

PERFORMANCE CHECK PROCEDURE

INTRODUCTION

PURPOSE

The "Performance Check Procedure" is used to verify the Performance Requirement statements listed in Table 1-1. It is the recommended acceptance check procedure for new instruments.

Instrument performance should be checked after every 2000 hours of operation or once each year, if used infrequently. A more frequent interval may be necessary, if your instrument is subjected to harsh environments or severe usage. The results of these periodic checks will determine the need for readjustment.

Selected procedures may also be used as preliminary troubleshooting aids or to verify instrument performance after repair or component replacement.

STRUCTURE

This procedure is structured into four major subsections, each of which can be performed independently, to permit checking individual portions of the instrument. At the beginning of each subsection there is an equipment-required list showing only the test equipment necessary for performing the steps in that subsection. In this list, the Item number that follows each piece of equipment corresponds to the Item number listed in Table 4-1.

Also at the beginning of each subsection is a list of all the front-panel control settings required to prepare the instrument for performing Step 1 in that subsection. Each succeeding step within a particular subsection should then be performed, both in the sequence presented and in its entirety, to ensure that control-setting changes will be correct for ensuing steps.

TEST EQUIPMENT

The test equipment listed in Table 4-1 is a complete list of the equipment required to accomplish both the "Performance Check Procedure" in this section and the "Adjustment Procedure" in Section 5. To assure accurate measurements, it is important that test equipment used for making these checks meet or exceed the specifications described in Table 4-1. When considering use of equipment other than that recommended, utilize the "Minimum Specification" column to determine whether available test equipment will suffice.

Each procedure in this section is written using the control and connector nomenclature imprinted on the "recommended" test equipment. When substitute equipment is used, control settings stated in the test setup and in the procedure itself may need to be altered.

Detailed operating instructions for test equipment are not given in this procedure. If more operating information is required, refer to the appropriate test-equipment instruction manual.

LIMITS AND TOLERANCES

The tolerances given in this procedure are valid for an instrument that is operating in and has been previously calibrated in an ambient temperature between +20°C and +30°C. The instrument also must have had at least a 20-minute warm-up period. Refer to Table 1-1 for tolerances applicable to an instrument that is operating outside this temperature range. All tolerances specified are for the instrument only and do not include test-equipment error.

PREPARATION FOR CHECKS

It is not necessary to remove the instrument cover to accomplish any subsection in the "Performance Check Procedure", since all checks are made using operator-accessible front- and rear-panel controls and connectors.

Test equipment items 1 through 8 in Table 4-1 are required to accomplish the complete Performance Check Procedure.

Before performing any procedure in this section, set the POWER switch to ON and allow a 20-minute warm-up period.

The most accurate display adjustments are made with a stable, well-focused, low-intensity display. Unless otherwise noted, adjust the INTENSITY, FOCUS, and TRIGGER LEVEL controls as needed to view the display.

Table 4-1
Test Equipment Required

Item No. and Description	Minimum Specification	Purpose	Examples of Suitable Test Equipment
1. Calibration Generator	Standard-amplitude signal levels: 10 mV to 50 V. Accuracy: $\pm 0.3\%$. High-amplitude signal levels: 1 V to 60 V. Repetition rate: 1 kHz. Fast-rise signal level: 1V. Repetition rate: 1 MHz Rise time: 1 ns or less Flatness: $\pm 0.5\%$.	Vertical and horizontal checks and adjustments.	TEKTRONIX PG 506 Calibration Generator. ^a
2. Leveled Sine-Wave Generator	Frequency: 250 kHz to above 100 MHz. Output amplitude: variable from 10 mV to 5 V p-p. Output impedance: 50 Ω . Reference frequency: 50 kHz. Amplitude accuracy: constant within 3% of reference frequency as output frequency changes.	Vertical, horizontal, and triggering checks and adjustments. Display adjustment and Z-Axis check.	TEKTRONIX SG 503 Leveled Sine-Wave Generator. ^a
3. Time-Mark Generator	Marker outputs: 10 ns to 0.5 s. Marker accuracy: $\pm 0.1\%$. Trigger output: 1 ms to 0.1 μ s, time-coincident with markers.	Horizontal checks and adjustments. Display adjustment.	TEKTRONIX TG 501 Time-Mark Generator. ^a
4. Cable (2 required)	Impedance: 50 Ω . Length: 42 in. Connectors: BNC.	Signal interconnection.	Tektronix Part Number 012-0057-01.
5. Termination (2 required)	Impedance: 50 Ω . Connectors: BNC.	Signal termination.	Tektronix Part Number 011-0049-01.
6. Dual-Input Coupler	Connectors: BNC-Female-to-Dual-BNC male.	Vertical checks and adjustments	Tektronix Part Number 067-0525-01.
7. 10X Attenuator	Ratio: 10X. Impedance: 50 Ω . Connectors: BNC.	Vertical compensation and triggering checks.	Tektronix Part Number 011-0059-02.

