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

535A

Tek form number:

March 1968
For all serial numbers.

CHANGE INFORMATION:

This procedure has been prepared by Product Manufacturing Staff Engineering. For information on changes made to this procedure, to make suggestions for changing this procedure, or to order additional copies: please contact PMSE, 39-307. (HD)

EQUIPMENT REQUIRED:

The following equipment is necessary to complete this procedure:

a. TEKTRONIX Instruments

1	TYPE 647 OSCILLOSCOPE with
1	TYPE 10A2 PLUG-IN UNIT and
1	TYPE 11B2 PLUG-IN UNIT (test scope)
*1	TYPE 184 TIME MARK GENERATOR
*1	TYPE 191 CONSTANT AMPLITUDE SIGNAL GENERATOR
1	TYPE 76TU LINE VOLTAGE CONTROL UNIT
1	TYPE 1A2 PLUG-IN UNIT
1	TYPE P6028 1X Probe
1	TYPE P6006 10X Probe

b. Test Fixtures and Accessories

*1	STANDARD AMPLITUDE CALIBRATOR (067-0502-00)
1	SINE WAVE GENERATOR (067-0542-99)
*1	CALIBRATION FIXTURE (067-0521-00)
1	50Ω Termination, BNC (011-0049-00)
2	Coaxial cables 50Ω 42 inches BNC (012-0057-00)
2	UHF Male to BNC Female Adapters (103-0015-00)
1	GR to BNC Female Adapter (017-0063-00)
1	Micro Shock Hammer

c. Other Equipment

1	Multimeter 20,000Ω/Volt (Sompson 262 or equivalent

*This equipment must be traceable to NBS for certification of measurement characteristics.

Substitute test equipment may be used. The Plant Staff Engineer must approve any substitutions. All equipment listed must perform within its manufacturer's specifications, unless otherwise stated.

QUALIFICATION

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 (set-ups, 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. POWER SUPPLIES

a. Time-delay relay: 15 to 60 seconds

b.

Power Supply	Max Error	MaxRipple
-150	±3V	5mV
+100	±2V	10mV
+225	±4.5V	5mV
+350	±7V	20mV
+500	±10V	20mV

regulation: 104.5VAC line to 125.5VAC line, high and low load

d. -1350 Volts: regulation: no trace bloom or voltage change >20V from 104.5 VAC to 125.5VAC line

5. GEOMETRY

a. Trace alignment: ≤0.5mm max error

c. Geometry bowing 1mm, max

6. FOCUS

a. Horizontal focus: no ovelap of 1mm spaced marks over the center 8.8cm of the graticule

b. Vertical focus: no overlap of 1mm spaced marks

7. BEAM POSITION INDICATORS AND SCALE ILLUMINATION

b. Beam position indicators: The proper beam position indicators must light and the opposite neon must go out before the spot leaves the graticule area.

c. SCALE ILLUM: on max, cw; off, ccw

8. 5X MAGNIFIER AND VARIABLE INDICATORS

a. MAG ON indicator: neon must light when 5X MAG knob is ON

b. UNCALIBRATED

TIME/CM VARIABLE	Indicator neon
CALIBRATED	off
all other positions	on

c. Time base indicators

indicator on	HORIZONTAL DISPLAY
A	A
A	"A" SINGLE SWEEP
B	all other positions

9. INTENSITY MODULATION: ≤20V

*10. VERTICAL AMPLIFIER

a. Output amplifier balance: 0.75cm

b. Driver cathode follower balance: 0.75cm

c. Overall amplifier balance

d. Hum and mincrophonics: hum 0.5mm; microphonics 2.5mm

e. Vertical gain: .1V/cm ±2%; range +10% and -10%

f. Compression/expansion: 1mm max with 2cm display

g. DC shift: 2mm, max after 3cm deflection

h. Vertical drift: 0.5cm, max from 104.5VAC to 125.5VAC

11. ALTERNATE TRACE AND CHOPPED BLANKING

a. Alternate trace: all sweep speeds A sweep

b. Alternate trace sync pulse: Amplitude ≥60V negative pulse rise-time ≤1μs

c. Alternate trace: all sweep speeds B sweep

d. Chopped blanking: blanking of fast chopping transients

*12. AMPLITUDE CALIBRATOR

b. Accuracy: ±2% all positions
c. Period: 1ms ±20%
d. Duty cycle: 45% to 55%

13. TIME BASE A TRIGGERING

c. Trigger sensitivity: will not trigger on 0.05V EXT
g. Triggering:

	±INT	±EXT
AC	2mm	0.2V
AC LF REJ	2mm	0.2V
DC	4mm within	
	4mm	0.2V
AUTO	2mm	0.2V

h. TRIGGERING LEVEL range: at least + and - 10V
i. Line triggering: correct slope

14. TIME BASE B TRIGGERING

f. Triggering

	±INT	±EXT
AC	2mm	0.2V
DC	4mm within	
	4mm	0.2V
AUTO	2mm	0.2V

g. TRIGGER LEVEL range: at least + and - 10V
h. Line triggering: correct slope

15. HIGH FREQUENCY SYNC

a. EXT HF sync: 1.5V at 5MHz and 30MHz; ≤1mm jitter
b. INT HF sync: 1.5cm at 5MHz and 30MHz; ≤1mm jitter

16. TIME BASE A LOW AND HIGH FREQUENCY TRIGGERING

	INT	EXT
a. AC at 5MHz:	1cm	1.0V
b. DC at 5MHz:	2cm	1.0V
c. AUTO at 2MHz:	1cm	1.0V
d. AC LF REJ at 200Hz:	Inoperable	
	2cm	2.0V

17. TIME BASE B HIGH FREQUENCY TRIGGERING

	INT	EXT
a. AC at 3MHz	1cm	1.0V
b. DC at 3MHz	2cm	1.0V
c. AUTO at 2MHz	2cm	1.0V

*18. HORIZONTAL AMPLIFIER

b. Sweep magnified: ±3%

19. MATCH TIME BASES

a. ±0.5% at 1 MILLISEC

20. TIME BASE A SWEEP LENGTH

a. Sweep length: 10.2 to 10.8cm

21. NORMAL MAGNIFIED REGISTRATION

a. Norm/Mag Regis: ±0.5cm at graticule center

22. VARIABLE TIME/CM

a. VARIABLE ratio: 2.5 to 1

*23. TIME BASE A SLOW SWEEP TIMING

a. Slow sweep timing: ±2% except 1, 2 and 5 SEC ±2.5%

*24. TIME BASE A FAST SWEEP TIMING

b. Horizontal compensation: ±2mm
i. Fast sweep timing: ±2% magnifier ±3%

25. DELAY PICKOFF JITTER

b. Jitter at 1.00: 2mm, max
c. Jitter at 9.00: 4mm, max

*26. DELAY START/STOP

c. Linearity: ±2 minor dial divisions

*27. TIME BASE B TIMING

a. Slow sweep rate accuracy: ±0.625% except .2, .5 and 1 SEC ±1% max
b. Fast sweep rates: ±0.65%, max

28. HOLD OFF

3µs to 400ms

29. TIME BASE B SWEEP LENGTH

b. Sweep length: cw; 10.2 to 10.8 cm ccw; 3.2 to 3.8cm

30. LOCKOUT LEVEL

a. Lockout level: 1.1 to 2:3
b. Gate amplitude: 9V min
c. SINGLE SWEEP triggering: sweeps once on triggering signal

31. FRONT PANEL WAVEFORMS

a. Front panel waveform:

VERT SIGN OUT	≥1.5V/cm
SAWTOOTH A OUT	≥130V
+ GATE A	≥20V
+ GATE B	≥20V
DEL'D TRIGGER	≥5V

*32. EXTERNAL HORIZONTAL AMPLIFIER

a. Ext Horiz Amp DC balance: 1cm shift, max
b. X10 aberrations: ±3% referenced to X1
c. Horizontal deflection factor: 5.6cm/V, min
d. EXT X10: ±2%
e. VARIABLE ratio: 10:1 min
f. Bandwidth: 350kHz at -3dB less

33. TRANSIENT RESPONSE:

≤1% aberration.

*34. VERTICAL AMPLIFIER BANDWIDTH

-3dB at ≥15MHz

[NOTE: THE FOLLOWING CHECKS ARE NOT MADE ON 100% OF THE INSTRUMENTS BUT ARE DONE ON A SAMPLING BASIS]

35. VERTICAL SIGNAL OUT BANDWIDTH

a,b. 10Hz to 5MHz at -3dB

36. TRIGGER BANDWIDTH

a,d. TIME BASE A

AC:	≤150Hz to ≥2MHz
AUTO:	≤50Hz to ≥1MHz
AC LF REJ:	≤10kHz to ≥2MHz

b,c. TIME BASE B

AC:	≤150Hz to ≥1MHz
AUTO:	≤50Hz to ≥1MHz

THE END

*Indicates measurement characteristic; test equipment used must be traceable to NBS for instrument certification.

Factory TEST LIMITS are limits an instrument must meet 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, it is necessary to set up some circuits so their performance is better than required by Factory Test Limits. Therefore, the instructions given in the Factory Calibration Procedure may call for checks or adjustments which result in less error than that allowed by the Factory Test Limits.

