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# Service Manual

Tektronix

# TDS 500D, TDS 600C, TDS 700D & TDS 714L Digitizing Oscilloscopes

## 071-0627-02

**Warning**
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

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# General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

*Only qualified personnel should perform service procedures.*

### To Avoid Fire or Personal Injury

**Use Proper Power Cord.** Use only the power cord specified for this product and certified for the country of use.

**Ground the Product.** This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

**Observe All Terminal Ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

**Connect and Disconnect Properly.** Do not connect or disconnect probes or test leads while they are connected to a voltage source.

**Do Not Operate Without Covers.** Do not operate this product with covers or panels removed.

**Use Proper Fuse.** Use only the fuse type and rating specified for this product.

**Avoid Exposed Circuitry.** Do not touch exposed connections and components when power is present.

**Do Not Operate With Suspected Failures.** If you suspect there is damage to this product, have it inspected by qualified service personnel.

**Do Not Operate in Wet/Damp Conditions.**

**Do Not Operate in an Explosive Atmosphere.**

**Provide Proper Ventilation.** Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

## Symbols and Terms

**Terms in this Manual.** These terms may appear in this manual:



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



***CAUTION.*** *Caution statements identify conditions or practices that could result in damage to this product or other property.*

**Terms on the Product.** These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

**Symbols on the Product.** The following symbols may appear on the product:



WARNING
High Voltage



Protective Ground
(Earth) Terminal



CAUTION
Refer to Manual



Double
Insulated

# Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

**Do Not Service Alone.** Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

**Disconnect Power.** To avoid electric shock, disconnect the mains power by means of the power cord or, if provided, the power switch.

**Use Caution When Servicing the CRT.** To avoid electric shock or injury, use extreme caution when handling the CRT. Only qualified personnel familiar with CRT servicing procedures and precautions should remove or install the CRT.

CRTs retain hazardous voltages for long periods of time after power is turned off. Before attempting any servicing, discharge the CRT by shorting the anode to chassis ground. When discharging the CRT, connect the discharge path to ground and then the anode. Rough handling may cause the CRT to implode. Do not nick or scratch the glass or subject it to undue pressure when removing or installing it. When handling the CRT, wear safety goggles and heavy gloves for protection.

**Use Care When Servicing With Power On.** Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

**X-Radiation.** To avoid x-radiation exposure, do not modify or otherwise alter the high-voltage circuitry or the CRT enclosure. X-ray emissions generated within this product have been sufficiently shielded.

# Preface

This preface contains information needed to properly use this manual to service the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes, as well as general information critical to safe and effective servicing of this oscilloscope.

The following models are covered:

| | |
|---|---|
| TDS 500: | TDS 520D, TDS 540D, and TDS 580D |
| TDS 600: | TDS 654C, TDS 680C, TDS 684C, and TDS 694C |
| TDS 700: | TDS 714L, TDS 724D, TDS 754D, TDS 784D, and TDS 794D |

## Manual Structure

This manual is divided into sections, such as *Specifications and Theory of Operation*. Further, it is divided into subsections, such as *Product Description* and *Removal and Installation Procedures.*

Sections containing procedures also contain introductions to those procedures. Be sure to read these introductions because they provide information needed to do the service correctly and efficiently. The following is a brief description of each manual section.

- *Specifications* contains a product description of the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes and tables of the characteristics and descriptions that apply to it.
- *Operating Information* includes general information and operating instructions at the level needed to safely power on and service this oscilloscope. A statement of the service strategy that this manual supports, and instructions for shipment of the oscilloscopes are found in this section.
- *Theory of Operation* contains circuit descriptions that support general service and fault isolation.
- *Performance Verification* contains a collection of procedures for confirming that these oscilloscopes function properly and meet warranted limits.
- *Adjustment Procedures* contains a collection of procedures for adjusting these oscilloscopes to meet warranted limits.

- *Maintenance* contains information and procedures for doing preventive and corrective maintenance of these oscilloscopes. Instructions for cleaning, for module removal and installation, and for fault isolation to a module are found here.
- *Options* contains information on servicing any of the factory-installed options that may be present in your oscilloscope.
- *Electrical Parts List* contains a statement referring you to *Mechanical Replaceable Parts*, where both electrical and mechanical modules are listed.
- *Diagrams* contains a block diagram and an interconnection diagram useful for isolating failed modules.
- *Mechanical Parts List* includes a table of all replaceable modules, their descriptions, and their Tektronix part numbers.

## Manual Conventions

This manual uses certain conventions which you should become familiar with before doing service.

### Modules

Throughout this manual, any replaceable component, assembly, or part of these oscilloscopes is referred to generically as a module. In general, a module is an assembly, like a circuit board, rather than a component, like a resistor or an integrated circuit. Sometimes a single component is a module; for example, each chassis part of the oscilloscope is a module.

### Channels

Some TDS models have two auxiliary channels called AUX 1 and AUX 2, instead of CH 3 and CH 4. References to these channels default to CH 3 and CH 4. If your oscilloscope is one of models TDS 520D, TDS 680C, or TDS 724D, read AUX 1 and AUX 2 respectively for all references to CH 3 and CH 4 in this manual.

### Safety

Symbols and terms related to safety appear in the Safety Summary found at the beginning of this manual.

### Symbols

Besides the symbols related to safety, this manual uses the following symbols:

***STOP****. The stop labels information which must be read in order to correctly do service and to avoid incorrectly using or applying service procedures.*



The clock icon labels procedure steps which require a pause to wait for the oscilloscope to complete some operation before you can continue.



Various icons such as the example icon at the left are used in procedures to help identify certain readouts and menu functions on screen.

## Related Manuals

The TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes come with the following manuals (see the *Options and Accessories* section for part numbers):

*TDS 500D, TDS 600B & TDS 700D User Manual* contains a tutorial to quickly show you how to operate the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes and an in depth discussion of how to more completely use their features. Applications are also discussed.

*TDS 500D, TDS 600B & TDS 700D Reference* contains a brief overview of oscilloscope operation.

*TDS Family Programmer Manual* (diskette, part of the *User Manual*) contains information for programmed operation via the GPIB interface. Included are the complete command set, setup information, and programming examples.

*TDS 500D, TDS 600C, TDS 700D & TDS 714L Technical Reference* contains performance verification procedures and specifications.

# Contacting Tektronix

| | |
|---|---|
| **Phone** | 1-800-833-9200* |
| **Address** | Tektronix, Inc.<br>Department or name (if known)<br>14200 SW Karl Braun Drive<br>P.O. Box 500<br>Beaverton, OR 97077<br>USA |
| **Web site** | www.tektronix.com |
| **Sales support** | 1-800-833-9200, select option 1* |
| **Service support** | 1-800-833-9200, select option 2* |
| **Technical support** | Email: techsupport@tektronix.com<br>1-800-833-9200, select option 3*<br>1-503-627-2400<br>6:00 a.m. – 5:00 p.m. Pacific time |

* **This phone number is toll free in North America. After office hours, please leave a voice mail message.**
**Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.**

# Introduction

## Service Strategy

***STOP****. Throughout this manual, any field-replaceable component, assembly, or part of this oscilloscope is referred to generically as a module.*

This manual contains all the information needed for periodic maintenance of the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes. (Examples of such information are procedures for checking performance and for readjustment.) Further, it contains all information for corrective maintenance down to the module level. This means that the procedures, diagrams, and other troubleshooting aids help isolate failures to a specific module, rather than to components of that module. Once a failure is isolated, replace the module with a fresh unit obtained from the factory.

All modules are listed in *Mechanical Parts List*. To isolate a failure to a module, use the fault isolation procedures found in Section 6, *Maintenance Information*. To remove and replace any failed module, follow the instructions in *Removal and Installation Procedures*, also found in Section 6.

## Service Offerings

Tektronix provides service to cover repair under warranty as well as other services that may provide a cost-effective answer to your service needs.

Whether providing warranty repair service or any of the other services listed below, Tektronix service technicians, trained on Tektronix products, are best equipped to service your TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes. Tektronix technicians are appraised of the latest information on improvements to the product as well as the latest new options to the product.

### Warranty Repair Service

Tektronix warrants this product for three years from date of purchase, excluding probes for which the warranty is one year. (The warranty appears after the title page and copyright page in this manual.) Tektronix technicians provide warranty service at most Tektronix service locations worldwide. Your Tektronix product catalog lists all service locations worldwide.

## Repair or Calibration Service

The following services may be purchased to tailor repair and/or calibration of your TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes to fit your requirements.

**At-Depot Service.** Tektronix offers several standard-priced adjustment (calibration) and repair services:

- A single repair and/or adjustment.
- Calibrations using equipment and procedures that meet the traceability standards specific to the local area.
- Annual maintenance agreements that provide for either calibration and repair or calibration only of the oscilloscope.

Of these services, the annual maintenance agreement offers a particularly cost-effective approach to service for many owners of the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes. Such agreements can be purchased to span several years.

**On-Site Service.** The annual maintenance agreement can be purchased with on-site service, with repair and calibration done at your facility. This service reduces the time your oscilloscope is out of service when calibration or repair is required.

## Self Service

Tektronix supports repair to the module level by providing *Module Exchange* and *Module Repair and Return*.

**Module Exchange.** This service reduces down time for repair by allowing you to exchange most modules for remanufactured ones. Tektronix ships you an updated and tested exchange module from the Beaverton, Oregon service center, typically within 24 hours. Each module comes with a 90-day service warranty.

**Module Repair and Return.** This service returns to you within 10 days the same module that you shipped to Tektronix. The module shipped is repaired, tested, and returned to you from the Beaverton, Oregon service center. It is *not* updated to match current modules of the same type. Again, each module comes with a 90-day service warranty.

**For More Information.** Contact your local Tektronix service center or sales engineer for more information on any of the repair or adjustment services just described.

## Before You Begin

This manual is for servicing the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes. To prevent injury to yourself or damage to the oscilloscope, do the following tasks before you attempt service:

- Read the Safety Summary found at the beginning of this manual.
- Read *Service Strategy* in this section and *Supplying Operating Power* in section 2.

When using this manual for servicing, be sure to read and follow all warnings, cautions, and notes.

# Specifications

This section begins with a general description of the traits of the TDS 500D, TDS 600C, TDS 700D and TDS 714L oscilloscopes. Three sections follow, one for each of three classes of traits: *nominal traits, warranted characteristics,* and *typical characteristics*.

## Product Description

The TDS 500D, TDS 600C, TDS 700D and TDS 714L oscilloscopes are portable, four-channel instruments suitable for use in a variety of test and measurement applications and systems. Table 1–1 lists key features.

**Table 1–1: Key features of TDS 500D, 600C, 700D and 714L oscilloscopes**

| Feature | TDS 600C | TDS 500D, TDS 700D & TDS 714L |
|---|---|---|
| Digitizing rate, maximum | TDS 684C: 5 GS/s on ea. of 4 ch<br>TDS 680C: 5 GS/s on ea. of 2 ch<br>TDS 654C: 5 GS/s on ea. of 4 ch<br>TDS 694C: 10 GS/s on ea. of 4 ch | TDS 580D, TDS 784D, TDS 794D: 4 GS/s<br>TDS 540D, 754D: 2 GS/s<br>TDS 520D, 724D: 1 GS/s<br>TDS 714L: 500 MS/s |
| Analog bandwidth | TDS 694C: 3 GHz<br>TDS 794D: 2 GHz<br>TDS 580D, TDS 680C, 684C, and 784D: 1 GHz<br>TDS 520D, 540D, 654C, 714L, 724D and 754D: 500 MHz | |
| No. of Channels | TDS 654C, 684C & 694C: 4<br>TDS 680C: 2 + 2[1] | TDS 540D, 580D,<br>TDS 714L, 754D, 784D & 794D: 4<br>TDS 520D & 724D: 2 + 2[1] |
| Record lengths, maximum | 15,000 samples<br>TDS 694C: 30,000 samples<br>(120,000 with option 1M) | 50,000 (250,000 on TDS 714L) samples<br>(500,000 with option 1M, not available on TDS 714L)<br>(8,000,000 with option 2M) |
| Acquisition modes | Sample, envelope, peak detect and average | Sample, envelope, average, high-resolution, and peak-detect |

**Table 1–1: Key features of TDS 500D, 600C, 700D and 714L oscilloscopes (cont.)**

| Feature | TDS 600C | TDS 500D, TDS 700D & TDS 714L |
|---|---|---|
| Trigger modes | Modes include:<br>Edge, logic, and pulse.<br><br>Video trigger, with option 05, modes include:<br>NTSC, SECAM, PAL, HDTV, and FlexFormat.<br>(Not available on TDS 694C/794D)<br><br>Communications Trigger with option 2C (not available on TDS 600C and TDS 714L), modes include: AMI, CMI, and NRZ | |
| Display | TDS 520D, 540D, 580D, 680C: Monochrome<br>TDS 645C, 684C, 694C, 714L, 724D, 754D, 784D, 794D: Color | |
| Storage | Floppy disk drive:<br>1.44 Mbyte, 3.5 inch, DOS 3.3-or-later floppy disk drive<br><br>Internal hard disk drive (optional)<br><br>Iomega Zip drive compatible<br><br>NVRAM storage for saving waveforms, hardcopies, and setups | |
| I/O | Full GPIB programmability.<br>Hardcopy output using GPIB, RS-232, or Centronics ports | |

1 **Two plus Two channel operation allows up to two of the four channels to be displayed simultaneously. Channels not displayed can be used to couple a triggering signal to the oscilloscope.**

## User Interface

Use a combination of front-panel buttons, knobs, and on-screen menus to control the many functions of the oscilloscope. The front-panel controls are grouped according to function: vertical, horizontal, trigger, and special. Set a function you adjust often, such as vertical positioning or the time base setting, directly by its own front-panel knob. Set a function you change less often, such as vertical coupling or horizontal mode, indirectly using a selected menu.

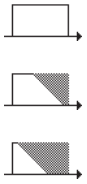
### Menus

Pressing one (sometimes two) front-panel button(s), such as vertical menu, displays a *main* menu of related functions, such as coupling and bandwidth, at the bottom of the screen. Pressing a main-menu button, such as coupling, displays a *side* menu of settings for that function, such as AC, DC, or GND (ground) coupling, at the right side of the screen. Pressing a side-menu button selects a setting such as DC.

**Indicators** On-screen readouts help you keep track of the settings for various functions, such as vertical and horizontal scale and trigger level. Some readouts use the cursors or the automatic parameter extraction feature (called measure) to display the results of measurements made or the status of the instrument.

**General Purpose Knob** Assign the general purpose knob to adjust a selected parameter function. More quickly change parameters by toggling the **SHIFT** button. Use the same method as for *selecting* a function, except the final side-menu selection assigns the general purpose knob to *adjust* some function, such as the position of measurement cursors on screen, or the setting for a channel fine gain.

**GUI** The user interface also makes use of a GUI, or Graphical User Interface, to make setting functions and interpreting the display more intuitive. Some menus and status are displayed using iconic representations of function settings, such as those shown here for full, 250 MHz and 20 MHz bandwidth. Such icons allow you to more readily determine status or the available settings.



## Signal Acquisition System

The signal acquisition system provides up to four, full-featured vertical channels with calibrated vertical scale factors from 1 mV to 10 V per division, depending on TDS model. All channels can be acquired simultaneously.