Table 4-1 (cont)

Item No. and Description	Minimum Specification	Purpose	Examples of Suitable Test Equipment
8. T-Connector	Connectors: BNC.	Signal interconnection.	Tektronix Part Number 103-0030-00.
9. Adapter	Connectors: BNC-Male-to-Miniature Probe Tip.	Signal interconnection.	Tektronix Part Number 013-0084-02.
10. Digital Voltmeter	Range: 0 to 140 V. Dc voltage accuracy: $\pm 0.15\%$. 4 1/2-digit display.	Power supply checks and adjustment. Vertical adjustment.	TEKTRONIX DM 501A Digital Multimeter. ^a
11. Test Oscilloscope with included 10X Probe	Bandwidth: dc to 10 MHz. Minimum deflection factor: 5 mV/div. Accuracy: $\pm 3\%$.	Holdoff check and general troubleshooting.	TEKTRONIX 2213 Oscilloscope.
12. DC Voltmeter	Range: 0 to 2500 V, calibrated to 1% accuracy at -2000 V.	High-voltage power supply check.	Triplett Model 630-NA.
13. Screwdriver	Length: 3-in shaft. Bit Size: 3/32 in.	Adjust variable resistors.	Xcelite R-3323.
14. Low-Capacitance Alignment Tool	Length: 1-in shaft. Bit size: 3/32 in.	Adjust variable capacitors.	J.F.D. Electronics Corp. Adjustment Tool Number 5284.

^aRequires a TM 500-series power-module mainframe.

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VERTICAL

Equipment Required (see Table 4-1):

- | | |
|--------------------------------------|-------------------------------|
| Calibration Generator (Item 1) | 50-Ω BNC Termination (Item 5) |
| Leveled Sine-Wave Generator (Item 2) | Dual-Input Coupler (Item 6) |
| 50-Ω BNC Cable (Item 4) | 10X Attenuator (Item 7) |

INITIAL CONTROL SETTINGS

Vertical (Both Channels)

- | | |
|--------------------|------------------|
| POSITION | Midrange |
| VERTICAL MODE | CH 1 |
| BW LIMIT | On (button in) |
| VOLTS/DIV | 2 mV |
| VOLTS/DIV Variable | CAL detent |
| INVERT | Off (button out) |
| AC-GND-DC | DC |

Horizontal

- | | |
|------------------|---------------|
| POSITION | Midrange |
| HORIZONTAL MODE | A |
| A SEC/DIV | 0.2 ms |
| SEC/DIV Variable | CAL detent |
| X10 Magnifier | Off (knob in) |

A TRIGGER

- | | |
|----------------|-----------|
| VAR HOLDOFF | NORM |
| Mode | P-P AUTO |
| SLOPE | OUT |
| LEVEL | Midrange |
| A&B INT | VERT MODE |
| A SOURCE | INT |
| A EXT COUPLING | AC |

c. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector. Set the VERTICAL MODE switch to CH 2.

