FACTORY CALIBRATION PROCEDURE

CONTENTS:

This is the guide for calibrating new instruments in Product Manufacturing. The procedure consists of 4 sections:

Equipment Required

Factory Test Limits - Factory Test Limits are limits an instrument must meet before leaving Manufacturing. These limits are often more stringent than advertised performance requirements. This is to insure that the instrument will meet advertised requirements after shipment, allows for individual differences in test equipment used, and (or) allows for changes in environmental conditions.

Short Form Procedure - The Short Form Procedure has the same sequence of steps and the same limits on checks or adjustments as the Main Procedure.

Main Procedure - The Main Procedure gives more detailed instructions for the calibration of the instrument. This procedure may require that some checks and adjustments be made so that performance is better than that required by the Factory Test Limits. This insures the Factory Test Limits will be met when side panels are added, permits some normal variation in test equipment and plug-in scopes, etc.

Abbreviations in this procedure will be found listed in TEKTRONIX STANDARD A-100. Definitions of terms used in this procedure may be found in TEKTRONIX STANDARD A-101.

In this procedure, all front panel control labels and Tektronix instrument names are in capital letters (VOLT/DIV, etc). Internal adjustment labels are capitalized only (Gain Adj, etc).

This procedure is company confidential

502A

June 1969

For serial number 31,000 and up.

Supersedes May 1966

CHANGE INFORMATION:

This procedure has been prepared by Test-Final Staff Engineering. For information on changes made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact T-FSE, 39-307.

EQUIPMENT REQUIRED

All TEKTRONIX test equipment must be calibrated to Factory Test Limits using methods specified in the applicable TEKTRONIX Factory Calibration Procedure. Other test equipment should be calibrated to its manufacturer's specifications. Exceptions to calibration procedures, which are necessary to improve the measurement capability of some test equipment, e.g. calibrated to ±0.5% accuracy at some specific setting, are noted on this Equipment Required List.

Equivalent test equipment may be used. A Test-Final Staff Engineer must approve any substitutions.

a. TEKTRONIX Instruments

1 **TYPE 547 OSCILLOSCOPE**
1 **TYPE 1A1 DUAL-TRACE UNIT**
1 **TYPE 184 TIME-MARK GENERATOR**
1 **TYPE 106 SQUAREWAVE GENERATOR**

b. Calibration Fixtures and Accessories

1 **P6010 10X Probe** (010-0188-00)
1 **P6011 1X Probe** (010-0193-00)
1 **DC Voltage Bridge** (DCVB) (067-0543-99)
1 **76TU Line Voltage Control Unit (067-0048-00)**
1 **Standard Amplitude Calibrator (067-0502-00)**
1 **Sinewave Generator (LFSWG) (067-0542-99)**
1 **GR to UHF Female adapter (017-0022-00)**
1 **Step Generator (067-0600-99)**
1 **4-way input adapter (067-0114-00)**
2 50Ω, UHF Cables (012-0001-00)
1 50Ω, termination (011-0045-00)
1 **T adapter (103-0026-00)**
1 50Ω, 10X UHF attenuator (011-0031-00)
1 **47pF input normalizer (067-0535-00)**
2 **UHF male to BNC female adapter (103-0015-00)**

c. Other Manufacturers Equipment

1 **20,000** Ω/VDC Multimeter

d. Equipment required for sample check

1 **ESI Model** PVB 300

Factory Test Limits are qualified by the conditions specified in the main body of the Factory Calibration Procedure. The numbers and letters to the left of the limits correspond to the procedure steps where the check or adjustment is made. Steps without Factory Test Limits (setups, presets, etc.) are not listed. Instruments may not meet Factory Test Limits if calibration or checkout methods and test equipment differ substantially from those in this procedure.

4. LOW VOLTAGE POWER SUPPLIES

b. Low Voltage Supplies: Max Ripple

Supply	Tolerance	105VAC to 125VAC
-150	±3%	7.5mV
-5.8	±3%	7.5mV
+100	±3%	7.5mV
+350	±3%	37.5mV

c. Elevated filaments

T602 term 5 +350V ±10%
T602 term 24 -2900V ±5%

5. AMPLITUDE CALIBRATOR SYMMETRY

25V ±20%

6. HIGH VOLTAGE, CRT, AC-DC

a. High Voltage: -2900V ±2%
b. Intensity Balance: Equal intensity between 2 and 8
c. INTENSITY Range: Trace appears between 2 and 6
d. High Voltage Regulation: .5mm, max blooming
e. Geometry: Vertical, ≤ 1mm curvature in 8 cm. Horizontal, ≤ 1mm bowing in 10 cm.
g. Focus: 0.1div display focused

7. HORIZ BEAM REGISTER AND SENS BALANCE

a. Horiz Beam Regis: .5mm, max

* 8. SWEEP TIMING, REGISTRATION AND SWEEP LENGTH

Sweep Timing, Registration and Sweep Length:

Sweep Timing Error:	
1, 2, and 5 sec	±2.5%, max
All other unmagnified ranges	±2%, max
Magnified ranges	±3%, max
Variable TIME/CM range	2.5:1
Sweep Length	10.2 to 10.8cm
Norm/Mag Registration	≤2mm

9. EXTERNAL HORIZONTAL

a. Ext Horiz DC Bal: ≤1.5cm shift
*b. Gain: ±4%, max
*c. Bandwidth: 100kHz, min at -3dB

11. VERTICAL DC BALANCE

b. Var V/CM Bal: ≤5mm shift
c. Trace FINDER
Display must remain within graticule area

12. VERTICAL PRECHECKS

a. Microphonics: ≤2cm (No ringing type)
b. Check Gate Current: ≤1cm
c. Noise: ≤2.5mm
d. Input protection: 25V, max, on each gate

13. GAIN

*b. Attenuator Accuracy: ±1.5%
.1mV range ±3%

13. (CONT'D)

c. VARIABLE SENSITIVITY range: 2.5:1, min

d. Compression/Expansion ≤1mm

14. COMMON MODE DYNAMIC RANGE

Common Mode Dynamic Range: ≥ 30V

15. HIGH FREQUENCY COMPENSATION

Aberration: ≤1%

16. TRIGGER OUTPUT

Signal output: ≥10.24 to ≤15V

17. COMMON MODE REJECTION RATIO

b. Common Mode Rejection Ratio: ≥50,000:1 at 50 kHz

18. ATTENUATOR INPUT COMPENSATION

Aberrations: ≤1.5% (except ≤5% at .1, .2, and .5mV/cm), after first 2μs.