Each of the full-featured channels can be displayed, vertically positioned, and offset, and their vertical coupling specified. Some models can have their bandwidth limited (250 MHz or 20 MHz). Fine gain can also be adjusted.

Besides these channels, up to three math waveforms and four reference waveforms are available for display. (A math waveform results when you specify dual waveform operations, such as add, on any two channels. A reference waveform results when you save a waveform in a reference memory).

## Horizontal System

There are three horizontal display modes: main only, main intensified, and delayed only. You can select among various horizontal record length settings.

A feature called “Fit to Screen” allows you to view entire waveform records within the 10 division screen area. Waveforms are compressed to fit on the screen. See Table 1–2.

Both the delayed only display and the intensified zone on the main intensified display may be delayed by time with respect to the main trigger. Both can be set to display immediately after the delay (delayed runs after main mode). The delayed display can also be set to display at the first valid trigger after the delay (delayed-triggerable modes).

The delayed display (or the intensified zone) may also be delayed by a selected number of events. In this case, the events source is the delayed-trigger source. The delayed trigger can also be set to occur after a number of events plus an amount of time.

**Table 1–2: Record length and divisions per record versus TDS model**

| Standard Models | Record length | Divisions per record | |
|---|---|---|---|
| | | FTS[1] Off[2] | FTS[1] On3 |
| All TDS 500D, TDS600C, TDS 694C, TDS 700D, & TDS 714L, all channels[4] | 500 | 10 div | 10 div |
| | 1,000 | 20 div | 10 div |
| | 2,500 | 50 div | 10 div |
| | 5,000 | 100 div | 10 div |
| | 15,000 | 300 div | 10 div |
| TDS 694C, all channels | 30,000 | 600 div | 15 div |
| TDS 500D, TDS 700D, & TDS 714L, all channels | 50,000 | 1,000 div | 15 div |
| **Models with Option 1M[5]** | **Record length** | **Divisions per record** | |
| | | **FTS[1] Off[2]** | **FTS[1] On[3]** |
| TDS 694C, all channels | 50,000 | 1,000 div | 10 div |
| TDS 500D, TDS 694C, TDS 700D, & TDS 714L, all channels | 75,000 | 1,500 div | 15 div |
| TDS 500D, TDS 694C, TDS 700D, & TDS 714L, all channels | 100,000 | 2,000 div | 12 div |
| TDS 694C, all channels | 120,000 | 2,400 div | 13 div |
| TDS 500D, TDS 700D, TDS 714L, all channels | 130,000 | 2,600 div | 10 div |
| TDS 520D, one channel only<br><br>TDS 540D, TDS 580D, all TDS 700D, & TDS 714L, one or two channels | 250,000 | 5,000 div | 10 div |
| TDS 540D, TDS 580D, & all TDS 700D, one channel only | 500,000 | 10,000 div | 10 div |

**Table 1–2: Record length and divisions per record versus TDS model (cont.)**

| Models with Option 2M | Record length | Divisions per record | |
|---|---|---|---|
| | | FTS[1] Off[2] | FTS[1] On[3] |
| TDS 520D & TDS 724D, one or two channels<br><br>TDS 540D, TDS 580D, TDS 714L, TDS 754D, TDS 784D & TDS 794D, three or four channels | 2,000,000 | 40,000 div | 10 div |
| TDS 520D & TDS 724D, one channel only<br><br>TDS 540D, TDS 580D, TDS 714L, TDS 754D, TDS 784D & TDS 794D, two channels | 4,000,000 | 80,000 div | 10 div |
| TDS 540D, TDS 714L, TDS 754D, TDS 784D & TDS 794D, one channel only | 8,000,000 | 160,000 div | 10 div |

1 **Fit to Screen setting**

2 **Fit to Screen off preserves 50 samples/division in a 1–2–5 sec/division sequence.**

3 **Fit to Screen on lets the samples/division and the sec/division sequence vary.**

4 **All channels means all that may be displayed at one time: four channels for some models, two for others. See Table 1–1 and its footnote.**

5 **1M is the standard record length on the TDS 714L.**

## Trigger System

The triggering system supports a varied set of features for triggering the signal-acquisition system. Trigger signals recognized include:

- Edge (main- and delayed-trigger systems): This familiar type of triggering is fully configurable for source, slope, coupling, mode (auto or normal), and holdoff.
- Logic (main-trigger system): This type of triggering can be based on pattern (asynchronous) or state (synchronous). In either case, logic triggering is configurable for sources, for Boolean operators to apply to those sources, for logic pattern or state on which to trigger, for mode (auto or normal), and for holdoff. Time qualification may be selected in pattern mode. Another class of logic trigger, setup/hold, triggers when data in one trigger source changes state within the setup and hold times that you specify relative to a clock in another trigger source.

- Pulse (main-trigger system): Pulse triggering is configurable for triggering on runt or glitch pulses, or on pulse widths or periods inside or outside limits that you specify. It can also trigger on a pulse edge that has a slew rate faster or slower than the rate you specify. The timeout trigger will act when events do *not* occur in a defined time period. The pulse trigger is also configurable for source, polarity, mode, and holdoff.
- Video (with option 05: Video Trigger): Video triggering is compatible with standard NTSC, PAL, SECAM, and HDTV formats. An additional feature called FlexFormat™ (flexible format) allows the user to define the video format on which to trigger.
- Comm (with option 2C): is provided for triggering on AMI, CMI, or NRZ communications signals.

You can choose where the trigger point is located within the acquired waveform record by selecting the amount of pretrigger data displayed. Presets of 10%, 50%, and 90% of pretrigger data can be selected in the horizontal menu, or the general purpose knob can be assigned to set pretrigger data to any value within the 0% to 100% limits.

## Acquisition Control

You can specify a mode and manner to acquire and process signals that matches your measurement requirements.

- Select the mode for interpolation (linear or sin (x)/x). This can increase the apparent sample rate on the waveform when the maximum real-time rate is exceeded.
- Use sample, envelope, average and peak detect modes to acquire signals. With the Oscilloscopes, also use high-resolution mode.
- Set the acquisition to stop after a single acquisition (or sequence of acquisitions if acquiring in average or envelope modes) or after a limit condition has been met.
- Select channel sources for compliance with limit tests. You can direct the TDS to signal you or generate hard copy output either to a printer or to a floppy-disk file based on the results. Also, you can create templates for use in limit tests.

## On-Board User Assistance

Help and autoset can assist you in setting up the oscilloscope to make your measurements.

**Help** Help displays operational information about any front-panel control. When help mode is in effect, manipulating any front-panel control causes the oscilloscope to display information about that control. When help is first invoked, an introduction to help is displayed on screen.

**Autoset** Autoset automatically sets up the oscilloscope for a viewable display based on the input signal.

## Measurement Assistance

Once you have set up to make your measurements, the cursor and measure features can help you quickly make those measurements.

**Cursor** Three types of cursors are provided for making parametric measurements on the displayed waveforms. Horizontal bar cursors (H Bar) measure vertical parameters (typically volts). Vertical bar cursors (V Bar) measure horizontal parameters (typically time or frequency). Paired cursors measure both amplitude and time simultaneously. These are delta measurements; that is, measurements based on the difference between two cursors.

Both H Bar and V Bar cursors can also be used to make absolute measurements. For the H Bars, either cursor can be selected to read out its voltage with respect to any channel's ground reference level. For the V Bars, the cursors measure time with respect to the trigger point (event) of the acquisition. The cursors can also control the portion of the waveform on which automatic measurements are made.

For time measurements, units can be either seconds or hertz (for 1/time).

With the video trigger option installed (Option 05), you can measure the video line number using the vertical cursors. You can measure IRE amplitude (NTSC) using the horizontal cursors with or without the video trigger option installed.

**Measure** Measure can automatically extract parameters from the signal input to the oscilloscope. Any four out of the 25 parameters available can be displayed to the screen. The waveform parameters are measured continuously with the results updated on-screen as the oscilloscope continues to acquire waveforms.

### Digital Signal Processing (DSP)

An important component of the multiprocessor architecture of this oscilloscope is Tektronix' proprietary digital signal processor, the DSP. This dedicated processor supports advanced analysis of your waveforms when doing such compute-intensive tasks as interpolation, waveform math, and signal averaging. It also teams with a custom display system to deliver specialized display modes (See *Display,* later in this description).

## Storage

Acquired waveforms may be saved in any of four nonvolatile REF (reference) memories or on a 3.5 inch, DOS 3.3-or-later compatible disk. Any or all of the saved waveforms may be displayed for comparison with the waveforms being currently acquired.

The Oscilloscopes instrument with option 2M can save waveforms to an internal hard disk drive. Any or all of the saved waveforms may be displayed for comparison with the waveforms being currently acquired.

The source and destination of waveforms to be saved may be chosen. You can save any of the four channels to any REF memory or move a stored reference from one REF memory to another. Reference waveforms may also be written into a REF memory location via the GPIB interface.

## I/O

The oscilloscope is fully controllable and capable of sending and receiving waveforms over the GPIB interface (IEEE Std 488.1–1987/IEEE Std 488.2–1987 standard). This feature makes the instrument ideal for making automated measurements in a production or research and development environment that calls for repetitive data taking. Self-compensation and self-diagnostic features built into the oscilloscope to aid in fault detection and servicing are also accessible using commands sent from a GPIB controller.

The oscilloscope can also output copies of its display using the hardcopy feature. This feature allows you to output waveforms and other on-screen information to a variety of graphic printers and plotters from the TDS front panel, providing hard copies without requiring you to put the TDS into a system-controller environment.

You can make hardcopies in a variety of popular output formats, such as PCX, TIFF, BMP, RLE, EPS, Interleaf, and EPS mono or color. You can also save hardcopies in a disk file in any of the formats listed in the I/O section.

The hardcopies obtained are based on what is displayed on-screen at the time hardcopy is invoked. The hardcopies can be stamped with date and time and spooled to a queue for printing at a later time. You can output screen information via GPIB, RS-232-C, or Centronics interfaces.

## Display

The TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes offer flexible display options. You can customize the following attributes of your display:

- Color (TDS 654C, TDS 684C, TDS694C, TDS 700D, and TDS 714L): Waveforms, readouts, graticule, and variable persistence with color coding
- Intensity: waveforms, readouts, and graticule
- Style of waveform display(s): vectors or dots, intensified or nonintensified samples, infinite persistence, and variable persistence
- Interpolation method: Sin(x)/x or Linear
- Display format: xy or yt with various graticule selections including NTSC and PAL to be used with video trigger (option 05)

This oscilloscope also provides an easy way to focus in on those waveform features you want to examine up close. By invoking zoom, you can magnify the waveform using the vertical and horizontal controls to expand (or contract) and position it for viewing.

# Nominal Traits

Tables 1–3 through 1–9 list the various *nominal traits* that describe the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes. Electrical and mechanical traits are included.

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

**Table 1–3: Nominal traits — Signal acquisition system**

| Name | Description | |
|---|---|---|
| Bandwidth Selections | 20 MHz, 250 MHz, and FULL (No BW limit on TDS 694C or TDS 794D) | |
| Samplers, Number of | TDS 540D, 580D, 654C, 684C, 694C, 714L, 754D, 784D, and 794D: Four, simultaneous<br>TDS 520D, 680C, and 724D: Two, simultaneous | |
| Digitized Bits, Number of | 8 bits[1] | |
| Input Channels, Number of | Four | |
| Input Coupling | DC, AC, or GND (TDS 694C/794D – DC or GND only) | |
| Input Impedance Selections | 1 MΩ or 50 Ω (TDS 694C/794D – 50 Ω only) | |
| Ranges, Offset<br>(All except TDS 694C/794D) | **Volts/Div setting** | **Offset range** |
| | 1 mV/div – 100 mV/div | ±1 V |
| | 101 mV/div – 1 V/div | ±10 V |
| | 1.01 V/div – 10 V/div | ±100 V |
| Ranges, Offset (TDS 694C/794D only) | 10 mV/div – 50 mV/div | ±0.50 V |
| | 50.5 mV/div – 100 mV/div | ±0.25 V |
| | 101 mV/div – 500 mV/div | ±5 V |
| | 505 mV/div – 1 V/div | ±2.5 V |
| Range, Position | ±5 divisions | |
| Range, 1 MΩ Sensitivity[3] | 1 mV/div to 10 V/div[2] | |
| Range, 50 Ω Sensitivity | 1 mV/div to 1 V/div[2] (10 mV/div – 1V/div on TDS 694C/794D) | |

1 **Displayed vertically with 25 digitization levels (DLs) per division and 10.24 divisions dynamic range with zoom off. A DL is the smallest voltage level change of the oscilloscope input that can be resolved by the 8-bit A-D Converter. Expressed as a voltage, a DL is equal to 1/25 of a division times the volts/division setting.**

2 **The sensitivity ranges from 1 mV/div to 10 V/div (for 1 MΩ) or to 1 V/div (for 50 Ω) in a 1–2–5 sequence of coarse settings with Fit-to-Screen off. Between coarse settings, the sensitivity can be finely adjusted with a resolution equal to 1% of the more sensitive coarse setting. For example, between 50 mV/div and 100 mV/div, the volts/division can be set with 0.5 mV resolution.**

3 **1 MΩ not available on TDS 694C &TDS 794D oscilloscopes.**

**Table 1–4: Nominal traits — Time base system**

| Name | Description |
|---|---|
| Range, Sample-Rate[1,3] | TDS 684C: 5 Samples/sec to 5 GSamples/sec on four channels simultaneously |
| | TDS 680C: 5 Samples/sec to 5 GSamples/sec on two channels simultaneously |
| | TDS 654C: 5 Samples/sec to 5 GSamples/sec on four channels simultaneously |
| | TDS 694C: 5 Samples/sec to 10 GSamples/sec on four channels simultaneously |
| | TDS 520D, and 724D: 5 Samples/sec to 2 GSamples/sec when acquiring 1 channel, to 1 GSample/sec when acquiring 2 channels |
| | TDS 540D: 5 Samples/sec to 2 GSamples/sec when acquiring 1 or 2 channels, to 1 GSample/sec when acquiring 3 or 4 channels |
| | TDS 540D Opt. 1G: 5 Samples/sec to 1 GSample/sec when acquiring 1 to 4 channels |
| | TDS 714L: 5 Samples/sec to 500 MSamples/sec when acquiring 1 to 4 channels |
| | TDS 754D: 5 Samples/sec to 2 GSamples/sec when acquiring 1 or 2 channels, to 1 GSample/sec when acquiring 3 or 4 channels |
| | TDS 754D Opt 1G: 5 Samples/sec to 1 GSample/sec when acquiring 1 to 4 channels |
| | TDS 580D, 784D, and 794D: 5 Samples/sec to 4 GSamples/sec when acquiring 1 channel, to 2 GSamples/sec when acquiring 2 channels, or to 1 GSample/sec when acquiring 3 or 4 channels |
| Range, Interpolated Waveform Rate[2,3] | TDS 600C: 10 GSamples/sec to 250 GSamples/sec |
| | TDS 694C: 10 GSamples/sec to 500 GSamples/sec |
| | TDS 520D, 540D, 714L, 724D, and 754D: 1 GSample/sec to 100 GSamples/sec |
| | TDS 580D, 784D, and 794D: 2 GSamples/sec to 250 GSamples/sec |
| Range, Seconds/Division | TDS 600C: 0.2 ns/div to 10 s/div |
| | TDS 694C: 0.1 ns/div to 10 s/div |
| | TDS 500D, 714L, 724D, and 754D: 0.5 ns/div to 10 s/div |
| | TDS 580D, 784D, and 794D: 0.2 ns/div to 10 s/div |

