Technical Reference

Tektronix

TLS 216 Logic Scope
Performance Verification and Specifications

070-8832-01

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Please check for change information at the rear of this manual.

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Instrument Serial Numbers

Each instrument manufactured by Tektronix has a serial number on a panel insert or tag, or stamped on the chassis. The first letter in the serial number designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B010000	Tektronix, Inc., Beaverton, Oregon, USA
E200000	Tektronix United Kingdom, Ltd., London
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heerenveen, The Netherlands

Instruments manufactured for Tektronix by external vendors outside the United States are assigned a two digit alpha code to identify the country of manufacture (e.g., JP for Japan, HK for Hong Kong, IL for Israel, etc.).

Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077

Printed in U.S.A.

TLS 216 WARRANTY

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of three (3) years from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

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P6240 WARRANTY

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In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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Safety Summary

Please take a moment to review these safety precautions. They are provided for your protection and to prevent damage to the logic scope. This safety information applies to all operators and service personnel.

Symbols and Terms

These two terms appear in manuals:

CAUTION. *These statements identify conditions or practices that could result in damage to the equipment or other property.*

WARNING. *These statements identify conditions or practices that could result in personal injury or loss of life.*

These two terms appear on equipment:

- *CAUTION* indicates a personal injury hazard not immediately accessible as one reads the marking or a hazard to property including the equipment itself.
- *DANGER* indicates a personal injury hazard immediately accessible as one reads the marking.

This symbol appears in manuals:

Static-Sensitive Devices

These symbols appear on equipment:

DANGER
High Voltage

Protective ground
(earth) terminal

ATTENTION
Refer to
manual

Specific Precautions

Observe all of these precautions to ensure your personal safety and to prevent damage to either the logic scope or equipment connected to it.

Power Source

The logic scope is intended to operate from a power source that will not apply more than 250 V_{RMS} between the supply conductors or between either supply conductor and ground. A protective ground connection, through the grounding conductor in the power cord, is essential for safe system operation.

Grounding the Logic Scope

The logic scope is grounded through the power cord. To avoid electric shock, plug the power cord into a properly wired receptacle where earth ground has been verified by a qualified service person. Do this before making connections to the input or output terminals of the logic scope.

Without the protective ground connection, all parts of the logic scope are potential shock hazards. This includes knobs and controls that may appear to be insulators.

Use the Proper Power Cord

Use only the power cord and connector specified for your product. Use only a power cord that is in good condition.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified in the parts list for your product, matched by type, voltage rating, and current rating.

Do Not Remove Covers or Panels

To avoid personal injury, do not operate the logic scope without the panels or covers.

Electric Overload

Never apply a voltage to a connector on the logic scope that is outside the voltage range specified for that connector.

Do Not Operate in Explosive Atmospheres

The logic scope provides no explosion protection from static discharges or arcing components. Do not operate the logic scope in an atmosphere of explosive gases.

Provide Proper Ventilation

To prevent overheating, keep the logic scope ventilation holes free from obstruction.

Do Not Operate With Suspected Failures

If you suspect the logic scope is damaged, have it inspected by a qualified service person.

Performance Verification

Introduction

The entire performance verification procedure includes both the *Brief Procedures* and the *Performance Tests,* found later in this section. You may not need to perform all of these procedures, depending on what you want to accomplish.

- To rapidly confirm that the logic scope functions and was adjusted properly, just do the procedures under *Self Tests*, which begin on page 1–5.

  Advantages: These procedures are short, require no external signal sources, and perform extensive functional and accuracy testing to provide high confidence that the logic scope will perform properly. You can use them as a quick check before making a series of important measurements.

  Time Required: Approximately 55 minutes.

- To further check functionality, first do the *Self Tests* just mentioned; then do the procedures under *Functional Tests* that begin on page 1–7.

  Advantages: These procedures require minimal additional time to perform, require no additional equipment other than the standard-accessory probes and a floppy disk, and more completely test the internal hardware of the logic scope. You can use them to quickly verify that the primary features of the logic scope are operational.

  Time Required: Approximately 45 minutes.

- If you desire a more extensive confirmation of performance, do the *Performance Tests*, beginning on page 1–15, after doing the *Functional* and *Self Tests* just referenced.

  Advantages: These procedures add direct and indirect checking of warranted specifications. They require more time to perform and suitable test equipment. (See *Equipment Required* beginning on page 1–15.)

  Time Required: Approximately 11 hours, 35 minutes.

Option 1S

If you ordered this product as an Option 1S, you must obtain a complete set (16) of probes to do a complete performance verification. (Option 1S substitutes Coax Adapters for the probes normally shipped.) Alternately, you may choose to adapt the procedures as follows:

1. Perform the procedure *Self Tests* on page 1–5, skipping the test *Verify Probe Function and Calibration* on page 1–6.

2. Skip all of the procedure *Functional Tests* except for the test *Verify the File System* on page 1–13.
3. If you desire a more extensive confirmation of performance, do the procedure *Performance Tests*. When doing the Performance Tests, you must also skip the test *Check Outputs — Probe Compensator on page 1–51*, since that check requires a probe.

Operating Information

If you are not familiar with operating this logic scope, read the TLS 216 Reference or the TLS 216 User Manual. These manuals contain instructions that will acquaint you with the use of the front-panel controls and the menu system.

Conventions

Throughout these procedures the following conventions apply.

- Each test procedure uses the following general format.

  Title of Test

  Equipment Required

  Time Required

  Prerequisites

  Procedure

- Each procedure consists of as many steps and substeps as required to do the test. Steps and substeps are sequenced as follows:

  1. First Step
     a. First Substep
     b. Second Substep
  2. Second Step

- Refer to Figure 1–1: "Main menu" refers to the menu that labels the seven menu buttons under the display; "side menu" refers to the menu that labels the five menu buttons to the right of the display. "Pop-up menu" refers to a menu that pops up when a main-menu button is pressed.

- Instructions for making a menu selection will follow this format: **FRONT PANEL BUTTON → Pop-Up (if necessary) → Main Menu Button → Side Menu Button.** For example, "Press **TRIGGER MENU → Type: Edge** (pop-up) **→ Source** (main) **→ AC** (side)."

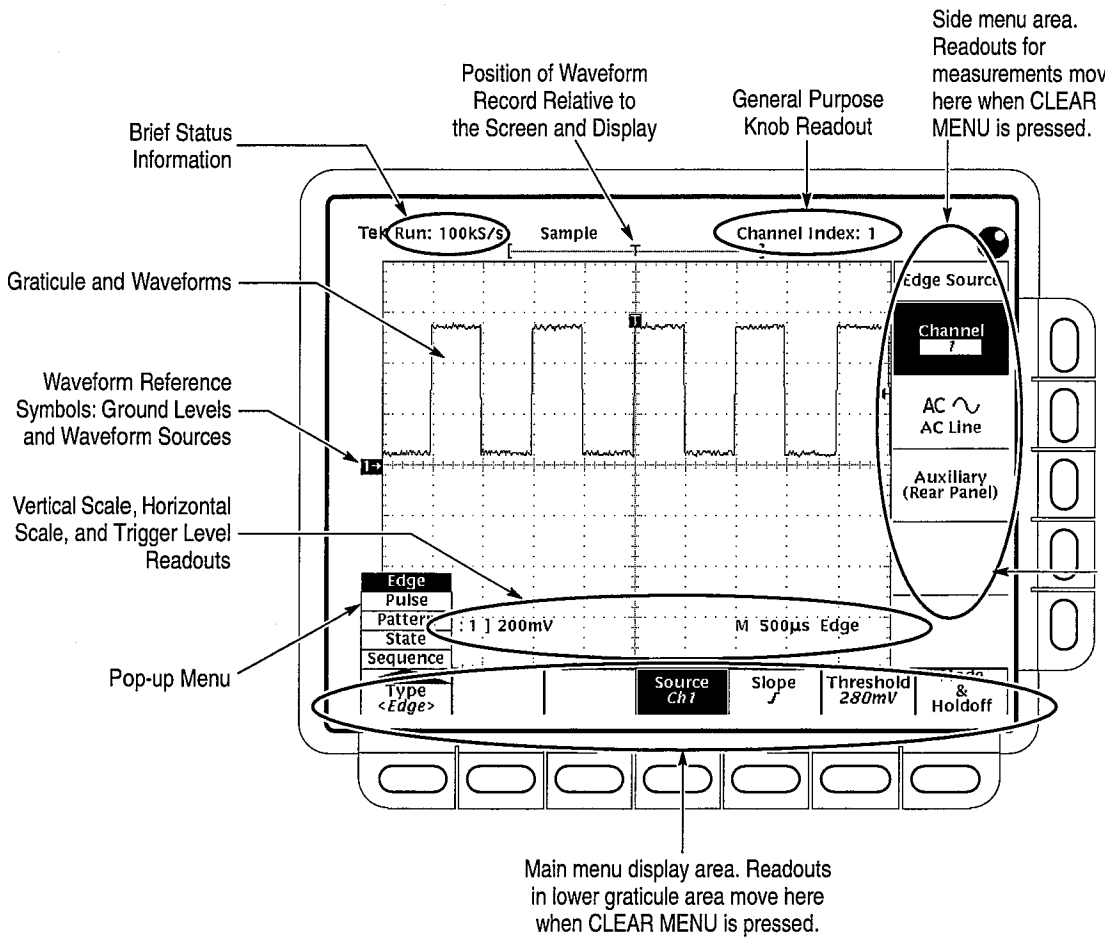

Figure 1–1: Map of Display Functions

Brief Procedures

The *Self Tests* use internal routines to confirm basic functionality and proper adjustment. The standard-accessory probes are the only equipment required.

The *Functional Tests* use the probe-calibration output at the front panel as a test-signal source to further verify that the logic scope functions properly. The standard accessory probes and a floppy disk are the only equipment required.

Self Tests

These procedures use internal routines to verify that the logic scope functions and was adjusted properly.

Verify Internal Adjustment, Self Calibration, and Diagnostics

Equipment Required: None.

Time Required: Approximately 40 minutes after warm-up period.

Prerequisites: Power on the logic scope and allow a 20 minute warm-up before doing this procedure.

Procedure:

1. *Verify that internal diagnostics pass:*

   a. Press **SHIFT**; then press **UTILITY** → **System: Diag/Err** (pop-up) → **Area: All** (pop-up).

   b. Disconnect all input signals and probes from all sixteen channels.

   c. Press **Execute** (main) → **OK Confirm Run Test** (side).

   d. Wait. The internal diagnostics do an exhaustive verification of proper logic scope function. This verification will take up to two minutes. At some time during the wait, a "clock" icon (shown at left) may appear on screen. When the logic scope finishes the verification, the resulting status will appear on the screen.

   e. Verify that no failures occur.

   f. Press **SHIFT**; then press **UTILITY** → **System: Cal** (pop-up).

   g. Verify that the word ***Pass*** appears in the main menu under the **Voltage Reference**, **Frequency Response**, and **Pulse Trigger** menu labels (See Figure 1–2.)

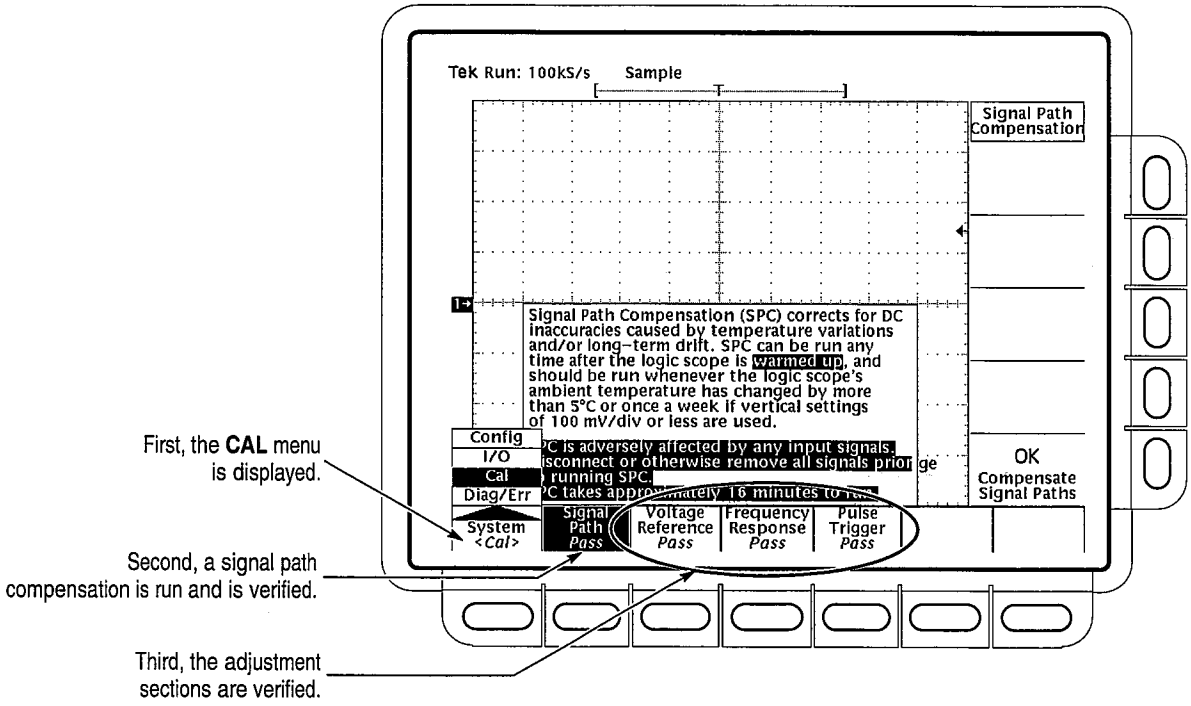

Figure 1–2: Verifying Adjustments and Signal-Path Compensation

h. Press **Signal Path** (main) → **OK Compensate Signal Paths** (side).

i. Wait. Signal-path compensation runs in about 16 minutes. While it progresses, a "clock" icon (shown at left) is displayed on screen.

j. Verify that the word ***Pass*** appears under **Signal Path** in the main menu. (See Figure 1–2.)

2. *Return to regular service:* Press **CLEAR MENU** to exit the system menus.

Verify Probe Function and Calibration

Equipment Required: Sixteen P6240 probes.

Time Required: Approximately 15 minutes.

STOP. *If your logic scope was ordered configured as Option 1S, it was shipped without the 16 probes included with the standard configured logic scope. You must have the probes to do the following steps and may wish to skip verification of probe function. Read the information under* Option 1S *on page 1–1 before continuing.*

Procedure:

1. *Connect the probes and preset the instrument controls:*
   a. Connect 16 P6240 probes to the logic scope (one to each channel).
   b. Connect each probe tip to a **PROBE CALIBRATION** output terminal (order is not important); ensure correct orientation of each probe (ground pins on the bottom).
   c. Press save/recall **SETUP → Recall Factory Setup** (main) → **Ok Confirm Factory Init** (side).
2. *Run the probe calibration routine on all probes:*
   a. Press **GROUP MENU → Group Definition** (main) → **Last Channel** (side). Use the numeric keypad to set the last channel to 16.
   b. Press the main menu button **Cal Probes**; then press the side menu button **OK Compensate Probes**.
   c. Wait. Calibration of all 16 probes will take about 4 minutes.
   d. Verify that no failures occur. If a failure occurs, consult the error log [**SHIFT – UTILITY → System: Diag/Err** (pop-up) → **Error Log** (main)] to pinpoint the faulty probe.
3. *Return to regular service:* Press **CLEAR MENU** to exit the system menus and disconnect the probes.

Functional Tests

The purpose of these procedures is to confirm that the logic scope functions properly. The only equipment required is two standard-accessory probes and a 3.5″, 720 K or 1.44 Mbyte floppy disk.

STOP. *These procedures verify functions; that is, they verify that the logic scope features operate. They DO NOT verify that they operate within limits.*

Therefore, when the procedure calls for you to verify that a signal appears on screen "that is about five divisions in amplitude" or "has a period of about six horizontal divisions," etc., do NOT interpret the quantities given as limits. To check operation within limits, proceed to the Performance Tests, which begin on page 1–15.

DO NOT make changes to the front-panel settings that are not called out in the procedures. Each verification procedure will require you to set the logic scope to certain default settings before verifying functions. If you make changes to these

settings other than those called out in the procedure you may obtain invalid results. In this case, just redo the procedure from step 1.

STOP. *If your logic scope was ordered configured as Option 1S, it was shipped without the 16 probes included with the standard configured logic scope. You must have the probes to do the following steps and may wish skip all the function tests except the last. Read the information under* Option 1S *on page 1–1 before continuing.*

Verify All Input Channels

Equipment Required: Two P6240 probes.

Time Required: Approximately 30 minutes.

Prerequisites: None.