1. PRELIMINARY INSPECTION

2. PRESET CONTROLS

3. RESISTANCE

4. POWER SUPPLIES

a. Check time-delay: 15 to 60 seconds
b. Adjust -150V Adj, R616, and check regulated voltages: ±2%; regulation 104.5VAC to 125.5VAC line, high and low load
c. Check elevated heaters
d. Adjust HV Adj, R840, and check HV regulation: no trace bloom or voltage change >20V from 104.5VAC to 125.5 VAC line

5. GEOMETRY

a. Align CRT
b. Adjust graticule: center of scan area
c. Adjust Geometry Adj, R861: bowing 1mm, max

6. FOCUS

a. Check horizontal focus: no overlap of 1mm spaced marks over the center 8.8cm of the graticule
b. Check vertical focus: no overlap of 1mm spaced marks

7. BEAM POSITION INDICATORS AND SCALE ILLUMINATION

b. Check beam position indicators: The proper beam position indicator must light and the opposite neon must go out before the spot leaves the graticule area.
c. Check SCALE ILLUM: on max, cw; off, ccw

8. MAGNIFIER AND VARIABLE

a. Check MAG ON indicator: neon must light when 5X MAG knob is ON
b. UNCALIBRATED

TIME/CM VARIABLE	Indicator neon
CALIBRATED	off
all other positions	on

c. Time base indicators

indicator	HORIZONTAL DISPLAY
A	A
A	"A" SINGLE SWEEP
B	all other positions

9. INTENSITY MODUALTION: ≤20V

10. VERTICAL AMPLIFIER

a. Check output amplifier balance: 0.75cm
b. Check driver cathode follower balance: 0.75cm

c. Check overall amplifier balance: 2cm
d. Check microphonics: 2.5mm
check hum: 0.5mm
e. Adjust Vert Gain Adj, R570: 4cm
Range: 3.6cm to 4.4cm
f. Check compression/expansion: 1mm at top or bottom of the graticule with 2cm display
g. Check DC shift: 2mm, max after 3cm deflection
h. Check vertical drift: 0.5cm, max from 104.5VAC to 125.5VAC line

11. ALTERNATED TRACE AND CHOPPED BLANKING

a. Check alternate trace at all TIME BASE A sweep speeds
b. Check alternate trace sync pulse, TIME BASE A: amplitude ≥60V negative pulse risetime ≤1μs
c. Check alternate trace at all TIME BASE B sweep speeds. Check TIME BASE B sync pulse: amplitude ≥60V negative pulse risetime: ≤1μs
d. Check chopped blanking: blanking of fast chopping transients

12. AMPLITUDE CALIBRATOR

a. Adjust Cal Adj, R879: 100V
b. Check accuracy: ±2% all positions
c. Check period: 1ms ±20%
d. Check duty cycle: 45% to 55%

13. TIME BASE A TRIGGERING

b. Adjust Triggering Level Centering, R39
c. Adjust Trig Sens, R47: will not trigger on 0.05V
d. Adjust Int Trig DC Level Adj, R3: 4mm
e. Adjust TRIGGERING LEVEL knob: + and - at 0
f. Set PRESET STABILITY: 50% of range
g. Check triggering:

TRIGGERING MODE	±INT	±EXT
AC	2mm	0.2V
AC LF REJ	2mm	0.2V
DC	4mm within 4mm	0.2V
AUTO	2mm	0.2V

h. Check TRIGGERING LEVEL range: at least + and - 10V
i. Check line triggering: correct slope

14. TIME BASE B TRIGGERING

b. Adjust Trig Level Centering, R78
c. Adjust Int Trig DC Level, R53: 4mm
d. Set TRIGGERING LEVEL knob: + and - at 0
e. Set PRESET ADJUST: 50% of range
f. Check TIME BASE B triggering:

TRIGGERING MODE	±INT	±EXT
AUTO	2mm	0.2V
AC	2mm	0.2V
DC	4mm within 4mm	0.2V

g. Check TRIGGERING LEVEL range: at least + and - 10V
h. Check line triggering: correct slope

15. HIGH FREQUENCY SYNC

a. Check external HF SYNC: 1.5V at 5MHz and 30MHz, ≤1mm jitter
b. Check internal HF SYNC: 1.5cm at 5MHz and 30MHz, ≤1mm jitter

16. TIME BASE A LOW AND HIGH FREQUENCY TRIGGERING

a. Check AC triggering: 1cm INT or 1V EXT at 5MHz
b. Check DC triggering: 2cm INT or 1V EXT at 5MHz
c. Check AUTO triggering: 1cm INT or 1V EXT at 2MHz
d. Check AC LF REJ: Inoperable at 2cm INT or 2V EXT at 200Hz

17. TIME BASE B HIGH FREQUENCY TRIGGERING

a. Check AC triggering: 1cm INT or 1V EXT at 3MHz
b. Check DC triggering: 2cm INT or 1V EXT at 3MHz
c. Check AUTO triggering: 1cm INT or 1V EXT at 2MHz

18. HORIZONTAL AMPLIFIER

b. Adjust Mag Gain, R375: linearity ±0.8mm
c. Adjust Swp Cal, R348

19. MATCH TIME BASES

a. Adjust R160z

20. TIME BASE A SWEEP LENGTH

a. Adjust Sweep Length, R176: 10.5cm

21. NORMAL-MAGNIFIED REGISTRATION

b. Adjust Norm/Mag Regis, R358: trace start at graticule center

22. VARIABLE TIME/CM

a. Check VARIABLE ratio: 2.5 to 1

23. TIME BASE A SLOW SWEEP TIMING

a. Check slow sweep timing: ±1.6mm except 1,2 and 5 SEC ±2mm

24. TIME BASE A FAST SWEEP TIMING

b. Adjust horizontal compensation, C330: coincidence of first mark
c. Adjust 10μSEC timing, C160E: ±1.6mm
d. Adjust 1μSEC timing, C160C: ±1.6mm
e. Adjust .5μSEC timing, C160A: ±1.6mm
f. Adjust .1μSEC timing, C348: ±1.6mm
g. Adjust 20ns timing, C346, C384, C375: ±2.4mm
h. Check 40ns timing: ±2.4mm
i. Check fast sweep timing: ±1.6mm

25. DELAY PICKOFF JITTER

b. Check jitter at 1.00: 2mm, max
c. Check jitter at 9.00: 4mm, max

26. DELAY START AND STOP

b. Adjust Delay Start, R436, and Delay Stop, R432
c. Check linearity: ±2 minor divisions

27. TIME BASE B TIMING

a. Check slow sweep rate accuracy: ±5 minor div; except .2, .5and 1 SEC ±8 minor div
b. Adjust fast sweep rates, C260C and C260A ±5 minor div

28. HOLD OFF

3μs to 400ms

29. TIME BASE B SWEEP LENGTH

b. Set B sweep LENGTH: 10.2 to 10.8cm, cw 3.2 to 3.8cm, ccw

30. LOCKOUT LEVEL

a. Adjust Lockout Level Adj, R125: 1:1 to 2:3
b. Check gate amplitude: 9V min
c. Check SINGLE SWEEP triggering: sweeps once on triggering signal

31. FRONT PANEL WAVE FORMS

a. Front panel waveforms:

VERT SIG OUT	≥1.5V/cm
SAWTOOTH A	≥130V
+ GATE A	≥20V
+ GATE B	≥20V
DEL'D TRIGGER	≥5V

32. EXTERNAL HORIZONTAL AMPLIFIER

a. Adjust Ext Horiz Amp DC Balance, R317: no trace shift
b. Adjust C301C: X10 to match X1
c. Check deflection factor: 5.6cm/V, min
d. Check X10: ±2mm
e. Check VARIABLE 10-1: ratio 10:1, min
f. Check bandwidth: ≥350kHz at -3dB

33. TRANSIENT RESPONSE

b. Preset delay line
c. Adjust delay line termination: ≤0.3mm aberration
d. Adjust delay line: ≤0.3mm aberration
e. Adjust transient response: ≤0.3mm overshoot or rounding

34. VERTICAL AMPLIFIER BANDWIDTH

-3dB at ≥15MHz

[NOTE: THE FOLLOWING CHECKS ARE NOT MADE ON 100% OF THE INSTRUMENTS BUT ARE DONE ON A SAMPLING BASIS]

35. VERTICAL SIGNAL OUT BANDWIDTH

a. Upper limit: ≥5MHz
b. Lower limit: ≤10Hz

36. TRIGGER BANDWIDTH

a. Check TIME BASE A lower limit
≤150Hz in AC
≤10kHz in AC LF REJ
≤50Hz in AUTO

b. Check TIME BASE B lower limit
≤150Hz in AC
≤50Hz in AUTO

c. Check TIME BASE B upper limit
≥1MHz in DC
≥1MHz in AC
≥1MHz in AUTO

d. Check TIME BASE A upper limit
≥2MHz in AC
≥2MHz in AC LF REJ
≥1MHz in AUTO

THE END

1. PRELIMINARY INSPECTION

a. Check shield

See that a HV shield is installed

b. Check CRT: tilt 1/32 inch, max; concavity or convexity 1/32 inch, max

Check that CRT neck pins are tight. Loosen the CRT clamp. Remove graticule, push CRT forward to straight edge firmly placed against the front panel. Check gap within the phosphor area with rule: 1/32 inch, max. Tighten the CRT clamp. Note the CRT serial number and code date. Inspect the CRT for structural defects including: phosphor defects, scratches, cracks around neck pins. Replace graticule.

c. Check fuse

Fuse must match the line voltage source as follows:

Connected for			
117VAC, 50Hz	3ag	6.25A	slo-blo
117VAC, 60Hz	3ag	6A	fast-blo
234VAC, 50Hz	3ag	3A	slo-blo
234VAC, 60Hz	3ag	3A	fast-blo

2. PRESET CONTROLS

FOCUS	ccw
INTENSITY	ccw
ASTIGMATISM	ccw
SCALE ILLUM	cw
HORIZONTAL DISPLAY	5X MAG
VARIABLE 10-1	cw
HORIZONTAL POSITION	midr

2. (cont'd)