**Table 1–4: Nominal traits — Time base system (cont.)**

| Name | Description |
|---|---|
| Record Length Selection | TDS 500D, TDS 700D & TDS 714L:<br>500, 1,000, 2,500, 5,000, 15,000 and 50,000 samples<br><br>TDS 714L:<br>1 or 2-channels: up to 250,000 samples<br>3 or 4-channels: up to 130,000 samples<br><br>TDS 694C:<br>500, 1,000, 2,500, 5,000, 15,000 30,000<br>with option 1M: 50,000, 75,000, 100,000 and 120,000 samples all channels<br><br>In addition to the record lengths previously listed, the following record lengths are available with the following options:<br><br>TDS 520D & TDS 724D with option 1M:<br>1-channel: up to 250,000 samples<br>2-channels: up to 130,000 samples<br><br>TDS 520D & TDS 724D with option 2M:<br>1-channel: up to 4,000,000 samples<br>2-channels: up to 2,000,000 samples<br><br>TDS 540D, TDS 580D, TDS 754D, TDS 784D & TDS 794D with option 1M:<br>1-channel: up to 500,000 samples<br>2-channels: up to 250,000 samples<br>3 or 4-channels up to 130,000 samples<br><br>TDS 540D, TDS 580D, TDS 714L, TDS 754D, TDS 784D & TDS 794D with option 2M:<br>1-channel: up to 8,000,000 samples<br>2-channels: up to 4,000,000 samples<br>3 or 4-channels up to 2,000,000 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.**

2 **The range of waveform rates for interpolated (or equivalent-time on the TDS 700D) waveform records.**

3 **The Waveform Rate (WR) is the equivalent sample rate of a waveform record. For a waveform record acquired by real-time sampling of a single acquisition, the waveform rate is the same as the real-time sample rate; for a waveform created by interpolation of real-time samples from a single acquisition or, on applicable products, the equivalent-time sampling of multiple acquisitions, the waveform rate created is faster than the real time sample rate. For all these cases, the waveform rate is 1/(Waveform Interval) for the waveform record, where the waveform interval (WI) is the time between the samples in the waveform record.**

**Table 1–5: Nominal traits — Triggering system**

| Name | Description |
|---|---|
| Range, Delayed Trigger Time Delay | 16 ns to 250 s |
| Range, Events Delay | TDS 600C; 2 to 10,000,000<br><br>TDS 500D/700D/714L: 1 to 10,000,000 |

**Table 1–5: Nominal traits — Triggering system (cont.)**

| Name | Description | |
|---|---|---|
| Range (Time) for Pulse-Glitch, Pulse-Width, Time-Qualified Runt, Timeout, or Slew Rate Trigger, Delta Time | 1 ns to 1 s | |
| Ranges, Setup and Hold for TimeSetup/Hold Violation Trigger | **Feature** | **Min to max** |
| | Setup Time | –100 ns to 100 ns |
| | Hold Time | –1 ns to 100 ns<br>–1 ns to 102 ns, TDS694C |
| | Setup + Hold Time | 2 ns |
| | For Setup Time, positive numbers mean a data transition before the clock edge and negative means a transition after the clock edge.<br>For Hold Time, positive numbers mean a data transition after the clock edge and negative means a transition before the clock edge.<br>Setup + Hold Time is the algebraic sum of the Setup Time and the Hold Time programmed by the user. | |
| Ranges, Trigger Level or Threshold | **Source** | **Range** |
| | Any Channel | ±12 divisions from center of screen |
| | Auxiliary | ±8 V |
| | Line | ±400 V |
| Video Trigger Modes of Operation (Option 05 Video Trigger, Not available on TDS 694C and TDS 794D) | Supports the following video standards:<br>■ NTSC (525/60) – 2 field mono or 4 field<br>■ PAL (625/50) – 2 field mono or SECAM, 8 field<br>■ HDTV –<br>(787.5/60)<br>(1050/60)<br>(1125/60)<br>(1250/60)<br>■ FlexFormat™ (user definable standards)<br>User can specify: field rate, number of lines, sync pulse width and polarity, line rate, and vertical interval timing. | |

**Table 1–5: Nominal traits — Triggering system (cont.)**

| Name | Description | | |
|---|---|---|---|
| Communication Trigger Modes of Operation<br>(Option 2C Comm Trigger, Not available on TDS 600C and TDS 714L) | Standard Name | Code[1] | Bit Rate |
| | OC1/STM0 | NRZ | 51.84 Mb/s |
| | OC3/STM1 | NRZ | 155.52 Mb/s |
| | OC12/STM4 | NRZ | 622.08 Mb/s |
| | DS0 Sgl | Masks[2] | 64 kb/s |
| | DS0 Dbl | Masks[2] | 64 kb/s |
| | DS0 Data Contra | Masks[2] | 64 kb/s |
| | DS0 Timing | Masks[2] | 64 kb/s |
| | E1 | AMI | 2.048 Mb/s |
| | E2 | AMI | 8.44 Mb/s |
| | E3 | AMI | 34.368 Mb/s |
| | E4 | CMI | 139.26 Mb/s |
| | E5 (CEPT) | NRZ | 565 Mb/s |
| | STM1E | CMI | 155.52 Mb/s |
| | DS1 | AMI | 1.544 Mb/s |
| | DS1A | AMI | 2.048 Mb/s |
| | DS1C | AMI | 3.152 Mb/s |
| | DS2 | AMI | 6.312 Mb/s |
| | DS3/DS3 Rate | AMI | 44.736 Mb/s |
| | DS4NA | CMI | 139.26 Mb/s |
| | STS-1 | AMI | 51.84 Mb/s |
| | STS-3 | CMI | 155.52 Mb/s |
| | FC133 | NRZ | 132.8 Mb/s |
| | FC266 | NRZ | 265.6 Mb/s |
| | FC531 | NRZ | 531.2 Mb/s |
| | FC1063 | NRZ | 1.0625 Mb/s |
| | D2 | NRZ | 143.18 Mb/s |
| | D1 | NRZ | 270 Mb/s |
| | FDDI | NRZ | 125 Mb/s |
| | 4:2:2 SMPTE 259M-D | NRZ | 360 Mb/s |
| | 10 Base-T | NRZ | 10 Mb/s |
| | 100 Base-T | NRZ | 125 Mb/s |
| | Gigabit Ethernet | NRZ | 1.25 Gb/s |

1 **AMI = Alternate Mark Inversion. CMI = Code Mark Inversion. NRZ = Non-return to Zero.**

2 **These Telecom DS0 standards are automatically selected from the Mask Menu. The trigger uses Pulse/Width trigger.**

**Table 1–6: Nominal traits — Display system**

| Name | Description |
|---|---|
| Video Display | 7 inch diagonal, with a display area of 5.04 inches horizontally by 3.78 inches vertically<br>TDS 520D, 540D, 580D, and 680C: Monochrome display<br>TDS 654C, 684C, 694C, 714L, 724D, 754D, 784D, and 794D: Color display |
| Video Display Resolution | 640 pixels horizontally by 480 pixels vertically |

**Table 1–6: Nominal traits — Display system (cont.)**

| Name | Description |
|---|---|
| Waveform Display Graticule | Single Graticule: 401 × 501 pixels, 8 × 10 divisions, where divisions are 1 cm by 1 cm |
| Waveform Display Levels/Colors | TDS 520D, 540D, 580D, and 680C:<br>Sixteen levels in infinite-persistence or variable persistence display<br><br>TDS 654C, 684C, 694C, 714L, 724D, 754D, 784D, and 794D:<br>Sixteen colors in infinite-persistence or variable persistence display |

**Table 1–7: Nominal traits — GPIB interface, output ports, and power fuse**

| Name | Description |
|---|---|
| Interface, GPIB | GPIB interface complies with IEEE Std 488-1987 |
| Interface, RS-232 | RS-232 interface complies with EIA/TIA 574 (talk only)<br>Optional on the TDS 520D, 540D, 580D, and 680C |
| Interface, Centronics | Centronics interface complies with Centronics interface standard<br>C332-44 Feb 1977, REV A<br>Optional on the TDS 520D, 540D, 580D, and 680C |
| Interface, Video | VGA video output with levels that comply with EIA RS 343A standard. DB-15 connector |
| Logic Polarity for Main- and Delayed-Trigger Outputs | Negative TRUE. High to low transition indicates the trigger occurred. |
| Fuse Rating | Either of two fuses[1] may be used: a 0.25″ × 1.25″ (UL 198.6, 3AG): 6 A FAST, 250 V<br>or a 5 mm × 20 mm (IEC 127): 5 A (T), 250 V. |
| Fuse Rating TDS694C | Either of two fuses[1] may be used: a 0.25″ × 1.25″ (UL 198.6, 3AG): 8 A FAST, 250 V<br>or a 5 mm × 20 mm (IEC 127): 6.3 A (T), 250 V. |

1 **Each fuse type requires its own fuse cap.**

**Table 1–8: Nominal traits — Data handling and reliability**

| Name | Description |
|---|---|
| Time, Data-Retention, Nonvolatile Memory[1, 2] | Battery life ≥ 5 years |
| Floppy disk drive | 3.5 inch, 720 K or 1.44 Mbyte, DOS 3.3-or-later compatible |
| Internal hard disk drive<br>(Option HD included in Option 2M) | 2.1 Gbyte capacity |
| External data storage | Iomega Zip drive compatible |

1 **The times that reference waveforms, stored setups, and calibration constants are retained.**

2 **Data is maintained by small lithium-thionyl-chloride batteries internal to the memory ICs. At the time of manufacture, no special disposal requirements were in effect for these batteries as the amount of hazardous material contained was below the regulated threshold. Consult your local waste disposal agency for proper disposal.**

**Table 1–9: Nominal traits — Mechanical**

| Name | Description |
|---|---|
| Cooling Method | Forced-air circulation with no air filter. Clearance is required. Refer to your user manual for minimum clearance dimensions. |
| 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 Tektronix Blue vinyl material. |
| Weight | Standard Oscilloscope<br>14.1 kg (31 lbs), with front cover.<br>24.0 kg (53 lbs), when packaged for domestic shipment<br>Rackmount Oscilloscopes<br>14.1 kg (31 lbs) plus weight of rackmount parts, for the rackmounted Oscilloscopes (Option 1R).<br>Rackmount conversion kit<br>2.3 kg (5 lbs), parts only; 3.6 kg (8 lbs), parts plus package for domestic shipping |
| Overall Dimensions | Standard Oscilloscope<br>Height: 193 mm (7.6 in), with the feet installed<br>Width: 445 mm (17.5 in), with the handle<br>Depth: 434 mm (17.1 in), with the front cover installed<br>Rackmount Oscilloscope<br>Height: 178 mm (7.0 in)<br>Width: 483 mm (19.0 in)<br>Depth: 558.8 mm (22.0 in) |

# Warranted Characteristics

Tables 1–10 through 1–14 lists the various *warranted characteristics* that describe the TDS 500D, TDS 600C, TDS 700D and TDS 714L oscilloscopes. Electrical and environmental characteristics are included. Table 1–15 lists certifications and compliances.

Warranted characteristics are described in terms of quantifiable performance limits which are warranted.

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***NOTE**. In these tables, those warranted characteristics that are checked in the procedure* Performance Verification *appear in **boldface type** under the column* **Name**.

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As stated above, this section lists only warranted characteristics. A list of *typical characteristics* starts on page 1–29.

The performance limits in this specification are valid with these conditions:

- The oscilloscope must have been calibrated/adjusted at an ambient temperature between +20° C and +30° C.
- The oscilloscope must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications.
- The oscilloscope must have had a warm-up period of at least 20 minutes.
- The oscilloscope must have had its signal-path-compensation routine last executed after at least a 20 minute warm-up period at an ambient temperature within ±5° C of the current ambient temperature.

**Table 1–10: Warranted characteristics — Signal acquisition system**

| Name | Description | | |
|---|---|---|---|
| Accuracy, DC Gain | TDS 600C: ±1.5% for all sensitivities from 2 mV/div to 10 V/div<br>± 2.0% at 1 mV/div sensitivity<br>TDS 500D, 700D, 714L: ±1% for all sensitivities from 1 mV/div to 10 V/div with offset from 0 V to ±100V<br>TDS 694C/794D: ±1% for all sensitivities from 10 mV/div to 1 V/div over permitted offset range | | |
| **Accuracy, DC Voltage Measurement, Averaged (using Average mode)** | **Measurement type** | **DC Accuracy** | |
| | Average of ≥ 16 waveforms | TDS 600C: ±((1.5% × \| reading – Net Offset[1] \| ) + Offset Accuracy) + (0.06 div × V/div))<br>TDS 500D, TDS 694C, 700D, 714L: ±((1.0% × \| reading – Net Offset[1] \| ) + 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 | TDS 600C: ±((1.5% × \| reading \| ) + (0.1 div × V/div) + 0.3 mV)<br>TDS 500D, TDS694C, 700D, 714L: ±((1.0% × \| reading \| ) + (0.1 div x V/div) + 0.3 mV) | |
| **Accuracy, Offset All except TDS 694C/794D** | **Volts/Div setting** | **TDS 600C Offset accuracy** | **TDS 500D/700D/714L Offset accuracy** |
| | 1 mV/div – 100 mV/div | ±((0.2% × \| Net Offset[1] \| ) + 1.5 mV + (0.6 div x V/div)) | ±((0.2% × \| Net Offset[1] \| ) + 1.5 mV + (0.1 div x V/div)) |
| | 101 mV/div – 1 V/div | ±((0.25% × \| Net Offset[1] \| ) + 15 mV + (0.6 div x V/div)) | ±((0.25% × \| Net Offset[1] \| ) + 15 mV + (0.1 div x V/div)) |
| | 1.01 V/div – 10 V/div | ±((0.25% × \| Net Offset[1] \| ) + 150 mV + ( 0.6 div x V/div)) | ±((0.25% × \| Net Offset[1] \| ) + 150 mV + (0.1 div x V/div)) |
| **Accuracy, Offset TDS 694C and TDS 794D** | **Volts/Div setting** | **TDS 694C Offset accuracy** | **TDS 794D Offset accuracy** |
| | 10 mV/div – 100 mV/div | ±((0.2% × \| Net Offset[1] \| ) + 1.5 mV + (0.1 div x V/div)) | ±((0.2% × \| Net Offset[1] \| ) + 1.5 mV + (0.1 div x V/div)) |
| | 101 mV/div – 1 V/div | ±((2.50% × \| Net Offset[1] \| ) + 15 mV + (0.1 div x V/div)) | ±((0.25% × \| Net Offset[1] \| ) + 15 mV + (0.1 div x V/div)) |