**Table 4-2
Deflection Accuracy Limits**

VOLTS/DIV Switch Setting	Standard Amplitude Signal	Vertical Deflection (Divisions)	Accuracy Limits (Divisions)
2 mV	10 mV	5	4.90 to 5.10
5 mV	20 mV	4	3.92 to 4.08
10 mV	50 mV	5	4.90 to 5.10
20 mV	0.1 V	5	4.90 to 5.10
50 mV	0.2 V	4	3.92 to 4.08
0.1 V	0.5 V	5	4.90 to 5.10
0.2 V	1 V	5	4.90 to 5.10
0.5 V	2 V	4	3.92 to 4.08
1 V	5 V	5	4.90 to 5.10
2 V	10 V	5	4.90 to 5.10
5 V	20 V	4	3.92 to 4.08

PROCEDURE STEPS

1. Check Deflection Accuracy and Variable Range

a. Connect the standard-amplitude generator output via a 50-Ω cable to the CH 1 OR X input connector.

b. CHECK—Deflection accuracy is within the limits given in Table 4-2 for each CH 1 VOLTS/DIV switch setting and corresponding standard-amplitude signal. When at the 20-mV VOLTS/DIV switch setting, rotate the CH 1 VOLTS/DIV Variable control fully counterclockwise and CHECK that the display decreases to 2 divisions or less. Then return the CH 1 VOLTS/DIV Variable control to the CAL detent and continue with the 50-mV check.

d. Repeat part b using the Channel 2 controls.

2. Check Position Range

a. Set:

- | | |
|------------------|-------|
| VOLTS/DIV (both) | 50 mV |
| AC-GND-DC (both) | AC |

b. Set the generator to produce a 0.5-V standard-amplitude signal.

c. Adjust the CH 2 VOLTS/DIV Variable control to produce a 4.4-division display. Set the CH 2 VOLTS/DIV switch to 10 mV.

d. CHECK—The bottom and top of the trace may be positioned above and below the center horizontal graticule line by rotating the Channel 2 POSITION control fully clockwise and counterclockwise respectively.

e. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector and set the VERTICAL MODE switch to CH 1.

f. Repeat parts c and d using the Channel 1 controls.

3. Check Trigger View Gain

a. Set:

Vertical POSITION (both)	Midrange
VOLTS/DIV (both)	0.1 V
VOLTS/DIV Variable (both)	CAL detent

b. While holding in the TRIG VIEW button, use the A TRIGGER LEVEL control to vertically center the display.

c. CHECK—Display amplitude is 4 to 6 divisions while holding in the TRIG VIEW button.

d. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector.

e. Repeat parts b and c.

f. Move the cable from the CH 2 OR Y input connector to the EXT INPUT connector. Set the A SOURCE switch to EXT.

g. Repeat parts b and c.

h. Set the A EXT COUPLING switch to DC.

i. Repeat parts b and c.

j. Set the A EXT COUPLING switch to DC ÷ 10.

k. Set the generator to produce a 5-V signal.

l. Repeat parts b and c.

m. Disconnect the test equipment from the instrument.

4. Check Aberrations

a. Set:

BW LIMIT	Off (button out)
VOLTS/DIV (both)	2 mV
AC-GND-DC (both)	DC
A SEC/DIV	0.05 μ s

b. Connect the fast-rise, positive-going square-wave output via a 50- Ω cable, a 10X attenuator, and a 50- Ω termination to the CH 1 OR X input connector.

c. Set the generator to produce a 1-MHz, 5-division display.

d. CHECK—Display aberrations are within 4% (0.2 division or less).

e. Repeat part d for each of the following VOLTS/DIV switch settings: 5 mV through 0.5 V. Adjust the generator output and attach or remove the 10X attenuator as necessary to maintain a 5-division display at each VOLTS/DIV switch setting.

f. Disconnect the cable from the CH 1 OR X input connector. Reconnect the 10X attenuator (if previously removed) and reduce the generator amplitude to minimum.

g. Connect the cable to the CH 2 OR Y input connector and set the VERTICAL MODE switch to CH 2.

h. Set the generator to produce a 5-division display.

i. Repeat parts d and e using the Channel 2 controls.

j. Disconnect the test equipment from the instrument.

5. Check Bandwidth

a. Set:

VOLTS/DIV (both)	2 mV
A SEC/DIV	20 μ s

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b. Connect the leveled sine-wave generator output via a 50-Ω cable and a 50-Ω termination to the CH 2 OR Y input connector.

c. Set the generator to produce a 50-kHz, 6-division display.

d. CHECK—Display amplitude is 4.2 divisions or greater as the generator output frequency is increased up to the value shown in Table 4-3 for the corresponding VOLTS/DIV switch setting.