VERNIER horizontal position	ccw
AMPLITUDE CALIBRATOR	OFF
POWER ON	off
TIME BASE A	
TRIGGERING LEVEL	
STABILITY	ccw (not PRESET)
TRIGGER SLOPE	+ INT
TRIGGERING MODE	AC
TIME/CM	1 MILLISEC
VARIABLE time/cm	CALIBRATED
TIME BASE B	
TRIGGERING LEVEL	
STABILITY	ccw (not PRESET)
TRIGGER SLOPE	+ INT
TRIGGERING MODE	AC
TIME/CM or DELAY TIME	1 MILLISEC
LENGTH	cw
DELAY TIME MULTIPLIER	1.00
CRT CATHODE SELECTOR	
(scope rear)	EXTERNAL CRT CATHODE
C375 (internal)	¼ turn from max
All other internal adjustments except vertical amplifier.	midr

3. RESISTANCE

a. Setup

Install a CALIBRATION FIXTURE in the TYPE 535A. Preset the CALIBRATION FIXTURE as follows:

VARIABLE	midr
AMPLITUDE	midr
REPETITION RATE	LOW
VERTICAL POSITION	midr
TEST FUNCTION	LOW LOAD

b. Measure resistance

Measure resistance between each power supply and ground as in the following table:

NOTES

3.b (cont'd)

Test Point	Aprox Resistance
Transformer term 1	inf
Transformer term 4	inf
-150V	2.5kΩ
+100V	500Ω
+225V	5-8kΩ
+350V	20kΩ
+500V	15-30kΩ

b. Ohmmeter may have to be reversed when measuring the +350V supply because of a protection diode across the filter capacitor.

4. POWER SUPPLIES

a. Check time-delay relay: 15 to 60 seconds

Apply power to the TYPE 531A via a TYPE 76TU. Set line voltage to 117 VAC. TURN the POWER switch ON. Check for a delay of 15 to 60 seconds before the time-delay relay closes with an audible click.

For first time turn-on of raw instruments, reduce the line voltage to 19VAC and measure power transformer secondary voltages.

Remove the fuse. The line voltage must not remain on terminals 1 or 4 of the power transformer. Replace the fuse.

It is important that shorted filament secondaries be located before full line voltage is applied because the cables may burn up before the fuse blows.

b. Adjust -150V Adj, R616, and check regulated voltages: ±2%; regulation 104.5VAC to 125.5VAC line, high and low load.

Adjust -150V Adj, R616, to bring all regulated power supplies within tolerance:

Power Supply	Max Error	Max Ripple
-150V	±3V	5mV
+100	±2V	10mV
+225	±4.5V	5mV
+350	±7V	20mV
+500	±10V	20mV

Check maximum ripple from 104.5VAC HIGH LOAD to 125.5VAC LOW LOAD . RE-turn line voltage to 117VAC.

c. Check elevated heaters

Check the elevated heater supply voltages according to the following table:

Transformer terminal	Approx DC voltage
22 and 23	+95V
27 and 28	+220V
9 and 16	+350V
24 and 25	-1000 to -1500

d. Adjust HV Adj, R840, and check HV regulation: voltage: -1350V regulation: no trace bloom or voltage change >20V from 104.5VAC to 125.5VAC line

Set the multimeter to a range suitable to read -1350V and connect the meter to the HV Adj Test Point (R847 - R857 junction) and adjust the HV Adj, R840, for a -1350V reading on the multimeter. Turn time base A STABILITY cw. Lower the line voltage to 104.5VAC and vary the INTENSITY control from full ccw to full cw while checking the reading on the multimeter. In similar fashion check the regulation at 125.5VAC line. Check for no trace blooming while varying the line from 104.5VAC to 125.5VAC. Return the line voltage to 117VAC.

5. GEOMETRY

a. Align CRT: ≤0.5mm

Turn FOCUS, INTENSITY and ASTIGMATISM controls as needed to get a usable, well-defined trace. Position trace to graticule center and use CRT clamp vernier rotation knob to align trace parallel to horizontal graticule lines.

b. Adjust graticule: center of scan area

Apply 1ms and .1ms markers to the X100 AMPLIFIER input of the SAC. Connect the X100 AMPLIFIER OUTPUT to the CALIBRATION FIXTURE EXT INPUT. Adjust time base A STABILITY and TRIGGER LEVEL for a stable display. Adjust CALIBRATION FIXTURE VARIABLE for a display height greater than the vertical scan.

It may be necessary to preadjust Trig Level Centering, R39, in order to obtain a stable display.

5.b (cont'd)

Adjust the graticule cam to place the 6cm vertical graticule in the center of the CRT vertical scan.

c. Adjust Geom Adj, R861: bowing 1mm, max

Adjust R861 for min bowing of the vertical lines. Check over the entire graticule for 1mm or less bowing within the 6cm height of the graticule. Remove the X100 AMPLIFIER OUTPUT.

Time Base A VARIABLE TIME/CM may be adjusted to obtain 1ms/cm display. Each time mark would then represent 1mm.

Turn the time base A STABILITY control cw. Turn the CALIBRATION FIXTURE VARIABLE full ccw. Position the trace over the entire graticule area with the VERTICAL POSITION control. Check for 1mm or less of bowing.

6. FOCUS

a. Check horizontal focus: no overlap of 1mm spaced marks over the center 8.8cm of the graticule

Apply TYPE 184 MARKER OUTPUT to CALIBRATION FIXTURE EXT INPUT. Turn CALIBRATION FIXTURE VARIABLE cw. Adjust STABILITY for stable display. Adjust the time base A TIME/CM VARIABLE for 10 marks/cm. Check that the FOCUS and ASTIGMATISM controls can be adjusted so all marks in the center 8.8cm of the graticule are clearly defined with no overlap. Remove CALIBRATION FIXTURE EXT INPUT.

b. Check vertical focus: no overlap of 1mm spaced marks

Apply SAC square wave OUTPUT to CALIBRATION FIXTURE EXT INPUT. Turn STABILITY cw. Turn SAC AMPLITUDE to 1 VOLT and adjust CALIBRATION FIXTURE VARIABLE for 1cm of display. Turn SAC AMPLITUDE to .1 VOLT. Position the display over the entire graticule area. Check for a clearly defined display with no overlap of the two lines within the graticule area. Remove CALIBRATION FIXTURE EXT INPUT.

7. BEAM POSITION INDICATORS AND SCALE ILLUMINATION

a. Setup

HORIZONTAL DISPLAY	X10 EXT
STABILITY (TIME BASE A)	ccw (not PRESET)
INTENSITY	minimum useable

b. Check beam position indicators: The spot must move off-screen in direction indicated. The proper beam position indicator must light and the opposite neon must go out before the spot leaves the graticule area.

Position Control	Turn	Spot Must Move	Beam Position Indicator
VERTICAL POSITION	cw	up	↑
VERTICAL POSITION	ccw	down	↓
HORIZONTAL POSITION	cw	right	→
HORIZONTAL POSITION	ccw	left	←
Turn HORIZONTAL DISPLAY		A	

c. Check SCALE ILLUM: on max, cw: off, ccw

Turn the SCALE ILLUM control full cw.
Observe maximum graticule illumination.
Turn the SCALE ILLUM control fully ccw.
The illumination should decrease smoothly from full illumination to no illumination.

8. 5X MAGNIFIER AND VARIABLE INDICATORS

a. Check MAG ON indicator: neon must light when the 5X MAG knob is in the ON position. Neon must be off whenever the 5X MAG knob is in the OFF position.

b. Check UNCALIBRATED indicator: neon must be off when the time base A TIME/CM VARIABLE knob is in the cw (CALIBRATED) position and lit in all other positions of the VARIABLE control.

c. Check A and B time base indicators: B indicator must be on in all positions of the HORIZONTAL DISPLAY knob except A and A SINGLE SWEEP when the A indicator must be on.

8.c (cont'd)

Leave HORIZONTAL DISPLAY knob at A after checking the time base indicators.

9. CRT CATHODE INPUT

a. Check intensity modulation: 20V

Remove CRT ground strap by loosening the EXT CRT CATHODE and GND binding posts at the rear of the scope. Swing the strap away from the EXT CRT CATHODE binding post, making sure the strap pivots on the GND binding post. Turn time base A TRIGGER SLOPE to + EXT.

Connect SAC square wave OUTPUT to time base A TRIGGER INPUT and EXT CRT CATHODE making sure the CRT CATHODE SELECTOR switch is in the proper position. Adjust SAC for 20 VOLTS and time base A STABILITY for a stable display. Check that alternate light and dark trace segments are displayed.

Remove the EXT CRT CATHODE and TRIGGER INPUT signals and replace CRT ground strap.

10. VERTICAL AMPLIFIER

a. Check output amplifier balance: 0.75cm

Turn the time base A STABILITY control cw. Short-circuit the CRT vertical deflection plates together and note the trace vertical position. This is the CRT vertical electrical center. Remove the short circuit.

Connect a jumper from V533 pin 8, to V543 pin 8. The trace must shift no more than 0.75cm from electrical center.