**Table 1–10: Warranted characteristics — Signal acquisition system (cont.)**

| Name | Description | | |
|---|---|---|---|
| **Analog Bandwidth, DC-50 Ω Coupled and Bandwidth selection is FULL, TDS 600C** | **Volts/Div** | **TDS 654C Bandwidth[2]** | **TDS 680C & 684C Bandwidth[2]** |
| | 10 mV/div – 1 V/div | DC – 500 MHz | DC – 1 GHz |
| | 5 mV/div – 9.95 mV/div | DC – 450 MHz | DC – 750 MHz |
| | 2 mV/div – 4.98 mV/div | DC – 300 MHz | DC – 600 MHz |
| | 1 mV/div – 1.99 mV/div | DC – 250 MHz | DC – 500 MHz |
| | **Volts/Div** | **TDS 694C Bandwidth[2]** | |
| | 10 mV/div – 1 V/div | DC – 3 GHz | |
| **Analog Bandwidth, DC-50 Ω Coupled and Bandwidth selection is FULL, TDS 500D/700D/714L** | **Volts/Div** | **TDS 520D, 540D, 714L, 724D & 754D Bandwidth[2]** | **TDS 580D & TDS 784D Bandwidth[2]** |
| | 10 mV/div – 1 V/div | DC – 500 MHz | DC – 1 GHz |
| | 5 mV/div – 9.95 mV/div | DC – 500 MHz | DC – 750 MHz |
| | 2 mV/div – 4.98 mV/div | DC – 500 MHz | DC – 600 MHz |
| | 1 mV/div – 1.99 mV/div | DC – 450 MHz | DC – 500 MHz |
| | **Volts/Div** | **TDS 794D Bandwidth[2]** | |
| | 10 mV/div – 1 V/div | DC – 2 GHz | |
| Crosstalk (Channel Isolation) | ≥100:1 at 100 MHz and ≥30:1 at the rated bandwidth for the channel's Volt/Div setting, for any two channels having equal Volts/Div settings.<br>TDS 694C: ≥100:1 at rated bandwidth for any two channels having equal Volts/Div settings. | | |
| **Delay Between Channels, Full Bandwidth** | TDS 600C: ≤100 ps for any two channels with equal Volts/Div and Coupling settings and both channels' deskew values set to 0<br>TDS 500D, TDS 694C, TDS 700D, TDS 714L: ≤50 ps for any two channels with equal Volts/Div and Coupling settings and both channel deskew values set to 0.0 μs. | | |
| Input Impedance, DC–1 MΩ Coupled | 1 MΩ ±0.5% in parallel with 10 pF ±3 pF (DC–50 Ω Coupled only on TDS 694C/794D) | | |
| Input Impedance, DC–50 Ω Coupled | 50 Ω ±1% with VSWR ≤1.3:1 from DC – 500 MHz, ≤1.5:1 from 500 MHz – 1 GHz | | |
| Input Impedance, DC–50 Ω Coupled TDS 694C | 50 Ω ±1.25% with VSWR ≤1.5:1 from 100 MHz – 1 GHz, VSWR ≤1.7:1 from 1 GHz – 2 GHz, VSWR ≤ 2.0:1 from 2 GHz – 3 GHz | | |
| Input Impedance, DC–50 Ω Coupled TDS 794D | 50 Ω ±1.25% with VSWR ≤1.5:1 from 100 MHz – 1 GHz, VSWR ≤1.7:1 from 1 GHz – 2 GHz | | |
| Input Voltage, Maximum, DC–1 MΩ, AC–1 MΩ, or GND Coupled | TDS 600C (except TDS694C): ±300 V CAT II, 400 V peak; derate at 20 dB/decade above 1 MHz<br>TDS 500D/700D/714L (except TDS 794D): ±300 V CAT II, 400 V peak; derate at 20 dB/decade above 1 MHz | | |

**Table 1–10: Warranted characteristics — Signal acquisition system (cont.)**

| Name | Description |
|---|---|
| Input Voltage, Maximum, DC-50 Ω or AC–50 Ω Coupled | 5 $V_{RMS}$, with peaks ≤ ±30 V |
| **1 Net Offset = Offset – (Position × Volts/Div). Net Offset is the nominal voltage level at the oscilloscope input that corresponds to the center of the A-D converter's dynamic range. Offset Accuracy is the accuracy of this voltage level.** | |
| **2 The limits given are for the ambient temperature range of 0°C to +30°C, range of 4°C to +30°C for a TDS694C. Reduce the upper bandwidth frequencies by 5 MHz for the TDS 600C, by 20 MHz for TDS 694C, by 2.5 MHz for the 500 MHz TDS 500D/700D/714L models, by 5 MHz for the 1 GHz TDS 500D/700D models, and by 10 MHz for the 2 GHz TDS 500D/700D models for each °C above +30°C.** | |
| Input Voltage, Maximum, DC-50 Ω Coupled TDS 694C/794D ? | 5 $V_{RMS}$, with peaks ≤ ±20 V |
| Lower Frequency Limit, AC Coupled | ≤10 Hz when AC–1 MΩ Coupled; ≤200 kHz when AC–50 Ω Coupled[3] |
| **3 The AC Coupled Lower Frequency Limits are reduced by a factor of 10 when 10X passive probes are used.** | |

**Table 1–11: Warranted characteristics — Time base system**

| Name | Description |
|---|---|
| **Accuracy, Long Term Sample Rate and Delay Time** | TDS 600C: ±100 ppm over any ≥1 ms interval<br>TDS 694C: ±10 ppm over any ≥1 ms interval<br>TDS 500D/700D/714L: ±25 ppm over any ≥1 ms interval |
| **Accuracy, Delta Time Measurement (Except for Option 1G and TDS 714L)** | The limits are given in the following table for signals having amplitude greater than 5 divisions, reference level = 50%, filter set to (sinX/X), acquired at 5 mV/div or greater. For the TDS 700D, pulse duration < 10 div. Channel skew not included.<br>For the Single Shot condition, $1.4 \leq T_r \div S \leq 4$, where S is the sample rate and $T_r$ is the displayed rise time.<br>Extra error in the measurement will occur for two-channel measurements due to channel-to-channel skew. This is described elsewhere in these specifications. |
| | **Time measurement accuracy** |
| Conditions for accuracy listed at right are: Single Shot or Sample mode (or HiRes mode on the TDS 500D/700D), with Full Bandwidth selected. | TDS 600C: ±((0.20 ÷ sample rate) + (100 ppm × \| Reading \|))<br>TDS 500D/700D: ±((0.15 ÷ sample rate) + (25 ppm × \| Reading \|))<br>TDS 694C: ±((0.15 ÷ sample rate) + (10 ppm × \| Reading \|))<br>Example: at 5 GS/s, 5 ns/div, measuring a 40 ns wide pulse, accuracy = ±(40 ps + 4 ps) = ±44 ps. |

**Table 1–12: Warranted characteristics — Triggering system**

| Name | Description | | |
|---|---|---|---|
| **Sensitivity, Edge-Type Trigger, Coupling set to "DC"[1]** | **Trigger source** | **Sensitivity** | |
| | Any Channel | TDS 694C: 0.35 division from DC to 50 MHz, increasing to 1 division at 3 GHz main, 1.5 GHz delayed<br>TDS 680C & 684C: 0.35 division from DC to 50 MHz, increasing to 1 division at 1 GHz<br>TDS 500D, 714L, 724D, & 754D: 0.35 division from DC to 50 MHz, increasing to 1 division at 500 MHz<br>TDS 580D & 784D: 0.35 division from DC to 50 MHz, increasing to 1 division at 1 GHz<br>TDS 794D: 0.35 division from DC to 50 MHz, increasing to 1 division at 1.5 GHz | |
| | Auxiliary | TDS 600C: 250 mV from DC to 50 MHz, increasing to 500 mV at 100 MHz<br>TDS 500D, 714L, 724D, & 754D: 400 mV from DC to 50 MHz, increasing to 750 mV at 100 MHz<br>TDS 580D & 784D: 250 mV from DC to 50 MHz, increasing to 500 mV at 100 MHz<br>TDS 794D: 250 mV from DC to 50 MHz, increasing to 500 mV at 100 MHz | |
| Width, Minimum Pulse and Rearm, for Pulse Triggering<br>The minimum pulse widths and rearm widths and transition times[2] required for Pulse-Type triggering. | For vertical settings > 10 mV/div. and ≤1 V/div at the BNC input | | |
| | **Pulse class** | **Minimum pulse width** | **Minimum re-arm width** |
| | Glitch | 1 ns | 2 ns + 5% of Glitch Width Setting |
| | Runt | 2 ns<br>TDS 694C: 1 ns | 2 ns |
| | Time-Qualified Runt | 2 ns<br>TDS 694C: 1 ns | TDS 694C & TDS 700D/714L: 8.5 ns + 5% of Width Setting |
| | Width | 1 ns | 2 ns + 5% of Width Upper Limit Setting |
| | Timeout | 1 ns | 2 ns + 5% of Width Upper Limit Setting |
| | Slew Rate | 600 ps[2] | TDS 694C & TDS 700D/714L: 8.5 ns + 5% of Delta Time Setting |

**Table 1–12: Warranted characteristics — Triggering system (Cont.)**

| Name | Description | |
|---|---|---|
| **Accuracy (Time) for Pulse-Glitch or Pulse-Width Triggering** | **Time range** | **Accuracy** |
| | 2 ns to 500 ns | ±(20% of setting + 0.5 ns) |
| | 520 ns to 1 s | ±(100 ns + 0.01% of Setting) |
| **Input Signal Sync Amplitude for Stable Triggering, NTSC and PAL modes (Option 05 Video Trigger)** | Field selection "Odd", "Even", or "All": 0.6 division to 4 divisions<br>Field selection "Numeric": 1 division to 4 divisions (NTSC mode) | |
| **Jitter (Option 05 Video Trigger)** | 60 $ns_{p-p}$ on NTSC or PAL signal | |

**1 The minimum sensitivity for obtaining a stable trigger. A stable trigger results in a uniform, regular display triggered on the selected slope. The trigger point must not switch between opposite slopes on the waveform, and the display must not "roll" across the screen on successive acquisitions. The TRIG'D LED stays constantly lighted when the SEC/DIV setting is 2 ms or faster but may flash when the SEC/DIV setting is 10 ms or slower.**

**2 For Slew Rate Triggering, this is the minimum transition time, defined to be the time the user's signal spends between the two trigger threshold settings.**

**Table 1–13: Warranted characteristics — Output ports, probe compensator, and power requirements**

| Name | Description | |
|---|---|---|
| **Logic Levels, Main- and Delayed-Trigger Outputs** | **Characteristic** | **Limits** |
| | Vout (HI) | ≥2.5 V open circuit; ≥1.0 V into a 50 Ω load to ground |
| | Vout (LO) | ≤0.7 V into a load of ≤4 mA;<br>≤0.25 V into a 50 Ω load to ground |
| **Output Voltage and Frequency, Probe Compensator** | **Characteristic** | **Limits** |
| | Output Voltage | 0.5 V (base-top) ±1% into a ≥50 Ω load |
| | Frequency | 1 kHz ±5% |
| **Output Voltage, Signal Out (CH 3[1])**<br>Not on TDS 694C | For TDS 600C: 20 mV/division ±20% into a 1 MΩ load;<br>10 mV/division ±20% into a 50 Ω load<br>For TDS 500D/700D/714L:<br>22 mV/division ±20% into a 1 MΩ load;<br>11 mV/division ±20% into a 50 Ω load | |
| Source Voltage | 100 to 240 $VAC_{RMS}$, continuous range, CAT II | |
| Source Frequency | 45 Hz to 440 Hz | |
| Power Consumption<br>TDS 694C | ≤350 W (450 VA)<br>≤450 W (500 VA) | |

**1 CH 3 signal out is present at the rear panel if CH 3 (AUX 1 on the TDS 680C) is selected as the trigger source for the main and/or delayed trigger systems. It is not available when a channel other than CH3 (AUX 1 on the TDS 680C) is the source for the Video Trigger when Option 05 is installed.**

**Table 1–14: Warranted characteristics — Environmental**

| Name | Description |
|---|---|
| Atmospherics | Temperature (no disk in floppy drive):<br>TDS 600C: Operating: +4° C to +45° C<br>TDS 694C: Operating: +4° C to +40° C<br>Floppy disk drive: Operating: +10° C to +45° C<br>Nonoperating: –22° C to +60° C<br>TDS 500D/700D/714L: Operating: +0° C to +50° C<br>Floppy disk drive: Operating: +10° C to +50° C<br>Nonoperating: –22° C to +60° C<br>Relative humidity (no disk in floppy drive):<br>Operating: 20% to 80%, at or below +32° C, upper limit derates to 30% relative humidity at +45° C<br>Operating: TDS 694C: 20% to 80%, at or below +32° C, upper limit derates to 30% relative humidity at +40° C<br>Nonoperating: TDS 500D/700D/714L: 5% to 90%, at or below +31° C, upper limit derates to 20% relative humidity at 60° C<br>TDS 600C: 5% to 90%, at or below +41° C, upper limit derates to 30% relative humidity at 60° C<br>Altitude:<br>To 4570 m (15,000 ft.), operating (excluding hard disk drive)<br>To 3048 m (10,000 ft.), operating (including hard disk drive)<br>To 12190 m (40,000 ft.), nonoperating |
| Dynamics | Random vibration (floppy disk not installed):<br>0.31 g rms, from 5 to 500 Hz, 10 minutes each axis, operating<br>2.46 g rms, from 5 to 500 Hz, 10 minutes each axis, nonoperating |

**Table 1–14: Warranted characteristics — Environmental (cont.)**

| Name | Description |
|---|---|
| Approvals | Conforms to and is certified where appropriate to:<br>UL 3111–1[2] – Standard for electrical measuring and test equipment<br>CAN/CSA C22.2 no. 1010.1[2] – Safety requirements for electrical equipment for measurement, control and laboratory use |

[2] **UL 3111, CSA 22.2 no.1010 Safety Certification Compliance:**
**Temperature (operating) 5 to +40 C**
**Altitude (maximum operating): 2000 meters**
**Equipment Type: Test and Measurement**
**Safety Class: Class I (as defined in IEC 1010–1, Annex H) – grounded product**
**Overvoltage Category: Overvoltage Category II (as defined in IEC 1010–1, Annex J)**
**Pollution Degree: Pollution Degree 2 (as defined in IEC 1010–1)**
**Note – Rated for indoor use only**

**Table 1–15: Certifications and compliances**

| | |
|---|---|
| EC Declaration of Conformity — EMC[3] (TDS 500D, TDS 700D, and TDS 714L) | Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Union:<br><br>EN 55011 Class A Radiated and Conducted Emissions<br>EN 50081-1 Emissions:<br>EN 60555-2 AC Power Line Harmonic Emissions<br>EN 50082-1 Immunity:<br>IEC 801-2 Electrostatic Discharge Immunity<br>IEC 801-3 RF Electromagnetic Field Immunity<br>IEC 801-4 Electrical Fast Transient/Burst Immunity<br>IEC 801-5 AC Power Line Surge Immunity |
| EC Declaration of Conformity — EMC[3] (TDS 600C) | Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Union:<br><br>EN 55011 Class A Radiated and Conducted Emissions<br>IEC 61000-3-2 AC Power Line Harmonic Emissions<br>EN 50082-1 Immunity:<br>IEC 61000-4-2 Electrostatic Discharge Immunity<br>IEC 61000-4-3 RF Electromagnetic Field Immunity<br>IEC 61000-4-4 Electrical Fast Transient/Burst Immunity<br>IEC 61000-4-5 AC Power Line Surge Immunity<br>IEC 61000-4-6 RF Conducted Immunity<br>IEC 1000-4-8 Magnetic Field Immunity<br>IEC 1000-4-11 AC Power Line Interruption Immunity |
| Australia/New Zealand Declaration of Conformity – EMC | Complies with EMC provision of Radiocommunications Act per the following standard(s):<br><br>AS/NZS 2064.1/2 Industrial, Scientific, and Medical Equipment: 1992 |
| EC Declaration of Conformity – Low Voltage | Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:<br><br>Low Voltage Directive 73/23/EEC, amended by 93/69/EEC<br>EN 61010-1/A2:1995 Safety requirements for electrical equipment for measurement, control, and laboratory use |

**3 To ensure compliance with EMC requirements, only high quality shielded cables having a reliable, continuous outer shield with full coverage and low impedance connections to shielded connector housings at both ends should be connected to this product. The following cables, or their equivalent, may be used:**
**GPIB: Tektronix P/N 012–0991–00, –01, –02, or –03**
**RS–232: Computer Accessories P/N CA 0294–9**
**Centronics: Tektronix P/N 012–1214–00**
**VGA: LCOM P/N CTL3VGAMM–5 (if connected, terminate the cable)**

# Typical Characteristics

Tables 1–16 and 1–18 list the various *typical characteristics* which describe the TDS 500D, TDS 600C, TDS 700D and TDS 714L oscilloscopes.