19. ATTENUATOR COMMON MODE REJECTION RATIO

a. Attenuator CMRR: ≥5000:1 at 100Hz
b. Attenuator HF CMRR: ≥500:1 at 50kHz

20. HORIZ MODE GAIN

±2%

21. X-Y PHASING

b. Phasing: ≤0.9° at 100kHz

22. BANDPASS

*a. .1mVOLT PER CM Bandpass: ≥100 kHz
*b. 5mVOLT PER CM Bandpass: ≥1 MHz
*c. Lower bandwidth limit, AC coupled: ≤2Hz

23. INTERNAL TRIGGERING

a. AC Triggering: ≤2mm
b. DC Triggering: ≤2mm

24. EXTERNAL TRIGGERING

EXT AC and DC Triggering: ≤0.5V

25. AUTOMATIC TRIGGERING

Internal: ≤2mm
External: ≤0.5V

26. LINE TRIGGERING

Proper Polarity

27. HOLDOFF

TIME/CM	HOLDOFF
1μs to 5μs	7.5μs to 50μs
10μs to 50μs	60μs to 300μs
.1ms to .5ms	250μs to 1500μs
1ms to 5ms	1.5ms to 10ms
10ms to 50ms	10ms to 70ms
.1s to 5s	100ms to 500ms

28. AMPLITUDE CALIBRATOR

b. Accuracy: ±2%
c. Repetition rate 1kHz ±30%

29. NEON INDICATORS

a. SWEEP MAGNIFIER neon
On when sweep is magnified

b. UNCALIBRATED neon
On for sweep speeds >1μs/cm

c. HORIZ DEF. PLATE SELECTOR neon
On in X-Y mode

30. INTENSITY MODULATION

Modulation with ≤20V

31. SAMPLED CHECKS

b. AMPLITUDE CALIBRATOR Accuracy: ±2%

*Indicates measurement characteristic

This instrument must meet Factory Test Limits before it leaves Manufacturing; therefore, it must be possible to inspect to these limits. Because of normal variations in test equipment and plug-in scopes, addition of side panels, etc, this procedure may require that some checks and adjustments be made so that performance is better than that required by Factory Test Limits.

1. PRELIMINARY INSPECTION

a. Make general examination
b. Check fuses
c. Make CRT prechecks
d. Adjust graticule lights

2. PRESET CONTROLS

3. RESISTANCE

4. LOW VOLTAGE POWER SUPPLIES

a. Adjust -150V supply: R622: -150V
b. Check low voltage supplies, 105VAC to 125VAC line:

Supply	Test Point	Voltage limit	Ripple limit
-5.8V	emitter of Q644	±3%	≤7.5mV
+100V	pin 1, V677	±3%	≤7.5mV
+350V	pin 1, V757	±3%	≤37.5mV

c. Check elevated filaments

Test Point	Voltage
T602 term 5	+350V ±10%
T602 term 24	-2900V ±5%

5. AMPLITUDE CALIBRATOR SYMMETRY

25V±20%

6. HIGH VOLTAGE, CRT, AC-DC

a. Set high voltage: R833: -2900V
b. Check INTENSITY BALANCE: balanced between 2 & 8
c. Check INTENSITY range: trace appears between 2 & 6
d. Check high voltage regulation: ≤0.5mm blooming
e. Adjust Geometry: R841
f. Adjust Astigmatism:
   Upper beam: R844
   Lower beam: R840
g. Check focus
   0.1div display focused

7. HORIZ BEAM REGISTER AND SENS BALANCE

a. Adjust Horiz Beam regis: R842
b. Adjust Horiz Sens Bal: R833

8. SWEEP TIMING, REGISTRATION AND SWEEP LENGTH

Timing accuracy:

1, 2, 5 sec	≤2.5%
.5 SEC thru 1μSEC	≤2%
Magnified timing	≤3%

TIME/CM VARIABLE range: ≥2.5:1
Sweep length: 10.2cm to 10.8cm

9. EXTERNAL HORIZONTAL

a. Adjust Ext Horiz DC Bal: R341
b. Check gain: ±4%
c. Check bandwidth: ≥100kHz

10. STABILITY

11. VERTICAL DC BALANCE

a. Adjust coarse DC Balance: R442
b. Adjust Var V/cm Bal: R457

11. (CONT)

c. Check trace FINDER
Display must stay within graticule area

12. VERTICAL PRECHECKS

a. Check microphonics: ≤2cm
b. Check gate current: ≤1cm
c. Check noise: ≤2.5mm
d. Check input protection: ±25V, max, on each gate

13. GAIN

a. Set gain: R475
b. Check attenuator accuracy: ±1.5%, except .1mV range: ±3%
c. Check VARIABLE SENSITIVITY range: ≥2.5:1
d. Check compression/expansion: ≤1mm

14. COMMON MODE DYNAMIC RANGE:

≥30V

15. HIGH FREQUENCY COMPENSATION

aberration: ≤1%

16. TRIGGER OUTPUT COMPENSATION

Adjust R491 for 0V at pin X
Signal output: ≥10.2V to ≤15V
Adjust C487

17. COMMON MODE REJECTION RATIO

a. Adjust for optimum CMR: R419, C411, C415, C438
b. Check CMRR: ≥50,000:1 at 50kHz

18. ATTENUATOR INPUT COMPENSATION

Adjust C404, C403A, C403C (A input)
Adjust C406, C405A, C405C (B input)

19. ATTENUATOR COMMON MODE REJECTION RATIO

a. Adjust attenuator CMRR: R403E: ≥5000:1
b. Adjust attenuator HF CMRR: C403C, C405C: ≥500:1

20. HORIZ MODE GAIN

Adjust R478 for 8cm deflection

21. X - Y PHASING

a. Adjust deflection plate leads: loop opening: ≤1.25mm
b. Adjust .1mVOLT PER CM Phasing: C408 loop opening: ≤1.25mm
c. Check Upper Beam HF compensation aberration: ≤1%

22. BANDPASS

a. Check .1mVOLT PER CM bandpass ≥100kHz
b. Check 5mVOLT PER CM bandpass ≥1MHz
c. Check lower bandwidth limit, AC coupled: ≤2Hz

23. INTERNAL TRIGGERING

a. Adjust Trig Level Cent: R23
b. Check DC triggering : triggers with 2mm signal

24. EXTERNAL TRIGGERING

Triggering on 0.5 in AC & DC

25. AUTOMATIC TRIGGERING

Triggering on 0.5V in AC & DC

26. LINE TRIGGERING

Proper polarity

27. HOLDOFF

TIME/CM	HOLDOFF
1µs to 5µs	7.5µs to 50µs
10µs to 50µs	60µs to 300µs
.1ms to .5ms	250µs to 1500µs
1ms to 5ms	1.5ms to 10ms
10ms to 50ms	10ms to 70ms
.1s to 5s	100ms to 500ms

28. AMPLITUDE CALIBRATOR

a. Set Cal Ampl: R879
b. Check amplitude calibrator accuracy: ±2%
c. Check repetition rate: 1kHz ±30%

29. NEON INDICATORS

a. Check SWEEP MAGNIFIER neon: on when sweep is magnified
b. Check Uncalibrated neon: on for sweep speeds >1µs/cm
c. Check HORIZ DEF PLATE SELECTOR neon: on in X-Y mode

