

TYPE 503
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

PRELIMINARY INSPECTION

Check for long ends, unsoldered joints, wire dress and etc. Turn the INTENSITY control CCW and preset all pots and trimmers to mid-range.

1. CHECK RESISTANCE OF POWER SUPPLIES TO GROUND

Check primary windings of power transformer for infinite resistance to ground.

Check power supply resistance to ground.

SUPPLY	APPROXIMATE RESISTANCE	CHECK POINT
485V	5k	C612
250V	2k	C654A
100V	2k	C654B
12.3V	4Ω	C654C
-100V	3k	C684
-3000V	5meg	Plate of V692

2. CHECK VOLTAGES, RIPPLE, AND REGULATION

Turn the scope on and set the -100V ADJ. This adjustment may be offset 2% to bring any of the other supplies within their 5% tolerance.

Supply	Maximum Ripple (at 117 v)	<u>120 cps</u>	<u>30kc</u>
250 v		25mv	20 mv
100 v		10mv	20 mv
12.3 v		10 mv	20 mv
-100 v		10 mv	20 mv
-3000 v		10 mv	20 mv

All supplies must regulate between 105 and 125 line volts.

3. CHECK GEOMETRY AND FOCUS

Set the scope sweep speed to 1 millisec/cm.

Apply 1 millisecond markers to the input of the vertical INPUT. (It may be necessary to adjust the STABILITY control to obtain a stable display.) Adjust the amplitude until the markers reach from the top to the bottom of the graticule.

Check the geometry and at the same time rough set the timing.

Position the first marker under the center line of the graticule with the magnifier set to 50X. Return the magnifier to 1X and position the first mark under the center line with the Sweep Mag Register control.

4. SET VERTICAL AND HORIZONTAL DC BALANCE

Switch HORIZONTAL DISPLAY to EXTERNAL AMPLIFIER. Reduce the Intensity of the spot on the crt to prevent burning it. Switch both SENSITIVITY controls to 20v/cm. Set both DC BAL. controls to mid-range. Position the spot to the center of the crt with both POSITION controls. Switch both Sensitivity controls to 1mv/cm and use the COARSE DC BALANCE adjustments to reposition the spot to the center of the crt graticule. Check for less than 1 cm of shift while rotating the VARIABLE sensitivity controls through their ranges.

5. SET HORIZONTAL AND VERTICAL GAIN

With the HORIZONTAL SENSITIVITY control set at 0.2v/cm, apply 1 volt from the test scope calibrator to the horizontal \pm input. Adjust the 0.2v gain Adjust for 5cm of deflection. Switch the SENSITIVITY control to the 1 mv range and apply 5 mv of signal. Adjust the 1 mv gain adj. for 5 cm of deflection. Check operation of the VARIABLE CONTROL. Check all ranges $\pm 2\%$. The two gain adjustments will interact so they may have to be set several times. The VERTICAL amplifier adjustment is the same as the HORIZONTAL.

6. CHECK HUM, NOISE, AND MICROPHONICS

There should not be more than 1 mm of hum or noise on the 1 mm range.

With the dot centered and both VERTICAL AND HORIZONTAL amplifiers in the 1 mv position, rap lightly on the top of the scope front panel. There should be no ringing microphonics.

7. CHECK FOR GAS OR GRID EMISSION

- a. Ground all four inputs.
- b. Switch one input at a time from ground to AC and back again. There should be less than 1 cm of shift.

8. CHECK COMPRESSION/EXPANSION

Obtain 2 cm of vertical signal from the test scope calibrator with the sweep running. There should be no more than 1 mm of compression or expansion as the display is moved from the bottom to the top of the graticule.

9. SET CALIBRATOR

- a. Turn the VERTICAL V/CM switch to .1v/CM and set the Cal Adj. for .5 V output from the 503 CALIBRATOR. (5 cm of vertical deflection.)
- b. Turn the VERTICAL V/CM switch to 1 mv. and check the 5 mv jack for 5 cm of vertical signal.