**Table 4-3
Settings for Bandwidth Checks**

VOLTS/DIV Switch Setting	Generator Output Frequency
2 mV	90 MHz
5 mV to 5 V	100 MHz

e. Repeat parts c and d for all indicated CH 2 VOLTS/DIV switch settings, up to the output-voltage upper limit of the sine-wave generator being used.

f. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector. Set the VERTICAL MODE switch to CH 1.

g. Repeat parts c and d for all indicated CH 1 VOLTS/DIV switch settings, up to the output-voltage upper limit of the sine-wave generator being used.

6. Check Bandwidth Limit Operation

a. Set:

BW LIMIT	On (button in)
CH 1 VOLTS/DIV	10 mV
A SEC/DIV	20 μs

b. Set the generator to produce a 50-kHz, 6-division display.

c. Increase the generator output frequency until the display amplitude decreases to 4.2 divisions.

d. CHECK—Generator output frequency is between 18 and 22 MHz.

e. Disconnect the test equipment from the instrument.

7. Check Common-Mode Rejection Ratio

a. Set:

BW LIMIT	Off (button out)
CH 2 VOLTS/DIV	10 mV
INVERT	On (button in)

b. Connect the leveled sine-wave generator output via a 50-Ω cable, a 50-Ω termination, and a dual-input coupler to the CH 1 OR X and the CH 2 OR Y input connectors.

c. Set the generator to produce a 50-MHz, 6-division display.

d. Vertically center the display using the Channel 1 POSITION control. Then set the VERTICAL MODE switch to CH 2 and vertically center the display using the Channel 2 POSITION control.

e. Set the VERTICAL MODE switches to BOTH and ADD.

f. CHECK—Display amplitude is 0.6 division or less.

g. If the check in part f meets the requirement, skip to part p. If it does not, continue with part h.

h. Set the VERTICAL MODE switch to CH 1.

i. Set the generator to produce a 50-kHz, 6-division display.

j. Set the VERTICAL MODE switch to BOTH.

k. Adjust the CH 1 or CH 2 VOLTS/DIV Variable control for minimum display amplitude.

l. Set the VERTICAL MODE switch to CH 1.

m. Set the generator to produce a 50-MHz, 6-division display.

n. Set the VERTICAL MODE switch to BOTH.

o. CHECK—Display amplitude is 0.6 division or less.

p. Disconnect the test equipment from the instrument.

c. Set the generator to produce a 50-MHz, 5-division display.

d. Set the VERTICAL MODE switch to CH 2.

e. CHECK—Display amplitude is 0.05 division or less.

f. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector.

g. Set:

VERTICAL MODE	CH 1
Channel 1 AC-GND-DC	GND
Channel 2 AC-GND-DC	DC

h. CHECK—Display amplitude is 0.05 division or less.

i. Disconnect the test equipment from the instrument.

8. Check Channel Isolation

a. Set:

VERTICAL MODE	CH 1
VOLTS/DIV (both)	1 V
VOLTS/DIV Variable (both)	CAL detent
INVERT	Off (button out)
Channel 2 AC-GND-DC	GND
A SEC/DIV	0.1 μ s

b. Connect the leveled sine-wave generator output via a 50- Ω cable and a 50- Ω termination to the CH 1 OR X input connector.

HORIZONTAL

Equipment Required (see Table 4-1):

Calibration Generator (Item 1)	50-Ω BNC Cable (Item 4)
Leveled Sine-Wave Generator (Item 2)	50-Ω BNC Termination (Item 5)
Time-Mark Generator (Item 3)	

INITIAL CONTROL SETTINGS

Vertical

POSITION (both)	Midrange
VERTICAL MODE	CH 1
BW LIMIT	Off (button out)
CH 1 VOLTS/DIV	0.5 V
CH 1 VOLTS/DIV Variable	CAL detent
Channel 1 AC-GND-DC	DC

Horizontal

POSITION	Midrange
HORIZONTAL MODE	A
A SEC/DIV	0.05 μs
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
B DELAY TIME POSITION	Fully counterclockwise

B TRIGGER

SLOPE	OUT
LEVEL	Fully clockwise

A TRIGGER

VAR HOLDOFF	NORM
Mode	NORM
SLOPE	OUT
LEVEL	Midrange
A&B INT	VERT MODE
A SOURCE	INT
A EXT COUPLING	DC ÷ 10

PROCEDURE STEPS

1. Check Timing Accuracy and Linearity

a. Connect the time-mark generator output via a 50-Ω cable and a 50-Ω termination to the CH 1 OR X input connector.

b. Select 50-ns time markers from the time-marker generator.

c. Adjust the A TRIGGER LEVEL control for a stable, triggered display.

d. Use the Horizontal POSITION control to align the second time marker with the second vertical graticule line.

e. CHECK—Timing accuracy is within 2% (0.16 division at the 10th vertical graticule line), and linearity is within 5% (0.1 division over any 2 of the center 8 divisions).