30. INTENSITY MODULATION

Modulation with ≤20V

31. SAMPLE CHECKS

a. Set Cal Ampl: R879
b. Check amplitude calibrator: ±2%

1. PRELIMINARY INSPECTION

a. Make general examination

Check for unsoldered joints, rosin joints, lead dress and long ends. Check for loose hardware and protruding parts. Check controls for smooth mechanical operation, proper indexing and knob spacing from front panel.

b. Check fuses

117V operation:	159-0017-00	4a 3ag mth fast-blo
234V operation:	159-0003-00	1.6a 3ag mdx slo-blo
110V operation:	159-0026-00	3.2a 3ag mdx slo-blo

c. Make CRT prechecks

Check CRT faceplate tilt relative to front panel; keep black light shield in place. Push CRT forward to a straight edge firmly placed against the front panel, across a diameter of the CRT. Check gap within phosphor area with rule or CRT fact tilt checker (special): 1/32", max. Adjust CRT alignment bracket for tilt, if necessary. Push CRT firmly into base socket. Push CRT forward to the straight edge and tighten CRT clamp. Check tightness of CRT pins.

d. Adjust graticule lights

Position the graticule lights so they are flush with the front surface of the graticule.

2. PRESET CONTROLS

Set the TYPE 502A controls:

UPPER FOCUS	cw
LOWER FOCUS	cw
INTENSITY	ccw
INTENSITY BALANCE	midr
POWER AND SCALE ILLUM	ccw (PWR OFF)

2. (cont'd)

Upper and lower beam verticals:

input selector	A DC
SENSITIVITY	.2 VOLTS PER CM
DC BAL	--
POSITION	midr
STABILITY ADJUST	midr
TRIGGERING LEVEL	ccw (not in AUTOMATIC)
TRIGGER SELECTOR	+UPPER AC
TIME/CM	1mSEC
HORIZONTAL DISPLAY	NORMAL (X1)
HORIZONTAL POSITION	midr
SQUARE-WAVE CALIBRATOR	OFF
HORIZ DEF PLATE SELECTOR (left side)	TIME BASE AMP

Set Internal adjustments:

C408 Upper and Lower Beam Verticals	Min capacitance
All other internal adjustments	midr

Leave controls and adjustments for any step as they were in the step preceding unless noted otherwise.

3. RESISTANCE

Check power supply resistances to chassis ground.

Supply	Check point	approx resistance
117VAC	T602 term 1	inf
117VAC	T602 term 4	inf
-150V	shell C602B	3.5k
+100V	pin 1 V677	4k
+350V	pin 1 V757	9k
6.3 AC	T602 term 18	50Ω
6.3 AC	T602 term 19	50Ω
-5.8 DC	T602 term 11	2.5Ω with V-636 removed

4. LOW VOLTAGE POWER SUPPLIES

a. Adjust -150V Supply ±3%

Connect the 502A to a variable line voltage source set at 117 VAC and turn power on. Connect the multimeter between the -150V supply and ground. Adjust R622 for -150V.

4a. Do not remove any nuvistors or transistors from EC Boards with power on.

b. Check Low Voltage Supplies

Connect the multimeter and a X1 probe from the test scope to the various test points listed below and check power supply ripple, regulation and tolerance. Change the test scope VOLTS/CM and TIME/CM as necessary to measure power supply ripple. Check ripple and regulation while varying the line voltage between 105 VAC and 125 VAC.

Supply	Test Point	Tolerance	Max Ripple
-150	shell of C602B	adjust with R622	7.5mV
-5.8	emitter of Q644	±3%	7.5mV
+100	pin 1 V677	±3%	7.5mV
+350	pin 1 V757	±3%	37.5mV

4b. The -150V supply may be readjusted (within 3%) to bring the other supplies within their value tolerances.

c. Check Elevated Filaments

Set the variable line voltage source to 117 VAC and check elevation of the following filament supplies.

Test Point	Elevation
T602 term 5 or 6	+350V ±10%
T602 term 24 or 25	-2900V ±5%

5. AMPLITUDE CALIBRATOR SYMMETRY

Check AMPLITUDE CALIBRATOR symmetry
25V ±20%

Connect the multimeter to pin 7 of V873 and adjust Cal Amp, R879 for 50V. Set calibrator to any position except OFF. Note meter reading: 25V ±20%

6. HIGH VOLTAGE, CRT, AC-DC

a. Set High Voltage -2900V ±2%

Connect the DCVB between the center top of R833 and GND. Adjust R833 for approx +100V. Connect the DCVB between GND and the High Voltage Test Point. Set HV Adj R826 for -2900V ±2%. Remove the meter leads. Mount the high voltage shields.

Set the TRIGGER LEVEL control to RECURRENT. With the INTENSITY and POSITION controls obtain two traces on the CRT. Adjust the UPPER and LOWER FOCUS controls until the two traces are well defined. Rotate the CRT to position the traces parallel to the horizontal graticule lines.

b. Check INTENSITY BALANCE equal intensity between 2 to 8

Rotate the INTENSITY BALANCE control until the traces have equal intensity. Note the dial reading. It must be between 2 to 8. Set the INTENSITY control full ccw.

c. Check INTENSITY range trace appears between 2 to 6

Rotate the INTENSITY control cw until the traces are just visible. The control indicator must fall between 2 and 6.

d. Check High Voltage Regulation .5mm, max

Attach the 4-way input connector. Apply 1msec and 100µsec markers from the TYPE **184** and adjust the TRIGGERING LEVEL control for a stable display. Set the LOWER BEAM input selector to B, DC and position its display off the screen. Rotate the INTENSITY control full ccw, then rotate it full cw while observing the display. Trace blooming (horiz expansion) must be ≤.5mm. Return the INTENSITY control to normal operating brightness.

e. Adjust Geometry vertical 1mm, max in 8cm horizontal 1mm, max in 10cm

Increase UPPER BEAM SENSITIVITY until TYPE **184** time marks fill the graticule area. Adjust Geom (R841) for minimum curvature of time marks, 1mm in 8cm. Return the LOWER BEAM input selector to A, DC and position its display on the CRT. Check the LOWER BEAM geometry. Compromise Geom Adjust within limits for optimum geometry.

6. These CRT specifications are simplified. Do not reject CRT without the authorization of a trained CRT checker, or without reference to CRT data.

c. One instruments SN 29,050 and above, R861 may be selected if INTENSITY does not fall between 2 and 6. Resistor must be 1W, 10%.

6e. Check geometry (and all other checks) only within each beam's respective scan area of 8cm: ±4cm from reference line.