The VOM leads may be used as a jumper by placing the VOM in its highest ampere range.

b. Check driver cathode follower balance: 0.75cm, max

Connect a jumper from V533 pin 7 to V543 pin 7. The trace must not shift more than 0.75cm from CRT electrical center.

c. Check overall amplifier balance: ±2cm, max

Turn the CALIBRATION FIXTURE TEST FUNCTION switch to COMMON MODE. The trace must not shift more than 2cm from CRT electrical center.

d. Check for hum and microphonics: microphonics 2.5mm, max hum 0.5mm, max

Set the TIME/CM switch to 10 MILLISEC, apply a shock from a micro-shock hammer at the top of the TYPE 535A front panel. Check for 0.25cm or less of microphonics with no ringing type. Check for 0.5mm or less of hum.

e. Adjust Vert Gain Adj, R570: 4cm Range: 3.6cm to 4.4cm

Turn CALIBRATION FIXTURE TEST FUNCTION switch to GAIN SET. Apply 100V square wave form SAC to EXT INPUT. Turn time base A TIME/CM to .1 MILLISEC. Turn Gain Adj, R570, full cw and check for at least 4.4cm of display. Turn Gain Adj, R570, full ccw and check for 3.6 cm or less of display. Adjust Gain Adj, R570, for exactly 4cm display.

f. Check compression/expansion: 1mm max at top or bottom of the graticule with 2cm display

Turn SAC AMPLITUDE to 50 VOLTS. Position the display to the top and bottom of the graticule and check for 2cm of deflection ±1mm, maximum. Remove EXT INPUT.

g. Check DC shift: 2mm, max after 3cm deflection

Position trace 3cm from the COMMON MODE position. Switch TEST FUNCTION between GAIN SET and COMMON MODE. Trace will

10.g (cont'd)

change position rapidly and then may slowly drift up or down. Check for a drift of less than 2mm.

h. Check vertical drift: 0.5cm, max from 104.5VAC to 125.5VAC

Check the trace drift while varying the line voltage from 104.5VAC to 125.5VAC.

11. ALTERNATE TRACE AND CHOPPED BLANKING

a. Check alternate trace at all time base A sweep speeds

Turn TEST FUNCTION switch to ALTERNATE, time base A TIME/CM to 1 MILLISEC and position trace so that both of the vertical position indicators are on. Check for two traces in all time base A TIME/CM positions. In .1, .2, .5, 1, 2 and 5 SEC positions of the time base A TIME/CM switch, the vertical position neons should flash alternately at the start of each sweep and may be the only indication that the alternate sweep circuit is functioning.

Another method of checking for alternate trace on lowest sweep rates is to apply a 100V square wave form SAC to EXT INPUT and check for 2 traces on every other sweep.

b. Check alternate trace sync pulse, TIME BASE A: amplitude $\geq$60V negative pulse risetime $\leq$1μs

Set TIME/CM to 2μSEC. Connect a 10X probe from test scope to pin 16 Amphenol connector. Set test scope VOLTS/CM to 2 and TIME/CM to 1μSEC. Check for at least 3cm of negative pulse amplitude with a risetime of 1μs or less. Remove 10X probe.

c. Check alternate trace at all TIME BASE B sweep speeds. Check TIME BASE B sync pulse

Switch the HORIZONTAL DISPLAY to B. Turn time base B STABILITY cw. Check for two traces in all time base B TIME/CM positions. Repeat step b with TIME BASE B. Return the HORIZONTAL DISPLAY to A.

d. Check chopped blanking

Set TEST FUNCTION to CHOPPED, time base A TRIGGER SLOPE to +INT and adjust time base A STABILITY control for a stable display of square waves.

Change the CRT CATHODE SELECTOR to CHOPPED BLANKING and check for blanking of the vertical lines (fast chopping transients).

Change the CRT CATHODE SELECTOR to EXTERNAL CRT CATHODE and the TEST FUNCTION to HIGH LOAD.

12. AMPLITUDE CALIBRATOR

a. Adjust Cal Adj, R879: 100V

Connect CAL OUT to SAC UNKNOWN INPUT. Set SAC AMPLITUDE to 100V, MODE to +DC and MIXED. Turn TYPE 535A AMPLITUDE CALIBRATOR to 100 VOLTS and remove V875 from the TYPE 535A. Connect SAC OUTPUT to test scope vertical input. Set test scope VOLTS/CM to 1 and test scope TIME/CM to 5mSEC. Trigger test scope on +LINE, AUTO. Set test scope input to AC.

Set the Cal Adj, R879, for a null (the square wave display becomes a straight line).

b. Check accuracy: ±2% all positions

Check the AMPLITUDE CALIBRATOR ERROR as the controls are changed according to the following table:

AMPLITUDE CALIBRATOR and SAC VOLTS	TEST SCOPE VOLTS/CM	max deflection
100	1.0	2cm
50	0.5	2cm
20	0.2	2cm
10	0.1	2cm
5	0.05	2cm
2	0.02	2cm
1	0.01	2cm
.5	0.005	2cm
.2	0.002	2cm
.1	0.001	2cm

The first complete half cycle of the test scope display is the SAC voltage. The next half cycle will be the error voltage. The direction of error can be determined by the direction of the error voltage. A positive going waveform indicates a positive error and a negative going waveform indicates a negative error.

12.b (cont'd)

Add the error found in the .1 VOLTS position to the errors found in the previous positions. The algebraic sum must not exceed 2cm.

c. Check period: 1ms ±20%

Set the SAC MODE to UNKNOWN INPUT and the test scope to .05 VOLTS/CM. Replace V875. Set test scope triggering for + INT AC and TIME/CM for 0.2ms. Check for 1 cycle in 4 to 6cm of display. Check for AMPLITUDE CALIBRATOR square wave out in all MILLIVOLTS positions.

d. Check duty cycle: 45% to 55%

Change test scope TIME/CM for 50µs and adjust the test scope VARIABLE for 1 cycle in 10cm. Check that ½ cycle occupies from 4.5cm to 5.5cm. Remove connector from AMPLITUDE CALIBRATOR CAL OUT.

13. TIME BASE A TRIGGERING

a. Setup

Set the TYPE 535A as follows:

TIME BASE A	
TIME/CM	50µSEC
TRIGGERING MODE	DC
TRIGGER SLOPE	+ EXT
STABILITY	for display on CRT
CALIBRATION FIXTURE	
VARIABLE	cw

Set test scope as follows:

TIME/CM	20µSEC
COUPLING	AC
TRIGGER SLOPE	+
SOURCE	INT
CHANNEL 1 VOLTS/CM	.01
CHANNEL 2 VOLTS/CM	.1
INPUT SELECTORS	AC
MODE	CH 1

13.a (cont'd)

Connect the X10 probe from the test scope INPUT 2 to V45 pin 6. Connect a grounding strap from the junction of R19-R20 to gnd.

Attach a BNC "T" connector to the CALIBRATION FIXTURE EXT INPUT. Connect the TYPE 191 to one side of the "T" with a 50Ω cable. Connect a 50Ω Termination from the other side of the "T" to the test scope INPUT 1. Set the TYPE 191 FREQUENCY RANGE to 50kHz. Adjust the AMPLITUDE controls for an output of .05 volts as indicated on the test scope. Change the coax cable and 50Ω Termination to the TYPE 535A time base A TRIGGER INPUT. Switch test scope to CH 2.

b. Adjust Triggering Level Centering, R39

Switch TYPE 535A time base TRIGGER SLOPE back and forth between + & - EXT and adjust the Triggering Level Centering, R39 for a stable display on the test scope. Continue to adjust R39 for stable triggering in both +EXT and -EXT while adjusting TRIG SENS, R47, for the minimum sensitivity which will still permit stable triggering.

c. Adjust Trig Sens, R47: will not trigger on 0.05V

Reduce the sensitivity of the trigger circuit by adjusting R47, to the point where a stable trigger cannot be obtained in either +EXT or -EXT.

d. Adjust Int Trig DC Level Adj, R3: 4mm

Set the TYPE 191 AMPLITUDE controls for 4mm of signal on the TYPE 535A. Position the bottom of the display to the graticule center line.

Set the TYPE 535A time base A TRIGGERING MODE to DC and TRIGGER SLOPE to +INT. Adjust the Int Trig DC Level Adj, R3, for a stable display. Switch the TRIGGER SLOPE between +INT and -INT and adjust R3 for stable triggering.

e. Set TRIGGERING LEVEL knob: + & - at 0

Set the TYPE 535A time base A TRIGGERING MODE to AC. Adjust the TYPE 191 for 2mm of display. Remove the strap from the junction of R19-R20. Tighten the TRIGGERING LEVEL knob set screw enough to allow movement of the pot. Set trace is obtained. Switch the TRIGGER SLOPE switch between +INT and -INT and adjust the TRIGGERING LEVEL for stable triggering in both slopes.

Loosen the TRIGGERING LEVEL knob set screw and set the index dot straight up and retighten. Check that a stable trigger in both + and - INT slopes is obtained at 0. Remove the X10 probe from V45 pin 6.

f. Set PRESET STABILITY: 50% of range

Set the TEST FUNCTION switch to COMMON MODE, the TYPE 535A time base A TRIGGER SLOPE to +LINE. Set the time base A STABILITY control to PRESET. Connect the mulitmeter from the center arm of the PRESET STABILITY pot to gnd.

The difference between the two meter readings will normally be $\geq$15V.

Adjust the PRESET ADJUST until the display appears, check the meter reading. Rotate the PRESET ADJUST clockwise until the trace brightens and check the meter reading. Set the PRESET ADJUST for reading half-way between the two readings.

Remove the meter leads, set the TYPE 535A time base A TRIGGER SLOPE to +INT.

g. Check triggering

Use the following table to check time base A triggering:

TRIGGERING MODE	signal amplitude	condition
AUTO	2mm	INT + & -
AC LF REJ	2mm	INT + & - use TRIGGERING LEVEL
AC	2mm	INT + & - use TRIGGERING LEVEL
DC	4mm	INT + & - within 4mm of graticule center, +INT within 4mm of -INT, use VERTICAL POSITION

13.g (cont'd)

TRIGGERING MODE	signal amplitude	condition	
DC	0.2V	EXT	use TRIGGERING LEVEL
AC	0.2V	EXT + & -	use TRIGGERING LEVEL
AC LF REJ	0.2V	EXT + & -	use TRIGGERING LEVEL
AUTO	0.2V	EXT + & -	

h. Check Time base A TRIGGERING LEVEL range: at least + & - 10V

Remove the 50Ω cable connected to the TYPE 191 from the "T" connector. Remove the 50Ω Termination from the TYPE 535A TRIGGER INPUT and reconnect the cable. Connect the SAC OUTPUT to the "T" connector. Set the SAC to 10 VOLTS, +DC, MIXED. Set the TRIGGERING MODE to DC TRIGGER SLOPE to +EXT and adjust the STABILITY and TRIGGERING LEVEL for a stable display. Rotate the TRIGGERING LEVEL to the plus extreme and check for enough range to lose triggering.