Procedure:

1. *Install the test hookup and preset the logic scope controls:*

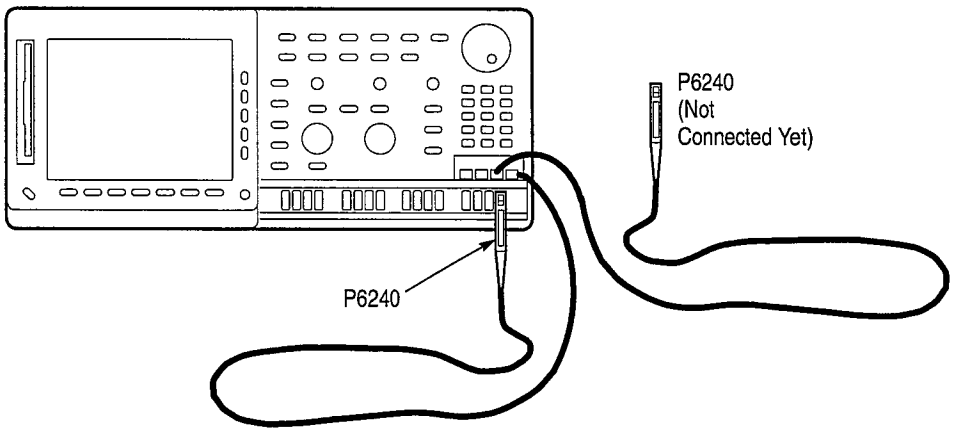

Figure 1–3: Test Hookup for Functional Tests

   a. Install one probe on channel 1. Connect the probe tip to a **PROBE CALIBRATION** signal output on the front panel. Connect the probe tip of a second probe to a **PROBE CALIBRATION** signal output, but *do not install it yet.*

   b. Press save/recall **SETUP → Recall Factory Setup** (main) **→ Ok Confirm Factory Init** (side).

c. Press **GROUP MENU → Cal Probes** (main) **→ OK Initialize Probes** (side).

d. Set the vertical **SCALE** to 500 mV.

e. Press **SET LEVEL TO 50%**.

f. Press **GROUP MENU → Group Definition** (main) **→ Last Channel** (side). Use the numeric keypad to set the last channel to 16.

2. *Verify that all input channels operate:* Do the following substeps — test channel 1 first and then proceed to the other channels.

a. Confirm that the following statements are true for the selected channel.

- A square-wave probe-calibration signal about one division in amplitude is on screen. (See Figure 1–4.)

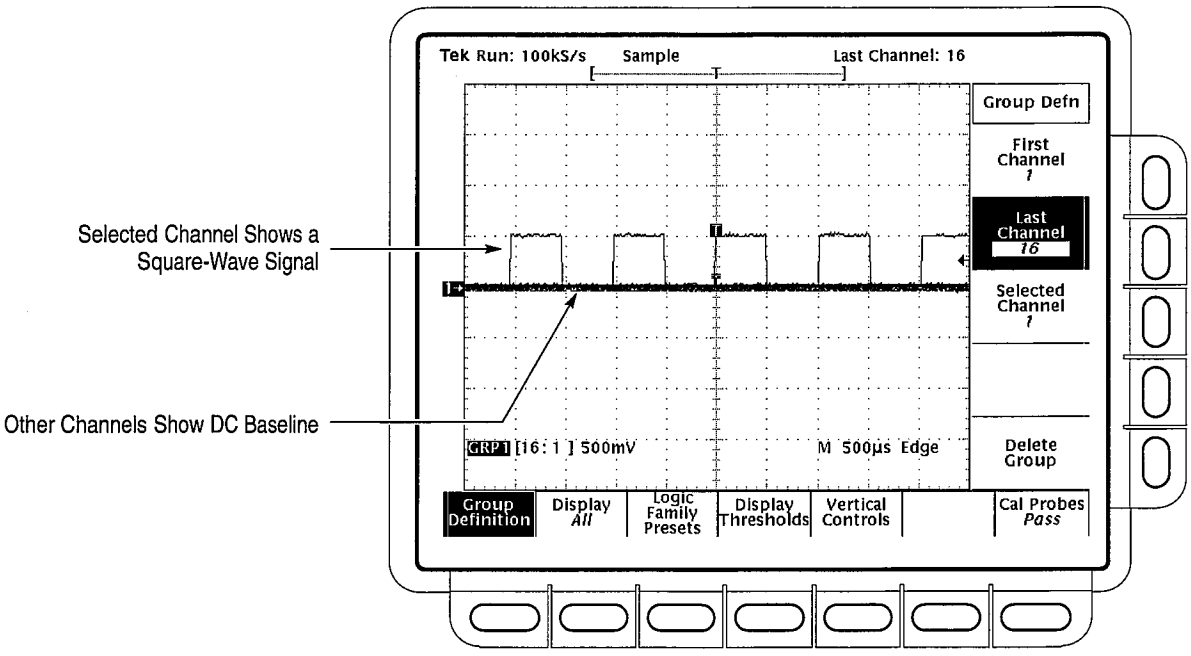

Figure 1–4: Square Wave Calibration and DC Baseline Signals

- The vertical **POSITION** knob moves all signals up and down the screen when rotated.
- Turning the vertical **SCALE** knob counterclockwise decreases the amplitude of the waveform on screen (this may untrigger the signal), turning the knob clockwise increases the amplitude, and returning the knob to 500 mV returns the amplitude to about one division.

b. Press **SHIFT**; then press **ACQUIRE MENU**. Use the side menu to select, in turn, each of the three acquisition modes and confirm that the following statements are true. Refer to the icons at the left of each statement as you confirm those statements.

- **Sample** mode displays an actively acquiring waveform on screen. (Note that there is noise present on the peaks of the square wave.)

- **Envelope** mode displays an actively acquiring waveform on screen with the noise displayed.

- **Average** mode displays an actively acquiring waveform on screen with the noise reduced. Now return the instrument to **Sample** mode.

c. Install the second probe (mentioned in step 1a) on the next channel in numeric sequence. *Leave the first probe installed on channel 1.*

d. Press **GROUP MENU → Group Definition** (main) **→ Selected Channel** (side). Press the side menu button **Selected Channel** again if necessary to increment the selected channel to the next channel to be tested.

e. Press **SET LEVEL TO 50%** as necessary to trigger the signal.

f. Repeat substeps a through d until you have verified all sixteen input channels.

3. *Remove the test hookup:* Disconnect the probes from the channel inputs and the probe calibration terminals.

Verify the Time Base

Equipment Required: One P6240 probe.

Time Required: Approximately 5 minutes.

Prerequisites: None.

Procedure:

1. *Install the test hookup and preset the logic scope controls:*

   a. Install the probe on channel **1**. Connect the probe tip to the **PROBE CALIBRATION** signal on the front panel. (See Figure 1–3 on page 1–8.)

   b. Press save/recall **SETUP → Recall Factory Setup** (main) **→ Ok Confirm Factory Init** (side).

   c. Press **SET LEVEL TO 50%**.

   d. Set the vertical **SCALE** to 500 mV.

e. Set the horizontal **SCALE** to 250 µs.

f. Press **CLEAR MENU** to remove the menus from the screen.

2. *Verify that the time base operates:* Confirm the following statements.

   a. One period of the square-wave probe-calibration signal is about four horizontal divisions on screen.

   b. Rotating the horizontal **SCALE** knob clockwise expands the waveform on screen (more horizontal divisions per waveform period), counter-clockwise rotation contracts it, and returning the horizontal scale to 250 µs returns the period to about four divisions.

   c. The horizontal **POSITION** knob positions the signal left and right on screen when rotated.

3. *Remove the test hookup:* Disconnect the probe from the channel input and the probe-calibration terminals.

Verify the Main and Delayed Trigger Systems

Equipment Required: One P6240 probe.

Time Required: Approximately 5 minutes.

Prerequisites: None.

Procedure:

1. *Install the test hookup and preset the logic scope controls:*

   a. Install the probe on channel **1**. Connect the probe tip to the **PROBE CALIBRATION** signal on the front panel. (See Figure 1–3 on page 1–8.)

   b. Press save/recall **SETUP** → **Recall Factory Setup** (main) → **Ok Confirm Factory Init** (side).

   c. Press **SET LEVEL TO 50%**.

   d. Set the vertical **SCALE** to 200 mV.

   e. Set the horizontal **SCALE** for the **M** (main) time base to 250 µs.

   f. Press **TRIGGER MENU** → **Mode & Holdoff** (main) → **Normal** (side).

2. *Verify that the main trigger system operates:* Confirm that the following statements are true.

   a. The trigger **Threshold** readout in the main menu changes with the trigger **THRESHOLD** knob.

b. The trigger **THRESHOLD** knob can trigger and untrigger the square-wave signal as you rotate it. (Leave the signal *un*triggered.)

c. Pressing **SET LEVEL TO 50%** triggers the signal that you just left untriggered. (Leave the signal triggered.)

3. *Verify that the delayed trigger system operates:*

a. Press **HORIZONTAL MENU** → **Time Base** (main) → **Delayed Triggerable** (side).

b. Press the side-menu button **Delayed Only**.

c. Set the horizontal **SCALE** for the **D** (delayed) time base to 250 µs.

d. Press **SHIFT**; then press **DELAYED TRIG** → **Threshold** (main) → **Threshold** (side).

e. Confirm that the following statements are true:

- The trigger **Threshold** readouts in the main and side menus change as you turn the general purpose knob.
- The general purpose knob can trigger and untrigger the square-wave signal as you rotate it. (Leave the signal *un*triggered.)
- Pressing **SET LEVEL TO 50%** triggers the signal that you just left untriggered. (Leave the signal triggered.)

f. Press the main-menu button **Delay by *Time***.

g. Use the keypad to enter a delay time of 1 second.

h. Verify that the trigger **READY** indicator on the front panel flashes about once every second as the waveform is updated on screen.

4. *Verify main and delayed triggering for the logic triggers:*

a. Press **HORIZONTAL MENU** → **Time Base** (main) → **Main Only** (side).

b. Press **TRIGGER MENU** → **Type: Pattern** (pop-up).

c. Verify that the screen shows a triggered square-wave signal.

d. Press **HORIZONTAL MENU** → **Time Base** (main) → **Delayed Only** (side).

e. Verify that the trigger **READY** indicator on the front panel flashes about once every second as the waveform is updated on screen.

5. *Remove the test hookup:* Disconnect the standard-accessory probe from the channel input and the probe calibration terminals.

Verify the File System

Equipment Required: One 720 K or 1.44 Mbyte, 3.5″ DOS compatible disk (formatted).

Time Required: Approximately 5 minutes.

Prerequisites: None.

Procedure:

1. *Preset the logic scope controls:*
   a. Insert the disk in the disk drive to the left of the monitor.
   b. Press save/recall **SETUP → Recall Factory Setup** (main) → **Ok Confirm Factory Init** (side).
   c. Set the horizontal **SCALE** to 250 µs (one click clockwise). Notice the horizontal readout now displays 250 µs at the bottom of the screen.
2. *Verify the file system works:*
   a. Press save/recall **SETUP → Save Current Setup** (main) → **To File** (side).
   b. Turn the general purpose knob to select the file to save. Choose `TEK?????.SET`. With this choice, you will save a file starting with `TEK`, then containing 5-numbers, and a `.SET` extension. For example, the first time you run this on a blank, formatted disk or on the Example Programs Disk, the logic scope will assign the name `TEK00000.SET` to your file. If you ran the procedure again, the logic scope would increment the name and call the file `TEK00001.SET`.
   c. Press the side-menu button **Save To Selected File**.
   d. Set the horizontal **SCALE** to 500 µs, and then use the vertical **POSITION** knob to place the channel 1 baseline trace two divisions above center screen.
   e. Press **Recall Saved Setup** (main) → **From File** (side).
   f. Turn the general purpose knob to select the file to recall. For example, if you followed the instructions above and used a blank disk, you had the logic scope assign the name TEK00000.SET to your file.
   g. Press the side-menu button **Recall From Selected File**.
   h. Verify that the logic scope retrieved the saved setup from the disk. Do this by noting that the horizontal **SCALE** again reads 250 µs and the channel 1 baseline waveform is again vertically positioned near center screens as when you saved the setup.
3. *Remove the test hookup:* Remove the disk from the disk drive.

Performance Tests

This section contains a collection of procedures for checking that the TLS 216 performs as warranted.

The procedures appear in four logical groupings: *Signal Acquisition System Checks, Time Base System Checks, Triggering System Checks*, and *Output Signal Checks*. They check (either directly or indirectly) all the characteristics that are designated as checked in the *Specifications*. (The characteristics that are checked appear in **boldface** type under *Warranted Characteristics* beginning on page 2–3.)

Prerequisites

The tests in this subsection comprise an extensive, valid confirmation of performance and functionality given the following prerequisites:

- The cabinet must be installed on the logic scope.
- You must have performed and passed the procedures under *Self Tests*, found on page 1–5, and those under *Functional Tests*, found on page 1–7.
- You must have performed *Preparation: Clear Probe Calibrations*, found on page 1–24.
- The logic scope must have been last adjusted at an ambient temperature between +20° C and +30° C, must have been operating for a warm-up period of at least 20 minutes, and must be operating at an ambient temperature between 4° C and +50° C. (The warm-up requirement is usually met by completing the *Self Tests* and *Functional Tests*.)

Read *General Instructions* and *Conventions* that start on page 1–1 before performing these procedures.

Equipment Required

These procedures use external, traceable signal sources to directly check warranted characteristics. Table 1–1 shows the required equipment list.

Table 1–1: Test Equipment

Item Number and Description	Minimum Requirements	Example	Purpose
1. Attenuator,10X (three required)	Ratio: 10X; impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011–0059–02	Signal Attenuation
2. Attenuator, 2X	Ratio: 2X; impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011–0069–02	Signal Attenuation

Table 1–1: Test Equipment (Cont.)

Item Number and Description	Minimum Requirements	Example	Purpose
3. Terminator, 50 Ω	Impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011–0049–01	Signal Termination for Channel Delay Test
4. Cable, Precision 50 Ω Coaxial (three required)	50 Ω, 36 in, male to male BNC connectors	Tektronix part number 012–0482–00	Signal Interconnection
5. Connector, Dual-Banana (two required)	Female BNC to dual banana	Tektronix part number 103–0090–00	Various Accuracy Tests
6. Connector, BNC "T"	Male BNC to dual female BNC	Tektronix part number 103–0030–00	Checking Trigger Sensitivity
7. Coupler, Dual-Input	Female BNC to dual male BNC	Tektronix part number 067–0525–02	Checking Delay Between Channels
8. Generator, Calibration	Variable amplitude to ±104 V; accuracy to 0.1%	Data Precision 8200	Checking DC Offset, Gain, and Measurement Accuracy
9. Generator, Leveled Sine Wave, Medium-Frequency	200 kHz to 250 MHz; Variable amplitude from 5 mV to 4 V_{p-p} into 50 Ω	Tektronix SG 503 Leveled Sine Wave Generator	Checking Trigger Sensitivity at low frequencies
10. Generator, Leveled Sine Wave, High-Frequency	250 MHz to 500 MHz; Variable amplitude from 500 mV to 4 V_{p-p} into 50 Ω; 6 MHz reference	Tektronix SG 504 Leveled Sine Wave Generator with a TM 500 Series Power Module with SG 504 Output Head	Checking Analog Bandwidth and Trigger Sensitivity at high frequencies
11. Generator, Time Mark	Variable marker frequency from 10 ms to 10 ns; accuracy within 2 ppm	Tektronix TG 501A Time Mark Generator	Checking Sample-Rate and Delay-time Accuracy
12. P6240 Probes, which are a Standard Accessory to this product[1]	P6240 probes	Tektronix part number P6240	Signal Interconnection
13. Adapter, Coaxial (two required)	Logic Scope channel input to female SMA adapter	Tektronix part number 013–0282–00	Signal Interconnection
14. Adapter, SMA to BNC (two required)	Male SMA to female BNC	Tektronix part number 015–0554–00	Signal Interconnection

1 **If your logic scope was ordered configured as Option 1S, it was shipped without the 16 probes included with the standard configured logic scope. Read the information under Option 1S on page 1–1 before continuing.**

Test Record Photocopy the next 7 pages and use them to record the performance test results for your instrument.

TLS 216 Test Record

Instrument Serial Number: _____ Certificate Number: _____
Temperature: _____ RH %: _____
Date of Calibration: _____ Technician: _____

Performance Test	Minimum	Incoming	Outgoing	Maximum
Offset Accuracy (Zero Setting)				
CH1 Offset	–60 mV	_____	_____	+60 mV
CH2 Offset	–60 mV	_____	_____	+60 mV
CH3 Offset	–60 mV	_____	_____	+60 mV
CH4 Offset	–60 mV	_____	_____	+60 mV
CH5 Offset	–60 mV	_____	_____	+60 mV
CH6 Offset	–60 mV	_____	_____	+60 mV
CH7 Offset	–60 mV	_____	_____	+60 mV
CH8 Offset	–60 mV	_____	_____	+60 mV
CH9 Offset	–60 mV	_____	_____	+60 mV
CH10 Offset	–60 mV	_____	_____	+60 mV
CH11 Offset	–60 mV	_____	_____	+60 mV
CH12 Offset	–60 mV	_____	_____	+60 mV
CH13 Offset	–60 mV	_____	_____	+60 mV
CH14 Offset	–60 mV	_____	_____	+60 mV
CH15 Offset	–60 mV	_____	_____	+60 mV
CH16 Offset	–60 mV	_____	_____	+60 mV
DC Gain				
CH1 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH2 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH3 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH4 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH5 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH6 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH7 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH8 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH9 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH10 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH11 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH12 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH13 **Δ**: Reading	+480 mV	_____	_____	+520 mV
CH14 **Δ**: Reading	+480 mV	_____	_____	+520 mV

TLS 216 Test Record (Cont.)