6e. (cont'd)

Remove the TYPE 184 signal and set the TRIGGERING LEVEL control to RECURRENT. With the vertical POSITION controls, move the traces to the top and bottom of their respective scan areas and note any bowing of the traces; 1mm, max in 10cm.

f. Adjust Astigmatism Upper and Lower Beam

Set UPPER and LOWER FOCUS controls full cw. Set HORIZONTAL DISPLAY to any EXT VOLTS/CM position. With the VERTICAL POSITION and HORIZONTAL POSITION controls place the dots at their respective graticule centers. Adjust Astig Upper (R844) and Astig Lower (R840) for optimum roundness of each dot. With the VERTICAL and HORIZONTAL POSITION controls, move the spots around the perimeters of their respective graticule areas. Check for deflection plate burrs or any other spot distortion.

g. Check Focus

Set the HORIZONTAL DISPLAY switch to NORMAL (X1) and TIME/CM to .1mSEC. Set the UPPER and LOWER BEAM VERTICAL SENSITIVITY switch to .5 VOLTS PER CM and apply 50mV from the STANDARD AMPLITUDE CALIBRATOR. Position each vertical to its own reference line and adjust the FOCUS controls for optimum definition of each display.

Move each beam vertically through its 8cm graticule area. With average intensity each vertical must remain focused well enough so that there is a darkened area between the two lines of each vertical.

7. HORIZ BEAM REGISTER AND SENS BALANCE

a. Adjust Horiz Beam Regis .5mm, max

Connect the TYPE **184** to the 4-way input connector and apply 1msec and 100μsec markers. Set the SENSITIVITY of each vertical to obtain approx 2cm of deflection. Adjust TRIGGERING LEVEL for a stable display and with the VERTICAL POSITION controls, superimpose the traces. Adjust Horiz Beam Regis (R842) so the first TYPE **184** mark on each trace coincides.

b. Adjust Horiz Sens Bal

Adjust CRT Horiz Sens Bal (R833) until all the TYPE **184** marks on each trace coincide. Readjustment of the INTENSITY BALANCE control for equal intensity is necessary each time R833 is adjusted. Readjustment of Horiz Beam Regis, Horiz Sens Bal and INTENSITY BALANCE is necessary due to interaction.

8. SWEEP TIMING, REGISTRATION AND SWEEP LENGTH

Adjust Sweep timing, registration and sweep length

sweep timing error:	
1, 2, 5 sec	*±2.5%, max*
all other unmagnified ranges	*±2%, max*
magnified ranges	*±3%, max*
VARIABLE TIME/CM range	*2.5:1*
sweep length	*10.2 to 10.8cm*

Set UPPER BEAM input selector to A-DC, set LOWER BEAM input selector to B-DC and with the POSITION control, move LOWER BEAM trace off-screen. Adjust or check timing and registration as follows:

8. Unless noted otherwise, use the middle 8 horizontal centimeters when making horizontal amplifier gain and timing checks or adjustments.

8. (cont'd)

TIME/CM	HORIZ DISPLAY	TYPE 184	Check or Adjust	for
1mSEC	X20	100µsec	20X Cal	1 mark/2cm,
.5mSEC	X20	100µsec	check	±1.6mm jitter

Turn HORIZONTAL POSITION so the right end of the sweep is on screen. Note any jitter: none allowed.

1mSEC	X1	1msec	1X Cal	1 mark/cm, ±1.6mm
1mSEC	X2	1msec	check	1 mark/2cm, ±2.4mm
1mSEC	X5	100µsec	check	2 marks/cm, ±2.4mm
1mSEC	X10	100µsec	check	1 mark/cm, ±2.4mm
1mSEC	X20	1msec	horizontal POSITION	place first mark at center graticule line
1mSEC	X1	1msec	Mag Regis	reposition first mark to center graticule line

The HORIZONTAL POSITION and Mag Regis interact, repeat and readjust as necessary. Return the first mark to the first graticule line. Rotate the VARIABLE TIME/CM control ccw noting that the UNCALIBRATED neon light operates when the control is moved from its detent position. At its maximum ccw position there must be a minimum of 5 markers per 2cm (2.5:1 range). Return the control to its CALIBRATED position.

Set the TYPE 184 for 1msec and 100µsec markers out. Adjust the TRIGGERING LEVEL control for a stable display and adjust Swp Length (R176) for a trace length of 10.2 to 10.8cm.

Rotate the HORIZONTAL POSITION control full cw and check that the first mark falls to the right of the center graticule line. Rotate the control full ccw and check that the last mark falls to the left of the graticule line. Recenter the display with the POSITION control.

Check the sweep timing as follows:

8. (cont'd)

TIME/CM	TYPE 184		
.1mSEC X1	100µsec	check	1 mark/cm, ±1.6mm
.2mSEC X1	100µsec	check	2 marks/cm, ±1.6mm
.5mSEC X1	500µsec	check	1 mark/cm, ±1.6mm
1mSEC X1	1msec	check	1 mark/cm, ±1.6mm
2mSEC X1	1msec	check	2 marks/cm, ±1.6mm
5mSEC X1	5msec	check	1 mark/cm, ±1.6mm
10mSEC X1	10msec	check	1 mark/cm, ±1.6mm
20mSEC X1	10msec	check	2 marks/cm, ±1.6mm
50mSEC X1	50msec	check	1 mark/cm, ±1.6mm

Set MODE to SINGLE SWEEP. For each of the following timing checks press MODE switch to RESET, note that READY neon lights, and trace sweeps only once.

.1 SEC X1	100msec	check	1 mark/cm, ±1.6mm
.2 SEC X1	100msec	check	2 marks/cm, ±1.6mm
.5 SEC X1	500msec	check	1 mark/cm, ±1.6mm
1 SEC X1	1 sec	check	1 mark/cm, ±2.0mm
2 SEC X1	1 sec	check	2 marks/cm, ±2.0mm
5 SEC X1	5 sec	check	1 mark/cm, ±2.0mm

Set the TIME/CM switch to 10µsec and the TYPE 184 for 10µsec marks. Apply 100µsec triggers from the TYPE 184 to the EXT TRIGGER INPUT. Set the TRIGGER SELECTOR to EXT AC and the MODE switch to NORMAL. Adjust the TRIGGERING LEVEL control for a stable display. Set the test scope to AC and connect a 10X probe to pin 3 of V183. Preadjust C311 for a flat base on the holdoff waveform. Remove the probe. Check or adjust HF timing as follows:

8. (cont'd)

TIME/CM	HORIZ DISPLAY	TYPE 184	Check or Adjust	for
10μSEC	X1	10μsec	C160C	1 mark/cm, ±1.6mm
20μSEC	X1	10μsec	check	2 marks/cm, ±1.6mm
50μSEC	X1	50μsec	check	1 mark/cm, ±1.6mm
5μSEC	X1	5μsec	C160A	1 mark/cm, ±1.6mm
1μSEC	X1	1μsec	C311	1 mark/cm, ±1.6mm
2μSEC	X1	1μsec	check	2 marks/cm, ±1.6mm

C311 and C160A interact, repeat the adjustments as necessary. Remove the TYPE 184 signal and trigger. Return the TRIGGER SELECTOR to UPPER AC and set the TRIGGERING LEVEL control to RECURRENT.