Change TRIGGER SLOPE to -EXT, SAC to -DC, rotate the TRIGGERING LEVEL to the minus extreme and check for enough range to lose triggering.

i. Check line triggering: correct slope

Remove the SAC signal and connect a 10X probe from the "T" connector to the fuse holder. Set the TRIGGERING MODE to AC, TRIGGER SLOPE to +LINE and TIME/CM to 10mSEC. Adjust the STABILITY and TRIGGERING LEVEL for a stable display. Check for the correct phase in both + and - LINE. Remove the 10X probe from the fuse holder and "T" connector.

14. TIME BASE B TRIGGERING

a. Setup

HORIZONTAL DISPLAY	B
TIME BASE B	
TIME/CM	50 SEC
TRIGGERING MODE	DC
TRIGGER SLOPE	+EXT
STABILITY	for display on CRT
Test Scope CH 2	
VOLTS/CM	.02

14.a (cont'd)

Connect a X10 probe from the test scope INPUT 2 to V95 pin 6. Connect a grounding from the junction of R69-R70 to gnd.

Attach a BNC "T" connector to the CALIBRATION FIXTURE EXT INPUT. Connect the TYPE 191 to one side of the "T" with a 50Ω cable. Connect a 50Ω Termination from the other side of the "T" to the test scope INPUT 1. Set the TYPE 191 FREQUENCY RANGE to 50kHz. Adjust the AMPLITUDE controls for an output of .1 volts as read on the test scope. Change the coax cable and 50Ω Termination to the TYPE 535A time base B TRIGGER INPUT. Switch test scope to CH 2.

b. Adjust Trig Level Centering, R78

Switch TYPE 535A time base B TRIGGER SLOPE back and forth between + & - EXT and adjust Trig Level Centering, R78, for stable triggering in both + and - EXT.

c. Adjust Int Trig DC Level, R53: 4mm

Readjust TYPE 191 for 4mm of signal on the TYPE 535A. Position the bottom of the display to the graticule center line.

Set the TYPE 535A time base B TRIGGER SLOPE to +INT. Adjust the Int Trig DC Level, R53, for a stable display. Switch the TRIGGER SLOPE between +INT and -INT and adjust R53 for stable triggering.

d. Set TRIGGERING LEVEL knob: + and - at 0

Set the TYPE 535A time base B TRIGGERING MODE to AC. Adjust the TYPE 191 for 2mm of display. Remove the strap from the junction of R69-R70. Tighten the TRIGGERING LEVEL knob set screw enough to allow movement of the pot. Set the knob to a position where a stable trace is obtained. Switch the TRIGGER SLOPE switch between +INT and -INT and adjust the TRIGGERING LEVEL for stable triggering in both slopes.

14.d (cont'd)

Loosen the TRIGGERING LEVEL knob set screw and set the index dot straight up and retighten. Check that a stable trigger in both + and - INT slopes is obtained at 0. Remove the X10 probe from V95 pin 6.

e. Set PRESET ADJUST: 50% of range

Set the TEST FUNCTION switch to COMMON MODE, the TYPE 535A time base B TRIGGER SLOPE to + LINE. Set the STABILITY control to PRESET. Connect the multimeter from the center arm of the PRESET ADJUST pot to ground.

Adjust the PRESET ADJUST until the display appears, check the meter reading. Rotate the PRESET ADJUST cw until the trace brightens and check the meter reading. Set the PRESET ADJUST for reading half-way between the two readings. Remove the meter leads, set the TEST FUNCTION to HIGH LOAD and the TIME BASE B TRIGGER SLOPE to +INT.

f. Check TIME BASE "B" triggering:

Use the following table to check triggering:

TRIGGERING MODE	signal amplitude	condition
AUTO	2mm	INT + & -
AC	2mm	INT + & - use TRIGGERING LEVEL
DC	4mm	Int + & - within 4mm of graticule center, +INT within 4mm of -INT use VERTICAL POSITION
DC	0.2V	EXT use TRIGGERING LEVEL
AC	0.2V	EXT + & - use TRIGGERING LEVEL
AUTO	0.2V	EXT + & -

g. Check TRIGGERING LEVEL range: at least + and - 10V

Remove the 50Ω cable connected to the 191 from the "T" connector. Remove the 50Ω Termination from the TYPE 535A B

14.g (cont'd)

TRIGGER INPUT and reconnect the cable. Connect the SAC OUTPUT to the "T" connector. Set the SAC to 10V, +DC, MIXED. Set the TIME BASE B TRIGGERING MODE to DC, TRIGGER LEVEL for a stable display. Rotate the TRIGGERING LEVEL to the plus extreme and check for enough range to lose triggering.

Change B TRIGGER SLOPE to -EXT, SAC to -DC, rotate the TRIGGERING LEVEL to the minus extreme and check for enough range to lose triggering.

h. Check line triggering: correct slope

Remove the SAC signal and connect a X10 probe from the "T" connector to the fuse holder. Set B TRIGGERING MODE to AC, TRIGGER SLOPE to +LINE and TIME/CM to 10 MILLISEC. Adjust the STABILITY and TRIGGERING LEVEL for a stable display. Check for the correct slope in both + and - LINE. Remove the X10 probe from the fuse holder and "T" connector.

15. HIGH FREQUENCY SYNC

a. Check external HF Sync: 1.5V at 5MHz and 30MHz ≤1mm jitter

Change HORIZONTAL DISPLAY to A. Set TIME BASE A TRIGGERING MODE to HF SYNC, TRIGGER SLOPE to +EXT and TIME/CM to .1 μSEC. Connect the 50Ω cable from the TYPE 191 to the "T" connector. Remove the 50Ω cable from the TYPE 535A TIME BASE B TRIGGER INPUT, connect a 50Ω Termination to the cable and connect the termination to the test scope INPUT 1. Set the TYPE 191 for 1.5 volts of 50kHz signal. Remove the 50Ω cable and 50Ω Termination from the test scope and connect it to the TYPE 535A TIME BASE A TRIGGER INPUT. Change the TYPE 191 frequency to 5MHz and adjust the TIME BASE A STABILITY for a stable display, 1mm or less jitter.

15.a (cont'd)

Set the TYPE 191 frequency to 30MHz and set the 5X MAGNIFIER to ON. Adjust the STABILITY for a stable display, 1mm or less display jitter.

b. Check internal HF SYNC: 1.5cm at 5MHz and 30MHz ≤1mm jitter

Remove the 50Ω cable and 50Ω Termination from the "T" connector. Do not remove the other end from the TIME BASE A TRIGGER INPUT. Adjust CALIBRATION FIXTURE VARIABLE for signal amplitude of 1.5cm. Set the A TRIGGER SLOPE to +INT. Adjust the STABILITY control for a stable display, 1mm or less of jitter.

Change the TYPE 535A 5X MAGNIFIER to OFF and the TYPE 191 frequency to 5MHz. Adjust the CALIBRATION FIXTURE VARIABLE control for 1.5cm of display. Adjust the TIME BASE A STABILITY for a stable display, 1mm or less of jitter.

16. TIME BASE A LOW AND HIGH FREQUENCY TRIGGERING

a. Check AC triggering: 1cm INT or 1.0V EXT at 5MHz

Reconnect the 50Ω cable and 50Ω Termination to the "T" connector. Change the TYPE 191 AMPLITUDE controls for a signal amplitude of 1.0V. Set TIME BASE A TRIGGER SLOPE to +EXT and TRIGGERING MODE to AC. Adjust the TYPE 535A for a stable display at 5MHz. Change TRIGGERING MODE to AC LF REJ. Check for a stable display at 5MHz.

Remove the 50Ω cable and 50Ω Termination from the "T" connector. Change A SLOPE to +INT. Adjust the CALIBRATION FIXTURE VARIABLE for 1cm of display. Adjust the TYPE 535A for a stable display. Change TRIGGERING MODE to AC. Check for a stable display at 5MHz.

b. Check DC triggering: 2cm INT or 1.0V EXT at 5MHz

Change TIME BASE A TRIGGERING MODE to DC. Increase display to 2cm. Adjust TYPE 535A for a stable display at 5MHz.

Change A TRIGGERING SLOPE to +EXT. Connect the 50Ω cable and 50Ω Terminator to the "T" connector. Adjust the TYPE 535A for a stable display at 5MHz.

c. Check AUTO triggering: 1.0cm INT or 1.0V EXT at 2MHz

Change TIME/CM to .2μSEC and TRIGGERING MODE to AUTO. Change the TYPE 191 frequency to 2MHz. Check for a stable display. Change TRIGGER SLOPE to +INT and remove the 50Ω Terminator from the "T" connector. Adjust the CALIBRATION FIXTURE VARIABLE for 1cm display. Check for a stable display. Remove the TYPE 191 connections.

d. Check AC LF REJ: Inoperable 2.0cm INT or 2.0V EXT at 200Hz

Connect the SINE WAVE GENERATOR to the CALIBRATION FIXTURE EXT INPUT and the TIME BASE A TRIGGER INPUT. Set the TIME/CM to 2 MILLISEC. Set the SINE WAVE GENERATOR for 2.0V out at 200Hz. Adjust the CALIBRATION FIXTURE VARIABLE for 2cm of display. Change TRIGGERING MODE to AC LF REJ. It should be impossible to obtain a stable display in any position of the TRIGGERING LEVEL and STABILITY controls in either INT or EXT TRIGGER SLOPE.

