while positioning from one side of the graticule to the other. Deviation from a straight vertical line must not exceed 0.75 minor division within the graticule. Transfer the signal from the VERTICAL input to the HORIZONTAL input. The resultant trace must not deviate more than 0.75 minor division from a straight horizontal line within the graticule.

THE FOLLOWING STEPS: 10 THROUGH 17 ARE THE SAME IN BOTH VERTICAL AND HORIZONTAL AMPLIFIERS EXCEPT FOR COMPONENT NUMBERS.

10. CHECK VERTICAL DC BALANCE

Short the horizontal deflection plates to find crt electrical center. Short the 6360 grids and check for not more than 1.5 major divisions of unbalance. Short the 6DJ8 grids and check for not more than 1 major division of unbalancing the stage. Depress the PRESS TO SHORT INPUT button on the horizontal TEST LOAD UNIT and check for not more than 2 major divisions of unbalance in the 12BY7 stage and the overall amplifier balance is not more than 2 major divisions from crt electrical center.

12. SET GAIN ADJ.

Switch the TEST LOAD UNIT attenuator to 250:1 and apply 100 v of CALIBRATOR signal to the horizontal input. Check for at least 4.4 cm of deflection at the maximum gain setting. Adjust horizontal GAIN ADJ. for 4 major divisions of deflection.

13. CHECK EXPANSION OR COMPRESSION

Check for compression and/or expansion in the horizontal amplifier by positioning 4 major divisions of CALIBRATOR signal to the horizontal extremes of the graticule and observing the change in amplitude. Compression and/or expansion should not exceed 0.5 minor divisons.

14. CHECK HUM AND MICROPHONICS

Check for hum and microphonics in the horizontal amplifier.

15. ADJUST BEAM-POSITION-INDICATOR CENTERING CONTROLS

Adjust the beam position indicator centering (R275 horiz.-R375 vert.) so that the indicator neons fire equidistant from the graticule center.

16. SET SIG. OUT DC LEVEL ADJ.

Position the spot to the center of the graticule and set the HORIZ SIG OUT DC ADJ. for 0 volts measured at the HORIZ. SIG. OUT post on the front panel.

17. ADJUST D.C. SHIFT COMP.

Insert a "K" plug in in the HORIZONTAL amplifier. Switch the plug in to DC coupled input.
Using an ohmmeter as a source of DC voltage, deflect the trace 6 major divisions and adjust DC SHIFT COMP. for minimum shift after deflection.

REPEAT STEPS 10 THROUGH 17 TO CALIBRATE THE VERTICAL AMPLIFIER BY SUBSTITUTING VERTICAL FOR HORIZONTAL IN THE TEXT.

18. CHECK SQUARE WAVE CALIBRATOR VOLTAGE STEPS AND THE VOLTS TO MILLIVOLTS DIVIDER.

Install a "T" unit in the horizontal amplifier and a "K" unit in the vertical amplifier.
Apply a .2 v signal from the SQUARE WAVE CALIBRATOR to the vertical INPUT. Connect VERT. SIG. OUT to TRIGGER INPUT, trigger the sweep, and check the calibrator waveform. Free run the sweep and check the CALIBRATOR voltage steps with the K UNIT VOLTS/CM switch.

CALIBRATOR VOLTS	VOLTS/CM	DEFLECTION/DIV
.2	.05	4
.5	.1	5
1.	.2	5
2	.5	4
5	1	5
10	2	5
20	5	4
50	10	5
100	20	5
100 millivolts	.05	2

19. ADJUST SIGNAL OUT WAVESHAPE AND CHECK AMPLITUDE

From a TYPE 105 SQUARE WAVE GENERATOR, apply a square wave of approximately 50 kc to the VERTICAL 53/54 K INPUT. Set the VOLTS/CM to 0.05 and the VARIABLE control full right (cw). Adjust the 105 OUTPUT for about 4 major divisions of deflection.
Connect a properly compensated 10X probe to the VERT. SIG OUT post and obtain a triggered display on the test scope. Adjust the signal output compensation capacitor (C292 horizontal - C392 vertical) for optimum flatness of the output waveform. The waveform should be approximately 1.5 volts/ division of deflection. Remove the test scope probe.