Typical characteristics are described in terms of typical or average performance. Typical characteristics are not warranted.

**Table 1–16: Typical characteristics — Signal acquisition system**

| Name | Description | |
|---|---|---|
| Analog Bandwidth, DC-50 Ω Coupled with P6243 or P6245 Probe and Bandwidth selection is FULL<br>TDS 520D, 540D, 714L, 724D & 754D | **Volts/Div as read out on screen** | **520D, 540D, 714L, 724D & 754D Bandwidth[1]** |
| | 10 V/div – 100 V/div | Not Applicable |
| | 100 mV/div – 10 V/div | DC – 500 MHz |
| | 50 mV/div – 99.5 mV/div | DC – 500 MHz |
| | 20 mV/div – 49.8 mV/div | DC – 500 MHz |
| | 10 mV/div – 19.9 mV/div | DC – 450 MHz (P6243)<br>DC – 500 MHz (P6245) |
| Analog Bandwidth, DC-50 Ω Coupled with P6245 Probe and Bandwidth selection is FULL<br>TDS 580D & TDS 784D | **Volts/Div as read out on screen** | **TDS 580D & TDS 784D** |
| | 10 V/div –100 V/div | (Not Applicable) |
| | 100 mV/div – 10 V/div | DC – 1 GHz |
| | 50 mV/div – 99.5 mV/div | DC – 750 MHz |
| | 20 mV/div – 49.8 mV/div | DC – 600 MHz |
| | 10 mV/div – 19.9 mV/div | DC – 500 MHz |
| Analog Bandwidth, DC-50 Ω Coupled with P6249 Probe<br>TDS 694C | **Volts/Div as read out on screen** | **TDS 694C[1]** |
| | 100 mV/div – 10 V/div | DC – 3 GHz |
| Analog Bandwidth, DC-50 Ω Coupled with P6217 Probe<br>TDS 794D | **Volts/Div as read out on screen** | **TDS 794D** |
| | 100 mV/div – 10 V/div | DC – 2 GHz |
| Analog Bandwidth, DC-1 MΩ Coupled with P6139A Probe and Bandwidth selection is FULL<br>TDS 520D, 540D, 580D, 714L, 724D, 754D & 784D | **Volts/Div as read out on screen** | **TDS 520D, 540D, 714L, 724D, 754D & 784D Bandwidth[1]** |
| | 10 V/div – 100 V/div | 500 MHz |
| | 100 mV/div – 10 V/div | 500 MHz |
| | 50 mV/div – 99.5 mV/div | 500 MHz |
| | 20 mV/div – 49.8 mV/div | 500 MHz |
| | 10 mV/div – 19.9 mV/div | 500 MHz |

**Table 1–16: Typical characteristics — Signal acquisition system (cont.)**

| Name | Description | | |
|---|---|---|---|
| Analog Bandwidth, DC-50 Ω Coupled with P6139A Probe (TDS 654C) or P6245 Probe (TDS 680C & 684C) and Bandwidth selection is FULL<br>TDS 600C | **Volts/Div as read out on screen** | **TDS 654C Bandwidth[1]** | **TDS 680C & 684C Bandwidth[1]** |
| | 10 V/div – 100 V/div | (Not Applicable) | (Not Applicable) |
| | 100 mV/div – 10 V/div | DC – 500 MHz | DC – 1 GHz |
| | 50 mV/div – 99.5 mV/div | DC – 450 MHz | DC – 750 MHz |
| | 20 mV/div – 49.8 mV/div | DC – 300 MHz | DC – 600 MHz |
| | 10 mV/div – 19.9 mV/div | DC – 250 MHz | DC – 500 MHz |
| Accuracy, Delta Time Measurement | The limits are given in the following table for signals having amplitude greater than 5 divisions, reference level = 50%, filter set to (sinX/X), acquired at 5 mV/div or greater. For the TDS 700D/714L, pulse duration < 10 division. Channel skew not included.<br>TDS 600C: For the averaged condition, $1.4 \leq T_r/W_i \leq 40$, where $W_i$ is the Waveform Interval, as described elsewhere in these specifications.<br>Extra error in the measurement will occur for two-channel measurements due to channel-to-channel skew. This is described elsewhere in these specifications. | | |
| | **Time measurement accuracy** | | |
| Conditions for accuracy listed at right are: ≥ 100 Averages, with Full Bandwidth selected, and for TDS 500D/700D/714L, repetitive mode. | TDS 600C: $\pm$(10 ps + (100 ppm × \| Reading \|) + (0.2 × $W_i$ ) )<br>TDS 500D/700D/714L: $\pm$(20 ps + (25 ppm × \| Reading \|) + (0.15 × $W_i$ ) )<br>TDS 694C: $\pm$(5 ps + (10 ppm × \| Reading \|) | | |
| Calculated Rise Time, TDS 600C[2] (except TDS 694C) | **Volts/Div setting** | **TDS 654C Rise time** | **TDS 680C & 684C Rise time** |
| | 10 mV/div – 1 V/div | 900 ps | 450 ps |
| | 5 mV/div – 9.95 mV/div | 1 ns | 600 ps |
| | 2 mV/div – 4.98 mV/div | 1.5 ns | 750 ps |
| | 1 mV/div – 1.99 mV/div | 1.8 ns | 900 ps |
| Calculated Rise Time, TDS 500D/700D/714L[2] | **Volts/Div setting** | **520D, 540D, 714L, 724D, & 754D Rise time** | **580D & 784D Rise time** |
| | 10 mV/div – 1 V/div | 800 ps | 400 ps |
| | 5 mV/div – 9.95 mV/div | 800 ps | 530 ps |
| | 2 mV/div – 4.98 mV/div | 800 ps | 600 ps |
| | 1 mV/div – 1.99 mV/div | 890 ps | 800 ps |
| Calculated Rise Time, TDS 694C[2] | **Volts/Div setting** | **694C Rise time** | |
| | 10 mV/div – 1 V/div | 133 ps | |
| Calculated Rise Time, TDS 794D[2] | **Volts/Div setting** | **794D Rise time** | |
| | 10 mV/div – 1 V/div | 200 ps | |

**Table 1–16: Typical characteristics — Signal acquisition system (cont.)**

| Name | Description | | |
|---|---|---|---|
| Effective Bits — TDS 694C<br>The chart on the right gives the typical effective bits for a 9.2 divisions p–p sine wave input at 50 mV/div @ 25° C. | | **Sample rate** | |
| | **Input frequency** | **10 GS/s** | |
| | 1 MHz | 6.6 bits | |
| | 1 GHz | 5.5 bits | |
| | 2 GHz | 4.5 bits | |
| | 3 GHz | 3.8 bits | |
| Effective Bits — TDS 600C (except TDS 694C)<br>The chart on the right gives the typical effective bits for a 9-division p-p sine-wave input, 50 mV/div, 10 ns/div (5 GS/s), with a record length of 1000 points | **Input frequency** | **Effective bits** | |
| | 98 MHz | 6.3 bits | |
| | 245 MHz | 6.0 bits | |
| | 490 MHz | 5.5 bits | |
| | 990 MHz | 5.2 bits (TDS 680C & 684C only) | |
| Effective Bits — TDS 520D & 724D<br>The chart on the right gives the typical effective bits for a sine wave adjusted to 9.2 divisions at 1 MHz, 50 mV/div @ 25° C. | | **Sample rate** | |
| | **Input frequency** | **1 GS/s** | **10 MS/s & HiRes** |
| | 1 MHz | 6.8 bits | 9.7 bits |
| | 490 MHz | 6.5 bits | N/A |
| Effective Bits — TDS 540D & 754D<br>The chart on the right gives the typical effective bits for a sine wave adjusted to 9.2 divisions at 1 MHz, 50 mV/div @ 25° C. | | **Sample rate** | |
| | **Input frequency** | **2 GS/s** | **10 MS/s & HiRes** |
| | 1 MHz | 6.8 bits | 9.7 bits |
| | 500 MHz | 6.8 bits | N/A |
| Effective Bits — TDS 714L<br>The chart on the right gives the typical effective bits for a sine wave adjusted to 9.2 divisions at 1 MHz, 50 mV/div @ 25° C. | | **Sample rate** | |
| | **Input frequency** | **500 MS/s** | **10 MS/s & HiRes** |
| | 1 MHz | 6.8 bits | 9.7 bits |
| | 500 MHz | 6.8 bits | N/A |
| Effective Bits — TDS 580D, 784D & 794D<br>The chart on the right gives the typical effective bits for a sine wave adjusted to 9.2 divisions at 1 MHz, 50 mV/div @ 25° C. | | **Sample rate** | |
| | **Input frequency** | **4 GS/s** | **10 MS/s & HiRes** |
| | 1 MHz | 6.6 bits | 9.7 bits |
| | 1 GHz | 5.5 bits | N/A |
| | 2 GHz – 6.5 divs (TDS 794D only) | 4.5 bits | N/A |
| Frequency Limit, Upper, 250 MHz Bandwidth Limited | 250 MHz | | |
| Frequency Limit, Upper, 20 MHz Bandwidth Limited | 20 MHz | | |

**Table 1–16: Typical characteristics — Signal acquisition system (cont.)**

| Name | Description | | | | |
|---|---|---|---|---|---|
| Step Response Settling Errors | | | Settling error (%)[3] at | | |
| | Volts/Div setting | ± Step amplitude | 20 ns | 100 ns | 20 ms |
| | 1 mV/div – 100 mV/div | ≤2 V | ≤0.5% | ≤0.2% | ≤0.1% |
| | 101 mV/div – 1 V/div | ≤20 V | ≤1.0% | ≤0.5% | ≤0.2% |
| | 1.01 V/div – 10 V/div | ≤200 V | ≤1.0% | ≤0.5% | ≤0.2% |
| Step Response Settling Errors TDS 694C/794D | 10 mV/div – 100 mV/div | ≤1.5 V | ≤0.5% | ≤0.2% | ≤0.1% |
| | 101 mV/div – 1 V/div | ≤3 V | ≤1.0% | ≤0.5% | ≤0.2% |

1 **The limits given are for the ambient temperature range of 0°C to +30°C, TDS 694C 4°C to +30°C. Reduce the upper bandwidth frequencies by 5 MHz for the TDS 600C or by 2.5 MHz for the TDS 500D/700D/714L for each °C above +30°C. For the TDS 694C and TDS 794D reduce the upper bandwidth frequencies by 10 MHz for each °C above +30°C.**

2 **The numbers given are valid 0°C to +30°C and will increase as the temperature increases due to the degradation in bandwidth. Rise time is calculated from the bandwidth. It is defined by the following formula:**

$$TDS\ 600C\ Rise\ Time\ (ns) = \frac{450}{BW\ (MHz)} \qquad TDS\ 500D/694C/700D\ Rise\ Time\ (ns) = \frac{400}{BW\ (MHz)}$$

**Note that if you measure rise time, you must take into account the rise time of the test equipment (signal source, etc.) that you use to provide the test signal. That is, the measured rise time ($RT_m$) is determined by the instrument rise time ($RT_i$) and the rise time of the test signal source (RTgen) according to the following formula:**

$$RT_m^{\ 2} = RT_i^{\ 2} + RT_{gen}^{\ 2}$$

3 **The values given are the maximum absolute difference between the value at the end of a specified time interval after the midlevel crossing of the step and the value one second after the midlevel crossing of the step, expressed as a percentage of the step amplitude.**

**Table 1–17: Typical characteristics — Time base system**

| Name | Description |
|---|---|
| Accuracy, Delta Time Measurement (TDS 500D/700D Option 1G and TDS 714L) | The limits are given in the following table for signals having amplitude greater than 5 divisions, reference level = 50%, filter set to (sinX/X), acquired at 5 mV/div or greater. For the TDS 500D/700D Option 1G and the TDS 714L, pulse duration < 10 div. Channel skew not included. |
| Conditions for accuracy listed at right are: Single Shot, Sample or HiRes mode with Full Bandwidth selected. | For the Single Shot condition, $1.4 \le T_r \div S \le 4$, where S is the sample rate and $T_r$ is the displayed rise time.<br>Extra error in the measurement will occur for two-channel measurements due to channel-to-channel skew. This is described elsewhere in these specifications. |
| | **Time measurement accuracy** |
| | ±((0.15 ÷ sample rate) + (25 ppm × \| Reading \|)) |

**Table 1–18: Typical characteristics — Triggering system**

| Name | Description | |
|---|---|---|
| Accuracy, Trigger Level or Threshold, DC Coupled (for signals having rise and fall times ≥ 20 ns) | **Trigger source** | **Accuracy** |
| | Any Channel | ±((2% × \| Setting – Net Offset \|) + (0.3 div × Volts/div Setting ) + Offset Accuracy) |
| | Auxiliary | Not calibrated or specified |
| Input, Auxiliary Trigger | The input resistance is ≥1.5 kΩ; the maximum safe input voltage is ±20 V (DC + peak AC). | |
| Trigger Position Error, Edge Triggering | **Acquisition mode** | **Trigger-position error[1,2]** |
| | Sample, Average | ±(1 Waveform Interval + 1 ns) |
| | Envelope | ±(2 Waveform Intervals + 1 ns) |
| Holdoff, Variable, Main Trigger | For all Time/Division ranges, the minimum holdoff is 250 ns and the maximum holdoff is 12 seconds. The minimum resolution is 8 ns for settings ≤ 1.2 µs. | |
| Lowest Frequency for Successful Operation of "Set Level to 50%" Function | 30 Hz<br>TDS 694C: 50 Hz | |
| Trigger Jitter | TDS 580D, 680C, 684C, 784D, and 794D: σ = 7 ps<br>TDS 520D, 540D, 654C, 694C, 714L, 724D, 754D: σ = 8 ps<br><br>Provide a pulse with $T_{rise}$ ≤ 350 ps into one channel. Set the scope to 100 ps/div (250 GS/s TDS 580D, 680C, 684C, 784D, and 794D; 5 GS/s TDS 654C, 680C, 684C), with 6 div of signal, and the trigger level set to 50% of the rising edge. Turn on a horizontal histogram, with the box set to minimum height at the trigger point. Enable **StdDev** and **Hits in Box** histogram measurements. Wait for a least 1000 hits, then note the standard deviation of the trigger point. | |
| Sensitivity, Edge Trigger, Not DC Coupled[3] | **Trigger source** | **Typical signal level for stable triggering** |
| | AC | Same as the DC-coupled limits for frequencies above 60 Hz. Attenuates signals below 60 Hz. |
| | Noise Reject | Three times the DC-coupled limits. |
| | High Frequency Reject | One and one-half times the DC-coupled limits from DC to 30 kHz. Attenuates signals above 30 kHz. |
| | Low Frequency Reject | One and one-half times the DC-coupled limits for frequencies above 80 kHz. Attenuates signals below 80 kHz. |
| Sensitivities, Logic Trigger and Events Delay, DC Coupled[4] | 1.0 division, from DC to 500 MHz, at vertical settings > 10 mV/div and ≤ 1 V/div at the BNC input | |
| Sensitivities, Pulse-Type Runt Trigger[5] | 1.0 division, from DC to 500 MHz, at vertical settings > 10 mV/div and ≤ 1 V/div at the BNC input | |
| Sensitivities, Pulse-Type Trigger Width and Glitch[6] | 1.0 division, at vertical settings > 10 mV/div and ≤ 1 V/div at the BNC input | |