10. SET VERTICAL ATTENUATOR COMPENSATION

- a. Use a 105 set to 1kc and a 47pf standardizer to set the attenuators. When setting either \pm input, switch the other input of the differential amplifier to ground.

(+) INPUT

<u>V/CM RANGE</u>	<u>ADJUST LEVEL</u>	<u>ADJUST SPIKE</u>
0.2	C416	-----
0.5	C415B	C415C
5.0	C414B	C414C

- b. Check all ranges.

(-) INPUT

<u>V/CM RANGE</u>	<u>ADJUST LEVEL</u>	<u>ADJUST SPIKE</u>
0.2	C406	-----
0.5	C405B	C405C
5.0	C404B	C404C

- c. Check all ranges.

11. SET HORIZONTAL ATTENUATOR COMPENSATIONS

- a. Use a 105 set to 1kc and a 47 pf standardizer to set the attenuators. When setting either \pm input, switch the other input of the differential amplifier to ground.

- b. Obtain a vertical sweep as follows:

1. Set the 503 VERTICAL V/CM to 20 and apply a sweep voltage from the SAWTOOTH OUT jack on the test scope to the (+) input.
2. Use a coax "T" to feed a portion of the 105 square wave to the EXTERNAL TRIGGER INPUT jack on the test scope.
3. Set the test scope to trigger on AUTO and EXT.

- c. Compensate the attenuators as follows:

(+) INPUT

<u>V/CM RANGE</u>	<u>ADJUST LEVEL</u>	<u>ADJUST SPIKE</u>
0.2	C306	-----
0.5	C304B	C304C
5.0	C305B	C305C

- d. Check all ranges.

(-) INPUT

<u>V/CM RANGE</u>	<u>ADJUST LEVEL</u>	<u>ADJUST SPIKE</u>
0.2	C316	-----
0.5	C315B	C315C
5.0	C314B	C314C

- e. Check all ranges.

12. CHECK HORIZONTAL AND VERTICAL REJECTION RATIO

- a. Connect from the Test scope Calibrator to the 503 with a "T" connector so 2 calibrator outputs are available.
- b. Connect the two outputs to the \pm inputs. Check both amplifiers.

<u>VOLTAGE INPUT</u>	<u>RANGE</u>	<u>MAXIMUM DEFLECTION</u>
100 v	5 v	4 mm
50 v	0.5 v	2 cm
5 v	0.2 v	2.5 mm

Check rejection ratio over entire graticule.

13. ADJUST STABILITY

- a. Set the TRIGGER LEVEL control to AUTO. Set sweep to approximately 1 millisec.
- b. Turn the STABILITY control cw until a trace appears. Continue to rotate the control until the sweep free runs. (Trace brightens) Set the pot half way between the point where the trace appears and the point where it brightens.

14. CHECK TRIGGERING

- a. The triggering must meet the following minimum specifications.

INT AC: \pm with the TRIGGER LEVEL grounded at the junction of R19 and R20 and 1 cm of vertical deflection.

\pm with 0.5cm of vertical deflection by adjusting the TRIGGER LEVEL.

DC same as AC within 2 cm of center of graticule.

Auto. \pm on 1 cm with no jitter.

EXT. AC: \pm on 1 V without adjusting trigger level. \pm on 0.5 V by adjusting trigger level.

DC. Same as AC

AUTO. \pm on 1V with no jitter.

LINE. Check for correct triggering on \pm slope. Connect 10X Probe from (+) Input to fuse holder. (Triggering will appear inverted if - input to vertical amplifier is used.)

15. SET TIMING

<u>TIME/CM</u>	<u>MARKERS FROM 180</u>	<u>ADJUST</u>
1Millisec/cm	1 millisec	SWP CAL and SWP LENGTH (10.5 cm)
10 μ sec/cm	10 μ sec	C160B
1 μ sec/cm	1 μ sec	C160A

Check timing on all ranges. $\pm 2\%$ except 1, 2, and 5 sec/cm 2.5%

16. SET SWEEP MAG REGISTER

- a. Set SWEEP SPEED to 1 millilsec/cm and use a 1 millilsec time marker.
- b. Turn the HORIZONTAL DISPLAY to X50 and position the first marker to the center of the graticule with the HORIZONTAL POSITION control.
- c. Turn the HORIZONTAL DISPLAY to X1 and reposition the first marker to the center of the graticule using the SWEEP MAG register.
- d. REPEAT steps b. and c. until the register remains correct as the HORIZONTAL DISPLAY switch is changed from X50 to X1.
- e. Check registration at both ends and center of sweep.