Instrument Serial Number: _____ Certificate Number: _____
Temperature: _____ RH %: _____
Date of Calibration: _____ Technician: _____

Performance Test		Minimum	Incoming	Outgoing	Maximum
DC Gain					
CH15	Δ: Reading	+480 mV	_____	_____	+520 mV
CH16	Δ: Reading	+480 mV	_____	_____	+520 mV
DC Accuracy					
CH1	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH2	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH3	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH4	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH5	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH6	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH7	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH8	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH9	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH10	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH11	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH12	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH13	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH14	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH15	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V
CH16	+2.7 V Offset	+2.898 V	_____	_____	+3.102 V
	−2.7 V Offset	−2.898 V	_____	_____	−3.102 V

TLS 216 Test Record (Cont.)

Instrument Serial Number: _____ Certificate Number: _____
Temperature: _____ RH %: _____
Date of Calibration: _____ Technician: _____

Performance Test	Minimum	Incoming	Outgoing	Maximum
Analog Bandwidth				
CH1 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH2 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH3 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH4 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH5 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH6 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH7 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH8 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH9 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH10 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH11 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH12 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH13 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH14 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH15 **Pk-Pk** Reading	848 mV	_____	_____	N/A
CH16 **Pk-Pk** Reading	848 mV	_____	_____	N/A
Delay Between Channels				
CH1 and CH2	N/A	_____	_____	200 ps
CH1 and CH3	N/A	_____	_____	200 ps
CH1 and CH4	N/A	_____	_____	200 ps
CH1 and CH5	N/A	_____	_____	200 ps
CH1 and CH6	N/A	_____	_____	200 ps
CH1 and CH7	N/A	_____	_____	200 ps
CH1 and CH8	N/A	_____	_____	200 ps
CH1 and CH9	N/A	_____	_____	200 ps
CH1 and CH10	N/A	_____	_____	200 ps
CH1 and CH11	N/A	_____	_____	200 ps
CH1 and CH12	N/A	_____	_____	200 ps
CH1 and CH13	N/A	_____	_____	200 ps
CH1 and CH14	N/A	_____	_____	200 ps

TLS 216 Test Record (Cont.)

Instrument Serial Number: _____ Certificate Number: _____
Temperature: _____ RH %: _____
Date of Calibration: _____ Technician: _____

Performance Test	Minimum	Incoming	Outgoing	Maximum
Delay Between Channels				
CH1 and CH15	N/A	_____	_____	200 ps
CH1 and CH16	N/A	_____	_____	200 ps
Long Term Sample Rate				
CH1	–4.0 Div	_____	_____	+4.0 Div
CH5	–4.0 Div	_____	_____	+4.0 Div
CH9	–4.0 Div	_____	_____	+4.0 Div
CH13	–4.0 Div	_____	_____	+4.0 Div
Delta Time				
C1 Per Reading	19.760 ns	_____	_____	20.240 ns
C5 Per Reading	19.760 ns	_____	_____	20.240 ns
C9 Per Reading	19.760 ns	_____	_____	20.240 ns
C13 Per Reading	19.760 ns	_____	_____	20.240 ns
Logic Triggering				
Pulse-Glitch (Main) Generator Readings At:				
10 ns	56.2 MHz	_____	_____	N/A
250 ns	2.27 MHz	_____	_____	N/A
2.5 µs	244 kHz	_____	_____	N/A
Pulse-Width (Main) Generator Readings At:				
10 ns	56.2 MHz	_____	_____	N/A
250 ns	2.27 MHz	_____	_____	N/A
2.5 µs	244 kHz	_____	_____	N/A
Pulse-Glitch (Delayed) Generator Readings At:				
10 ns	56.2 MHz	_____	_____	N/A
250 ns	2.27 MHz	_____	_____	N/A
2.5 µs	244 kHz	_____	_____	N/A
Pulse-Width (Delayed) Generator Readings At:				
10 ns	56.2 MHz	_____	_____	N/A
250 ns	2.27 MHz	_____	_____	N/A
2.5 µs	244 kHz	_____	_____	N/A

TLS 216 Test Record (Cont.)

Instrument Serial Number: _____ Certificate Number: _____
Temperature: _____ RH %: _____
Date of Calibration: _____ Technician: _____

Performance Test	Minimum	Incoming	Outgoing	Maximum
Logic Triggering				
Sequence (Main) Generator Readings	2.27 MHz	_____	_____	N/A
Sequence (Delayed) Generator Readings	2.27 MHz	_____	_____	N/A
Trigger Threshold				
Threshold Readings				
Positive Slope	2.54 V	_____	_____	3.46 V
Negative Slope	2.54 V	_____	_____	3.46 V
Edge Trigger				
CH1 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH2 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH3 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH4 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH5 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH6 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH7 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH8 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH9 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A

TLS 216 Test Record (Cont.)

Instrument Serial Number: _____ Certificate Number: _____
Temperature: _____ RH %: _____
Date of Calibration: _____ Technician: _____

Performance Test	Minimum	Incoming	Outgoing	Maximum
Edge Trigger				
CH10 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH11 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH12 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH13 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH14 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH15 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH16 (50 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
AUX Trigger Input				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH1 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH2 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH3 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH4 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH5 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A

TLS 216 Test Record (Cont.)

Instrument Serial Number: _____ Certificate Number: _____
Temperature: _____ RH %: _____
Date of Calibration: _____ Technician: _____

Performance Test	Minimum	Incoming	Outgoing	Maximum
Edge Trigger				
CH6 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH7 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH8 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH9 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH10 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH11 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH12 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH13 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH14 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH15 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
CH16 (500 MHz)				
Positive Slope	Stable Trigger	_____	_____	N/A
Negative Slope	Stable Trigger	_____	_____	N/A
Output Signal Checks				
Probe Calibrator Output				
Voltage	490 mV	_____	_____	510 mV
Frequency	950 Hz	_____	_____	1050 Hz
Main Trigger Output	High ≥1.0 V	_____	_____	Low ≤0.25 V
Delayed Trigger Output	High ≥1.0 V	_____	_____	Low ≤0.25 V

Preparation: Clear Probe Calibrations

Before performing any of the performance checks that follow, you must initialize all channels to remove any previously stored probe calibrations. To do so, perform the following procedure.

Equipment Required: None.

Time Required: Approximately 5 minutes.

Procedure:

1. *Create a 16-channel group:*
   a. Disconnect any input signals and probes from the front panel.
   b. Press save/recall **SETUP → Recall Factory Setup** (main) → **OK Confirm Factory Init** (side).
   c. Press **GROUP MENU → Group Definition** (main) → **Last Channel** (side). Use the numeric keypad to set the last channel to 16.
2. *Run the probe initialization routine on all probes:* Press the main menu button **Cal Probes**; then press the side menu button **OK Initialize Probes**.

NOTE. *Ignore the message that appears on screen that instructs you to connect probes; installation of probes is only required when compensation of probes is to be performed.*

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3. *Return to regular service:* Press **CLEAR MENU** to exit the system menus.

Signal Acquisition System Checks

These procedures check (either directly or indirectly) those characteristics that relate to the signal-acquisition system and are listed as checked under *Warranted Characteristics* in the *Specifications* section.

Check Accuracy of Offset (Zero Setting)

Equipment Required: None.

Time Required: Approximately 20 minutes.

Prerequisites: The logic scope must meet the prerequisites listed on page 1–15.

1. *Preset the instrument controls:*
   a. Disconnect any input signals from all channels.
   b. Press save/recall **SETUP → Recall Factory Setup** (main) → **OK Confirm Factory Init** (side).
   c. Set the horizontal **SCALE** to 1 ms.
   d. Press **SHIFT**; then press **ACQUIRE MENU → Mode** (main) → **Average 16** (side).
   e. Press **DISPLAY → Graticule** (main) → **Frame** (side).
   f. Press **CURSOR → Function** (main) → **H Bars** (side).
   g. Press **CLEAR MENU**.
2. *Confirm input channels are within limits for offset accuracy at zero offset:* Do the following substeps — test channel **1** first and then proceed to the rest of the channels.
   a. Set the vertical **SCALE** setting to 200 mV.
   b. Rotate the general purpose knob to superimpose the active cursor over the baseline DC test level. (Ignore the other cursor.)
   c. Read the measurement results at the absolute (**@:**) cursor readout (see Figure 1–5).

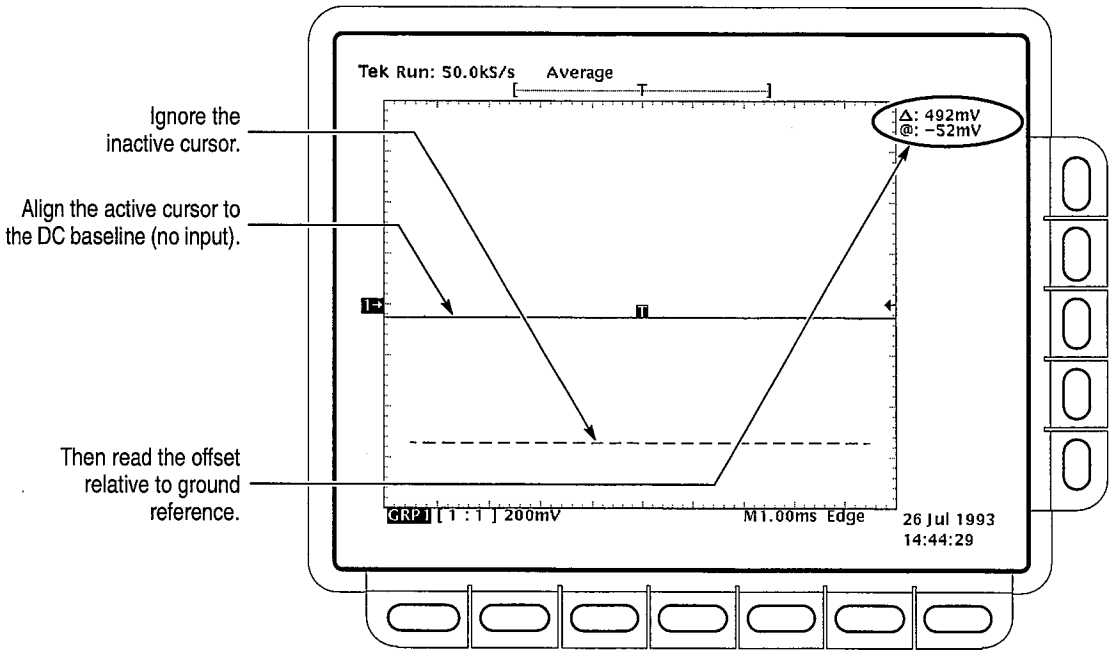


Figure 1–5: Measurement of DC Offset Accuracy at Zero Setting

d. Check that the readout indicates an offset between +60 mV and –60 mV.

e. Press **GROUP MENU** → **Group Definition** (main) → **First Channel** (side). Press the side menu button **First Channel** again if necessary to increment to the next channel to be tested.

f. Press **CURSOR**; press **CLEAR MENU**.

g. Repeat substeps b through f for all 16 channels. (Substeps e and f will not be necessary for channel 16.)

Check DC Gain and Voltage Measurement Accuracy

Equipment Required: Two dual-banana connectors (Item 5), one BNC T connector (Item 6), one DC calibration generator (Item 8), two precision coaxial cables (Item 4), one coaxial adapter (Item 13), and one SMA to BNC adapter (Item 14).

Time Required: Approximately 3 hours.

Prerequisites: The logic scope must meet the prerequisites listed on page 1–15.

Procedure:

1. *Install the test hookup and preset the instrument controls:*

   a. Set the output of the DC calibration generator to 0 V.

b. Connect the output of the DC calibration generator through a dual-banana connector followed by a 50 Ω precision coaxial cable to one side of a BNC T connector. See Figure 1–6.

c. Connect the Sense output of the generator through a second dual-banana connector followed by a 50 Ω precision coaxial cable to the other side of the BNC T connector. Now connect the BNC T connector to channel **1** through the SMA to BNC adapter and a coaxial adapter. See Figure 1–6.

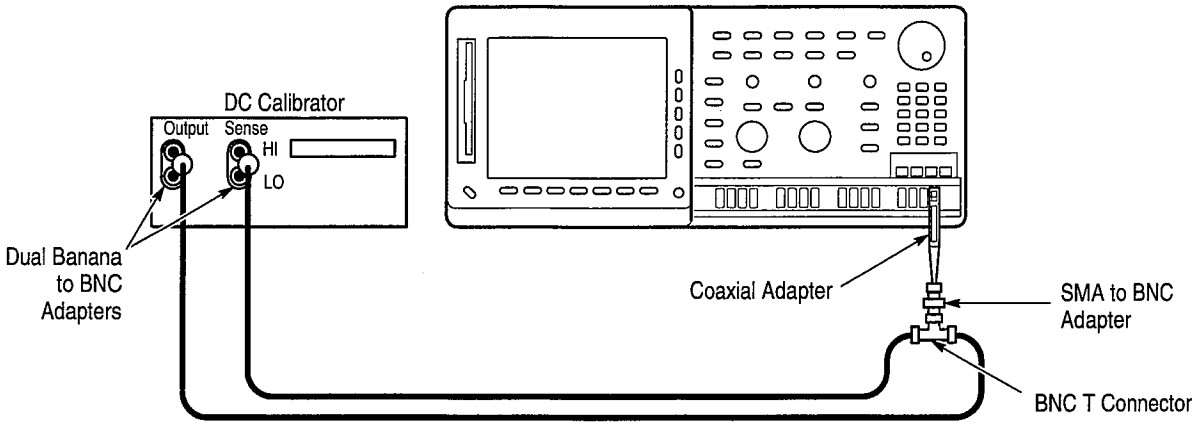


Figure 1–6: Test Hookup for DC Gain and Accuracy Tests

d. Press save/recall **SETUP → Recall Factory Setup** (main) → **OK Confirm Factory Init** (side).

e. Set the vertical **SCALE** to 100 mV.

f. Press **SHIFT**; then press **ACQUIRE MENU → Mode** (main) → **Average 16** (side).

g. Press **DISPLAY → Graticule** (main) → **Frame** (side).

h. Press **CURSOR → Function** (main) → **H Bars** (side).

2. *Confirm input channels are within limits for DC gain accuracy:* Do the following substeps — test channel **1** first, then proceed on to the other channels.

a. Press **GROUP MENU → Vertical Controls** (main) → **Offset** (side). Use the keypad to set offset to 250 mV. (Press **250**, then press **SHIFT m**, and then press **ENTER**.)

b. Set the generator output to 0 V.

c. Press **CLEAR MENU**. Use the general purpose knob to precisely align the active cursor to the DC baseline level on screen.

d. Set the generator output to 500 mV.

e. Press **SELECT**. Use the general purpose knob to precisely align the alternate cursor to the 500 mV DC test level on screen.

f. Read the measurement results from the delta (**Δ:**) readout, not the absolute (**@:**) readout. (See Figure 1–7.) Check that the **Δ:** readout on screen is between 480 mV and 520 mV

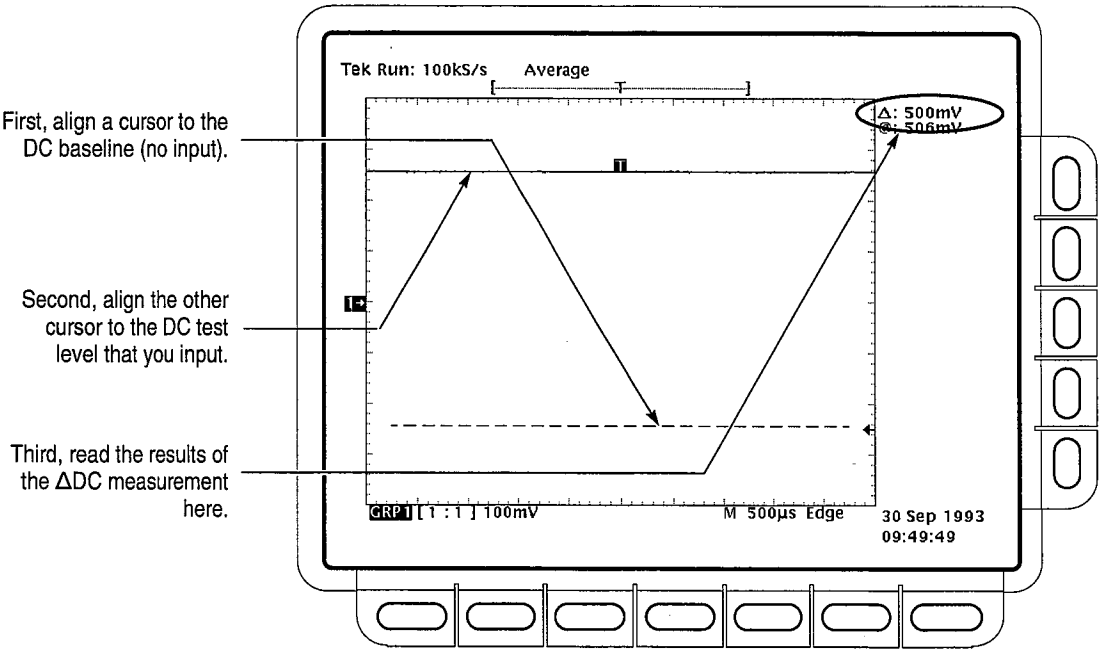


Figure 1–7: Measurement of DC Gain Accuracy

g. Press **GROUP MENU → Group Definition** (main) **→ First Channel** (side). Press the side menu button **First Channel** again if necessary to increment to the next channel to be tested.

h. Set the generator output to 0 V.

i. Move the test hookup to the channel you select.

j. Repeat substeps c through i for all 16 channels. (Substeps g through i will not be necessary for channel 16.)