**Table 1–18: Typical characteristics — Triggering system (cont.)**

| Name | Description | | | |
|---|---|---|---|---|
| Width, Minimum Pulse and Rearm, for Logic Triggering or Events Delay | For vertical settings > 10 mV/div and ≤ 1 V/div at the BNC input | | | |
| | **Triggering type** | **Minimum pulse width** | **Minimum re-arm width** | **Minimum time between channels[7]** |
| | Logic | Not Applicable | 1 ns | 1 ns |
| | Events Delay | 1 ns (for either + or – pulse widths) | Not Applicable | 2 ns |
| Width, Minimum Pulse and Rearm, for Pulse Triggering<br>The minimum pulse widths and rearm widths and transition times[8] required for Pulse-Type triggering. | For vertical settings > 10 mV/div. and 3 1 V/div at the BNC input | | | |
| | **Pulse class** | **Minimum pulse width** | **Minimum re-arm width** | |
| | Glitch | 1 ns | 2 ns + 5% of Glitch Width Setting | |
| | Runt | 2 ns | 2 ns | |
| | Time-Qualified Runt | 2 ns<br>TDS 694C: 1 ns | TDS 500D/700D/714L: 8.5 ns + 5% of width setting<br>TDS 600C: 7 ns + 5% of Width Setting<br>TDS 694C: 8 ns + 5% of Width Setting | |
| | Width | 1 ns | 2 ns + 5% of Width Upper Limit Setting | |
| | Timeout | 1 ns | 2 ns + 5% of Width Upper Limit Setting | |
| | Slew Rate | 600 ps[8] | TDS 500D/700D/714L: 8.5 ns + 5% of delta time setting<br>TDS 600C: 7 ns + 5% of Delta Time Setting | |
| Setup/Hold Time Violation Trigger, Minimum Clock Pulse Widths | For vertical settings > 10 mV/div and ≤ 1 V/div at the BNC input, the minimum requirements are: | | | |
| | **Minimum Pulse Width, Clock Active[9]** | | **Minimum Pulse Width, Clock Inactive[9]** | |
| | User Hold Time + 2.5 ns[10]<br>User Hold Time + 2.6 ns[10] | | 2 ns | |
| **Input Signal Sync Amplitude for Stable Triggering, HDTV and FLEXFMT modes (Option 05 Video Trigger)** | All field selections: 0.6 division to 4 divisions | | | |
| Jitter for HDTV mode (Option 05 Video Trigger) | 17 $ns_{p-p}$ | | | |
| **Sync Width Flex Format and HDTV modes (Option 05 Video Trigger)** | min. 400 ns | | | |
| **Sync Duty Cycle, Flex Format and HDTV modes (Option 05 Video Trigger)** | min. 50 to 1 | | | |
| **Hum Rejection (Option 05 Video Trigger)** | NTSC and PAL: –20 dB without any trigger spec deterioration. Triggering will continue down to 0 dB with some performance deterioration. | | | |

**Table 1–18: Typical characteristics — Triggering system (cont.)**

| Name | Description |
|---|---|
| 1 | The trigger position errors are typically less than the values given here. These values are for triggering signals having a slew rate at the trigger point of ≥ 0.5 division/ns. |
| 2 | The waveform interval (WI) is the time between the samples in the waveform record. Also, see the footnote for the characteristics *Sample Rate Range or Interpolated Waveform Rates* in Table 1–4, on page 1–12. |
| 3 | The minimum sensitivity for obtaining a stable trigger. A stable trigger results in a uniform, regular display triggered on the selected slope. The trigger point must not switch between opposite slopes on the waveform, and the display must not "roll" across the screen on successive acquisitions. The TRIG'D LED stays constantly lighted when the SEC/DIV setting is 2 ms or faster but may flash when the SEC/DIV setting is 10 ms or slower. |
| 4 | The minimum signal levels required for stable logic or pulse triggering of an acquisition, or for stable counting of a DC-coupled, events-delay signal. Also, see the footnote for *Sensitivity, Edge-Type Trigger, DC Coupled* in this table. (Stable counting of events is counting that misses no events and produces no extra, phantom events). |
| 5 | The minimum signal levels required for stable runt pulse triggering of an acquisition. Also, see the footnote for *Sensitivity, Edge-Type Trigger, DC Coupled* in this table. (Stable counting of events is counting that misses no events). |
| 6 | The minimum signal levels required for stable pulse width or glitch triggering of an acquisition. Also, see the footnote for *Sensitivity, Edge-Type Trigger, DC Coupled* in this table. (Stable counting of events is counting that misses no events). |
| 7 | For Logic, time between channels refers to the length of time a logic state derived from more than one channel must exist to be recognized. For Events, the time is the minimum time between a main and delayed event that will be recognized if more than one channel is used. |
| 8 | For Slew Rate Triggering, this is the minimum transition time, defined to be the time the user's signal spends between the two trigger threshold settings. |
| 9 | Active pulse width is the width of the clock pulse from its active edge (as defined in the Clock Edge selection in the Clock Source menu) to its inactive edge. Inactive pulse width is the width of the pulse from its inactive edge to its active edge. |
| 10 | User Hold Time is the number selected by the user in the Hold Time Menu. |

# Installation

## Supplying Operating Power

***NOTE**. Read all information and heed all warnings in this subsection before connecting the oscilloscope to a power source.*



***WARNING.** AC POWER SOURCE AND CONNECTION. The oscilloscope operates from a single-phase power source. It has a three-wire power cord and two-pole, three-terminal grounding type plug. The voltage to ground (earth) from either pole of the power source must not exceed the maximum rated operating voltage, 250 volts.*

*Before making connection to the power source, be sure the digitizing oscilloscope has a suitable two-pole, three-terminal grounding-type plug.*

*GROUNDING. This instrument is safety Class 1 equipment (IEC designation). All accessible conductive parts are directly connected through the grounding conductor of the power cord to the grounded (earthing) contact of the power plug.*



***WARNING.** The power input plug must be inserted only in a mating receptacle with a grounding contact where earth ground has been verified by a qualified service person. Do not defeat the grounding connection. Any interruption of the grounding connection can create an electric shock hazard.*

*For electric shock protection, the grounding connection must be made before making connection to the instrument's input or output terminals.*

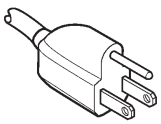
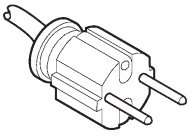
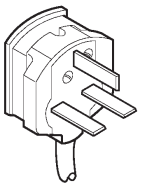
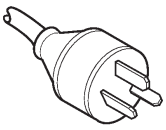
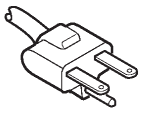
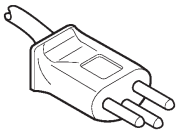
### Power Cord Information

A power cord with the appropriate plug configuration is supplied with each oscilloscope. Table 2–1 gives the color-coding of the conductors in the power cord. If you require a power cord other than the one supplied, refer to Table 2–2, Power Cord Identification.

**Table 2–1: Power cord conductor identification**

| Conductor | Color | Alternate Color |
|---|---|---|
| Ungrounded (Line) | Brown | Black |
| Grounded (Neutral) | Light Blue | White |
| Grounded (Earthing) | Green/Yellow | Green |

**Table 2–2: Power cord identification**

| Plug configuration | Normal usage | Option number |
|---|---|---|
|  | North America<br>125 V | Standard |
|  | Europe<br>230 V | A1 |
|  | United Kingdom<br>230 V | A2 |
|  | Australia<br>230 V | A3 |
|  | North America<br>230 V | A4 |
|  | Switzerland<br>230 V | A5 |

## Operating Voltage

This oscilloscope operates with any line voltage from 90–250 $VAC_{RMS}$ with any line frequency from 45–440 Hz. There are two fuses, either of which may be used throughout the line voltage and frequency ranges. (The two fuses are not totally interchangeable as each requires a different fuse cap.)

### Memory Backup Power

Memory modules with on-board batteries allow the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes to retain some types of data upon loss of the AC power source. The stored adjustment constants, saved front-panel settings, current front-panel settings (instrument status), and waveforms saved in memory are retained.

The on-board batteries of the memory modules have a shelf life of about five years. Partial or total loss of stored settings upon power on may indicate that the memory modules need to be replaced.

## Operating Environment

The following environmental requirements are provided to ensure proper operation and long instrument life.

### Operating Temperature

Operate oscilloscopes where the ambient air temperature is from 4° C to +45° C (+40° C for TDS 694C, +50° C for the TDS 500D, 700D and TDS 714L) with no diskette in the floppy drive. Store the oscilloscopes in ambient temperatures from –22° C to +60° C with no diskette in the floppy drive. After storage at temperatures outside the operating limits, allow the chassis to stabilize at a safe operating temperature before applying power.

### Ventilation Requirements

The oscilloscopes are cooled by air drawn in and exhausted through their cabinet side panels by an internal fan. To ensure proper cooling of the oscilloscope, allow at least two inches clearance on both sides and 3/4 inch on the bottom of the oscilloscope. (The feet on the bottom of the oscilloscope provide the required clearance when set on flat surfaces.) The top of the oscilloscope does not require ventilation clearance.



***CAUTION.*** *If air flow is restricted, the digitizing oscilloscope's power supply may temporarily shut down.*

## Applying and Interrupting Power

Consider the following information when you power on or power off the instrument, or when power is interrupted due to an external power failure.

### Power On

Upon power on, the oscilloscope runs a power-on self check. If it passes, the oscilloscope displays a "passed" status message and a prompt to press CLEAR MENU to continue. If it fails, the oscilloscope displays a diagnostic log that identifies the area(s) that failed and a prompt to press CLEAR MENU to continue. See Section 6, *Maintenance*, for information on diagnostics and fault isolation.

### Power Off



***CAUTION.*** *DO NOT power off the oscilloscope when either running a signal path compensation or when doing any of the adjustments described in Section 5,* Adjustment Procedures. *To do so might result in the loss of internally stored adjustment constants.*

*In general, do not power off the instrument when doing operations that affect the data types listed in Table 1–1. Wait for the instrument to finish the operation when doing adjustments, saving waveforms, or saving setups.*

*Improper power off or unexpected loss of power to the oscilloscope can result in the following corruptions of nonvolatile RAM (NVRAM). The following table describes the messages displayed when power is restored after an abnormal power off.*

**Table 2–3: Effects of corrupted data**

| Corrupted Data Type | Results |
|---|---|
| Adjustment Constants: | |
| Signal Path Compensation | A signal path compensation is required |
| Voltage Reference | A voltage reference adjustment is required (Section 5) |
| Frequency Response | A frequency response adjustment is required (Section 5) |
| Error Log | Errors logged are lost |
| Reference Waveforms | Waveform Lost |
| Saved Setups | Setup Lost |

## Repackaging Instructions

Use a corrugated cardboard shipping carton having a test strength of at least 275 pounds and with an inside dimension at least six inches greater than the instrument dimensions.

If the instrument is being shipped to a Tektronix Service Center, enclose the following information: the owner's address, name and phone number of a contact person, type and serial number of the instrument, reason for returning, and a complete description of the service required.

Seal the shipping carton with an industrial stapler or strapping tape.

Mark the address of the Tektronix Service Center and also your own return address on the shipping carton in two prominent locations.

## Installed Options

Your instrument may be equipped with one or more instrument options. Except for the line-cord options described by Table 2–2 (on page 2–2 of this section), all options and optional accessories are listed and described in Section 7, *Options*. For further information and prices of instrument options, see your Tektronix Products catalog or contact your Tektronix Field Office.

# Operating Instructions

Before doing service, read the following operating instructions. These instructions are at the level appropriate for servicing these oscilloscopes. The *User Manual* contains more complete operating instructions.

Additional instructions are integrated into the service procedures found in later sections of this manual. For instance, the procedures found in the section *Performance Verification* contain instructions for making the front-panel settings required to check each instrument characteristic included there. Also, the general instructions for operating these oscilloscopes' internal diagnostic routines are found in Section 6, *Maintenance.* You may also find the *Product Description* in Section 1 useful for understanding how the oscilloscope functions.

## Screen Layout

Figure 2–1 on page 2–8 shows the screen layout. This figure illustrates a full graticule. You may also select a grid, crosshair, or frame graticule from the display menu.

## Basic Procedures

### How to Power On

Push the principal power switch found on the rear panel of the oscilloscope, then push the **ON/STBY** (standby) switch to toggle the oscilloscope into operation. The switch at the rear panel is the true power disconnect switch. The **ON/STBY**(standby) switch simply toggles operation on and off.