9. EXTERNAL HORIZONTAL

a. Adjust Ext Horiz DC Bal *1.5cm shift, max*

Ground the EXTERNAL HORIZONTAL input and adjust Ext Horiz DC Bal (R341) for minimum shift of the spot while switching between 2 and .1 of the EXT VOLTS/CM switch. Remove the ground.

b. Check Gain *±4%, max*

Set the HORIZONTAL DISPLAY EXT VOLTS/CM switch to 2 and connect the STANDARD AMPLITUDE CALIBRATOR (SAC) to the EXTERNAL HORIZONTAL input. Check the horizontal deflection as follows:

EXT VOLTS/CM	SAC	horizontal deflection
2	10V	5cm ±2mm
1	5V	5cm ±2mm
.5	2V	4cm ±1.6mm
.2	1V	5cm ±2mm
.1	0.5V	5cm ±2mm

Remove the SAC signal.

9. (CONT)

c. Check bandwidth: 100kHz, min at -3dB

Set the SINE WAVE GENERATOR FREQUENCY to 1 +0, MULTIPLIER to 10kHz and AMPLITUDE to 1. Connect SINE WAVE GENERATOR -- 50Ω cable -- clip lead adapter -- TYPE 502A HORIZONTAL DISPLAY EXTERNAL input. Adjust the AMPLITUDE MULTIPLIER for exactly 6cm of horizontal deflection on the TYPE 502A. Change the SINE WAVE GENERATOR MULTIPLIER switch to 100kHz. Check for at least 4.25cm of horizontal deflection. Remove the SINE WAVE GENERATOR connections and set the HORIZONTAL DISPLAY switch to NORMAL (X1).

10. STABILITY

Adjust Stability

Set the TIME/CM switch to 50μsec and the TRIGGERING LEVEL control to AUTOMATIC. Connect the multimeter between the STABILITY ADJUST pot center arm and ground.

Rotate the STABILITY ADJUST full ccw (trace will disappear). Turn slowly cw noting the meter reading where trace first appears. Continue turning cw until the trace brightens (free runs) and again note meter reading. Set the STABILITY ADJUST halfway between the two meter readings. Remove the meter leads. Set the LOWER BEAM input selector to A-DC and return the LOWER BEAM trace to the graticule area with the VERTICAL POSITION control.

11. VERTICAL DC BALANCE

a. Adjust coarse DC Balance

Short the input of the 4-way input connector. Set the UPPER BEAM DC BAL to midr and adjust the coarse DC Bal (R442) for no trace shift as the SENSITIVITY switch is rotated from .2 VOLTS PER CM to .1mVOLTS PER CM.

11. (CONT)

b. Adjust Var V/CM Bal

Return the SENSITIVITY switch to .2 VOLTS PER CM and with the POSITION control, position the trace to the beam reference line. Set the SENSITIVITY switch to .1mVOLTS PER CM and adjust DC BAL to bring the trace back to the beam reference line. Reset the SENSITIVITY switch to .2 VOLTS PER CM. Rotate the VARIABLE SENSITIVITY back and forth thru its range while adjusting the Var V/C Bal (R457) for no vertical shift at the reference line.

Repeat for the lower beam amplifier.

c. Check trace FINDER

Press UPPER BEAM trace FINDER, rotate POSITION throughout its range, and check that trace stays within graticule area.

Repeat for LOWER BEAM.

12. VERTICAL PRECHECKS

a. Check microphonics ≤2cm (no ringing type)

Set the UPPER BEAM SENSITIVITY switch to .4mVOLTS PER CM. Set the base of the micro-shock hammer on the top, front, center of the scope and check for microphonics.

b. Check Gate Current ≤1cm

Set the UPPER BEAM SENSITIVITY switch to .1mVOLTS PER CM. While observing the trace, set the input selector to A-AC and note trace shift: 1cm, max. Set the input selector to B-DC, note the trace position, and switch to B-AC. Check trace shift: 1cm, max. Return the input selector to A-DC.

c. Check noise ≤2.5mm

Set the TRIGGER SELECTOR to -LINE and the TIME/CM switch to 10msec. Set the TRIGGERING LEVEL control to AUTOMATIC. Check for noise: 2.5mm, max. Return the TRIGGER SELECTOR to +UPPER AC and TIME/CM to 1msec.

Repeat for the lower beam amplifier.

Install FET and transistor shield.

Remove the short from the 4-way imput connector.

12. (CONT)

d. Check input protection

Set the UPPER BEAM SENSITIVITY to .1mVOLTS PER CM and input selector to A-AC. Set the LOWER BEAM SENSITIVITY to 20 VOLTS PER CM. Set the Step Generator (067-0600-99) AMPLITUDE for +350VDC. Connect the output of the Step Generator to the 4-way input connector. Connect a test scope probe to the gate of Q410A (UPPER BEAM). Press and release the button to provide a + step. Check for a + pulse ≤25V in amplitude. Change the Step Generator to provide a - pulse, and press the button. Check for a - pulse ≤25V in amplitude. Change the UPPER BEAM input selector to B-AC, connect the test probe to the gate of Q410B (UPPER BEAM), and again apply a + and - step to the input and check for ±25V max pulse.

Change the UPPER BEAM SENSITIVITY to 20 VOLTS PER CM and LOWER BEAM SENSITIVITY to .1mVOLTS PER CM and input selector to A-AC. Connect the test probe to the gate of Q410A (LOWER BEAM), apply a + and - step to the input, and check that the pulses are ≤25V in amplitude. Change the LOWER BEAM input selector to B-AC, the test probe to the gate of Q410B (LOWER BEAM), and apply + and - steps to the input. Check that input protection limits the pulses to ≤25V. Remove the Step Generator and test probe.