Disconnect EXT INPUT and TRIGGER INPUT.

17. TIME BASE B HIGH FREQUENCY TRIGGERING

a. Check AC triggering: 1cm INT or 1.0V EXT at 3MHz

Reconnect the 50Ω cable and 50Ω Termination to the "T" connector. Change HORIZONTAL DISPLAY to B. Connect the TYPE 191 OUTPUT to the "T" connector. Set the TYPE

17.a (cont'd)

191 for 1.0V at 3MHz out. Set the TIME BASE B TRIGGER SLOPE to +EXT and TRIGGERING MODE to AC. Change the TIME BASE B TIME/CM to 2μSEC. Adjust the TYPE 535A for a stable display at 3MHz.

Remove the 50Ω cable and 50Ω Termination from the "T" connector. Change the TIME BASE B TRIGGER SLOPE to +INT. Adjust the CALIBRATION FIXTURE VARIABLE for 1cm of display. Adjust the TYPE 535A for a stable display.

b. Check DC triggering: 2cm INT or 1.0V EXT at 3MHz

Change B TRIGGERING MODE to DC. Increase display to 2cm. Adjust TYPE 535A for a stable display at 3MHz.

Change B TRIGGERING SLOPE tp +EXT. Connect the 50Ω cable and 50Ω Terminator to the "T" connector. Adjust the TYPE 535A for a stable display at 3MHz.

c. Check AUTO triggering: 1.0cm INT or 1.0V EXT and 2MHz

Change TIME BASE B TRIGGERING MODE to AUTO. Change the TYPE 191 frequency to 2MHz. Check for a stable display. Change TRIGGER SLOPE to +INT and remove the 50Ω Terminator from the "T" connectot. Adjust the CALIBRATION FIXTURE VARIABLE for a 1cm display. Check for a stable display. Remove the TYPE 191 connections.

18. HORIZONTAL AMPLIFIER

a. Setup

Connect the TYPE 184 MARKER OUTPUT to the CALIBRATION FIXTURE EXT INPUT. Set the 535A TIME BASE B TIME/CM to 1 MILLISEC. Set TIME BASE V TRIGGERING MODE to AC and TRIGGER SLOPE to +INT. Adjust STABILITY and TRIGGERING LEVEL for a stable display. Set 5X MAGNIFIER to ON.

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

b. Adjust Mag Gain, R375: linearity ±0.8mm

Adjust Mag Gain, R375, for two 0.1ms marks per cm at the center of the sweep.

Check timing accuracy over the entire sweep. Check for a maximum error of 0.8 mm.

c. Adjust Swp Cal, R348

Switch 5X MAGNIFIER to OFF. Adjust Swp Cal, R348, for one 1ms mark per cm.

c. If horizontal jitter is present, select V252.

19. MATCH TIME BASES

a. Adjust R160Z

Change HORIZONTAL DISPLAY to A, TIME BASE A TRIGGERING MODE to AC, TRIGGER SLOPE to +INT, STABILITY and TRIGGERING LEVEL for a stable display. Set TIME BASE A TIME/CM to 1 MILLISEC.

Adjust R160Z for one 1ms mark per cm.

20. TIME BASE A SWEEP LENGTH

a. Adjust Sweep Length, R176: 10.5cm

Adjust Sweep Length, R176, for 10.5cm

21. NORMAL-MAGNIFIED REGISTRATION

a. Adjust Norm/Mag Regis, R358: at graticule center

Switch 5X MAGNIFIER to ON. Position the start of the trace to the graticule center. Switch 5X MAGNIFIER OFF and adjust Norm/Mag Regis, R358, for trace start at the graticule center. Repeat as necessary.

22. VARIABLE TIME/CM

a. Check VARIABLE ratio: 2.5 to 1

Set 184 for 10ms markers. Check 10ms equals 10cm. Turn TIME BASE A VARIABLE ccw. Check 10ms equals 4cm or less.

23. TIME BASE A SLOW SWEEP TIMING

a. Check slow sweep timing: ±1.6mm except 1, 2 and 5SEC 2mm

Using the following table check slow sweep rate accuracy of TIME BASE A.

TYPE 535A TIME/CM	TYPE 184 time marks	time marks/cm	max error
.1mSEC	.1mS	1	1.6mm
.2mSEC	.1mS	2	1.6mm
.5mSEC	.5mS	1	1.6mm
1mSEC	1mS	1	1.6mm
2mSEC	2mS	2	1.6mm
5mSEC	5mS	1	1.6mm
10mSEC	10mS	1	1.6mm
20mSEC	10mS	2	1.6mm
50mSEC	50mS	1	1.6mm
.1 SEC	.1 S	1	1.6mm
.2 SEC	.1 S	2	1.6mm
.5 SEC	.5 S	1	1.6mm
1 SEC	1 S	1	2mm
2 SEC	1 S	2	2mm
5 SEC	5 S	1	2mm

24. TIME BASE A FAST SWEEP TIMING

a. Setup

Connect the TYPE 184 TRIGGER OUTPUT to the TYPE 535A TIME BASE A TRIGGER INPUT. Set the TYPE 184 for 10μs trigger and 10μs markers. Set the TIME BASE A TRIGGER SLOPE to +EXT and set the STABILITY and TRIGGERING LEVEL for a stable display.

b. Adjust horizontal compensation, C330: coincidence of first mark

Set X5 MAGNIFIER to ON. Switch TIME BASE A TIME/CM between .1 MILLISEC and 50μSEC and adjust C330 for coincidence of the first time mark.

c. Adjust 10μSEC timing, C160E: ±1.6mm

Set TIME BASE A TIME/CM to 10μSEC and 5X MAGNIFIER to OFF. Adjust C160E for one mark/cm.

d. Adjust 1μSEC timing, C160C: ±1.6mm

Change the TYPE 184 to 1μS and the TIME BASE A TIME/CM to 1μSEC. Adjust C160C for 1 mark/cm.

e. Adjust .5μSEC timing, C160A: ±1.6mm

Change the TIME BASE A TIME/CM to .5μSEC. Adjust C160A for 1 mark/2cm.

f. Adjust .1μSEC timing, C348: ±1.6mm

Change the TYPE 184 to .1 Ş and the TIME BASE A TIME/CM to .1μSEC. Adjust C348 for 1 mark/cm.

g. Adjust 20ns timing, C346, C384, C375: ±2.4mm

Connect the TYPE 184 MARKER OUTPUT to one of the vertical CRT leads through a 47pF capacitor. Change the TYPE 184 marker output for 20ns.

Set the 5X MAGNIFIER to ON. Adjust C364 and C384 for 1 cycle/cm at the center of the trace. Adjust C375 for 1 cycle/cm at the left end of the trace. Check for correct timing over the entire trace.

h. Check 40ns timing: ±2.4mm

Change TIME BASE A TIME/CM to .2μSEC and check for 2 cycles/cm at the center of the trace.

i. Check fast sweep timing: ±1.6mm

Connect the TYPE 184 MARKER OUTPUT to the CALIBRATION FIXTURE EXT INPUT. Change the TYPE 184 TRIGGER SELECTOR to .1mS. Turn the TYPE 535A 5X MAGNIFIER to OFF.

24.i (cont'd)

Check fast sweep timing accuracy using the following table.

TYPE 535A TIME/CM	TYPE 184 time marks	check for	max error
50μSEC	50μS	1 mark/cm	1.6mm
20μSEC	10μS	2 marks/cm	1.6mm
10μSEC	10μS	1 mark/cm	1.6mm
5μSEC	5μS	1 mark/cm	1.6mm
2μSEC	1μS	2 marks/cm	1.6mm
1μSEC	1μS	1 mark/cm	1.6mm
.5μSEC	.5μS	1 mark/cm	1.6mm
.2μSEC	.1μS	2 marks/cm	1.6mm
.1μSEC	.1μS	1 mark/cm	1.6mm

25. DELAY PICKOFF JITTER

a. Setup

Set the TYPE 184 for 1ms markers. Switch HORIZONTAL DISPLAY to B INTENSIFIED BY A. Set the TYPE 535A controls as follows:

TIME BASE B TIME/CM	1 MILLISEC
TIME BASE A TIME/CM	1μSEC
TIME BASE A STABILITY	cw
TIME BASE B STABILITY and TRIGGERING LEVEL	Adjust for a stable display

b. Check jitter at 1.00: 2mm, max

Adjust the DELAY-TIME MULTIPLIER so that the 1ms marker at 1cm is intensified. Change HORIZONTAL DISPLAY to A DEL'D BY B and adjust the DELAY-TIME MULTIPLIER to position the leading edge of the marker within the graticule area. Check that the horizontal jitter is not greater than 2mm.

Excessive jitter may be caused by V414 or V424 or a noisy timing resistor.

Some slow drift may be present and is normal.

c. Check jitter at 9.00: 4mm, max

Change HORIZONTAL DISPLAY to B INTENSIFIED BY A. Adjust the DELAY-TIME MULTIPLIER so that the 1ms marker at 9cm is intensified. Change HORIZONTAL DISPLAY to A DEL'D BY B and adjust the leading edge of the marker within the graticule area. Check that the horizontal jitter is not greater than 4mm.

Repeat jitter checks with TIME BASE A TIME/CM at .5μSEC and TIME BASE B TIME/CM at .5 MILLISEC.

25.c (cont'd)

Repeat jitter checks with TIME BASE A TIME/CM at .2μSEC and TIME BASE B TIME/CM at .2 MILLISEC.