***WARNING.*** *The principal power switch at the rear panel is the true power disconnect switch. The* **ON/STBY** *(standby) switch simply toggles operation on and off. When connected to a power source and when the principal power switch is on, the internal power supplies and much of the other circuitry of these oscilloscopes are energized regardless of the setting of the* **ON/STBY** *switch.*

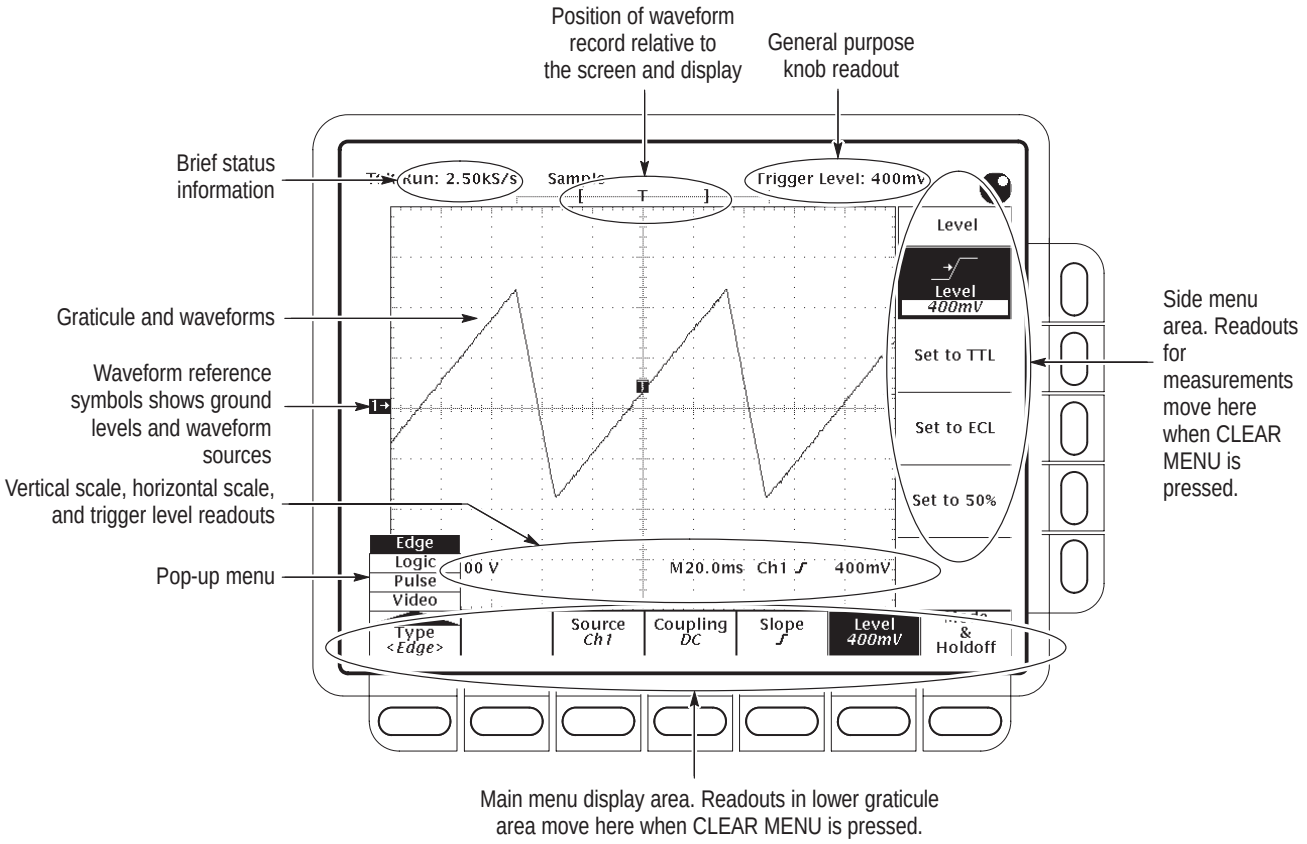



**Figure 2–1: Map of display functions**

## How to Use Help

Push the **HELP** front-panel button to enter help mode. Front-panel knobs and buttons now display information about their function when turned or pushed. Push **HELP** again to exit help mode.

To get help information on a menu item, display the menu desired (if you are in help mode, exit help first). Push **HELP**. Now the menu buttons display information about their function when pushed.

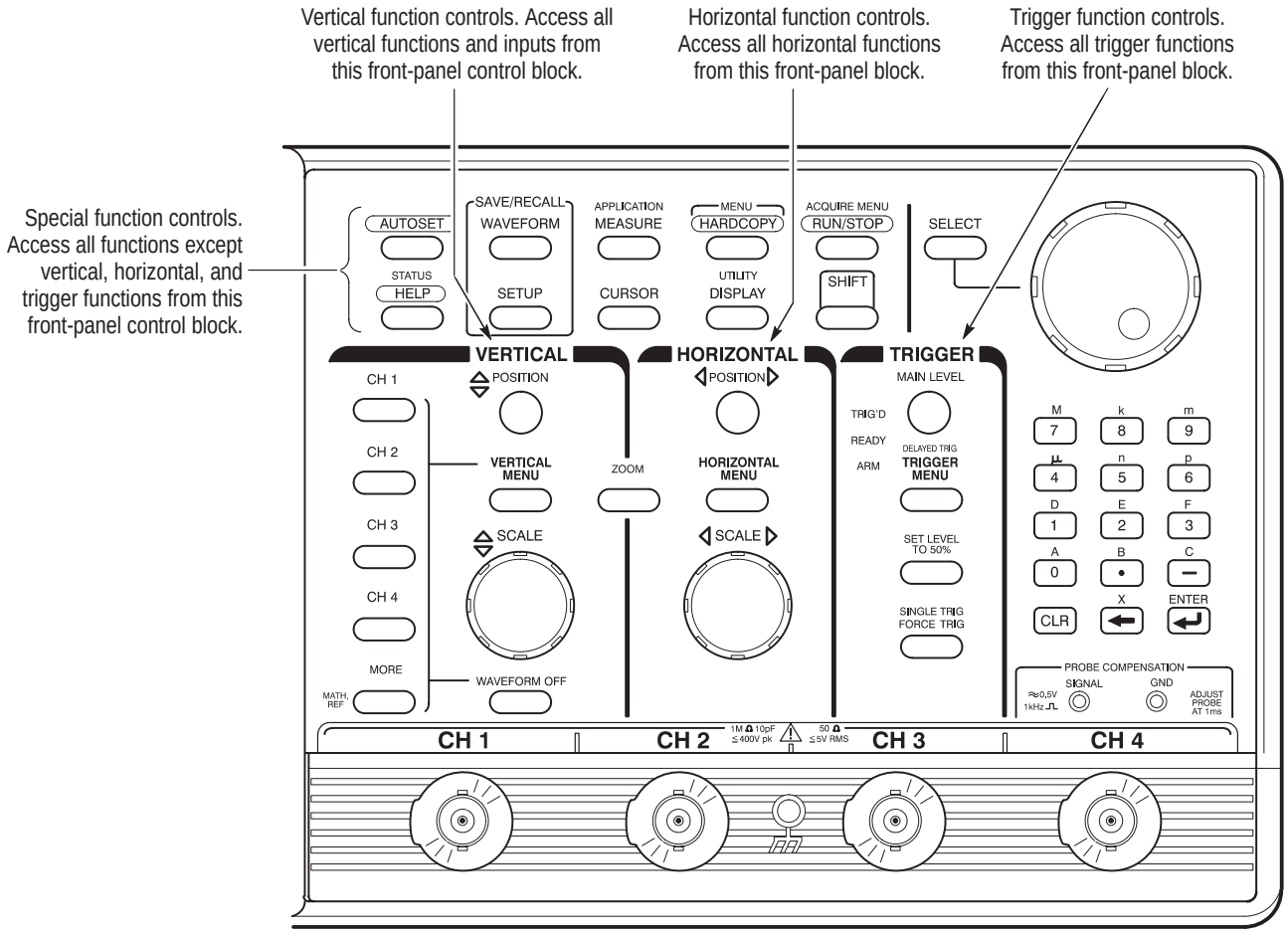
## How to Use the Status Menu

Push the **SHIFT**, then the **STATUS** front-panel buttons to display the status menu. You will find messages reflecting the state of the acquisition system, whether it is running or stopped (and if it is stopped, why), as well as setup-related information.

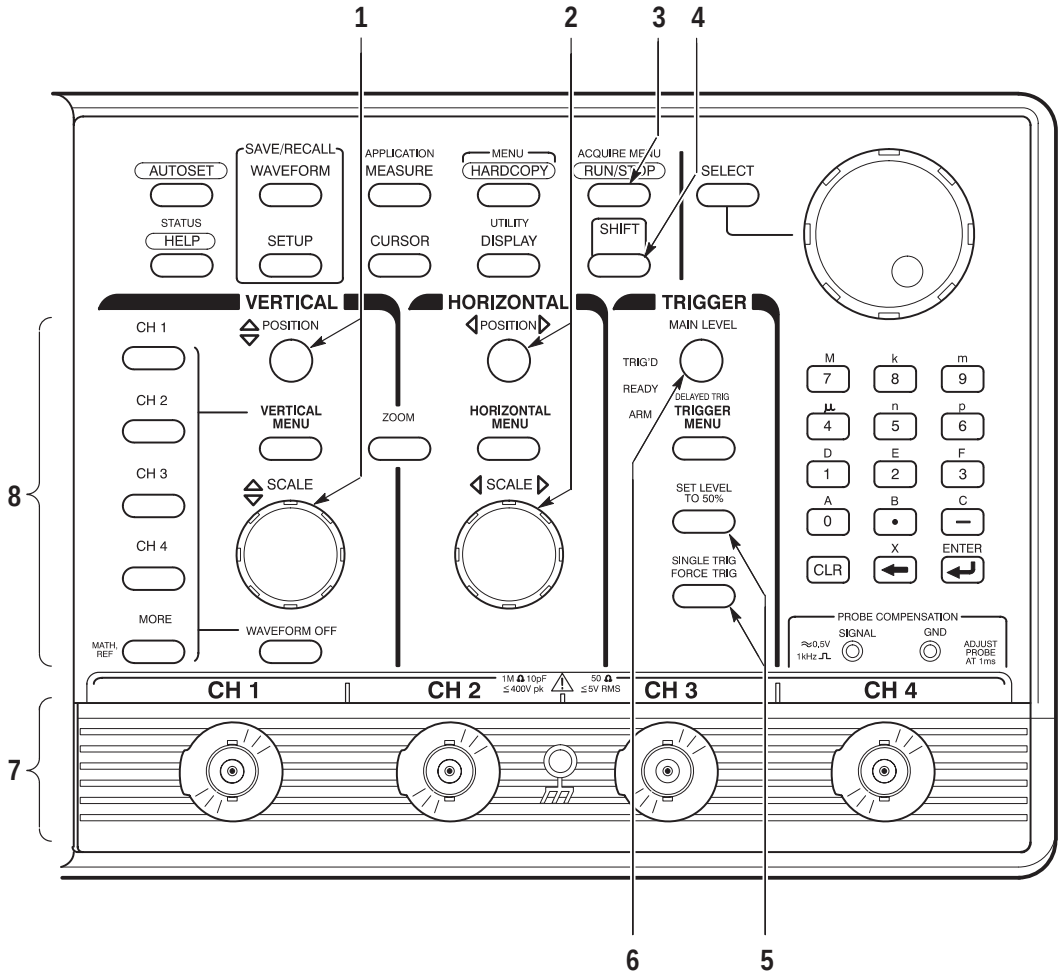
## How to Set Functions

Most functions can be set either by using one (or two) front-panel button(s) or knob(s), or by pushing a front-panel button to use a main menu, and then a side-menu button to set the function. The following steps illustrate both procedures.

1. Locate the block that contains the function to be set.



**2.** Select the waveform source(s). Position, scale, and set trigger level for waveform source(s) directly from the front panel. The steps that follow provide examples of possible control selections.




**a.** Input waveforms into these channels (7). Example: **CH 1**.

**b.** Push any channel's button (8) to display its waveform. The last channel turned on determines which waveform is positioned and scaled. The indicator above the channel last selected is lighted.
Example: Push **CH 1**; then **CH 2**.

**c.** Vertically (1) and horizontally (2) scale and position the waveform(s) selected. Example: Set the scale to 100 mV/div and center the waveform on screen.

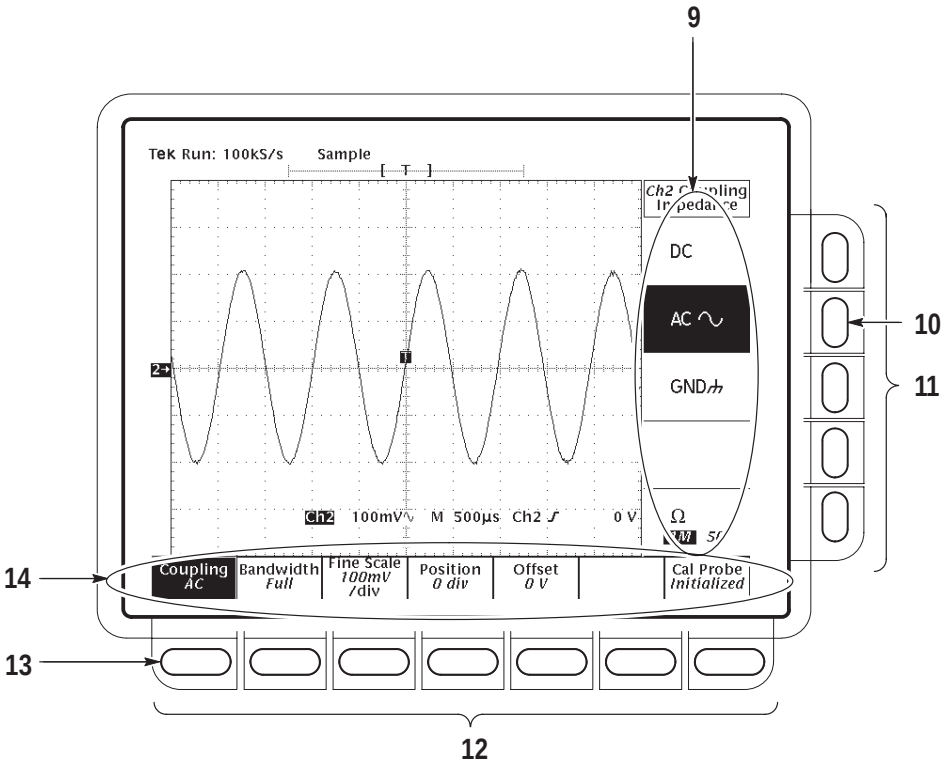
**d.** Stop and start acquiring waveforms (3). Example: Push **RUN/STOP** if not acquiring.

**e.** Adjust trigger level (6) to trigger the waveform(s) selected or use these buttons (5) to either set a trigger level at the mid-amplitude level of the selected waveform or to force a single trigger. Example: Push **SET LEVEL TO 50%**.

**3.** Set all other functions using menus.

**a.** Choose the waveform source (8) first if setting a vertical function; else skip to step b. Example: Push **CH 2**.

**b.** Push **SHIFT** (4) if the function to be set is highlighted in blue; else skip to step c.




**c.** Push the front-panel button that corresponds to the menu containing the function. A main menu (14) for selecting among related functions appears. Example: Push **VERTICAL MENU**.

Note the two labels: the top label is a function to choose from; the bottom label tells you the current setting for that function. **Offset** is currently set to ***0 V***.

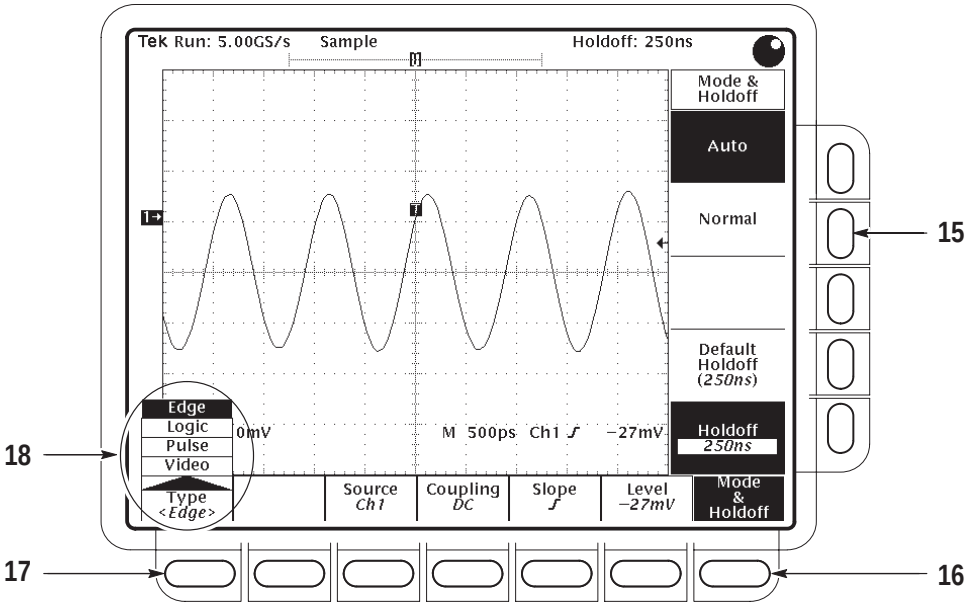
**d.** Select a function from the main menu using the main-menu buttons (12). A side menu for selecting among that the available settings for that function appears. Example: Push **Coupling** (13).