13. GAIN

a. Set Gain

Set the UPPER BEAM SENSITIVITY switch to 10mVOLTS PER CM. Apply 50mV from the STANDARD AMPLITUDE CALIBRATOR (SAC) and adjust the Gain Adj (R475) for exactly 5cm deflection. Repeat for the lower beam amplifier.

b. Check Attenuator Accuracy ±1.5%
.1mV range ±3%

Check the attenuator accuracy of both beams simultaneously as follows:

input selector	SENSITIVITY/CM	SAC	check	for
A DC	.1mVOLTS	.5mV	check	5cm, ±1.5mm
A DC	.2mVOLTS	1mV	check	5cm, ±.75mm
A DC	.5mVOLTS	2mV	check	4cm, ±.6mm
A DC	1mVOLTS	5mV	check	5cm, ±.75mm
A DC	2mVOLTS	10mV	check	5cm, ±.75mm
A DC	5mVOLTS	20mV		4cm, ±.6mm
A DC	10mVOLTS	50mV	check	5cm, ±.75mm
A DC	20mVOLTS	.1 V	check	5cm, ±.75mm
A DC	50mVOLTS	.2 V	check	4cm, ±.6mm
A DC	.1 VOLTS	.5 V	check	5cm, ±.75mm
A DC	.2 VOLTS	1 V	check	5cm, ±.75mm
A DC	.5 VOLTS	2 V	check	4cm, ±.6mm
A DC	1 VOLTS	5 V	check	5cm, ±.75mm
A DC	2 VOLTS	10 V	check	5cm, ±.75mm
A DC	5 VOLTS	20 V	check	4cm, ±.6mm
A DC	10 VOLTS	50 V	check	5cm, ±.75mm
A DC	20 VOLTS	100 V	check	5cm, ±.75mm
B DC	.1mVOLTS	.5mV	check	5cm, ±1.5mm
B DC	.2mVOLTS	1mV	check	5cm, ±.75mm
B DC	.5mVOLTS	2mV	check	4cm, ±.6mm
B DC	1mVOLTS	5mV	check	5cm, ±.75mm
B DC	2mVOLTS	10mV	check	5cm, ±.75mm
B DC	5mVOLTS	20mV	check	4cm, ±.6mm
B DC	10mVOLTS	50mV	check	5cm, ±.75mm
B DC	20mVOLTS	.1 V	check	5cm, ±.75mm
B DC	50mVOLTS	.2 V	check	4cm, ±.6mm
B DC	.1 VOLTS	.5 V	check	5cm, ±.75mm
B DC	.2 VOLTS	1 V	check	5cm, ±.75mm

13b. (CONT)

B DC	.5 VOLTS	2 V	check	4cm, ±.6mm
B DC	1 VOLTS	5 V	check	5cm, ±.75mm
B DC	2 VOLTS	10 V	check	5cm, ±.75mm
B DC	5 VOLTS	20 V	check	4cm, ±.6mm
B DC	10 VOLTS	50 V	check	5cm, ±.75mm
B DC	20 VOLTS	100 V	check	5cm, ±.75mm

The Gain Adj may be adjusted (within limits ±1.5%) to bring the other attenuator positions within tolerance.

c. Check VARIABLE SENSITIVITY RANGE 2.5:1, min

Rotate both VARIABLE SENSITIVITY controls full ccw and check for 2cm deflection or less. Return the controls to the CALIBRATED position.

Repeat for lower beam amplifier.

d. Check Compression/Expansion ≤1mm

Adjust the UPPER BEAM VARIABLE SENSITIVITY for 2cm deflection at the Upper Beam's graticule center. Check deflection at top and bottom of Upper Beam's graticule area: 1.9cm to 2.1cm.

Repeat for LOWER BEAM.

14. COMMON MODE DYNAMIC RANGE

Check Common Mode Dynamic Range 30V, min

Set the UPPER and LOWER BEAM SENSITIVITY switches to 10mVOLTS PER CM and the input selectors to A-B (DIFF) AC. Apply a 1 kHz signal from the SINE WAVE GENERATOR to the 4-way input. Increase the amplitude of the applied signal until a distortion of the trace occurs. The amplitude of the signal must be 30V P to P or greater. Remove the signal from the 4-way input connector. Return the input selectors to A-DC.

Repeat for lower beam amplifier.

15. HIGH FREQUENCY COMPENSATION

Adjust HF Comp *aberration ±1%*

Connect a 50Ω cable from the TYPE 106 SQUARE WAVE GENERATOR FAST RISE OUTPUT with a 50Ω Termination to the 4-way input connector. Adjust the TYPE 106 for 10 kHz and an amplitude of 6cm on the UPPER BEAM VERTICAL. Position top of waveform to graticule center. Set the TIME/CM switch to 20μsec and adjust HF Comp (C496) for optimum response. Aberrations are not to exceed .6mm (1%).

Repeat for lower beam amplifier.

Remove the TYPE 106 signal from the 4-way input connector.

16. TRIGGER OUTPUT COMPENSATION

Adjust Trigger Output Compensation

Set the input selectors of both beams to A-DC and the SENSITIVITY switches to 10mVOLTS PER CM. Balance the verticals using the DC Bal control and set TIME/CM to .5msec. Set trace to respective graticule center and adjust R-491 for zero volts on pin X. Connect a 50Ω cable with a 50Ω termination to the 4-way input connector from the TYPE 106 HI AMPLITUDE OUTPUT connector. Adjust the TYPE 106 for a frequency of 10kHz and an amplitude of 6cm. Connect a X1 probe from the test scope to the UPPER BEAM Vertical Sig output connector. Check for ≥10.2 to ≤15V signal and adjust C487 for optimum square-wave as indicated on the test scope.

Repeat for the LOWER BEAM VERTICAL. Remove the X1 probe and the TYPE 106 signal from the 4-way input connector.

Recheck step 15.

17. COMMON MODE REJECTION RATIO

a. Adjust for optimum Common Mode Rejection

Set both input selectors to A-B, DC and both SENSITIVITY switches to .1mVOLTS PER CM. Set the TIME/CM switch to .1msec and the HORIZONTAL DISPLAY switch to EXT VOLTS/ CM 1. From the SINE WAVE GENERATOR, apply a 50 Hz, 10V P to P signal to the 4-way input and EXTERNAL HORIZONTAL input connector.

With UPPER BEAM DC BAL and POSITION controls, bring the display to its respective graticule area and adjust Common Mode DC Bal (R419) for minimum tilt of the display.

The DC Bal will have to be readjusted to keep trace on screen.

Set the SINE WAVE GENERATOR to 500Hz, 10V, and adjust C411 for minimum tilt.

Set the SINE WAVE GENERATOR to 50 kHz, 10V and adjust HF Common Mode Bal .1mV (C415) for minimum opening of the loop.

Q414 and Q514 may be interchanged or selected to improve overall CMRR. If changed, recheck step 11a.

Set the UPPER BEAM SENSITIVITY switch to .2 VOLTS PER CM and the HORIZONTAL DISPLAY to NORMAL (X1). Adjust HF Common Mode Bal .2V (C438) for minimum deflection of the 50 kHz signal: .5mm maximum deflection. Repeat the above adjustments due to interaction of R419, **C411, C415, and C438.**

Repeat for the LOWER BEAM VERTICAL.

b. Check Common Mode Rejection Ratio ≥50,000:1 at 50 kHz

With the 50 kHz 10V P to P signal applied check CMRR as follows. Check both beams simultaneously.

SENSITIVITY	Max CMRR Signal
.1mVOLTS PER CM	2.0cm
.2mVOLTS PER CM	1.0cm
.5mVOLTS PER CM	4mm
1mVOLTS PER CM	2mm
2mVOLTS PER CM	1mm
5mVOLTS PER CM to .2 VOLTS PER CM	less than .5mm deflection.