20. ADJUST HF COMPENSATIONS

Obtain about 4 major divisions of deflection at 400 kc from a 105. Adjust L304 and L324 vertical - L204 and L224 horizontal for maximum spike. Adjust L350 and L356 vertical - L250 and L256 horizontal for optimum wave shape. Switch the 105 to 100 kc and adjust L323 vertical - L223 horizontal for optimum wave shape.

21. CHECK AMPLIFIER FREQUENCY RESPONSE

From a TYPE 190 CONSTANT AMPLITUDE SIGNAL GENERATOR obtain 6 divisions of vertical deflection at about 50 to 500 kc. ("K" VOLTS/CM at .05 and VARIABLE full right.) Check for at least 4.2 major divisions of deflection at 12.5 mc. (3.4 div at 15 mc on a TU50).

22. CHECK INTENSITY MOD. INPUT

Interchange the 53/54 K UNIT and the 53/54 T UNIT. Switch INTENSITY MODULATION to EXT DC. and connect +GATE OUT to INTENSITY MOD. INPUT. Free run the sweep and switch INTENSITY MODULATION to AC and note dimming of the trace. Return the INTENSITY MODULATION switch to DC and repeat steps 19 through 21 for the horizontal amplifier. The horizontal and vertical amplifier frequency response should be as nearly identical as possible.

23. CENTER AMPLIFIER PHASING CONTROL RANGE

Remove the "T" unit from the vertical amplifier and install a "K" unit. Apply a 10 mc signal from a 190 to both the vertical and horizontal "K" units. Use equal cable lengths and terminations.
Set both "K" units to .05 V/CM and variable controls full right. Adjust the 190 for 10 divisions of vertical and horizontal deflection. (This will be a trace extending from the lower left corner to the upper right corner of the graticule.)
Adjust C254 so that rotation of the AMPLIFIER PHASING control results in equal and opposite phase shift from zero degrees. (Zero degrees may not necessarily be the mechanical mid range of the AMPLIFIER PHASING CONTROL.)

24. CHECK AMPLIFIER PHASING RANGE AT 10 MC.

From the TYPE 190, obtain 10 divisions of deflection at 10 mc (as in step 23). Rotation of the AMPLIFIER PHASING control must effect an overall amplifier phase shift of at least 5 degrees. (1 degree of phase shift is equal to .87 minor divisions of loop separation with 10 cm of deflection.)

25. CHECK PHASE SHIFT OF AMPLIFIER (DC TO 15 MC)

With the TYPE 190 at 10 MC and 10 divisions of horizontal and vertical deflection, adjust the AMPLIFIER PHASING control for 1 degree phase shift display. Reduce the generator frequency (maintaining 10 divisions of deflection) and observe the display deviation from the 10 mc pattern. The deviation must not exceed 1 degree from dc to 10 mc. If 1 degree is exceeded, return to 10 MC and readjust the AMPLIFIER PHASING for an opposite 1 degree phase shift pattern and repeat the check. Check that the relative phase shift does not exceed 1 degree from DC to 15 mc using less than 10 divisions of deflection, not overdriving the amplifiers.

26. CHECK AMPLIFIER PHASE SHIFT BALANCE TO 30 MC

Set the TYPE 190 to 20 MC and adjust the output amplitude for approximately 5 divisions of horizontal and vertical deflection. The amplifier must balance (0 degrees of phase shift) with the adjustment of AMPLIFIER PHASING control. The amplifiers must also balance at 30 mc with 2 divisions of horizontal and vertical deflection. (It may be necessary to readjust the amplifier hf adjustments slightly to achieve this. The lower inductances have more effect on the higher frequencies and the upper inductances have greater effect at the lower frequencies.)

27. CHECK CRT CATHODE INPUT

Install a "T" unit in the horizontal channel and a TEST LOAD UNIT in the vertical channel. Advance stability until a trace appears. Switch the TIME/DIV switch to 1 MILLISEC/DIV. Apply 20 v of CALIBRATOR signal to the CRT CATHODE input at the rear of the scope. Check for intensity modulation of the trace.

28. CHECK ALTERNATE SWEEP OPERATION

Advance the STABILITY control on the "T" unit until a trace appears. Switch the vertical TEST LOAD UNIT to DUAL TRACE and 1:1. Check alternate trace operation.

29. RECORD CRT TYPE AND SERIAL NUMBER ON THE CALIBRATION RECORD.