Table 4-4
Settings for Timing Accuracy Checks

SEC/DIV Switch Setting	Time-Mark Generator Setting	
	Normal	X10 Magnified
0.05 μ S	50 ns	10 ns
0.1 μ S	0.1 μ S	10 ns
0.2 μ S	0.2 μ S	20 ns
0.5 μ S	0.5 μ S	50 ns
1 μ S	1 μ S	0.1 μ S
2 μ S	2 μ S	0.2 μ S
5 μ S	5 μ S	0.5 μ S
10 μ S	10 μ S	1 μ S
20 μ S	20 μ S	2 μ S
50 μ S	50 μ S	5 μ S
0.1 ms	0.1 ms	10 μ S
0.2 ms	0.2 ms	20 μ S
0.5 ms	0.5 ms	50 μ S
1 ms	1 ms	0.1 ms
2 ms	2 ms	0.2 ms
5 ms	5 ms	0.5 ms
10 ms	10 ms	1 ms
20 ms	20 ms	2 ms
50 ms	50 ms	5 ms
A Sweep Only		
0.1 s	0.1 s	10 ms
0.2 s	0.2 s	20 ms
0.5 s	0.5 s	50 ms

NOTE

For checking the timing accuracy of the A SEC/DIV switch settings from 50 ms to 0.5 s, watch the time marker tips only at the 2nd and 10th vertical graticule lines while adjusting the Horizontal POSITION control.

f. Repeat parts c through e for the remaining A SEC/DIV and time-mark generator setting combinations shown in Table 4-4 under the "Normal" column.

g. Set:

A SEC/DIV	0.05 μ S
X10 Magnifier	On (knob out)

h. Select 10-ns time markers from the time-mark generator.

i. Use the Horizontal POSITION control to align the first time marker that is 25 ns beyond the start of the sweep with the second vertical graticule line.

j. CHECK—Timing accuracy is within 3% (0.24 division at the 10th vertical graticule line), and linearity is within 5% (0.1 division over any 2 of the center 8 divisions). Exclude any portion of the sweep past the 100th magnified division.

k. Repeat parts i and j for the remaining A SEC/DIV and time-mark generator setting combinations shown in Table 4-4 under the "X10 Magnified" column.

l. Set:

HORIZONTAL MODE	B
A SEC/DIV	0.1 μ S
B SEC/DIV	0.05 μ S
X10 Magnifier	Off (knob in)

m. Repeat parts b through k for the B Sweep. Keep the A SEC/DIV switch one setting slower than the B SEC/DIV switch.

2. Check Variable Range and Sweep Separation

a. Set:

HORIZONTAL MODE	A
A and B SEC/DIV	0.2 ms
SEC/DIV Variable	Fully counterclockwise
X10 Magnifier	Off (knob in)
A TRIGGER Mode	P-P AUTO

b. Select 0.5-ms time markers from the time-mark generator.

c. CHECK—Time markers are 1 division or less apart.

d. Set:

Channel 1 AC-GND-DC	GND
SEC/DIV Variable	CAL detent
HORIZONTAL MODE	ALT

e. Use the Channel 1 POSITION control to set the A Sweep at the center horizontal graticule line.

f. CHECK—The B Sweep can be positioned more than 3.5 divisions above and below the A Sweep when the A/B SWP SEP control is rotated fully clockwise and counterclockwise respectively.