3. *Reestablish the initial test setup:*

a. Set the generator output to 0 V.

b. Move the test hookup back to channel **1**.

c. Press save/recall **SETUP → Recall Factory Setup** (main) → **OK Confirm Factory Init** (side).

d. Press **SHIFT**; then press **ACQUIRE MENU → Mode** (main) → **Average 16** (side).

e. Press **DISPLAY → Graticule** (main) → **Frame** (side).

4. *Confirm input channels are within limits for DC accuracy:* Do the following substeps — test channel **1** first, then proceed on to the other channels.

a. Set the vertical **SCALE** to 100 mV.

b. Press **GROUP MENU → Vertical Controls** (main) → **Offset** (side). Use the keypad to set vertical offset to +2.7 V. The baseline level will move off screen.

c. Set the generator to +3 V. The DC test level should appear on screen. (If it doesn't return, the DC accuracy check has failed for the current channel.)

d. Press **MEASURE → Select Measrmnt for *Ch x*** (main).

e. Press the side-menu button **more** until the menu label **Mean** appears in the side menu (its icon is shown at the left). Press the side-menu button **Mean**.

f. Press **CLEAR MENU**. Read the measurement results at the **Mean** measurement readout. See Figure 1–8.

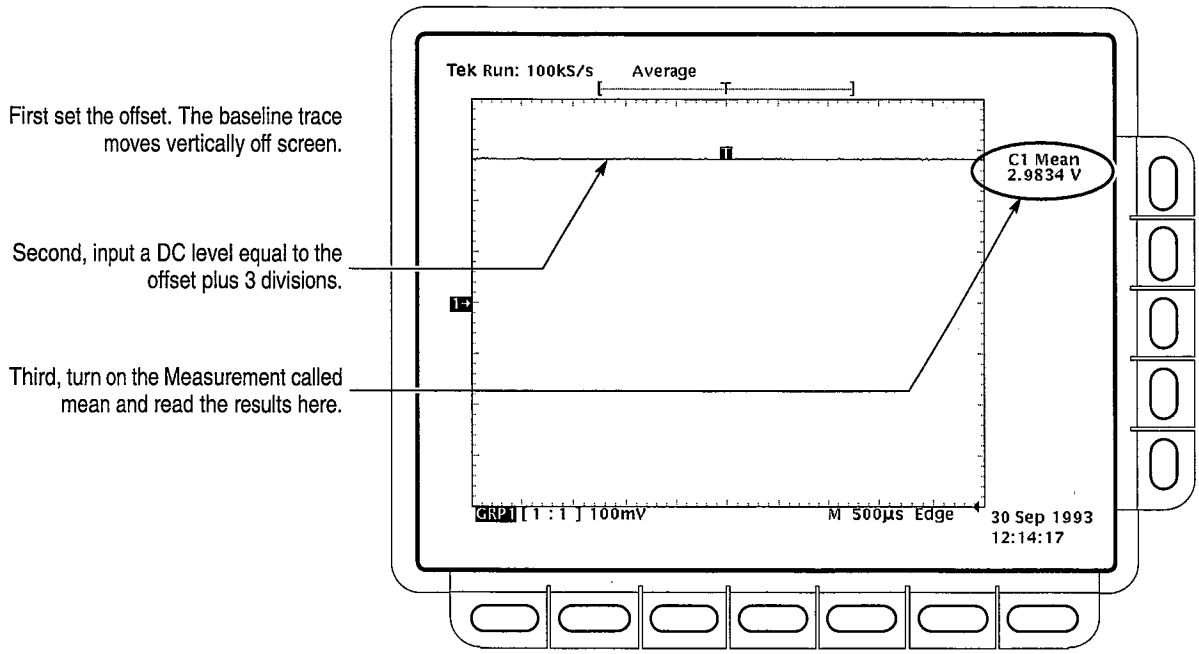


Figure 1–8: Measurement of DC Accuracy

g. Check that the **Mean** measurement readout is within the limits listed in Table 1–2.

Table 1–2: DC Accuracy

Scale Setting	Offset Setting	Generator Setting	Accuracy Limits
100 mV	+2.7 V	+3 V	+2.898 V to +3.102 V
	–2.7 V	–3 V	–2.898 V to –3.102 V

h. Press **GROUP MENU → Group Definition** (main) **→ First Channel** (side). Press the side menu button **First Channel** again if necessary to increment to the next channel to be tested.

i. Move the test hookup to the selected channel.

j. Repeat substeps d through i for all 16 channels. (Substeps h and i will not be necessary for channel 16.)

k. Repeat substeps b and c, reversing the polarity of the offset and generator settings as is listed in Table 1–2.

l. Move the test hookup back to channel **1**.

m. Press **GROUP MENU → Group Definition** (main) → **Last Channel** (side). Use the numeric keypad to set the last channel to **1**.

n. Repeat substeps d through i for all 16 channels. (Substeps h and i will not be necessary for channel **16**.)

5. *Disconnect the hookup:*

   a. Set the generator output to 0 V.

   b. Disconnect the test hookup at the input connector of channel 16.

Check Analog Bandwidth

Equipment Required: One high-frequency leveled sine wave generator and its leveling head (Item 10), one coaxial adapter (Item 13), one SMA to BNC adapter (Item 14).

Time Required: Approximately 1 hour and 25 minutes.

Prerequisites: The logic scope must meet the prerequisites listed on page 1–15.

Procedure:

1. *Install the test hookup and preset the instrument controls:*

   a. Press save/recall **SETUP → Recall Factory Setup** (main) → **OK Confirm Factory Init** (side).

   b. Set the horizontal **SCALE** to 50 ns.

   c. Press **MEASURE → High-Low Setup** (main) → **Min-Max** (side).

   d. Connect, through its leveling head, an SMA to BNC adapter, and a coaxial adapter, the sine wave output of a high-frequency leveled sine wave generator to channel **1**. Set the output of the generator to a reference frequency of 6 MHz. See Figure 1–9.

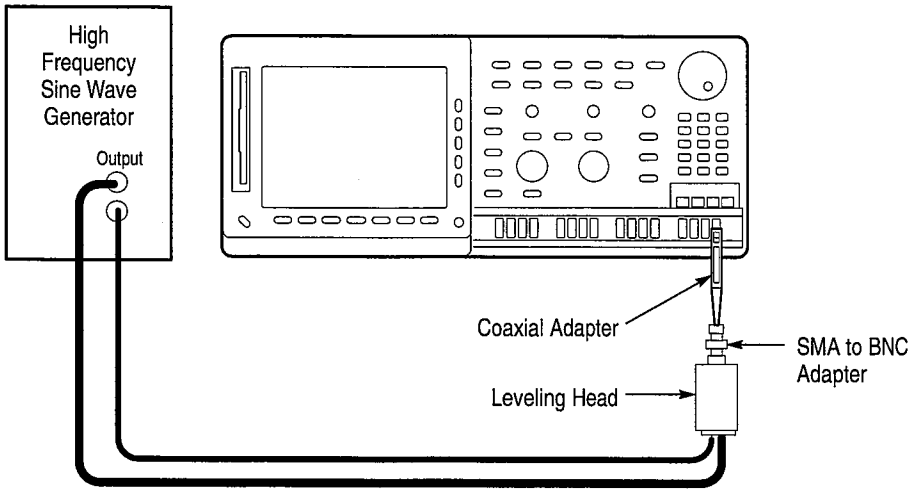


Figure 1–9: Test Hookup for Analog Bandwidth Test

2. *Confirm the input channels are within limits for analog bandwidth:* Do the following substeps — test channel **1** first, then proceed on to the other channels.

   a. Set the vertical **SCALE** to 200 mV.

   b. Press **TRIGGER MENU** → **Source** (main) → **Channel** (side). Use the keypad to specify the selected channel as the trigger source.

   c. Press **MEASURE** → **Select Measrmnt for *Ch x*** (main).

   d. Press the side-menu button **more** until the menu label **Pk-Pk** appears in the side menu (its icon is shown at the left). Press the side-menu button **Pk-Pk**.

   e. Repeatedly press the side-menu button **–more–** until **Frequency** appears in the side menu (its icon is shown at the left). Press the side-menu button **Frequency**.

   f. Press **CLEAR MENU**.

   g. Set the generator output so the **C1 Pk-Pk** readout equals 1.2 V. Press **SET LEVEL TO 50%** as necessary to trigger a stable display and ensure an accurate setting.

   h. Set the frequency of the generator, as shown on screen, to approximately 500 MHz.

   i. Set the horizontal **SCALE** to 1 ns. If necessary, adjust the generator until the output frequency is 500 MHz. Press **SHIFT**; then press **ACQUIRE MENU** → **Mode** (main) → **Average 16** (side).

j. Read the results at the **C1 Pk-Pk** readout, which will automatically measure the amplitude of the test signal. See Figure 1–10.

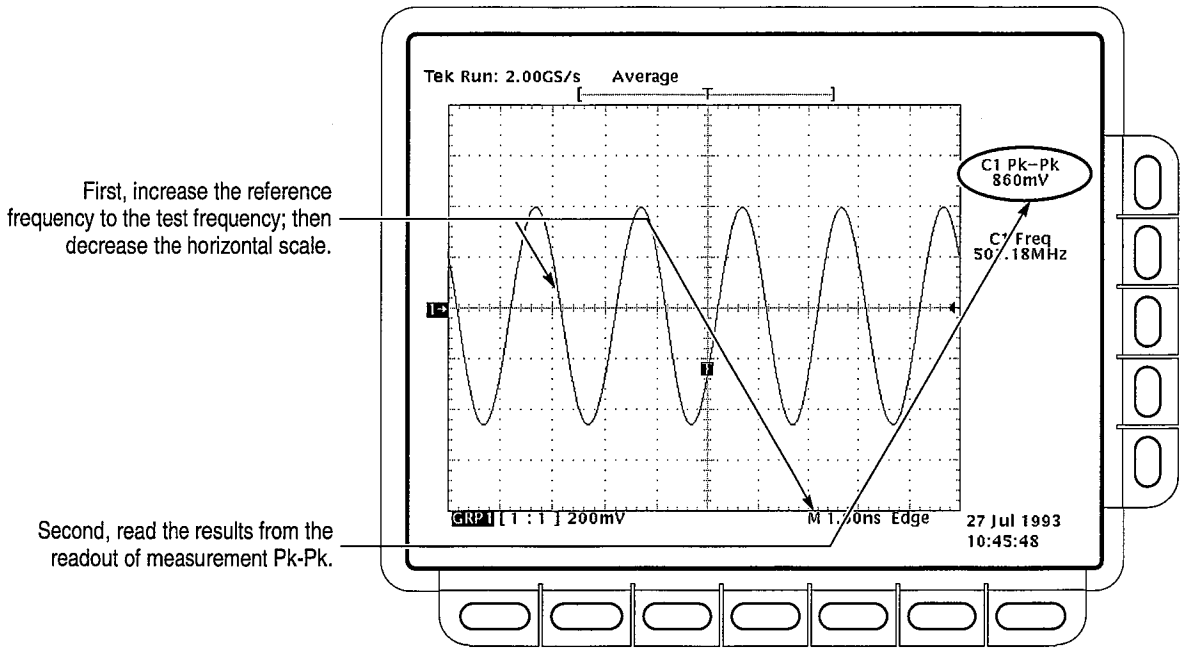


Figure 1–10: Measurement of Analog Bandwidth

k. Press the side menu button **Sample**. Check that the **Pk-Pk** readout on screen is ≥ 848 mV.

l. Set the horizontal **SCALE** back to the 50 ns.

m. Press **GROUP MENU** → **Group Definition** (main) → **First Channel** (side). Press the side menu button **First Channel** again if necessary to increment to the next channel to be tested.

n. Set the generator output to a reference frequency of 6 MHz.

o. Move the test hookup to the selected channel.

p. Repeat substeps b through o for all 16 channels. (Substeps l through o will not be necessary for channel **16**.)

3. *Disconnect the hookup:* Disconnect the test hookup at the input connector of channel **16**.

Check Delay Between Channels

Equipment Required: One medium-frequency leveled sine wave generator (Item 9), one precision coaxial cable (Item 4), one 50 Ω terminator (Item 3), one dual-input coupler (Item 7), two coaxial adapters (Item 13), and two SMA to BNC adapters (Item 14).

Time Required: Approximately 1 hour.

Prerequisites: The logic scope must meet the prerequisites listed on page 1–15.

Procedure:

1. *Install the test hookup and preset the instrument controls:*
   a. Press save/recall **SETUP → Recall Factory Setup** (main) → **OK Confirm Factory Init** (side).
   b. Set the horizontal **SCALE** to 500 ps.
   c. Press **SHIFT**; then press **ACQUIRE MENU → Mode** (main) → **Average 16** (side).
   d. Press **GROUP 2**.
   e. Connect, through a 50 Ω precision coaxial cable followed by a 50 Ω termination, the output of a medium-frequency sine wave generator to a dual-input coupler. See Figure 1–11.
   f. Connect the coupler to channels **1** and **2** through two coaxial adapters and two SMA to BNC adapters. See Figure 1–11.

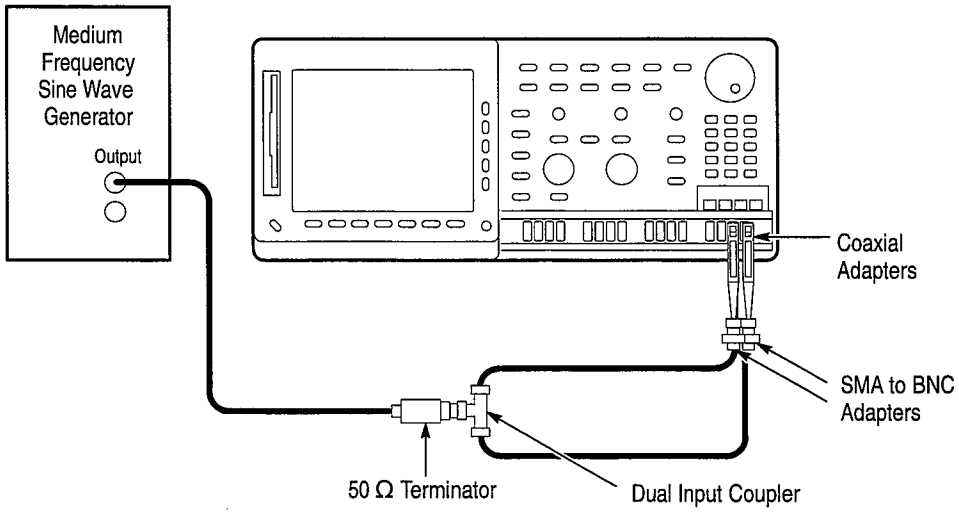


Figure 1–11: Test Hookup for Channel Delay Test

2. *Confirm all channels are within limits for channel delay:*

a. Set the generator frequency to 250 MHz and the amplitude for about two divisions in channel **1**.

b. Locate the point on the rising edge of the left-most waveform where it crosses the center horizontal graticule line. This is the *time reference point* for this waveform. Note the corresponding *time reference point* for the right-most waveform. See Figure 1–12.