17. CHECK MAGNIFIER

- a. Set SWEEP SPEED to 1 millilsec/cm and use 1 millilsec markers with those listed.

HORIZ DISPLAY SW.	MARKERS	MARKS/CM
X2	500μsec	1
X5	100μsec	2
X10	100μsec	1
X20	50μsec	2
X50	10μsec	2

- b. Magnified timing must be within $\pm 3\%$.

18. CHECK SWEEP JITTER

- a. Display 1μsec markers
- b. Set the SWEEP SPEED TO 5μsec/cm.
- c. Set the HORIZONTAL DISPLAY to X50.
- d. With the scope triggered at the optimum point, there should be no more than 1 minor division of sweep jitter.

19. CHECK POSITION CONTROL

With the HORIZONTAL DISPLAY switch on HORIZONTAL AMPLIFIER and both HORIZONTAL and VERTICAL SENSITIVITIES at 20V/cm, it must be possible to position the spot off the graticule horizontally and vertically at both extremes with the POSITION controls.

20. CHECK Z AXIS MODULATION

Apply 10V from the test scope Calibrator to the CRT GRID EXTERNAL INPUT with the shorting strap removed. The trace should be modulated with the INTENSITY set at a normal level.

21. CHECK CRT TYPE, SERIAL NUMBER, AND RECORD ON CALIBRATION RECORD.

TYPE 503

TEST SPECIFICATIONS

<u>SUPPLIES</u>	<u>VOLTAGE</u>	<u>RIPPLE (max) AT 117 V LINE</u>	
		<u>120 CYCLES</u>	<u>30 KC</u>
250	±5%	20 mv	5 mv
100	±5%	10 mv	5 mv
12.3	±5%	10 mv	5 mv
-100	±2%	10 mv	5 mv
-3000	±5%		

REGULATION: 105-125 V all supplies

GEOMETRY: 1°

FOCUS: Resolution of 1 mm

COARSE DC BAL: Be able to center the dot with front panel controls centered.

DC BALANCE: 1 cm shift with variable v/cm control.

MICROPHONICS: No microphonics of the ringing variety.

INPUT STAGE: 1 cm of vertical shift due to gas or grid emission.

HORIZ. & VERT GAIN STEPS: ±2%

COMPRESSION & EXPANSION: ±1mm

CALIBRATOR: Exact on .5 V ±2% on 5 mv. Symmetry: 2:1

OVERSHOOT ON SQUARE WAVE: 2%

REJECTION RATIO: 100:1 .2 v/cm through 1 mv/cm
50:1 20 v/cm through .5 v/cm

The Rejection Ratios specs. must be met anywhere on the graticule.

TRIGGERING:

INT: AC: - ± on 1 cm with LEVEL control grounded at R19 and R20 Jnct.
± on .5 cm by adjusting LEVEL control.

DC: - Same as AC within 2 cm of center of graticule.

AUTO: ± on 1 cm with no jitter

EXT: AC: - (+) or (-) on .5 v

DC: - Same as AC

AUTO: ± on 1 V with no jitter

TIMING: .5 sec/cm through 1 μs/cm ±2%
5 sec/cm through 1 sec/cm ±2.5%
Magnified ranges ±3%

SWEEP JITTER: 2 mm on any range (magnified)

POSITION RANGE: It must be possible to position the dot off the graticule in any direction.

Z AXIS MODULATION: 10 V at normal viewing levels.

Phase Difference between Vertical and Horizontal Amp:

Equal Sensitivities

DC to 100 KC - 1°
DC to 450 KC - 2°

Unequal Sensitivities

DC to 50 KC - 6°