3. Check Delay Time Dial Range and Accuracy

a. Set the B DELAY TIME POSITION dial fully counterclockwise.

b. Align the start of the A Sweep with the 1st vertical graticule line using the Horizontal POSITION control.

c. CHECK—Intensified portion of the trace starts within 0.5 division of the start of the sweep.

d. Rotate the B DELAY TIME POSITION control fully clockwise.

e. CHECK—Intensified portion of the trace is past the 11th vertical graticule line.

f. Set:

A and B SEC/DIV 0.5 μ s
 B DELAY TIME POSITION Fully counterclockwise

g. Align the start of the A Sweep with the 1st vertical graticule line using the Horizontal POSITION control.

h. CHECK—Intensified portion of the trace starts within 1.1 divisions of the start of the sweep.

i. Repeat parts d and e.

j. Set:

Channel 1 AC-GND-DC DC
 HORIZONTAL MODE B
 A SEC/DIV 0.5 μ s
 B SEC/DIV 0.05 μ s
 B DELAY TIME POSITION 1.00

k. Select 5- μ s time markers from the time-mark generator.

l. Adjust the Horizontal POSITION control so that the top of the first fully displayed time marker is aligned with the center vertical graticule line.

m. Without changing the Horizontal POSITION control setting, set the B DELAY TIME POSITION dial to 9.00. Slightly readjust the B DELAY TIME POSITION dial to align the top of the time marker with the center vertical graticule line.

n. CHECK—The B DELAY TIME POSITION dial setting is between 8.905 and 9.095.

o. Repeat parts l through n for the remaining A and B SEC/DIV and time-mark generator setting combinations shown in Table 4-5.

**Table 4-5
 Settings for Delay Time Accuracy Checks**

A SEC/DIV Switch Setting	B SEC/DIV Switch Setting	Time-Mark Generator Setting
0.5 μ s	0.05 μ s	0.5 μ s
5 μ s	0.5 μ s	5 μ s
0.5 ms	50 μ s	0.5 ms
5 ms	0.5 ms	5 ms
0.5 s	50 ms	0.5 s

p. Set:

A SEC/DIV 0.5 ms
 B SEC/DIV 50 μ s
 B DELAY TIME POSITION 1.00

q. Select 0.5-ms time markers from the time-mark generator.

r. Adjust the Horizontal POSITION control so that the rising edge of the displayed time marker is aligned with the center vertical graticule line.

s. Without changing the Horizontal POSITION control setting, turn the B DELAY TIME POSITION dial clockwise to position the next time marker leading edge to the center vertical graticule line.

t. CHECK—The B DELAY TIME POSITION dial setting is 0.975 to 1.025 greater than the previous setting.

u. Set the B DELAY TIME POSITION dial to the exact integer setting.

v. Repeat parts r through u for each successive time marker up to the marker corresponding to the B DELAY TIME POSITION dial setting of 10.00.

4. Check Delay Jitter

a. Set:

A SEC/DIV	0.5 ms
B SEC/DIV	0.5 μ s
B DELAY TIME POSITION	10.00

b. Select 50- μ s time markers from the time-mark generator.

c. Rotate the B DELAY TIME POSITION control counterclockwise to position a time marker within the graticule area for each major dial division and CHECK that the jitter on the leading edge of the time marker does not exceed 0.5 division. Disregard slow drift.

5. Check Position Range

a. Set:

HORIZONTAL MODE	A
A SEC/DIV	10 μ s

b. Select 10- μ s time markers from the time-mark generator.

c. CHECK—Start of the sweep can be positioned to the right of the center vertical graticule line by rotating the Horizontal POSITION control fully clockwise.

d. CHECK—The 11th time marker can be positioned to the left of the center vertical graticule line by rotating the Horizontal POSITION control fully counterclockwise.

e. Select 50- μ s time markers from the time-mark generator.

f. Align the 3rd time marker with the center vertical graticule line using the Horizontal POSITION control.

g. Set the X10 Magnifier knob to On (knob out).

h. CHECK—Magnified time marker can be positioned to the left of the center vertical graticule line by rotating the Horizontal POSITION control fully counterclockwise.

i. CHECK—Start of the sweep can be positioned to the right of the center vertical graticule line by rotating the Horizontal POSITION control fully clockwise.

j. Disconnect the test equipment from the instrument.