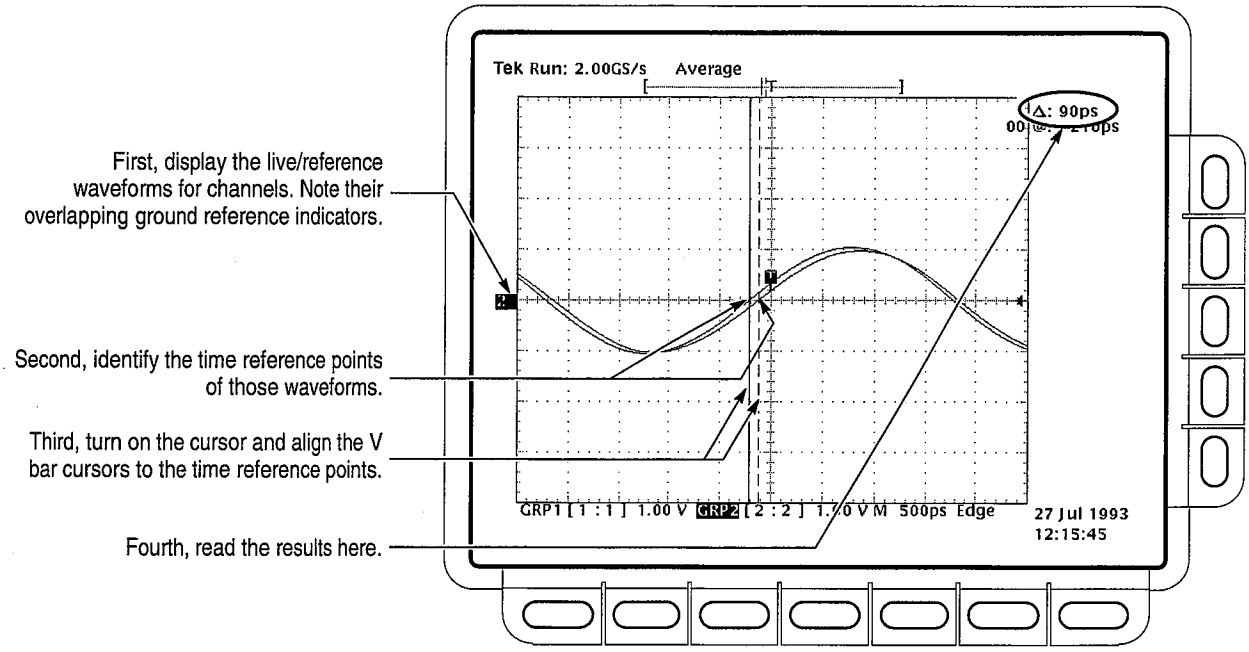


Figure 1–12: Measurement of Channel Delay

c. Press **CURSOR → Function** (main) **→ V Bars** (side).

d. Press **CLEAR MENU**.

e. Rotate the General Purpose knob to align one cursor to the *time reference point* of the left-most waveform edge and the other cursor to the *time reference point* of the right-most waveform edge. (Press **SELECT** to switch between the two cursors.) See Figure 1–12.

f. Read the measurement results at the **Δ:** cursor readout, not the **@:** readout on screen.

g. Check that the cursor readout on screen is ≤200 ps.

h. Leaving one half of the test hookup installed on channel **1**, move the other half to the next channel in sequence (for example, from channel **2** to channel **3**).

i. Press **GROUP MENU** → **Group Definition** (main) → **First Channel** (side) to increment First Channel to next channel to be checked. Press the side menu button **First Channel** again if necessary to increment the first channel.

j. Repeat substeps c through i until you have checked all 16 channels (substeps h and i will not be necessary for channel **16**).

3. *Disconnect the hookup:* Disconnect the hookup at the input connectors of channels **1** and **16**.

Time Base System Check

This procedure checks (either directly or indirectly) those characteristics that relate to the Main and Delayed time base system and are listed as checked under *Warranted Characteristics* in the *Specifications* section.

Check Accuracy for Long-Term Sample Rate, Delay Time, and Delta Time Measurements

Equipment Required: One time-mark generator (Item 11), one 50 Ω precision coaxial cable (Item 4), one coaxial adapter (Item 13), and one SMA to BNC adapter (Item 14).

Time Required: Approximately 40 minutes.

Prerequisites: The logic scope must meet the prerequisites listed on page 1–15.

Procedure:

1. *Install the test hookup and preset the instrument controls:*

   a. Connect, through a 50 Ω precision coaxial cable, a coaxial adapter, and an SMA to BNC adapter, the time-mark output of a time-mark generator to channel **1**. Set the output of the generator for 10 ms markers. See Figure 1–13.

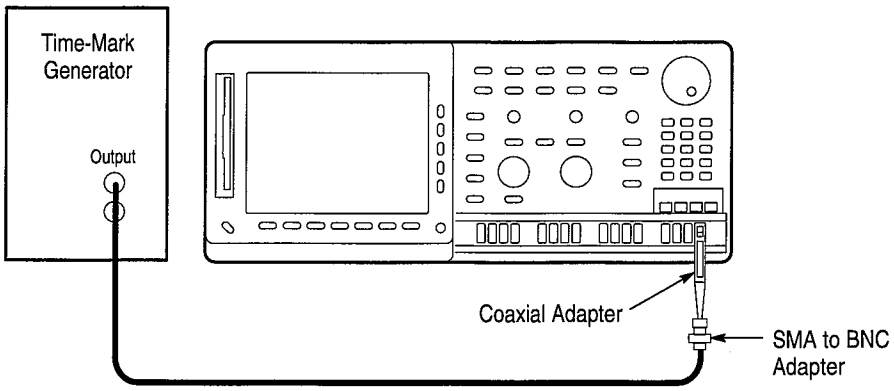


Figure 1–13: Test Hookup for Time Base System Check

b. Press save/recall **SETUP → Recall Factory Setup** (main) → **OK Confirm Factory Init** (side).

c. Set the vertical **SCALE** to 500 mV.

d. Press **SET LEVEL TO 50%**.

e. Use the vertical **POSITION** knob to center the test signal on screen.

f. Press **TRIGGER MENU → Mode & Holdoff** (main) → **Normal** (side).

g. Press **HORIZONTAL MENU → Record Length** (main) → **1000 Points in *20divs*** (main).

h. Press the main-menu button **Trigger Position**. Press the side-menu button **Set to 20%**.

i. Press **SHIFT**; then press **ACQUIRE MENU**. Press the main-menu button **Mode**; then press the side-menu button **Average 16**.

j. Press **MEASURE → High-Low Setup** (main) → **Min-Max** (side).

2. *Confirm Main and Delayed time bases are within limits for accuracies:*

a. Set the horizontal **SCALE** of the Main time base to 1 ms. Press **SET LEVEL TO 50%** as necessary to trigger the signal.

b. Adjust the horizontal **POSITION** so the trigger **T** is aligned to the center vertical graticule line.

c. Press **HORIZONTAL MENU → Time Base** (main) → **Delayed Only** (side) → **Delayed Runs After Main** (side).

d. Set the horizontal **SCALE** of the **D** (delayed) time base to 250 ns.

e. Use the keypad to set delayed time to 10 ms. (Press **10**, then **SHIFT**, then **m** followed by **ENTER**.) Press **SET LEVEL TO 50%** as necessary to trigger the signal.

f. Check that the rising edge of the marker crosses the center horizontal graticule line at a point within ±4.0 divisions of center graticule (see Figure 1–14).

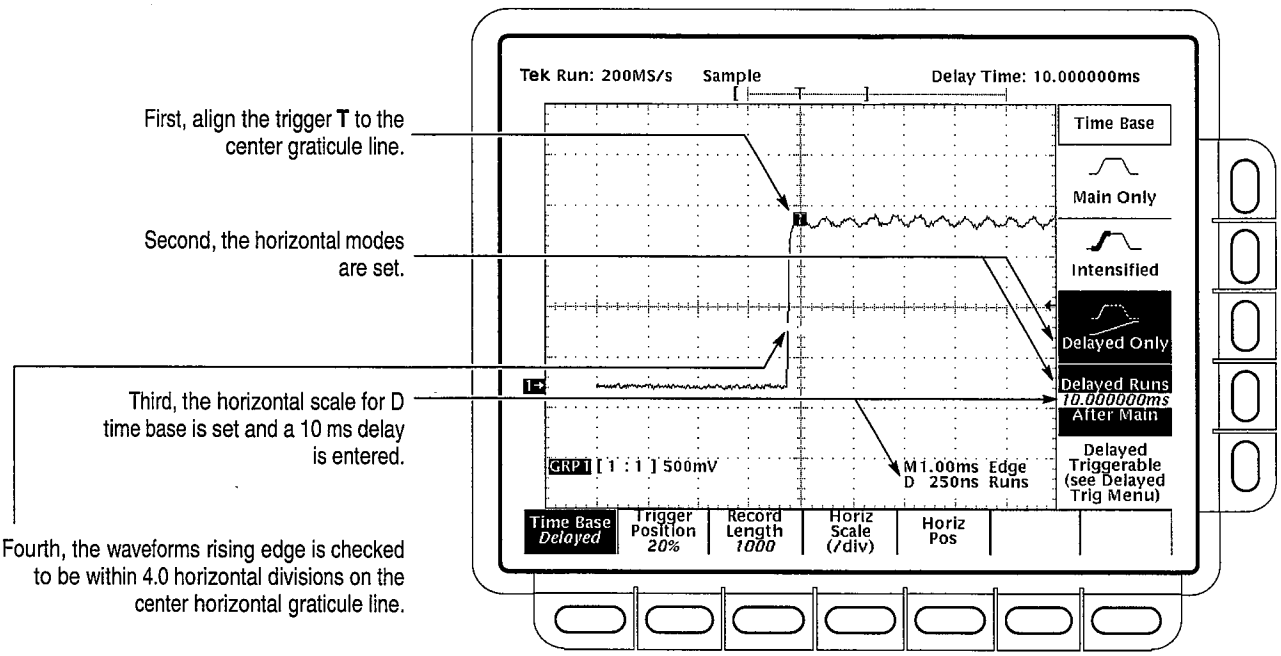


Figure 1–14: Measurement of Accuracy — Long-Term and Delay Time

g. Press the side-menu button **Main Only**. Set the horizontal **SCALE** to 2.5 ns.

h. Set the output of the generator for 20 ns markers.

i. Press **SET LEVEL TO 50%**.

j. Press **MEASURE → Select Measrmnt for *Ch x***. Press the side-menu button **–more–**, until **Period** appears in the side menu. Press **Period**.

k. Press **CLEAR MENU**.

l. Check that the readout for **C1 Per** is within 19.760 ns to 20.240 ns.

m. Move the test hookup to the first channel in the next bank (**5**, **9**, or **13**).

n. Press **GROUP MENU** → **Group Definition** (main). Press the side menu button **First Channel** four times. (The channel with the test hookup connected should become the first channel.)

o. Press **TRIGGER MENU** → **Source** (main) → **Channel** (side). Use the numeric keypad to set the trigger source to the selected channel.

p. Set the generator output back to 10 ms markers.

q. Press **HORIZONTAL MENU**.

r. Repeat substeps a through q until you have checked channels **1**, **5**, **9**, and **13**. (Substeps m through q will be unnecessary for channel **13**.)

3. *Disconnect the hookup:* Disconnect the test hookup at the input connector of channel **13**.

Trigger System Checks

These procedures check (either directly or indirectly) those characteristics that relate to the Main and Delayed trigger systems and are listed as checked under *Warranted Characteristics* in the *Specifications* section.

Check Accuracy for Logic Triggering

Equipment Required: One medium-frequency leveled sine wave generator (Item 9), one 10X attenuator (Item 1), one precision coaxial cable (Item 4), one coaxial adapter (Item 13), and one SMA to BNC adapter (Item 14).

Time Required: Approximately 1 hour and 35 minutes.

Prerequisites: *See page 1–15.*

Procedure:

1. *Install the test hookup and preset the instrument controls:*

   a. Press save/recall **SETUP** → **Recall Factory Setup** (main) → **OK Confirm Factory Init** (side).

   b. Set the horizontal **SCALE** to 10 ns.

   c. Set the vertical **SCALE** to 100 mV.

   d. Connect the output of a medium-frequency leveled sine wave generator to channel **1** through a 50 Ω precision coaxial cable, a 10X attenuator, an SMA to BNC adapter, and a coaxial adapter. See Figure 1–15.

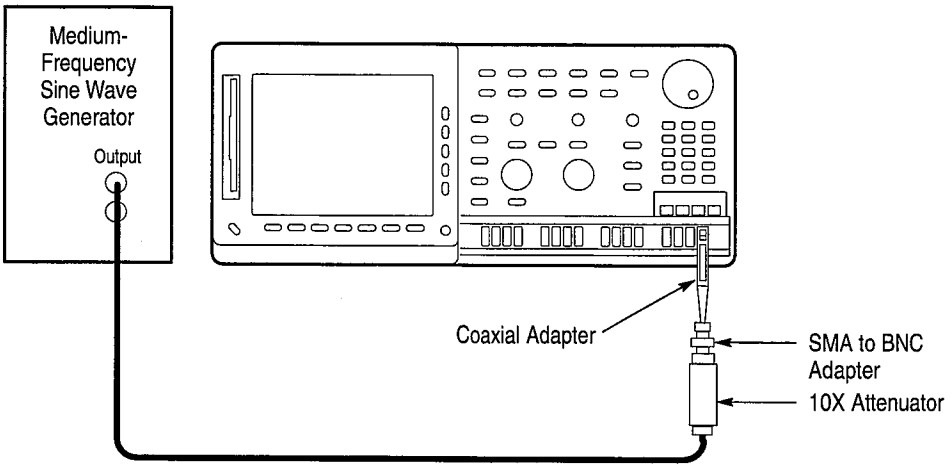


Figure 1–15: Test Hookup for Logic Trigger Check

e. Press **MEASURE → Select Measurement for *Ch x*** (main).

f. Repeatedly press the side-menu button **–more–** until **Frequency** appears in the side menu. Press **Frequency**.

g. Press **High-Low Setup** (main) → **Min-Max** (side).

2. *Confirm the trigger system is within time-accuracy limits for main, nonsequence logic triggering:*

a. Set the output of the sine wave generator for a 84.7 MHz, four-division sine wave on screen. Press **SET LEVEL TO 50%**.

b. Press **TRIGGER MENU → Mode & Holdoff** (main) → **Normal** (side).

c. Press **Type: Pulse** (pop-up) → **Trig When** (main).

d. Press the side menu button **Width**. See Table 1–3. Use the numeric keypad to enter the width dictated by the current time base setting. (Use the number in the "Upper Limit or Width Setting" column).

Table 1–3: Settings For Logic Trigger Accuracy Checks

Time Base Setting	Upper Limit or Width Setting	Initial Generator Setting	Low Frequency Limit
10 ns	8 ns	84.7 MHz	56.2 MHz
250 ns	200 ns	3.13 MHz	2.27 MHz
2.5 µs	2 µs	263 kHz	244 kHz

e. Slowly decrease the output frequency until the **TRIG'D** LED on the front panel turns off. The **READY** LED should be lit.

f. Check that the **C1 Freq** readout is greater than the "Low Frequency Limit" listed in Table 1–3.

g. Set the generator output frequency to the next "Initial Generator Setting" listed in Table 1–3. Set the time base accordingly.

h. Repeat substeps d through g until you have checked all the time base settings listed in Table 1–3.

i. Set the generator output frequency back to 84.7 MHz; set the horizontal **SCALE** to 10 ns.

j. Press the main menu button **Class**. Press it again to select pulse-width triggering.

k. Press the side-menu button **Upper Limit**. Use the numeric keypad to enter the upper limit dictated by the current time base setting. (See Table 1–3).

l. Slowly decrease the output frequency until the signal becomes untriggered (the **TRIG'D** LED turns off).

m. Check that the **C1 Freq** readout is greater than the "Low Frequency Limit" listed in Table 1–3.

n. Set the generator output frequency to the next "Initial Generator Setting" listed in Table 1–3. Set the time base accordingly.

o. Repeat substeps k through n until you have checked all the time base settings listed in Table 1–3.

p. Press the side menu button **Upper Limit**; use the numeric keypad to set the upper limit to 3 µs. Press **Class: Glitch** (pop-up) → **Width** (side); use the numeric keypad to set the width to 3 µs.

3. *Confirm the trigger system is within time-accuracy limits for delayed, nonsequence logic triggering:*

a. Set the output of the sine wave generator to 84.7 MHz.

b. Press **HORIZONTAL MENU** → **Time Base** (main) → **Delayed Only** (side); press the side menu button **Delayed Triggerable**.

c. Set the horizontal **SCALE** of the delayed time base to 10 ns

d. Press **SHIFT** – **DELAYED TRIG**.

e. Repeat steps 2c through 2o. When performing step 2e, ignore the front–panel LEDs. Instead decrease the output frequency until the word **D TRIG?** appears at the top center of the screen.