26. DELAY START AND STOP

a. Setup

Change TIME BASE B TIME/CM to .5 MILLISEC and TIME BASE A TIME/CM to 10μSEC. Set the TYPE 184 for 0.5ms markers. Change HORIZONTAL DISPLAY to B INTENSIFIED BY A. Adjust TIME BASE B TRIGGERING LEVEL and STABILITY for a stable display.

Set the DELAY-TIME MULTIPLIER fully ccw and check for a dial reading of 0.00. Readjust the DELAY-TIME MULTIPLIER knob if a dial reading of 0.00 does not occur at the mechanical stop.

b. Adjust Delay Start, R436, and Delay Stop, R432

Set the DELAY-TIME MULTIPLIER to 1.00. Adjust Delay Start, R436, so that intensification begins at the marker at 1cm.

Set the DELAY-TIME MULTIPLIER to 9.00. Adjust Delay Stop, R432, so that intensification begins at the marker at 9cm.

The Delay Start, R436, and Delay Stop, R432, adjustments interact. Repeat the adjustments as necessary. Make final adjustments with HORIZONTAL DISPLAY set to A DEL'D BY B so that the leading edge of the marker coincides with the start of the trace.

c. Check linearity: ±2 minor dial divisions

With marker leading edge at the start of the trace, check for a DELAY-TIME MULTIPLIER reading as in the following table.

In B INTENSIFIED BY A marker at:	In A DEL'D BY B DELAY-TIME MULTIPLIER reads between
1cm	0.98 and 1.02
2cm	1.98 and 2.02
3cm	2.98 and 3.02
4cm	3.98 and 4.02
5cm	4.98 and 5.02

26.c (cont'd)

In B INTENSIFIED BY A marker at:	In A DEL'D BY A DELAY-TIME MULTIPLER reads between
6cm	5.98 and 6.02
7cm	6.98 and 7.02
8cm	7.98 and 8.02
9cm	8.98 and 9.02

27. TIME BASE B TIMING

a. Check slow sweep rate accuracy: ±5 minor div max; except .2, .5 and 1 SEC ±8 minor div max

Set TIME BASE B TIME/CM to .2mSEC. Set the TYPE 184 to .1mS. Use the following table to check slow sweep rate accuracy. Use B INTENSIFIED BY A to locate time marks and check accuracy with the HORIZONTAL DISPLAY in A DLY'D BY B.

a. Slow sweep rates

The delay-time at slow sweep rates keeps the repetition rate low. One method of speeding up this check is to use min LENGTH while finding the time mark at 1.00 then increasing the LENGTH to max to measure accuracy at 9.00.

TIME BASE B TIME/CM	TIME BASE A TIME/CM	TYPE 184	minor div difference between 1.00 & 9.00
.2mSEC	5µSEC	.1mS	±5 max
.5mSEC	10µSEC	.5mS	±5 max
1mSEC	10µSEC	1mS	±5 max
2mSEC	20µSEC	1mS	±5 max
5mSEC	50µSEC	5mS	±5 max
10mSEC	.1mSEC	10mS	±5 max
20mSEC	.2mSEC	10mS	±5 max
50mSEC	.5mSEC	50mS	±5 max
.1 SEC	1mSEC	.1 S	±5 max
.2 SEC	2mSEC	.1 S	±8 max
.5 SEC	5mSEC	.5 S	±8 max
1 SEC	10mSEC	1 S	±8 max

b. Adjust fast sweep rates C260C & C260A ±5 minor div

Set TIME BASE B TIME/CM to 50µSEC; TIME BASE A TIME/CM to 2µSEC. Change TYPE 184 to 50 S. Set the HORIZONTAL DISPLAY to B INTENSIFIED BY A. Adjust C260C for 1 mark/cm. Change HORIZONTAL DISPLAY to A DLY'D BY B for final adjustments (1.00 to 9.00)

27.b (cont'd)

Change TIME BASE B TIME/CM to 5μSEC, TIME BASE A TIME/CM to .2μSEC and TYPE 184 to 5μS. Set the HORIZONTAL DISPLAY to B INTENSIFIED BY A and adjust C260A for 1 mark/cm. Make final adjustment in A DLY'D BY B. (1.00 to 9.00).

Use the following table to check fast sweep accuracy:

TIME BASE B TIME/CM	TIME BASE A TIME/CM	TYPE 184	minor div difference between 1.00 & 9.00
2μSEC	.1μSEC	1μS	±5 max
5μSEC	.2μSEC	5μS	±5 max
10μSEC	.5μSEC	10μS	±5 max
20μSEC	1μSEC	10μS	±5 max
50μSEC	2μSEC	50μS	±5 max
.1mSEC	5μSEC	.1mS	±5 max

28. HOLD OFF

a. Setup

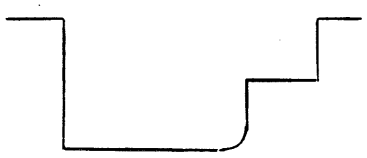
Remove the TYPE 184 signal and change the HORIZONTAL DISPLAY to A. Set the test scope input coupling to DC and connect a 10X probe to the Vertical Input. Connect the probe tip to the + GATE A binding post.

b. Check + GATE Interval: 3μs to 400ms

Check A & B + GATE Internal as listed in the table below. Change test scope TIME/CM TRIGGERING LEVEL and STABILITY control settings as necessary.

TIME/CM	TIME BASE A + GATE Interval	TIME BASE B + GATE Interval
.05μSEC	4 to 9μs	
.1μSEC	4 to 9μs	
.2μSEC	4 to 9μs	
.5μSEC	4 to 9μs	
1μSEC	15 to 40μs	
2μSEC	15 to 40μs	5 to 15μs
5μSEC	15 to 40μs	5 to 15μs
10μSEC	15 to 40μs	5 to 15μs
20μSEC	15 to 40μs	50 to 150μs
50μSEC	15 to 40μs	50 to 150μs

b. The + GATE A waveform with TIME BASE A TIME/CM at 1mSEC and .05μSEC and the + GATE B waveform with TIME BASE B TIME/CM at .1mSEC and 2μSEC should resemble the following illustration with the final portion flat.



28.b (cont'd)

TIME/CM	TIME BASE A + GATE Interval	TIME BASE B + GATE Interval
.1mSEC	150 to 400µs	50 to 150µs
.2mSEC	150 to 400µs	.5 to 1.5ms
.5mSEC	150 to 400µs	.5 to 1.5ms
1mSEC	1.5 to 4ms	.5 to 1.5ms
2mSEC	1.5 to 4ms	5 to 15ms
5mSEC	1.5 to 4ms	5 to 15ms
10mSEC	15 to 40ms	5 to 15ms
20mSEC	15 to 40ms	50 to 150ms
50mSEC	15 to 40ms	50 to 150ms
.1 SEC	150 to 400ms	50 to 150ms
.2 SEC	150 to 400ms	50 to 150ms
.5 SEC	150 to 400ms	50 to 150ms
1 SEC	150 to 400ms	50 to 150ms
2 SEC	150 to 400ms	

29. TIME BASE B SWEEP LENGTH

a. Setup

Set the TYPE 184 for 1mS and .1mS marks. Change HORIZONTAL DISPLAY to B, B TIME/CM to 1mSEC and use STABILITY and TRIGGERING LEVEL to obtain stable display.

Connect Ohms Picker.

b. Set B SWEEP LENGTH: 10.2 to 10.8cm, cw 3.2 to 3.8cm, ccw

Set ohms picker R277 and R278 controls so that when TIME BASE B LENGTH is cw, trace is 10.s to 10.8cm and 3.2 to 3.8cm with LENGTH at ccw. Remove ohms picker.

29.b (cont'd)

Note ohms picker R277 and R278 values. Select 10% ½W comp resistors to correcpond to ohms picker values and install them in the TYPE 585A.

Check sweep length with LENGTH ccw and cw and TIME/CM at 50mSEC.

30. LOCKOUT LEVEL

a. Adjust Lockout Level Adj, R125: 1.1 to 2.3

Change the HORIZONTAL DISPLAY to B INTENSIFIED BY A. Set both TIME/CM controls to .1mSEC and TRIGGERING LEVEL controls cw. Turn TIME BASE B STABILITY cw and TIME BASE A STABILITY ccw.

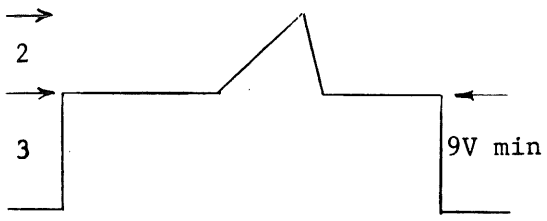
Connect the test scope 10X probe to pin 2 of V125. Set test scope TIME/CM to .2mSEC and VOLTS/CM to .5.

Slowly turn TIME BASE A STABILITY cw until the sawtooth-gate waveform appears on the test scope. Adjust Lockout Level Adj R125 for a sawtooth to gate amplitude ratio between 1:1 and 2:3. Readjust TIME BASE A STABILITY as necessary. Remove the probe.

The waveform illustrated can be obtained by adjustment of the test scope VARIABLE TIME/CM and VARIABLE VOLTS/CM controls. With a total waveform amplitude of 5cm, adjust LOCKOUT LEVEL ADJ.

b. Check gate amplitude: 9V min

Check the amplitude of the gate portion of the waveform for 9 volts or more.



c. Check SINGLE SWEEP triggering: sweeps once on triggering signal

Set Horizontal Display to A. Apply a .2V SAC signal to the CALIBRATION FIXTURE EXT INPUT. Adjust AMPLITUDE control for 2mm of deflection. Adjust TIME BASE A STABILITY and TRIGGERING LEVEL for a stable display.