6. Check X Gain

a. Set:

CH 1 VOLTS/DIV	10 mV
Horizontal POSITION	Midrange
A SEC/DIV	X-Y
X10 Magnifier	Off (knob in)

b. Connect the standard-amplitude generator output via a 50- Ω cable to the CH 1 OR X input connector.

c. Set the generator to produce a 50-mV signal. Vertically center the trace using the Channel 1 POSITION control.

d. CHECK—Display is 4.85 to 5.15 horizontal divisions.

e. Disconnect the test equipment from the instrument.

7. Check X Bandwidth

a. Connect the leveled sine-wave generator output via a 50- Ω cable and a 50- Ω termination to the CH 1 OR X input connector.

b. Set the generator to produce a 5-division horizontal display at an output frequency of 50 kHz.

c. Increase the generator output frequency to 3 MHz.

d. CHECK—Display is at least 3.5 horizontal divisions.

e. Disconnect the test equipment from the instrument.

8. Check Sweep Length

a. Set the A SEC/DIV control to 0.1 ms and position the start of the sweep at the first vertical graticule line using the Horizontal POSITION control.

b. CHECK—End of the sweep is to the right of the 11th vertical graticule line.

TRIGGER

Equipment Required (see Table 4-1):

Leveled Sine-Wave Generator (Item 2)
50-Ω BNC Cable (Item 4)

50-Ω BNC Termination (Item 5)

INITIAL CONTROL SETTINGS

Vertical

POSITION (both) Midrange
VERTICAL MODE CH 1
BW LIMIT Off (button out)
CH 1 VOLTS/DIV 5 mV
CH 2 VOLTS/DIV 50 mV
VOLTS/DIV Variable
(both) CAL detent
INVERT Off (button out)
AC-GND-DC (both) DC

c. Set the CH 1 VOLTS/DIV switch to 50 mV.

d. CHECK—Stable display can be obtained by adjusting the A TRIGGER LEVEL control for each switch combination given in Table 4-6.

Table 4-6
Switch Combinations for A Triggering Checks

A TRIGGER Mode	A TRIGGER SLOPE
NORM	OUT
NORM	IN
P-P AUTO	IN
P-P AUTO	OUT

Horizontal

POSITION Midrange
HORIZONTAL MODE A
A and B SEC/DIV 0.2 μs
SEC/DIV Variable CAL detent
X10 Magnifier Off (knob in)
B DELAY TIME
POSITION Fully counterclockwise

e. Set the HORIZONTAL MODE switch to B.

f. CHECK—Stable display can be obtained by adjusting the B TRIGGER LEVEL control in a position other than the B RUNS AFTER DLY position for both the OUT and IN positions of the B TRIGGER SLOPE switch.

B TRIGGER

SLOPE OUT
LEVEL Midrange

A TRIGGER

VAR HOLDOFF NORM
Mode P-P AUTO
SLOPE OUT
LEVEL Midrange
A&B INT CH 1
A SOURCE INT
A EXT COUPLING DC

g. Set:

VERTICAL MODE CH 2
HORIZONTAL MODE A
A&B INT CH 2

h. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector.

i. Repeat parts d through f.

j. Set:

HORIZONTAL MODE A
A SEC/DIV 0.1 μs
X10 Magnifier On (knob out)

PROCEDURE STEPS

1. Check Internal Triggering

a. Connect the leveled sine-wave generator output via a 50-Ω cable and a 50-Ω termination to the CH 1 OR X input connector.

b. Set the generator to produce a 10-MHz, 3-division display.

k. Set the generator to produce a 60-MHz, 1.0-division display.

l. Repeat parts d through f.

m. Set:

VERTICAL MODE	CH 1
HORIZONTAL MODE	A
A&B INT	VERT MODE

n. Move the cable from the CH 2 OR Y input connector to the CH 1 OR X input connector.

o. Repeat parts d through f.

p. Set:

HORIZONTAL MODE	A
A SEC/DIV	0.05 μ s

q. Set the generator to produce a 100-MHz, 1.5-division display.

r. Repeat parts d through f.

s. Set:

VERTICAL MODE	CH 2
HORIZONTAL MODE	A

t. Move the cable from the CH 1 OR X input connector to the CH 2 OR Y input connector.

u. Repeat parts d through f.

v. Disconnect the test equipment from the instrument.