4. *Confirm the trigger system is within time-accuracy limits for main and delayed sequence triggering:*

   a. Press save/recall **SETUP → Recall Factory Setup** (main) → **OK Confirm Factory Init** (side).

   b. Press **TRIGGER MENU → Mode & Holdoff** (main) → **Normal** (side).

   c. Press **MEASURE → Select Measurement for *Ch x*** (main).

   d. Repeatedly press the side-menu button **–more–** until **Frequency** appears in the side menu. Press **Frequency**.

   e. Set the output of the sine wave generator to 3.13 MHz; set the horizontal **SCALE** to 250 ns.

   f. Set the vertical **SCALE** to 100 mV.

   g. Press **TRIGGER MENU → Type: Sequence** (pop-up).

   h. Press the main menu button **Define End Pattern**, then press the side menu button **Ch Index**. Use the numeric keypad to set the channel index to 2.

   i. Press the side menu button **Set to Don't Care**; then press the side menu button **Set to Low**.

   j. Press the main menu button **Sequence Trig When**; then press the side menu button **Time**. Use the numeric keypad to set the time to 200 ns.

   k. Press the side menu button **< Time**.

   l. Slowly decrease the generator output frequency until the signal becomes untriggered (the **TRIG'D** LED turns off).

   m. Check that the **C1 Freq** readout is greater than 2.27 MHz.

   n. Press the side menu button **Time**; set the time to 1 µs. Press **HORIZONTAL MENU → Time Base** (main) → **Delayed Only** (side); press the side menu button **Delayed Triggerable**.

   o. Press **SHIFT – DELAYED TRIG**.

   p. Repeat substeps e through m for the delayed trigger.

5. *Disconnect the hookup:* Disconnect the cable from the generator output at the input connector of channel **1**.

Check Accuracy, Trigger Threshold

Equipment Required: One DC calibration generator (Item 8), one BNC T connector (Item 6), two precision coaxial cables (Item 4), one coaxial adapter (Item 13), one SMA to BNC adapter (Item 14), and two dual banana connectors (Item 5).

Time Required: Approximately 5 minutes.

Prerequisites: The logic scope must meet the prerequisites listed on page 1–15. It must also pass the *Signal Acquisition System Checks* beginning on page 1–25.

Procedure:

1. *Install the test hookup and preset the instrument controls:*

   a. Set the output of the DC calibration generator to 0 volts.

   b. Connect the output of the DC calibration generator through a dual-banana connector followed by a 50 Ω precision coaxial cable to one side of a BNC T connector. (See Figure 1–16)

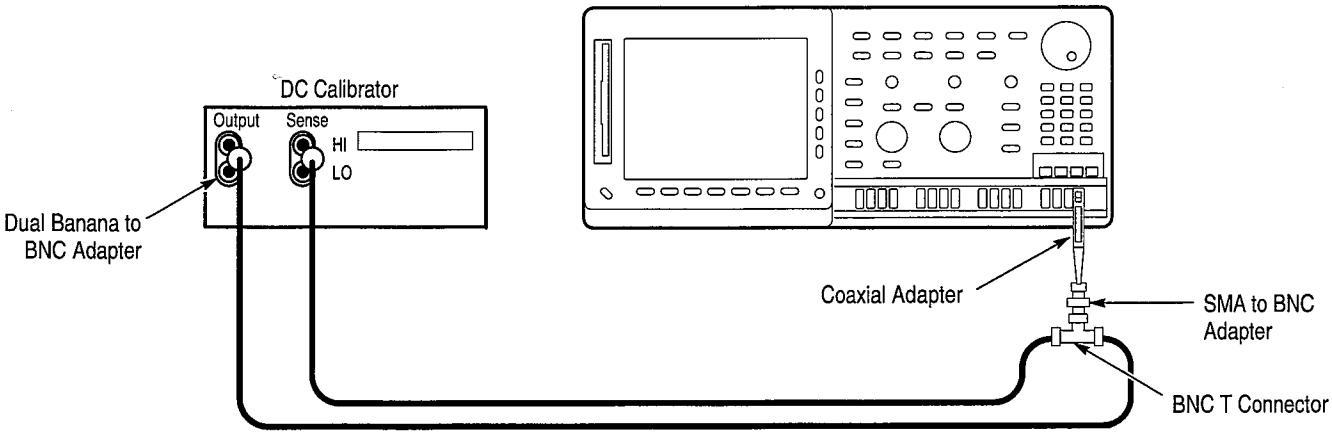


Figure 1–16: Test Hookup for Trigger Threshold Check

   c. Connect the Sense output of the generator, through a second dual-banana connector followed by a 50 Ω precision coaxial cable, to the other side of the BNC T connector.

   d. Connect the BNC T connector to channel **1** through a coaxial adapter and an SMA to BNC adapter.

   e. Press save/recall **SETUP → Recall Factory Setup** (main) **→ OK Confirm Factory Init** (side).

2. *Confirm Main trigger system is within limits for trigger threshold accuracy:*

   a. Press **GROUP MENU → Vertical Controls** (main) **→ Vertical Position** (side). Use the keypad to set vertical position to –3 divisions. The baseline level will move down three divisions.

   b. Press the side menu button **Offset**. Use the keypad to set vertical offset to +3 volts. The baseline level will move off screen.

   c. Set the standard output of the DC calibration generator to +3 volts. The DC test level will appear on screen.

   d. Press **SET LEVEL TO 50%**.

   e. Press **TRIGGER MENU**.

   f. Check that the **Threshold** readout in the main menu is between 2.54 V and 3.46 V. See Figure 1–17.

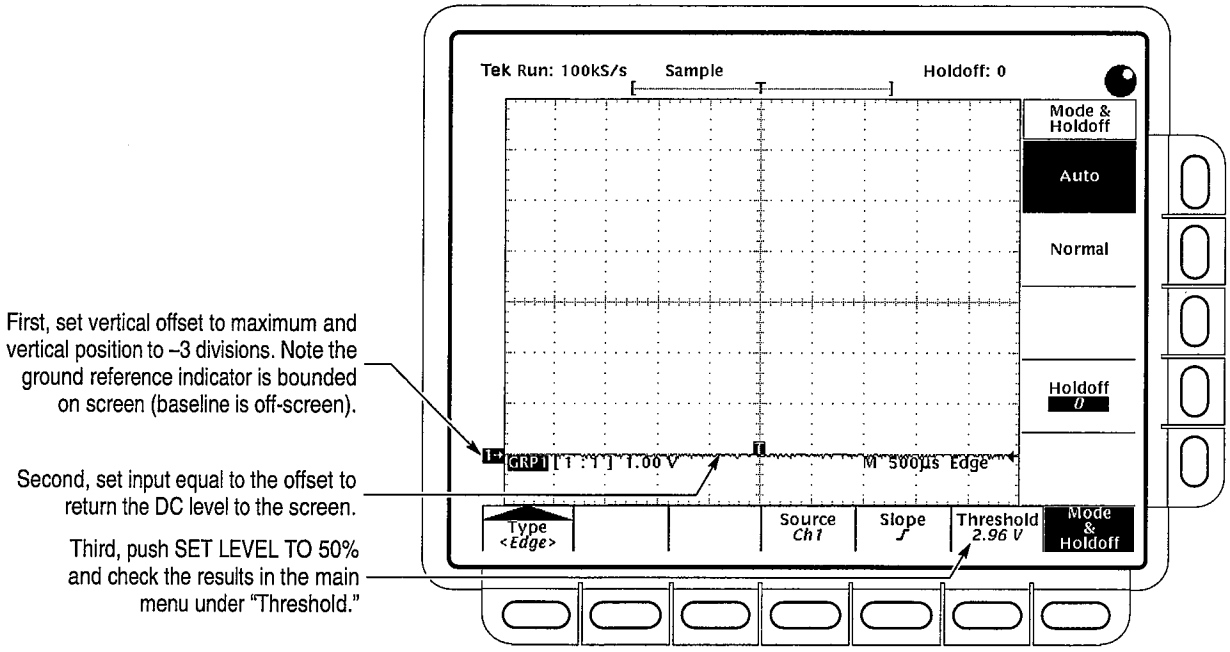


Figure 1–17: Measurement of Trigger-Level Accuracy

g. Press the main-menu button **Slope**; then press the side-menu button for negative slope. (See icon at left.)

h. Press **SET LEVEL TO 50%**.

i. Check that the **Threshold** readout in the main menu is between 2.54 V to 3.46 V.

3. *Disconnect the hookup:*

a. Set the output of the DC calibration generator to 0 volts.

b. Disconnect the cable from the generator output at the input connector of channel **1**.

Sensitivity, Edge Trigger

Equipment Required: One medium-frequency leveled sine wave generator (Item 9), one high-frequency leveled sine wave generator (Item 10), two precision 50 Ω coaxial cables (Item 4), one 10X attenuator (Item 1), one BNC T connector (Item 6), one 2X attenuator (Item 2), one coaxial adapter (Item 13), and one SMA to BNC adapter (Item 14).

Time Required: Approximately 3 hours and 15 minutes.

Prerequisites: The logic scope must meet the prerequisites listed on page 1–15. It must also pass the *Signal Acquisition System Checks* beginning on page 1–25.

Procedure:

1. *Install the test hookup and preset the instrument controls:*

   a. Press save/recall **SETUP → Recall Factory Setup** (main) → **OK Confirm Factory Init** (side).

   b. Set the horizontal **SCALE** for the **M** (main) time base to 25 ns.

   c. Set the vertical **SCALE** to 200 mV.

   d. Press **TRIGGER MENU → Mode & Holdoff** (main) → **Normal** (side).

   e. Press **SHIFT**; then press **ACQUIRE MENU → Mode** (main) → **Average 16** (side).

   f. Press **MEASURE → High-Low Setup** (main) → **Min-Max** (side).

   g. Connect the signal output of a medium-frequency sine wave generator to channel **1** through a 50 Ω coaxial cable, a coaxial adapter, and an SMA to BNC adapter. See Figure 1–18.

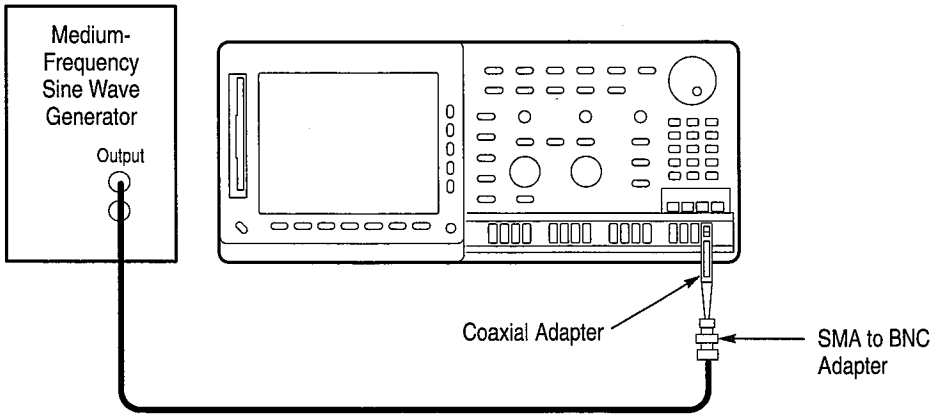


Figure 1–18: Test Hookup for Main Edge Trigger Sensitivity Checks

2. *Confirm Main trigger system is within sensitivity limits (50 MHz):*

   a. Set the generator frequency to 50 MHz.

   b. Press **MEASURE → Select Measrmnt for *Ch x***.

   c. Press the side-menu button **–more–** until **Amplitude** appears in the side menu (its icon is shown at the left). Press the side-menu button **Amplitude**.

   d. Press **SET LEVEL TO 50%**.

e. Press **CLEAR MENU**.

f. Adjust the generator output until the **C1 Amplitude** readout indicates the amplitude is 1.000 V. (Readout may fluctuate around 1.000 V.)

g. Disconnect the precision 50 Ω coaxial cable from the SMA to BNC adapter and reconnect it through a 10X attenuator.

h. Press **TRIGGER MENU → Slope** (main).

i. Press **SET LEVEL TO 50%**. Check that the instrument obtains a stable trigger for the test waveform on both the positive and negative slopes. See Figure 1–19. (Use the side menu to switch between trigger slopes; use the **THRESHOLD** knob to stabilize the trigger if required.)

j. Disconnect the test hookup, remove the 10X attenuator, and reconnect it to the next channel in numeric sequence.

k. Press **GROUP MENU → Group Definition** (main) **→ First Channel** (side). Press the side menu button **First Channel** again if necessary to increment the first (and selected) channel.

l. Press **TRIGGER MENU → Source** (main) **→ Channel** (side). Use the numeric keypad to enter the next channel in sequence.

m. Repeat substeps b through l for all sixteen channels. (Substeps j through l will be unnecessary for channel **16**.)

n. Leave the Main trigger system triggered on the positive slope of the waveform before continuing to the next step.

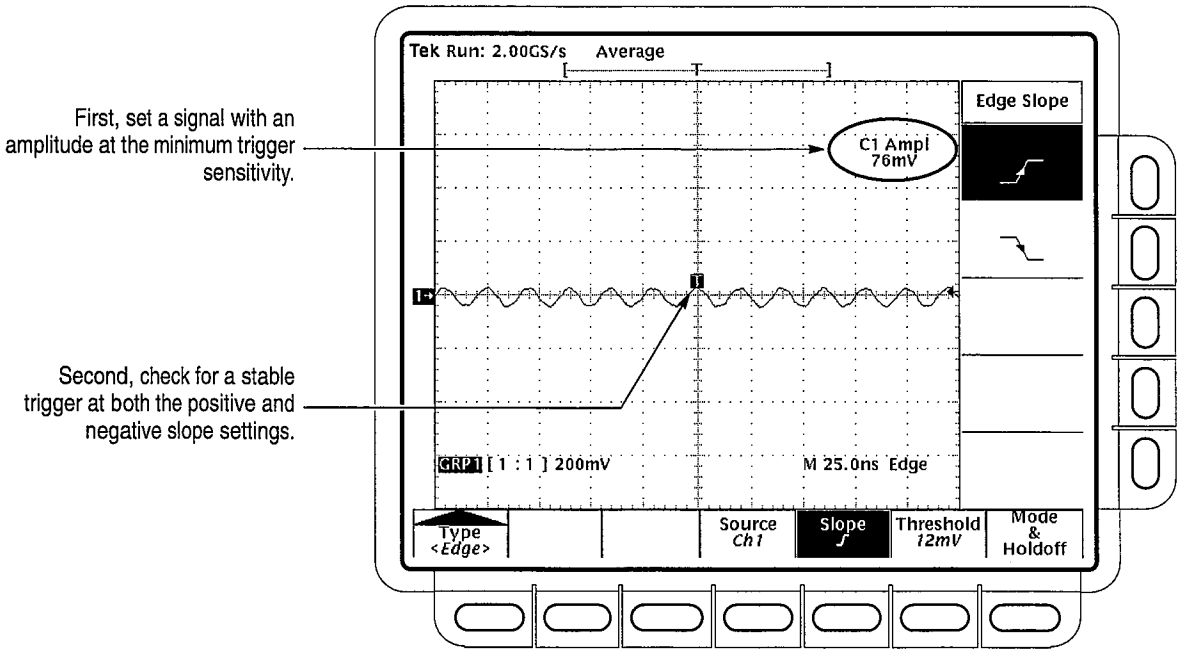


Figure 1–19: Measurement of Trigger Sensitivity

3. *Confirm the AUX Trigger input:*

   a. Remove the 10X attenuator from the hookup. Connect a BNC-T connector to the **AUX TRIGGER** input on the rear panel. Connect one side of the T connector to the generator through a 50 Ω coaxial cable; connect the other side of the T connector to channel **1** through a 50 Ω coaxial cable, an SMA to BNC adapter, and a coaxial adapter. See Figure 1–20.