Remove the signal from the 4-way input connector and set input selectors to A-DC.

18. ATTENUATOR INPUT COMPENSATION

Adjust Attenuator Input Compensation
±1% aberration

Connect a 50Ω cable with a 50Ω Termination from the TYPE 106 HI AMPLITUDE OUTPUT to the 47pF Input Normalizer. Connect the normalizer to the UPPER BEAM A input, set the TYPE 106 for a 1 kHz, 5cm signal and the TIME/CM switch to .2msec.

Adjust C404 for best flat top and corner. Set the SENSITIVITY switch to .5 VOLTS PER CM and again adjust the TYPE 106 for an amplitude of 5cm. Adjust C403A for best flat top and C403C for best front corner. Check all positions of the SENSITIVITY switch for proper compensation. There must be no more than 1% aberration on any attenuator setting.

Remove the normalizer from the A input and connect it to the B input. Set the input selector to B-DC and return the SENSITIVITY switch to the .2 VOLTS PER CM position. Adjust C406 for best flat top and corner on the bottom of the waveform. Set the SENSITIVITY switch to .5 VOLTS PER CM and adjust C405A for best flat top and C405C for best front corner of the bottom of the waveform. Again check all positions of the SENSITIVITY switch for proper compensation. No more than 1% aberration on any attenuator setting.

Repeat for the LOWER BEAM VERTICAL. Remove the normalizer and replace the 4-way input connector.

19. ATTENUATOR COMMON MODE REJECTION RATIO

a. Adjust Attenuator CMRR : ≥5000:1

Set the UPPER and LOWER BEAM input selectors to A-B, DC and the SENSITIVITY switches to .5 VOLTS PER CM. Set the TIME/CM switch to 10msec and apply a 100 Hz, 100V P to P signal from the SINE WAVE GENERATOR to the 4-way input connector. Adjust UPPER BEAM Atten LF CM (R403E) for optimum rejection: ≥5000:1 (≤.4mm deflection). Repeat for the LOWER BEAM VERTICAL.

b. Adjust Attenuator HF CMRR: ≥500:1

Set the TIME/CM switch to .1msec and apply 50 kHz, 100V P to P from the SINE WAVE GENERATOR. Adjust C403C and C405C of the UPPER BEAM Attenuator for maximum rejection. (This is a fine readjustment.) 4mm max deflection (≥500:1). Repeat for LOWER BEAM VERTICAL. Remove the signal from the 4-way input connector.

19b. Leads to attenuator may have to be dressed for optimum CMRR.

20. HORIZ MODE GAIN

Adjust Horiz Mode Gain

Set the traces to their respective graticule reference lines. Set the HORIZ DEF PLATE SELECTOR (left side) to UPPER BEAM AMP and the UPPER BEAM input selector to A-B, DC. Connect a 50Ω cable from the SINE WAVE GENERATOR set at 1 kHz to the 4-way input connector. Adjust the amplitude of the SINE WAVE GENERATOR for exactly 8cm of vertical deflection. Set the UPPER BEAM input selector to A-DC and the LOWER BEAM input selector to A-B, DC. Adjust the Gain Adj for Horiz Mode (R478) for exactly 8cm of horizontal deflection.

21. X-Y PHASING

a. Adjust Deflection Plate leads for minimum loop opening, 1.25mm max

Set the LOWER BEAM input selector to A-DC and the SINE WAVE GENERATOR to 100 kHz. Dress the deflection plate leads to obtain ≤1.25mm loop opening along vertical graticule line.

b. Adjust .1mVOLT PER CM Phasing for minimum loop opening: 1.25mm max

Return the LOWER BEAM input selector to A-B, DC and set both beam SENSITIVITY switches to .1mVOLTS PER CM. Reduce the SINE WAVE GENERATOR amplitude and/or add 50Ω Attenuator pads to obtain 8cm of horizontal deflection. Set the LOWER BEAM input selector to A-DC and adjust C408 UPPER and LOWER BEAM for minimum loop opening: 1.25mm max. (Compromise the adjustments of C408 between the UPPER and LOWER VERTICALS to maintain minimum capacitance on both while obtaining desired results.)

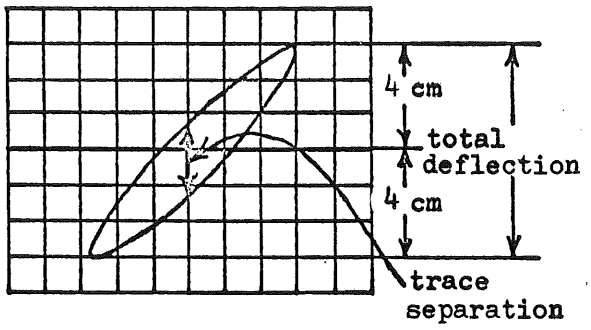
Check all positions of the SENSITIVITY switches for maximum loop opening of 1.25mm. Maintain 8cm of deflection in each position as explained above except the 20 VOLTS PER CM position, where the SINE WAVE GENERATOR cannot supply the necessary output amplitude required. Adjust for 4cm deflection and check for .5mm loop opening, max.

c. Check UPPER BEAM HF Compensation

Return the Horiz Def Plate Selector to Time Base Amp, remove the SINE WAVE GENERATOR signal from the 4-way input and the UPPER BEAM SENSITIVITY switch to 10mVOLTS PER CM.

Recheck HF Compensation (step 15) and adjust if necessary. If adjusted, repeat step 22.

b. Procedure to measure X-Y Phasing.



22. BANDPASS

a. Check .1mVOLT PER CM Bandpass 100 kHz, min

Set the TIME/CM switch to 1msec and both UPPER and LOWER BEAM verticals to .1mVOLTS PER CM. Set the TRIGGERING LEVEL control to RECURRENT and position the LOWER BEAM trace off the graticule. Connect a 50Ω cable from the SINE WAVE GENERATOR set at 1 kHz to the 4-way input connector. Adjust the amplitude control to obtain a 6cm display. (It may be necessary to add attenuator pads to obtain proper amplitude.) Increase the SINE WAVE GENERATOR frequency to 100 kHz. The amplitude of the display must not be less than 4.2cm. Return the SINE WAVE GENERATOR to 1 kHz, position the UPPER BEAM off the graticule and repeat for the LOWER BEAM.

b. Check 5mVOLT PER CM Bandpass 1 MHz, min

Set both beam SENSITIVITY switches to 5mVOLTS PER CM. Return the SINE WAVE GENERATOR to 1 kHz and adjust for a 4cm display on the LOWER BEAM. Increase the frequency to 1 MHz and check for an amplitude of not less than 2.8cm. Return the UPPER BEAM to the graticule area and repeat.

c. Check lower bandwidth limit, AC coupled: ≤2Hz

Return SINE WAVE GENERATOR to 1kHz and check for 4cm of display with UPPER BEAM input selector at A-AC. Change frequency to 2Hz and check signal amplitude: ≥2.8cm and <4cm.