2. Check External Triggering

a. Set:

VERTICAL MODE	CH 1
HORIZONTAL MODE	A
X10 Magnifier	Off (knob in)
A SOURCE	EXT

b. Connect a 35-mV, 10-MHz leveled sine-wave signal via a 50- Ω cable and a 50- Ω termination to the EXT INPUT connector.

c. Push in and hold the TRIG VIEW button.

d. CHECK—Stable display can be obtained by adjusting the A TRIGGER LEVEL control for each switch combination given in Table 4-6. Then release the TRIG VIEW button.

e. Set the generator output voltage to 120 mV and the frequency to 60 MHz. Set the X10 Magnifier to On (knob out).

f. Repeat parts c and d.

g. Set the generator output voltage to 200 mV and the frequency to 100 MHz.

h. Repeat parts c and d.

i. Disconnect the test equipment from the instrument.

3. Check External Trigger Ranges

a. Set:

CH 1 VOLTS/DIV	0.5 V
A SEC/DIV	20 μ s
X10 Magnifier	Off (knob in)
A TRIGGER Mode	NORM

b. Connect the leveled sine-wave generator output via a 50- Ω cable, a 50- Ω termination, and a dual-input coupler to both the CH 1 OR X and EXT INPUT connectors.

c. Set the generator to produce a 50-kHz, 6.4-division display.

d. CHECK—Display is triggered along the entire positive slope of the waveform as the A TRIGGER LEVEL control is rotated.

e. CHECK—Display is not triggered (no trace) at either extreme of rotation.

f. Set the A TRIGGER SLOPE button to IN.

g. CHECK—Display is triggered along the entire negative slope of the waveform as the A TRIGGER LEVEL control is rotated.

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h. CHECK—Display is not triggered (no trace) at either extreme of rotation.

4. Check Single Sweep Operation

a. Adjust the A TRIGGER LEVEL control to obtain a stable display.

b. Set:

Channel 1 AC-GND-DC	GND
A SOURCE	INT

c. Press in the SGL SWP button. The READY LED should illuminate and remain on.

d. Set the Channel 1 AC-GND-DC switch to DC.

e. CHECK—READY LED goes out and a single sweep occurs.

NOTE

The A INTENSITY control may require adjustment to observe the single-sweep trace.

f. Press in the SGL SWP button several times.

g. CHECK—Single-sweep trace occurs, and the READY LED illuminates briefly every time the SGL SWP button is pressed in and released.

h. Disconnect the test equipment from the instrument.

EXTERNAL Z-AXIS AND PROBE ADJUST

Equipment Required (see Table 4-1):

Leveled Sine-Wave Generator (Item 2)	BNC T-Connector (Item 8)
Two 50- Ω BNC Cables (Item 4)	10X Probe (provided with instrument)
50- Ω BNC Termination (Item 5)	

INITIAL CONTROL SETTINGS

Vertical

Channel 1 POSITION	Midrange
VERTICAL MODE	CH 1
BW LIMIT	Off (button out)
CH 1 VOLTS/DIV	1 V
CH 1 VOLTS/DIV Variable	CAL detent
Channel 1 AC-GND-DC	DC

Horizontal

POSITION	Midrange
HORIZONTAL MODE	A
A SEC/DIV	20 μ s
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)

A TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
A&B INT	VERT MODE
A SOURCE	INT

PROCEDURE STEPS

1. Check External Z-Axis Operation

a. Connect the leveled sine-wave generator output via a 50- Ω cable and a T-connector to the CH 1 OR X input con-

connector. Then connect a 50- Ω cable and a 50- Ω termination from the T-connector to the EXT Z AXIS INPUT connector on the rear panel.

b. Set the generator to produce a 5-V, 50-kHz signal.

c. CHECK—For noticeable intensity modulation. The positive part of the sine wave should be of lower intensity than the negative part.

d. Disconnect the test equipment from the instrument.

2. Check Probe Adjust Operation

a. Set:

CH 1 VOLTS/DIV	10 mV
A SEC/DIV	0.5 ms

b. Connect the 10X Probe to the CH 1 OR X input connector and insert the probe tip into the PROBE ADJUST jack on the instrument front panel. If necessary, adjust the probe compensation for a flat-topped square-wave display.

c. CHECK—Display amplitude is 4.75 to 5.25 divisions.

d. Disconnect the probe from the instrument.