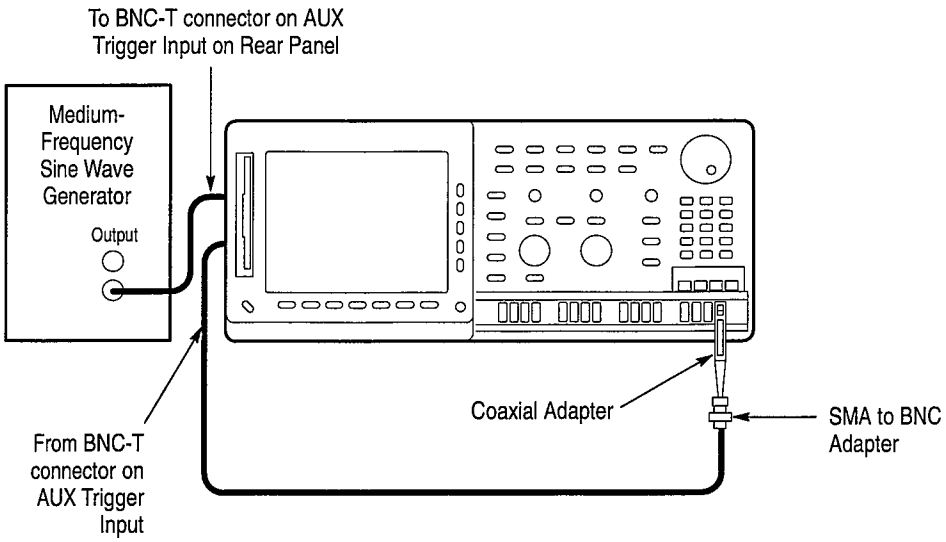


Figure 1–20: Test Hookup for AUX TRIGGER Input Sensitivity Check

b. Press **GROUP MENU → Group Definition** (main) → **First Channel** (side). Use the numeric keypad to set the first channel to **1**.

c. Press **GROUP MENU → Group Definition** (main) → **Last Channel** (side). Use the numeric keypad to set the last channel to **1**.

d. Set the vertical **SCALE** to 1 V.

e. Press **TRIGGER MENU → Source** (main) → **Channel** (side). Use the numeric keypad to set the channel index to **1**. Press **SET LEVEL to 50%**.

f. Press **MEASURE → Select Measrmnt for *Ch x*** (main).

g. Press the side-menu button **–more–** until **Amplitude** appears in the side menu (its icon is shown at the left). Press the side-menu button **Amplitude**.

h. Set the generator frequency to 25 MHz; adjust the generator output until the **C1 Amplitude** readout indicates the amplitude is 4 V. (Readout may fluctuate around 4 V.)

i. Press **TRIGGER MENU → Source** (main) → **Auxiliary** (side).

j. Press **SET LEVEL TO 50%**. Check that the instrument obtains a stable trigger for the test waveform on both the positive and negative slopes. Press the main-menu button **Slope**; then use the side menu to switch between trigger slopes. Use the general purpose knob to stabilize the trigger if required.

k. Leave the Main trigger system triggered on the positive slope of the waveform.

l. Press the main-menu button **Source**; then press the side-menu button **CH 1**.

4. *Confirm that the Main trigger system is within sensitivity limits (500 MHz):*

a. Disconnect the hookup. Connect, through its leveling head, a coaxial adapter, and an SMA to BNC adapter, the signal output of a high-frequency leveled sine wave generator to channel **1**.

b. Set the horizontal **SCALE** to 500 ps for the **M** (Main) time base.

c. Set the vertical **SCALE** to 200 mV.

d. Set the generator frequency to 500 MHz; press **SET LEVEL TO 50%**.

e. Set the test signal amplitude for about six divisions on screen. Now fine adjust the generator output until the **C1 Amplitude** readout indicates the amplitude is 1.2 V. (Readout may fluctuate around 1.2 V.)

f. Disconnect the high frequency sine wave generator from the SMA to BNC adapter and reconnect it through a 2X attenuator.

g. Press **TRIGGER MENU → Slope** (main).

h. Check that the instrument obtains a stable trigger for the test waveform on both the positive and negative slopes. (Use the side menu to switch between trigger slopes; use the **THRESHOLD** knob to stabilize the trigger if required.)

i. Disconnect the test hookup and move it to the next channel in numeric sequence.

j. Press **GROUP MENU → Group Definition** (main) **→ First Channel** (side). Press the side menu button **First Channel** again if necessary to increment to the next channel to be tested.

k. Press **TRIGGER MENU → Source** (main) **→ Channel** (side). Use the numeric keypad to enter the next channel in sequence.

l. Press **MEASURE → Select Measrmnt for *Ch x***.

m. Press the side-menu button **–more–** until **Amplitude** appears in the side menu (its icon is shown at the left). Press the side-menu button **Amplitude**.

n. Repeat substeps g through m for all sixteen channels. (Substeps i through m will be unnecessary for channel **16**.)

5. Disconnect the test hookup at the channel **16** input.

Output Signal Checks

These procedures check those characteristics of the output signals that are listed as checked under *Warranted Characteristics* in the *Specifications* section.

Check Outputs — Probe Compensator

Equipment Required: One P6240 probe.

Time Required: Approximately 5 minutes.

Prerequisites: The logic scope must meet the prerequisites listed on page 1–15. It must also pass the *Signal Acquisition System Checks* beginning on page 1–25.

STOP. *If your logic scope was ordered configured as Option 1S, it was shipped without the 16 probes included with the standard configured logic scope. You must have one probe to check the probe compensator output and may wish skip this test. Read the information under* Option 1S *on page 1–1 before continuing.*

Procedure:

1. *Install the test hookup and preset the logic scope controls:*

   a. Install one probe on channel **1**. Connect the probe tip to a **PROBE CALIBRATION** signal output on the front panel. (See Figure 1–21.)

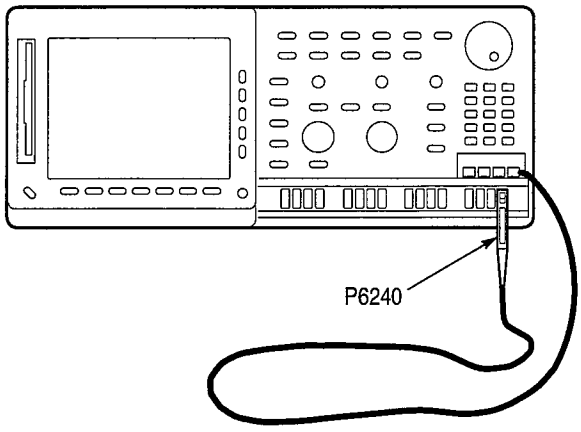


Figure 1–21: Test Hookup for Probe Compensator Check

   b. Press save/recall **SETUP → Recall Factory Setup** (main) **→ Ok Confirm Factory Init** (side).

   c. Set the vertical **SCALE** to 200 mV.

d. Press **SHIFT**; then press **ACQUIRE MENU** → **Mode** (main) → **Average** (side). Use the keypad to set the number of averages to 64.

2. *Confirm Probe Compensator output voltage is within limits:*

   a. Press **MEASURE** → **Select Measurement for *Ch x*** (main).

   b. Repeatedly press the side-menu button **–more–** until **Pk–Pk** appears in the side menu. Press **Pk–Pk**.

   c. Repeatedly press the side-menu button **–more–** until **Frequency** appears in the side menu. Press **Frequency**. (See Figure 1–22.)

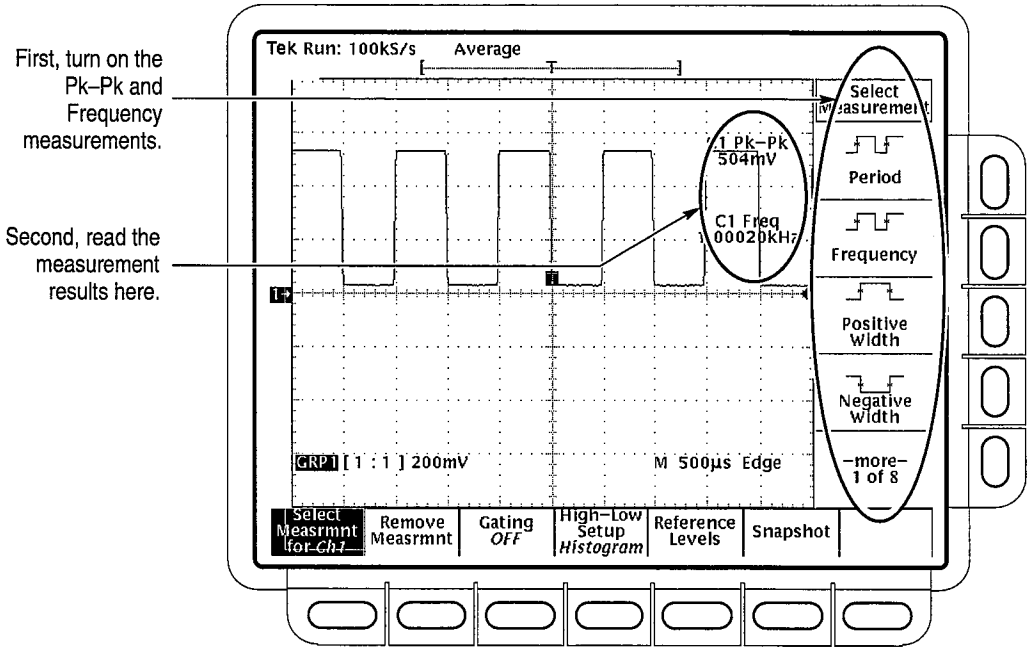


Figure 1–22: Measurement of Probe Compensator Limits

   d. Check that the **C1 Pk–Pk** readout is between 490 and 510 mV.

   e. Check that the **C1 Freq** readout is between 950 and 1050 Hz.

3. Disconnect the probe from the channel **1** input.

Check Outputs — Main and Delayed Trigger

Equipment Required: One precision coaxial cable (Item 4), one coaxial adapter (Item 13), one SMA to BNC adapter (Item 14).

Time Required: Approximately 10 minutes.

Prerequisites: The logic scope must meet the prerequisites listed on page 1–15. It must also pass the *Signal Acquisition System Checks* beginning on page 1–25.

Procedure:

1. *Install the test hookup and preset the instrument controls:*

   a. Connect the **MAIN TRIGGER OUTPUT** at the rear panel to channel **1** through a 50 Ω precision cable, a coaxial adapter, and an SMA to BNC adapter (see Figure 1–23).

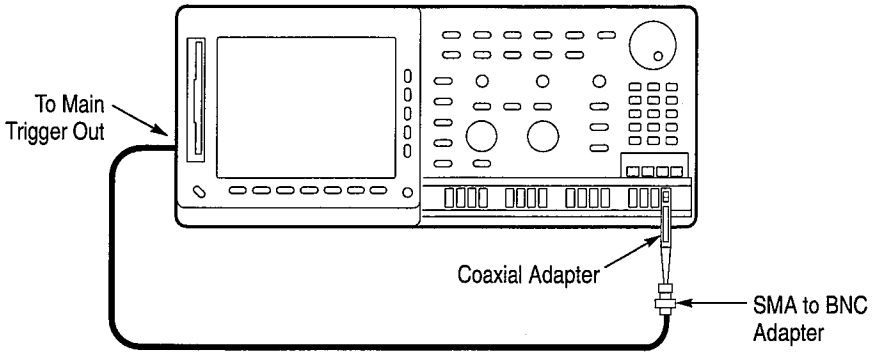


Figure 1–23: Test Hookup for Main Trigger Output Check

   b. Press save/recall **SETUP → Recall Factory Setup** (main) **→ OK Confirm Factory Init** (side).

   c. Set the horizontal **SCALE** to 250 µs.

   d. Press **SHIFT**; then press **ACQUIRE MENU → Mode** (main) **→ Average** (side). Use the keypad to set the number of averages to 64.

2. *Confirm Main and Delayed Trigger outputs are within limits for logic levels:*

   a. Use the vertical **POSITION** knob to center the display on screen.

   b. Press **MEASURE → Select Measurement for Ch 1** (main).

   c. Repeatedly press the side-menu button **–more–** until **High** and **Low** appear in the side menu (their icons are shown at the left). Press both side-menu buttons **High** and **Low**. (See Figure 1–24.)

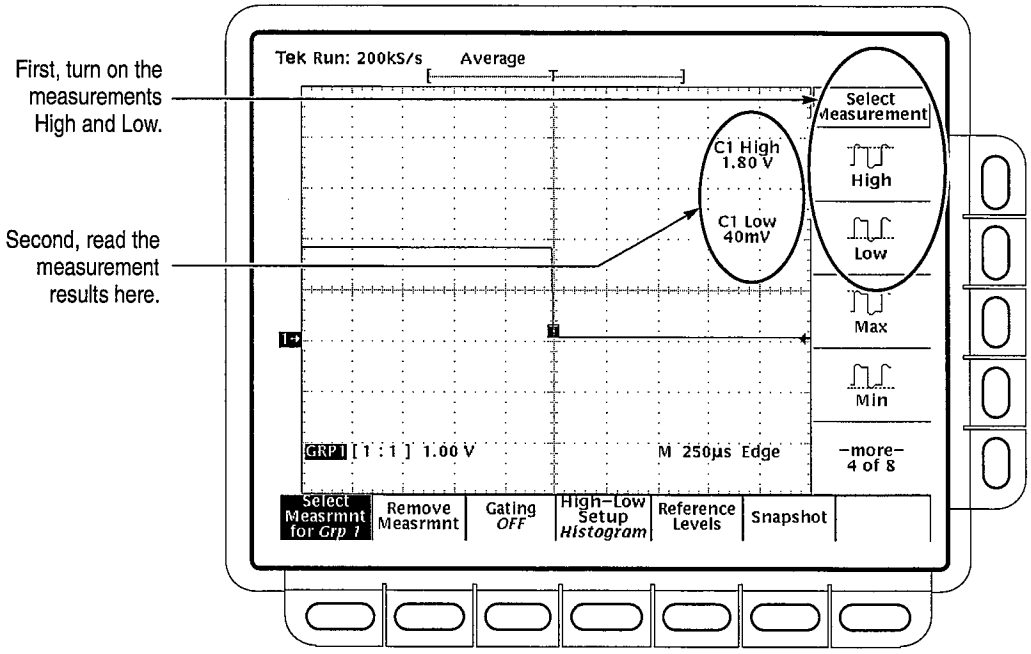


Figure 1–24: Measurement of Main Trigger Output Limits

d. Check that the **C1 High** readout is ≥1.0 V and that the **C1 Low** readout is ≤0.25 V.

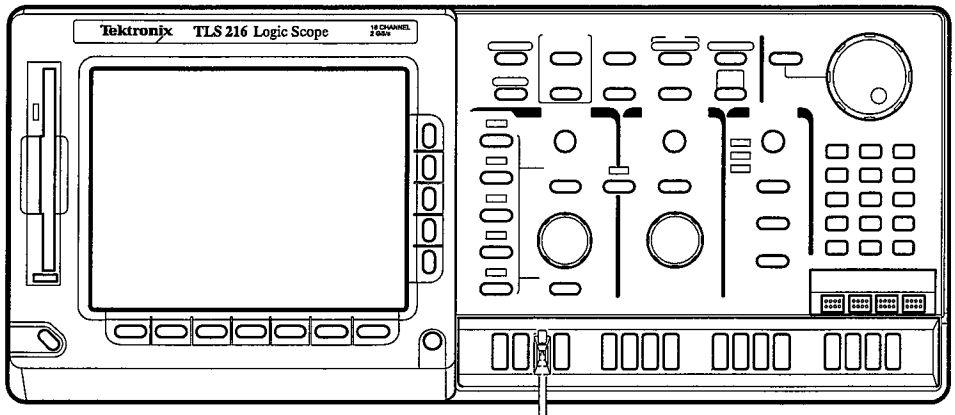
e. Move the precision 50 Ω cable from the **MAIN TRIGGER OUTPUT** BNC to the **DELAYED TRIGGER OUTPUT** BNC.

f. Check that the **C1 High** readout is ≥1.0 volt and that the **C1 Low** readout ≤0.25 volts.

3. Disconnect the cables from the channel **1** input and the rear panel output.

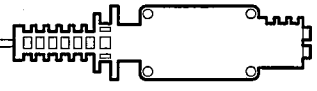
Specifications

Product Description



The Tektronix TLS 216 Logic Scope is a superb tool for analyzing and debugging digital circuits. Its performance addresses the needs of digital designers and troubleshooters of such circuits with the following features:

- sixteen channels, equipped with sixteen 2.5 pF FET probes, for acquiring waveforms from digital circuits
- three display modes — displays analog waveforms, digital BusForms, and dual-threshold timing diagrams
- four threshold level presets based on four logic families, TTL, CMOS, +ECL, and –ECL, for deriving digital levels for BusForm™ and timing diagram displays
- five trigger types — Edge, Pulse, Pattern, State, and Sequence
- 500 MHz maximum bandwidth, a 2 Gigasamples/second maximum digitizing rate, eight-bit digitizers, and up to a 2,000-sample record length per channel
- full GPIB software programmability and hardcopy output using GPIB, RS-232, or Centronics ports
- complete measurement and documentation capability
- intuitive operation using graphic icons and the more familiar and traditional horizontal and vertical knobs
- on-line help at the touch of a button



Warranted Characteristics

This subsection lists the various *warranted characteristics* that describe the TLS 216, including both electrical and environmental characteristics.

Warranted characteristics are quantifiable performance limits that are warranted.

NOTE. *In these tables, those warranted characteristics that are checked (either directly or indirectly) in the* Performance Verification, *found in Section 1, appear in* ***boldface type*** *under the column* **Name.**

Performance Conditions

The electrical characteristics found in these tables of warranted characteristics apply when the TLS 216 has been adjusted at an ambient temperature between +20° C and +30° C, has had a warm-up period of at least 20 minutes, and is operating at an ambient temperature between +4° C and +50° C (unless otherwise noted), and has passed both the signal path compensation and probe calibration routines.

Table 2–1: Warranted Characteristics: Input System

Name	Description
Input Resistance with Coaxial Adapter	50 Ω, ±1%.
Input Resistance with P6240 Probe	1 MΩ, ±15% at DC.
Input Dynamic Range with Coaxial Adapter	±5 V (DC + Peak AC).
Input Dynamic Range with P6240 Probe	+15 V to –12 V (DC + Peak AC).
Maximum Input Voltage with Coaxial Adapter	±5 V (DC + Peak AC).
Maximum Input Voltage with P6240 Probe	±25 V (DC + Peak AC).
Maximum Input Voltage (Instrument Front Panel)	±5 V (DC + Peak AC).