Remove the signal from the INPUT and switch the HORIZONTAL DISPLAY to SINGLE SWEEP. Press the RESET button. The READY neon should light. Reconnect the signal to the INPUT and check that

30.c (cont'd)

a single sweep is initiated and the READY light extinguished.

31. FRONT PANEL WAVEFORMS

a. Front panel WAVEFORMS

VERT SIG OUT	≥1.5V/cm
SAWTOOTH A	≥130V
+ GATE A	≥20V
+ GATE B	≥20V
DEL'D TRIGGER	≥5V

Connect the TYPE 535A CAL OUT to the EXT INPUT with a coax cable. Set the AMPLITUDE CALIBRATOR for 2 VOLTS. Adjust the CALIBRATION FIXTURE VARIABLE for 2cm of vertical display. Set the test scope INPUT SELECTOR to DC. Set the test scope TRIGGERING MODE to DC and TRIGGER SLOPE to -INT. Use the test scope X10 probe and check the following amplitudes:

VERT SIG OUT	3 volts min
SAWTOOTH OUT	130 volts min
+ GATE A	20 volts min
+ GATE B	20 volts min
DEL'D TRIGGER	5 volts min

Remove the coax cable from the EXT INPUT and the TYPE 535A CAL OUT.

32. EXTERNAL HORIZONTAL AMPLIFIER

a. Adjust Ext Horiz Amp DC Balance, R317: no shift

Connect a jumper lead from SAWTOOTH A to EXT INPUT. Switch HORIZONTAL DISPLAY to EXT X1. Turn STABILITY control fully cw. Center the vertical trace on the graticule. Rotate the VARIABLE 10-1 back and forth while adjusting Ext Horiz DC Balance, R317, for no trace shift. Leave the VARIABLE 10-1 control fully cw.

b. Adjust C301C: X10 to match X1

Connect a 0.5V signal from SAC to the HORIZ INPUT and the TIME BASE A TRIGGER INPUT. Set the TIME BASE A TIME/CM and TRIGGERING MODE to AC. Adjust TRIGGERING LEVEL and STABILITY for a stable display. Check the waveform for aberrations.

Change the HORIZONTAL DISPLAY to X10 and SAC for 5V out. Adjust C301C to match the X1 waveform.

c. Check deflection factor: 5.6cm/V min

Set HORIZONTAL DISPALY to X1 and SAC for 1V out. With the VARIABLE 10-1 fully cw, check for 5.6cm deflection, min.

d. Check EXT X10: ±2mm

Set SAC for 2V out and VARIABLE 10-1 for exactly 10cm of horizontal amplitude. Change HORIZONTAL DISPALY to X10 and SAC to 20V out. Check for 10cm of amplitude ±2mm.

e. Check VARIABLE 10-1: 10:1 ratio, min

Change SAC to 10V out and VARIABLE 10-1 to full cw. Check amplitude. Turn VARIABLE 10-1 fully ccw. Change the SAC out to 100V. The horizontal deflection should be equal to or less than the full cw amplitude. Remove the SAC.

f. Check bandwidth: 350kHz at -3dB or less

Turn the VARIABLE 10-1 fully cw and the HORIZONTAL DISPLAY to X1. Turn STABILITY cw.

Apply 4cm of 50kHz from TYPE 191 to HORIZ INPUT. Increase the TYPE 191 output frequency to 350kHz. Check for 2.8cm minimum deflection.

Remove TYPE 191 and SAWTOOTH OUT connections.

33. TRANSIENT RESPONSE

a. Setup

CALIBRATION FIXTURE	067-0521-00
TEST FUNCTION	+ PULSE
REPITION RATE	HIGH
AMPLITUDE	3cm
VERTICAL POSITION	centered

TYPE 535A	
A TIME/CM	.1 SEC
HORIZONTAL DISPLAY	A
A STABILITY	stable display
A TRIGGERING LEVEL	" "
A TRIGGER SLOPE	+INT
A TRIGGERING MODE	AC

b. Preset delay line

Preset the vertical amplifier and delay line as follows:

L506 and L523: slugs just below the windings
L553 and L563: bottom slugs just into the windings and top slugs 1/8 inch from top of coil form
C553 and C563: midr
delay line trimmers C903 thru C940: ¼ inch out
L955 and L956: ¼ of the slug into the windings

c. Adjust delay line termination: ≤0.3mm aberration

Adjust the TYPE 535A VARIABLE TIME/CM for approx 1 cycle/10cm.

Adjust L553, L563 (both top and bottom slugs) C553 and C563 to eliminate the termination aberration. Keep the slugs in L563 even with the slugs in L553.

d. Adjust delay line: ≤0.3mm aberration

Adjust the delay line trimmer capacitors a little at a time (1/2 turn or so) keeping them even. After each time trimmers have been adjusted, change the TYPE 535A A TIME/CM switch to 2μSEC and check the slant of the top of the pulses. This is the aberration, 0.3mm max. If the top is not level repeat steps 25c and d.

e. Adjust transient response: ≤0.3mm overshoot or rounding

Return the TYPE 535A TIME/CM switch to .1 SEC and adjust L955 and L956 for the best front corner, 0.3mm or less overshoot or rounding. If the range of L955 and L956 is not adequate L506 and L956, and L506 and L523 equal. Recheck the termination and delay line trimmers for 0.3mm or less aberration.

34. VERTICAL AMPLIFIER BANDWIDTH

-3dB at ≥15MHz

Remove the CALIBRATION FIXTURE from the TYPE 535A and install a TYPE 1A2 PLUG-IN UNIT. Set the TYPE 1A2 MODE to CH 1, CHANNEL 1 INPUT SELECTOR to DC and VOLTS/CM to .05.

Connect the TYPE 191 to the TYPE 1A2 CHANNEL 1 INPUT with a 50Ω coax cable and 50Ω Termination. Set the TYPE 191 FREQUENCY RANGE to 50kHz. Adjust the TYPE 191 AMPLITUDE controls for 4cm of display amplitude with the TYPE 535A A TIME/CM at 1mSEC and STABILITY cw.

Set the TYPE 191 FREQUENCY RANGE to 8-18 MEGAHERTZ and adjust the frequency dial for 2.8cm of deflection remaining (-3dB point). Check the reading of the TYPE 191 frequency dial for ≥15MHz.

[NOTE: THE FOLLOWING CHECKS ARE NOT MADE ON 100% OF THE INSTRUMENTS BUT ARE DONE ON A SAMPLING BASIS]

35. VERTICAL SIGNAL OUT BANDWIDTH

a. Upper limit: ≥5MHz at 3dB down

Connect the test scope to the VERT SIG OUT binding post through a 10X probe.

35.a (cont'd)

Apply 2cm of 50kHz signal to the 1A2 CHANNEL 1 INPUT from the TYPE 191. Adjust the test scope for 4cm of deflection. Change the TYPE 191 frequency to 5MHz and check for at least 2.8cm of vertical deflection on the test scope. Remove the TYPE 191 from the 1A2 CHANNEL 1 INPUT.

b. Lower limit: ≤10Hz at 3dB down

Connect the SINE WAVE GENERATOR to the 1A2 INPUT CHANNEL 1 and adjust the SINE WAVE GENERATOR for 4cm at 50kHz on the test scope. Change the SINE WAVE GENERATOR frequency to 10Hz and check for at least 2.8cm deflection on the test scope. Remove the 10X probe.

36. TRIGGER BANDWIDTH

a. Check TIME BASE A lower limit:
≤150Hz in AC
≤10kHz in AC LF REJ
≤50Hz in AUTO

Adjust the SINE WAVE GENERATOR for 150Hz. Connect the SINE WAVE GENERATOR to the 1A2 INPUT and the TIME BASE A TRIGGER INPUT and adjust the output for 0.2V out. Turn the 1A2 to 1V/cm and check that a stable trace can be obtained in +EXT and +INT AC.

Change the SINE WAVE GENERATOR frequency to 10kHz and check that a stable trace can be obtained in +EXT and +INT AC LF REJ.

Change the SINE WAVE GENERATOR frequency to 50Hz and the A TRIGGERING MODE for AUTO triggering. Check for a stable display in +INT and +EXT.

b. Check TIME BASE B lower limit:
≤150Hz in AC
≤50Hz in AUTO

36.b (cont'd)

Remove the TIME BASE A TRIGGER INPUT and connect to B TRIGGER INPUT. Change the HORIZONTAL DISPLAY to B. Change the B TRIGGERING MODE to AUTO. Check for a stable display in +EXT amd +INT.

Change the SINE WAVE GENERATOR frequency to 150Hz. Change the B TRIGGERING MODE to AC. Check that a stable trace can be obtained in +EXT and +INT. Remove the SINE WAVE GENERATOR.

c. Check TIME BASE B upper limit
≥1MHz in DC
≥1MHz
≥1MHz

Connect the 191 to the 1A2 INPUT and the TIME BASE B TRIGGER INPUT. Adjust the 191 for 1MHz at 0.2V out. Check that a stable trace can be obtained in +INT and +EXT, AC or DC.

Change the 191 frequency to 1MHz at 0.4V out for a stable trace in +EXT and +INT AUTO.

d. Check TIME BASE A upper limit response: *≥2MHz in AC*
≥2MHz in AC LF REJ
≥1MHz in AUTO

Connect the TYPE 191 to the 1A2 INPUT and the TIME BASE A TRIGGER INPUT. Adjust TYPE 191 frequency to 2MHz and output voltage to 0.2V. Check that a stable trace can be obtained in +INT AC and +EXT AC. Check that a stable trace can be obtained in +INT and +EXT AC LF REJ.

Change TYPE 191 frequency to 1MHz at 0.4V out check for a stable trace in +EXT and +INT AUTO.

Remove TYPE 191 connections.

THE END