Repeat for LOWER BEAM.

Remove the signal from the 4-way input connector.

23. INTERNAL TRIGGERING

a. Adjust Trig Level Cent: 2mm min

Set both beam SENSITIVITY switches to 1 VOLT PER CM and the TIME/CM switch to .5msec. Connect a 50Ω cable from the SAC set at .2V to the 4-way input connector. Connect a multimeter between the center arm of the TRIGGERING LEVEL pot (R17) and gnd. Adjust the TRIGGERING LEVEL control to obtain a 0V reading on the meter. While switching the TRIGGER SELECTOR back and forth between + and -, adjust the Trig Level Cent Adjust (R23) to obtain proper triggering for the + and - positions of the TRIGGER SELECTOR.

Set the TRIGGER SELECTOR to LOWER AC and check for proper triggering.

b. Check DC Triggering: 2mm min

Position the 2mm display to their respective graticule reference lines. Set the TRIGGER SELECTOR to LOWER DC and while switching the TRIGGER SELECTOR back and forth between + and - adjust the TRIGGERING LEVEL control to obtain proper triggering for the + and - positions of the TRIGGER SELECTOR.

24. EXTERNAL TRIGGERING

Check EXT AC and DC triggering: 0.5V min

Set the TRIGGER SELECTOR to EXT AC and apply .5V signal from the SAC to both the 4-way input connector and the Ext TRIGGER INPUT. The display must trigger in both the + and - positions of the TRIGGER SELECTOR with adjustment of the TRIGGERING LEVEL control (but not AUTOMATIC). Repeat the above with the TRIGGER SELECTOR in EXT DC.

25. AUTOMATIC TRIGGERING

Check Automatic Triggering: *2mm Int min*
.5V Ext min

Set the TRIGGERING LEVEL control to AUTOMATIC and check for proper triggering in both EXT AC and EXT DC while switching the TRIGGER SELECTOR back and forth between + and -.

Set the SAC for .2V and check for proper triggering in all INT positions of the TRIGGER SELECTOR while switching back and forth between + and -. Remove the SAC signal and the 4-way input connector.

26. LINE TRIGGERING

Check Line Triggering

Set the TRIGGERING SELECTOR to LINE and TIME/CM to .5msec. Set the UPPER BEAM SENSITIVITY switch to 10 VOLTS PER DIV, connect a 10X probe to the UPPER BEAM A input and attach the probe to the 117 VAC fuse holder. It must be possible to trigger the display in both the + and - positions of the TRIGGER SELECTOR using the TRIGGERING LEVEL control (not in AUTOMATIC). Remove the probe and return the TRIGGER to UPPER DC.

27. HOLDOFF

Check Holdoff

Set the TRIGGERING LEVEL control to RECURRENT. Connect a X10 probe from the test scope (DC coupled) to pin 1 of V324. Check holdoff as follows:

TIME/CM	HOLDOFF
1µs to 5µs	7.5µs to 50µs
10µs to 50µs	60µs to 300µs
.1ms to .5ms	250µs to 1500µs
1ms to 5ms	1.5ms to 10ms
10ms to 50ms	10ms to 70ms
.1s to .5s	100ms to 500ms
1s to 5s	100ms to 500ms

Remove the probe.

28. AMPLITUDE CALIBRATOR

a. Set the 50V range ±2%

Remove V875 from the 502A and set the AMPLITUDE CALIBRATOR at 50V. Set the TRIGGERING LEVEL to AUTOMATIC, the TRIGGER SELECTOR to +LINE and TIME/CM to 5mSEC. Set the LOWER BEAM VERTICAL Input Selector to A, AC coupled and SENSITIVITY to 50mV.

Connect a 50Ω coax cable from the AMPLITUDE CALIBRATOR to the STANDARD AMPLITUDE CALIBRATOR (SAC) UNKNOWN INPUT. Set the SAC AMPLITUDE to 50V and the MODE to +DC, MIXED. Connect a 50Ω coax cable from the SAC OUTPUT to the 502A LOWER BEAM A Input. Adjust Cal Amp R879 for zero deflection on the CRT.

b. Check Amplitude Calibrator Accuracy ±2%

Check all positions of the Amplitude Calibrator as follows:

AMPLITUDE CALIBRATOR	SAC	LOWER BEAM SENSITIVITY	max diff
50V	50V	.5 V	2cm
5V	5V	50mV	2cm
.5V	.5V	5mV	2cm
50mV	50mV	.5mV	2cm
5mV	5mV	.1mV	1cm
.5mV	.5mV	.1mV	1mm

Replace V875.

c. Check repetition rate 1kHz ±30%

Apply 1ms markers to 502A and set TIME/CM and VARIABLE for 0.2ms/div (5div/marker). Apply CAL OUT to 502A and check calibrator period: 0.77ms to 1.43ms.

29. NEON INDICATORS

a. Check SWEEP MAGNIFIER neon

Set HORIZONTAL DISPLAY to each position of SWEEP MAGNIFIER (X2 to X20). Check that the SWEEP MAGNIFIER neon lights in all settings.

29. (CONT)

b. Check the UNCALIBRATED neon

The UNCALIBRATED neon must light whenever the sweep speed exceeds 1μSEC/CM. Check as follows:

SWEEP MAGNIFIED	TIME/CM range
X20	10 through 1μSEC
X10	5 through 1μSEC
X5	2 through 1μSEC
X2	1μSEC

Return the HORIZONTAL DISPLAY to NORMAL (X1) and the TIME/CM switch to 1msec.

c. Check HORIZ DEF PLATE SELECTOR neon

Set the HORIZ DEF PLATE SELECTOR to UPPER BEAM AMP. The neon (next to SCALE ILLUM) must light. Return the selector to TIME BASE AMP.

30. INTENSITY MODULATION

Check Intensity Modulation: ≤20V, min

Remove the strap from the CRT cathode binding post, located on the rear panel. Connect a cable from the SAC, set at 20V to the binding post. Check the trace for intensity modulation. Remove the SAC signal and replace the strap.

31. SAMPLE CHECKS

THE FOLLOWING CHECKS ARE NOT MADE ON 100% OF THE INSTRUMENTS, BUT ARE DONE ON A SAMPLING BASIS.

a. Set the AMPLITUDE CALIBRATOR 50V range ±2%

Remove V875 from the TYPE 502A and set the AMPLITUDE CALIBRATOR to 50V. Set up the Portametric PVB 300 to measure 50V and connect it to the AMPLITUDE CALIBRATOR CAL OUT. Adjust Cal Amp R879 for a null as indicated on the PVB.

b. Check AMPLITUDE CALIBRATOR Accuracy ±2%

Check all positions of the AMPLITUDE CALIBRATOR for accuracy as indicated on the PVB 300 decade dials.

THE END