Table 2–2: Warranted Characteristics: Signal Acquisition System

Name	Description
DC Gain Accuracy with P6240 Probe	±1.5% for time base settings of 50 mV/Div to 2 V/Div.
DC Gain Accuracy with Coaxial Adapter	±4.0% for time base settings of 50 mV/Div to 2 V/Div.

Table 2–2: Warranted Characteristics: Signal Acquisition System (Cont.)

Name	Description
DC Voltage Measurement Accuracy, Averaged, with Coaxial Adapter	For an average of ≥ 16 waveforms: ±(4.0% × | reading – Offset | + Offset Accuracy + (0.06 Div x V/Div)) Delta Volts between any two averages of ≥ 16 waveforms acquired under the same setup and ambient conditions: ±(4.0% × | reading | + (0.1 Divs x V/Div) + 0.3 mV)
DC Voltage Measurement Accuracy, Averaged, with P6240 Probe	For an average of ≥ 16 waveforms: ±(1.5% × | reading – Offset | + Offset Accuracy + (0.06 Div x V/Div)) Delta Volts between any two averages of ≥ 16 waveforms acquired under the same setup and ambient conditions: ±(1.5% × | reading | + (0.1 Divs x V/Div) + 0.3 mV)
DC Voltage Measurement Accuracy, Not Averaged, with Coaxial Adapter	Any sample: ±(4.0% × | reading – Offset | + Offset Accuracy + (0.13 Divs x V/Div) + 0.6 mV) Delta Volts between any two samples acquired under the same setup and ambient conditions: ±(4.0% × | reading | + (0.26 Divs x V/Div) + 1.2 mV)
DC Voltage Measurement Accuracy, Not Averaged, with P6240 Probe	Any sample: ±(1.5% × | reading – Offset | + Offset Accuracy + (0.13 Divs x V/Div) + 0.6 mV) Delta Volts between any two samples acquired under the same setup and ambient conditions: ±(1.5% × | reading | + (0.26 Divs x V/Div) + 1.2 mV)
Offset Accuracy	V/Div Setting — Offset Accuracy 50 mV/Div to 499 mV/Div — 2% of offset ± .3 Divs x V/Div 500 mV/Div to 2 V/Div — 2% of offset ± .2 Divs x V/Div
Analog Bandwidth with P6240 Probe or Coaxial Adapter	Limits given for an ambient temperature range of 0° C to +30° C. Derate upper bandwidth frequencies by 5.0 MHz for each ° C above +30° C. V/Div Setting — Bandwidth 200 mV/Div to 2 V/Div — DC to 500 MHz 100 mV/Div to 199 mV/Div — DC to 450 MHz 50 mV/Div to 99.9 mV/Div — DC to 350 MHz
Delay Between Channels with Coaxial Adapter	≤ 200 ps for any two channels with equal V/Div settings.

Table 2–2: Warranted Characteristics: Signal Acquisition System (Cont.)

Name	Description
Delay Between Channels with P6240 Probe	≤ 500 ps for any two channels with equal V/Div settings.
Cross Talk (Channel Isolation)	≥ 100:1 at 100 MHz and ≥ 30:1 at the rated bandwidth for the sensitivity rating of the channel, for any two channels having equal V/Div settings.

Table 2–3: Warranted Characteristics: Time Base System

Name	Description	
Sample Rate and Delay Time Accuracy	± 100 ppm over any interval ≥ 1 ms.	
Seconds/Div Time Base Accuracy	± 100 ppm over any interval ≥ 1 ms.	
Delta Time Measurement Accuracy	Conditions	Time Measurement Accuracy
	Single shot sample mode, 20 MHz Bandwidth selected	±(1 WI[1] + 100 ppm × | Reading | + 1.1 ns)
	Repetitive, ≥ 8 averages, bandwidth selected	±(1 WI[1] + 100 ppm × | Reading | + 180 ps)

1 **The Waveform Interval (WI) is the time between the samples in the waveform record.**

Table 2–4: Warranted Characteristics: Triggering System

Name	Description	
Edge Trigger Accuracy	Any channel: 0.50 Divs from DC to 50 MHz, increasing to 3.0 Divs at 500 MHz.	
Pulse-, Sequence-, or Pattern-Type Trigger Time Accuracy (Single Channel)	Width or Limit Setting	Trigger Time Accuracy
	2.4 ns to 35 ns	±(5% of setting + 0.5 ns)
	35 ns to 1 µs	±(10% of setting + 0.5 ns)
	1.02 µs to 1 s	±(.01% of setting +50 ns)
Pulse-, Sequence-, or Pattern-Type Trigger Time Accuracy (Multiple Channels)	Width or Limit Setting	Trigger Time Accuracy
	2.4 ns to 35 ns	±(5% of setting + 2.5 ns)
	35 ns to 1 µs	±(10% of setting + 2.5 ns)
	1.02 µs to 1 s	±(.01% of setting +50 ns)
Pulse-, Sequence-, or Pattern-Type Trigger Minimum Time Interval	500 ps.	
Edge-Type Trigger Minimum Pulse Width	800 ps.	
Pulse-Type Trigger Rearm Time	2.5 ns.	
Pulse-Type Trigger Minimum Pulse Width	2.0 ns.	
Pattern-Type Trigger Minimum Pattern Width	4.0 ns.	

Table 2–4: Warranted Characteristics: Triggering System (Cont.)

Name	Description
Pattern-Type Trigger Rearm Time	4.5 ns.
Sequence-Type Trigger Rearm Time	4.5 ns.
Sequence-Type Trigger Minimum Pulse Width	4.0 ns.
State-Type Trigger Setup and Hold Times	Setup: 4.0 ns; hold time: 4.0 ns.
Trigger Threshold Accuracy	±2% of (threshold setting – offset setting) + 0.2 Divs + offset accuracy
Auxiliary Trigger Input Sensitivity	DC to 50 MHz input frequency with $V_{IN(HI)}$ = 2.0 V and $V_{IN(LO)}$ = 0.8 V.

Table 2–5: Warranted Characteristics: Output Ports and Power Distribution System

Name	Description
Main and Delayed Trigger Output Logic Levels	Logic-High ($V_{OUT(HI)}$): ≥ 2.5 V open circuit, ≥ 1.0 V into a 50 Ω load to ground. Logic-Low ($V_{OUT(LO)}$): ≤ 0.7 V into a load of ≤ 4 mA; ≤ 0.25 V into a 50 Ω load to ground.
Source Voltage	90 to 250 VAC_{RMS}, continuous range.
Source Frequency	47 Hz to 440 Hz.
Power Consumption	≤ 350 W.
Probe Compensator Output Voltage and Frequency	Output voltage: 0.5 V (base to top) ±2% into a ≥ 50 Ω load; frequency: 1 kHz ±5%.

Table 2–6: Warranted Characteristics: Environmental

Name	Description
Temperature (Operating and Nonoperating)	Operating: +4° C to +50° C. Nonoperating: –22° C to +60° C
Electrostatic Discharge Susceptibility	Up to 8 kV with no change to control settings, or impairment of normal operation; up to 15 kV with no damage that prevents recovery of normal operation by the user.

Table 2–6: Warranted Characteristics: Environmental (Cont.)

Name	Description
Emissions	The instrument meets or exceeds the EMC requirements of the following standards: Vfg. 243/1991 Amended per Vfg. 46/1992 FCC Code of Federal Regulations, 47 CFR, Part 15, Subpart B, Class A
Third Party Certification	UL: 1244, Ninth Edition CSA: C22.2 No. 231-M89

Typical Characteristics

This subsection contains tables that list the various *typical characteristics* that describe the TLS 216 Logic Scope.

Typical characteristics describe typical or average performance. Typical characteristics are not warranted.

Table 2–7: Typical Characteristics: Input System

Name	Description
Input Resistance (Instrument Front Panel)	75 Ω, ±1% at DC.
Probe Input Capacitance	2.5 pF maximum.

Table 2–8: Typical Characteristics: Signal Acquisition System

Name	Description
Effective Bits	For a 9-division (peak-to-peak) sine wave output: Output Frequency — 2 GS/s Sample Rate 98 MHz — 5.5 bits 245 MHz — 5.0 bits 490 MHz — 4.5 bits
Input Current	≤ 60 µA at an ambient temperature ≤ 30° C.
Step Response Rise Time	V/Div Setting — Rise Time 50 mV/Div to 99.9 mV/Div — 1.0 ns 100 mV/Div to 199 mV/Div — 900 ps 200 mV/Div to 2 V/Div — 800 ps
Step Response Settling Time with Coaxial Adapter	V/Div Setting — ±Step Response — Settling Error at 20 ns — 100 ns — 20 ms 50 mV/Div to 99.9 mV/Div — ≤ 5.0 V — ≤ 0.5% — ≤ 0.2% — ≤ 0.1% 100 mV/Div to 199 mV/Div — ≤ 5.0 V — ≤ 1.0% — ≤ 0.5% — ≤ 0.2% 200 mV/Div to 2 V/Div — ≤ 5.0 V — ≤ 1.0% — ≤ 0.5% — ≤ 0.2%

Table 2–9: Typical Characteristics: Triggering System

Name	Description	
Trigger Position Accuracy (All Types)	Acquisition Mode	Accuracy
	Sample or Average	±(1 WI[1] + 1.5 ns)
	Envelope	±(2 WI[1] + 1.5 ns)
Edge-Type Trigger Jitter	0.3 ns peak-to-peak for 100 records.	
Pulse-, Pattern-, State-, or Sequence-Type Trigger Sensitivity	1.0 Div from DC to 200 MHz, with a minimum slew rate of 25 Divs/µs at the trigger level threshold.	
Pulse-, Pattern-, or Sequence-Type Trigger Time Range and Resolution	Range: 2.4 ns to 1 s.	
	Time Range	Time Resolution
	2.4 ns to 10 ns	0.2 ns
	10.5 ns to 20 ns	0.5 ns
	21 ns to 50 ns	1 ns
	52 ns to 100 ns	2 ns
	104 ns to 200 ns	4 ns
	210 ns to 500 ns	10 ns
	520 ns to 1 s	20 ns
Trigger Holdoff Range	0.5 ns to 10 s.	
"Set Trigger Level to 50%" Minimum Operable Frequency	50 Hz.	
Delayed Trigger Time Range	16.5 ns to 250 ns at 10 µs or faster; 15.152 ns to 250 s at 25 µs or slower.	
Delayed Trigger Events Range	2 to 10 million events.	
Auxiliary Trigger Input Logic Levels	$V_{IN(HI)}$ = 2.0 V and $V_{IN(LO)}$ = 0.8 V.	
Auxiliary Trigger Input Characteristics	Input is TTL compatible.	

[1] **The Waveform Interval (WI) is the time between the samples in the waveform record.**

Table 2–10: Typical Characteristics: Display and Data Handling Systems

Name	Description
Video Display Resolution	640 pixels horizontally by 480 pixels vertically in a display area of 12.8 cm (5.04 in.) horizontally by 9.6 cm (3.78 in.) vertically.
Nonvolatile Memory Capacity	Reference waveforms (4), stored setups (10), and calibration constants are retained in nonvolatile memory.
Nonvolatile Memory Retention Time	≥ 5 years.
Floppy Disk Drive	3.5" floppy disk, 1.44 Mbyte, DOS 4.0 format for storing waveforms, hard copies, and instrument setups.

Table 2–11: Typical Characteristics: Operating Environment

Name	Description
Humidity (Operating and Nonoperating)	Nonoperating: to 90% relative humidity from –22° C to +40° C to 50% relative humidity from –22° C to +50° C Operating: to 80% relative humidity from +4° C to +29° C to 20% relative humidity from +4° C to +50° C
Altitude (Operating and Nonoperating)	Operating: to 4570 m (15,000 ft.). Nonoperating: to 12190 m (40,000 ft.).
Random Vibration (Operating and Nonoperating)	Operating: 0.31 g_{RMS} from 5 to 500 Hz, 10 minutes each axis Nonoperating: 3.04 g_{RMS} from 5 to 500 Hz, 10 minutes each axis.

Nominal Traits

This subsection contains a collection of tables that list the various *nominal traits* that describe the TLS 216, including both electrical and mechanical traits.

Nominal traits are described using simple statements of fact such as "16, all identical" for the trait "Input Channels, Number of," rather than in terms of limits that are performance requirements.

Table 2–12: Nominal Traits: Input System

Name	Description
Input Probe Type	Tektronix P6240 only.
Input Coaxial Adapter Type	Tektronix part number 013–0282–00.
Probe Input Coupling	DC.
Input Probe Connector Type	Amp Inc. Amplimite coax Mix, Amp part number 750019–1. Mates with Amp part number 750020–1.

Table 2–13: Nominal Traits: Signal Acquisition System

Name	Description
Input Channels, Number of	16, all identical; identified as Ch1, Ch2,... Ch16.
Input Coupling	DC only.
Samplers, Number of	16, all identical; one per channel.
Digitized Bits, Number of	8 bits.
V/Div Gain Sensitivity Settings	50 mV/Div to 2 V/Div in a 1–2–5 sequence.
V/Div Fine Gain Range and Resolution	Range: adjustable between the V/Div step gain setting and the next lower step gain setting. Resolution: 1% of the lower step gain setting.
Offset Voltage Range and Resolution	Range: +15 V to –12 V. Resolution: 5 mV.
Position Range	±5 divisions.
Position Accuracy	0.1 divisions.
Analog Bandwidth Selections	20 MHz and FULL (500 MHz) bandwidth.

Table 2–14: Nominal Traits: Time Base System

Name	Description
Seconds/Division Range	0.5 ns/div to 5 s/div.
Seconds/Division Step Settings	0.5 ns/Div to 5 s/div in a 1–2.5–5 sequence.
Sample-Rate Range, Real-Time[1]	10 Samples/s to 2 GS/s on 16 channels simultaneously.
Sample-Rate Range, Interpolated[1]	5 GSamples/s to 100 GSamples/s.
Record Length Selection	500 samples, 1000 samples, 2000 samples.

1 **The range of real-time rates, expressed in samples/second, at which a digitizer samples signals at its inputs and stores the samples in memory to produce a record of time-sequential samples.**

Table 2–15: Nominal Traits: Triggering System

Name	Description
Trigger Threshold Range and Resolution (Any Trigger Source)	Range: ±10 Divs; Resolution: 0.02 Divs.
Line Trigger Level	0 V. Triggers at all 0 volt crossings regardless of whether positive going or negative going.

Table 2–16: Nominal Traits: Display System

Name	Description
Contrast Ratio	> 100:1.
Waveform Display Graticule	Single Graticule: 401 × 501 pixels, 8 ×10 divisions, where divisions are 1 cm by 1 cm
Waveform Display Color Scale	16 colors in infinite persistence and variable persistence display styles.

Table 2–17: Nominal Traits: GPIB Interface and Output Ports

Name	Description
Video Output, VGA	DB-15 rear panel video connector, noninterlaced; levels comply with ANSI Standard R5343A.
GPIB Interface	GPIB interface complies with IEEE Std 488-1987.
RS-232 Interface	RS-232 interface complies with EIA/TIA 574.
Centronics Interface	Centronics interface complies with Centronics interface standard C332-44 Feb 1977, REV A.

Table 2–18: Nominal Traits: Fuse Rating

Name	Description
Fuse Rating	Either of two fuses may be used. 0.25″ × 1.25″ (UL 198.6, 3AG): 6 A FAST, 250 V. 5 mm × 20 mm (IEC 127): 5A (T), 250 V.

Table 2–19: Nominal Traits: Mechanical

Name	Description
Weight	12.3 kg (29 lbs) with front cover. 24.7 kg (54 lbs), when packaged for shipment.
Dimensions	Height: 193 mm (7.6 in) with the feet installed. Width: 445 mm (17.5 in), with handle. Depth: 434 mm (17.1 in), with front cover installed.
Cooling Method	Forced-air circulation with no air filter.
Finish Type	Tektronix Blue vinyl-clad material on an aluminum cabinet.
Construction Material	Chassis parts constructed of aluminum alloy; front panel constructed of plastic laminate; circuit boards constructed of glass laminate. Cabinet is aluminum and is clad in Tek Blue vinyl material.
Weight of Rackmounted Instrument and Rackmount Conversion Kit	2.3 kg (5 lbs) for the rackmount conversion kit only; 3.6 kg (8 lbs) when packaged for shipment. 12.3 kg (29 lbs) plus weight of rackmount parts for the rack-mounted instrument (Option 1R). 20.5 kg (54 lbs) when the rackmounted instrument is packaged for domestic shipment.
Dimensions of Rackmount Instrument	Height: 178 mm (7 in). Width: 483 mm (19 in). Depth: 559 mm (22 in).