**e.** Select the setting for the function from the side menu (9) using the side-menu buttons (11). Example: Push **AC** (10).

## How to Set Complex Functions

A few functions require more than just two levels (main and side) of menus to completely specify their settings. In such cases, either the main menu, the side menu, or both are modified to supply additional choices. The procedures that follow show both schemes.

**1.** Set up a function using pop-up menus:



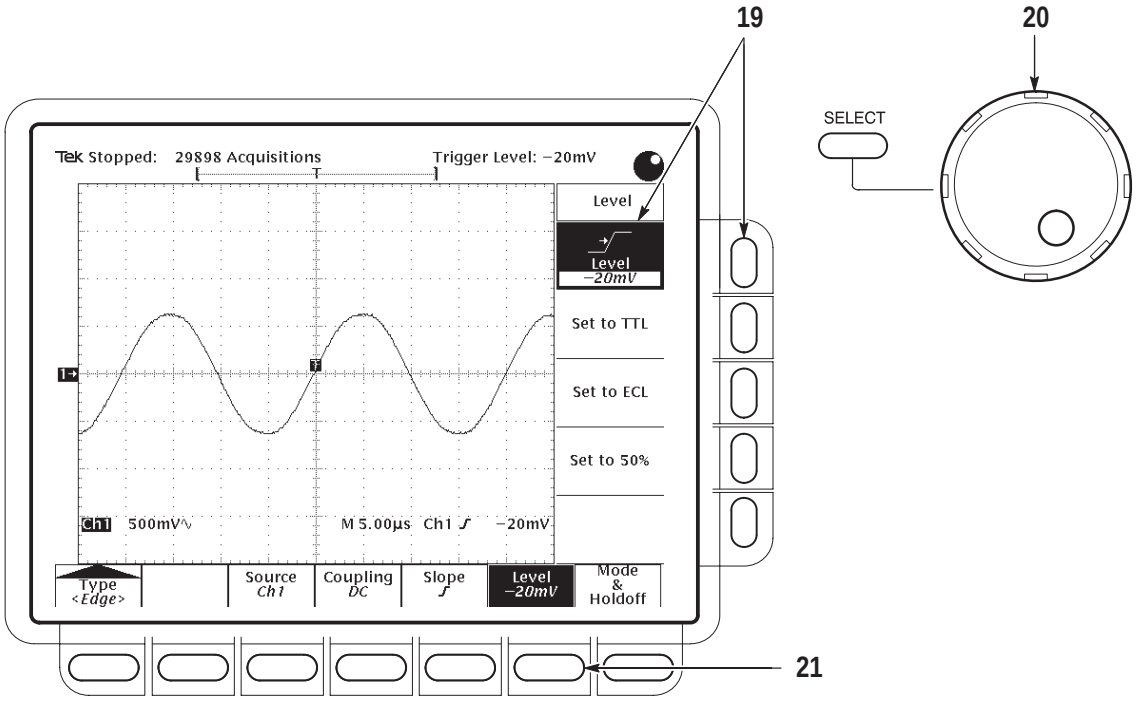

**a.** For some selections, pushing a main-menu button pops up a menu (18) of subfunctions. Example: Push **Type** (17).

Note the pop-up menu for **Type** is set to **Edge**. All the main-menu buttons to the right of the pop-up menu are labeled with subfunctions of **Edge**.

**b.** Pushing the button that popped up the menu (17) toggles through the pop-up menu choices. Example: Repeatedly push **Type** to move through the pop-up menu. Notice the other main-menu button labels change accordingly. Push **Type** to move back to **Edge**.

**c.** Complete the setting of the desired mode by selecting from the main menu and the side menu that results. Example: Push **Mode & Holdoff** (16), and then push **Normal** (15).

2. Set up a function using the general purpose knob (20). (The examples of possible menu selections in the substeps that follow assume you have pushed **TRIGGER MENU**.)




**a.** Pushing some main-menu buttons displays a side menu with labels containing readouts that can be varied. Example: Push **Level** (21).

**b.** Pushing the side-menu button **Level** assigns the general purpose knob to control the readout appearing in the button label. It also copies the readout to the general purpose knob readout area in the right corner of the screen. Example: Push **Level** (19).

**c.** Use the general purpose knob (20) to adjust the trigger level to the setting desired. Example: Turn the knob to **–20 mV**.

**More About the General Purpose Knob.** As you've just seen, the general purpose knob can be used to extend the number of choices available to a side menu button. The general purpose knob can also be assigned to control the following functions:

- Cursor positioning
- Display intensities
- Delay time

- Gated measurements
- Number of events
- Template generation
- Trigger position
- Holdoff
- Offset
- Variable persistence

In all cases, the menus are used to select the function to which the general purpose knob is assigned. The following attributes apply to this knob:

- Depending on the function it is assigned to control, the general purpose knob may vary numerical readouts, position objects (cursors) on screen, or select between icon-label settings that show up in side-menu labels.
- The general purpose knob has a readout area at the upper right corner of the screen. (See Figure 2–1.) This readout always reflects the name and value of the function that the general purpose knob is currently controlling.
- Whenever the general purpose knob assignment is changed, a knob icon appears immediately to the left of the general purpose knob readout to notify you of the assignment change. The icon is removed as soon as you use the general purpose knob to change the value of the function it is assigned to.
- To assign the general purpose knob to control a function, display the menu containing the function; then select the function. (Note that not all functions can be controlled by the general purpose knob.)
- Whenever the menu is removed, the general purpose knob is not assigned and doesn't control any function. (An exception is the cursor function. If cursors are turned on, removing the menu leaves the knob assigned to control the cursors until reassigned by selecting another menu and function that uses the knob.)
- When the **SHIFT** button is lighted, the general purpose knob becomes a coarse adjustment. When the **SHIFT** button is not lighted, the general purpose knob becomes a fine adjustment.
- The general purpose knob also has a **SELECT** button. This button is used to toggle the knob between the control of either of the two cursors displayed when H-bar or V-bar cursors are turned on in the cursor menu.

**Display and Utility Menus.** Using the techniques described for using menus, you can access and change functions in the display menu and utilities menu. In the Display menu, you can set the following functions:

- Color: waveforms, readouts, graticule
- Intensity: waveforms, readouts, graticule, etc.
- Style of waveform display(s): vectors or dots, intensified or nonintensified samples, and infinite or variable persistence
- Display format: XY or YT
- Graticule format: type
- Waveform interpolation filter and readout options

From the Utility menu, you can configure the GPIB port (talk/listen, address, etc.) and access internal routines for self diagnostics and self compensation. Instructions for setting up communication over the GPIB are found in Section 5, *Adjustment Procedures*.

# Theory of Operation

This section describes the electrical operation of the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes using the major circuit blocks or modules.

This section has two main parts:

- *Logic Conventions* describes how logic functions are discussed and represented in this manual.
- *Module Overview* describes circuit operation from a functional-circuit block perspective.

## Logic Conventions

The oscilloscopes contain many digital logic circuits. This manual refers to these circuits with standard logic symbols and terms. Unless otherwise stated, all logic functions are described using the positive-logic convention: the more positive of the two logic levels is the high (1) state, and the more negative level is the low (0) state. Signal states may also be described as "true" meaning their active state or "false" meaning their nonactive state. The specific voltages that constitute a high or low state vary among the electronic devices.

Active-low signals are indicated by a tilde prefixed to the signal name (~RESET). Signal names are considered to be either active-high, active-low, or to have both active-high and active-low states.

## Module Overview

This module overview describes the basic operation of each functional circuit block as shown in Figure 9-2.

### General

The TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes have four channels. Each channel provides a calibrated vertical scale factor.

### Input Signal Path

A signal enters the oscilloscope through a probe connected to a BNC on the A10 Attenuator/Acquisition board.

**Attenuators.** Circuitry in the attenuator selects the input coupling, termination, and the attenuation factor. The processor system, by way of the acquisition system, controls the attenuators. For example, if 50 Ω input termination is

selected and the input is overloaded, the processor system switches the input to the 1 MΩ position (on TDS models with 1 MΩ termination).

**Probe Coding Interface.** Probe coding interface signals pass through the attenuator portion of the A10 Attenuator/Acquisition to the acquisition system, where they are sensed and controlled.

**Acquisition System.** The acquisition system amplifies the input signals, samples them, converts them to digital signals, and controls the acquisition process under direction of the processor system. The acquisition system includes the trigger, acquisition timing, and acquisition mode generation and control circuitry.

**Voltage Controlled Oscillator (VCO).** Master clocks for the acquisition system are generated by the circuitry on the A10 Acquisition board. The circuitry makes up a phase-locked loop. The master clock is divided down by the A10 Acquisition circuitry under control of the processor system.

**D1 Bus.** The acquisition system passes the digital values representing the acquired waveform through the A14 D1 Bus to the A11 DRAM Processor/Display board. This happens after a waveform acquisition is complete if the digital signal processor in the processor system requests the waveform.

**Processor System.** The processor system contains a microprocessor that controls the entire instrument. This system also includes the firmware and a GPIB interface. You can reprogram the firmware from a remote controller using the GPIB and an external software package.

The processor also includes a digital signal processor. This signal processor processes each waveform as directed by the system processor. Waveforms and any text to be displayed are passed on to the display system. The A11 DRAM Processor/Display board contains both the processor and display systems.

**Display System.** Text and waveforms are processed by different parts of the display circuitry. The display system sends the text and waveform information to the tube assembly as a video signal. The display system also generates and sends vertical (VSYNC) and horizontal (HSYNC) sync signals to the tube assembly. A VGA-compatible video output is at the rear of the TDS 500D, TDS 600C, TDS 700D and TDS 714L.

## Tube Assembly

All information (waveforms, text, graticules, and pictographs) is displayed by the A30/31/32 Display system. The A30 generates the high voltages necessary to drive the display tube. It also contains the video amplifier, horizontal oscillator, and the vertical and horizontal yoke driver circuitry.

### Front Panel

The processor system sends instructions to and receives information from the Front Panel Processor on the A12 Front Panel board. The Front Panel Processor reads the front-panel switches and potentiometers. Any changes in their settings are reported to the processor system. The Front Panel Processor also turns the LEDs on and off and generates the bell signal.

Front-panel menu switches are also read by the Front Panel Processor. The processor sends any changes in menu selections to the processor system. The **ON/STBY** switch is one of the menu switches. However, it is not read by the Front Panel Processor, but passes through the A12 Front Panel board and the A11 DRAM Processor/Display board to the low voltage power supply.

The front panel also generates the probe compensation signals **SIGNAL** and **GND**.

### Rear Panel

The **GPIB** connector provides access to stored waveforms and allows external control of the oscilloscope.

You can make hardcopies on the GPIB, RS-232 and Centronics ports.

### Low Voltage Power Supply

The low voltage power supply is a switching power converter with active power factor control. It supplies power to all of the circuitry in the oscilloscope.

The principal **POWER** switch, located on the rear panel, controls all power to the oscilloscope including the Low Voltage Power Supply. The **ON/STBY** switch, located on the front panel, also controls all of the power to the oscilloscope except for part of the circuitry in the Low Voltage Power Supply.

The power supply sends a power fail (~PF) warning to the processor system if the power is going down.

### Fan

The fan provides forced air cooling for the oscilloscope. It connects to +25 V from the Low Voltage Power Supply by way of the A11 DRAM Processor/Display module.

# Performance Verification Procedures

Two types of Performance Verification procedures can be performed on this product: *Brief Procedures* and *Performance Tests*. You may not need to perform all of these procedures, depending on what you want to accomplish.

- To rapidly confirm that the oscilloscope functions and was adjusted properly, just do the brief procedures under *Self Tests*, which begin on page 4–5.

  **Advantages:** These procedures are quick to do, require no external equipment or signal sources, and perform extensive functional and accuracy testing to provide high confidence that the oscilloscope will perform properly. They can be used as a quick check before making a series of important measurements.

- To further check functionality, first do the *Self Tests* just mentioned; then do the brief procedures under *Functional Tests* that begin on page 4–7.

  **Advantages:** These procedures require minimal additional time to perform, require no additional equipment other than a standard-accessory probe, and more completely test the internal hardware of the oscilloscope. They can be used to quickly determine if the oscilloscope is suitable for putting into service, such as when it is first received.

- If more extensive confirmation of performance is desired, do the *Performance Tests*, beginning on page 4–17, after doing the *Functional* and *Self Tests* just referenced.

  **Advantages:** These procedures add direct checking of warranted specifications. They require more time to perform and suitable test equipment is required. (See *Equipment Required* beginning on page 4–18).

If you are not familiar with operating this oscilloscope, read the oscilloscope reference or user manuals. These contain instructions that will acquaint you with the use of the front-panel controls and the menu system.

## Input Channels versus Model

When performing the procedures in this section, be aware that some TDS models refer to input channels Ch 3 and Ch 4 as Aux 1 and Aux 2 respectively. Where appropriate, both names will appear in the procedure, for example, Ch 3 (Aux 1). The channel names for the various TDS models are shown below.

| TDS Model | Channel Names |
|---|---|
| TDS 540D, 580D, 654C, 684C, 694C, 714L, 754D, 784D, and 794D | Ch 1, Ch 2, Ch 3, and Ch 4 |
| TDS 520D, 680C, and 724D | Ch 1, Ch 2, Aux 1, and Aux 2 |

## Conventions

Throughout these procedures the following conventions apply:

- Each test procedure uses the following general format:

  Title of Test

  Equipment Required

  Prerequisites

  Procedure

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

  **1.** First Step

  **a.** First Substep

  - First Subpart
  - Second Subpart

  **b.** Second Substep

  **2.** Second Step

- In steps and substeps, the lead-in statement in italics instructs you what to do, while the instructions that follow tell you how to do it, as in the example step below, *"Initialize the oscilloscope"* by doing "Press save/recall **SETUP**. Now, press the main-menu button...".

*Initialize the oscilloscope:* Press save/recall **SETUP**. Now, press the main-menu button **Recall Factory Setup**; then the side-menu button **OK Confirm Factory Init**.

- Where instructed to use a front-panel button or knob, or select from a main or side menu, or verify a readout or status message, the name of the button or knob appears in boldface type: "press **SHIFT**; then **UTILITY**, press the main-menu button **System** until **Cal** is highlighted in the pop-up menu. Verify that the status message is ***Pass*** in the main menu under the **Voltage Reference** label."

***STOP****. The* ***STOP*** *notation at the left is accompanied by information you must read to do the procedure properly.*

- Refer to Figure 4–1: "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 buttons to the right of the display. "Pop-up menu" refers to a menu that pops up when a main-menu button is pressed.

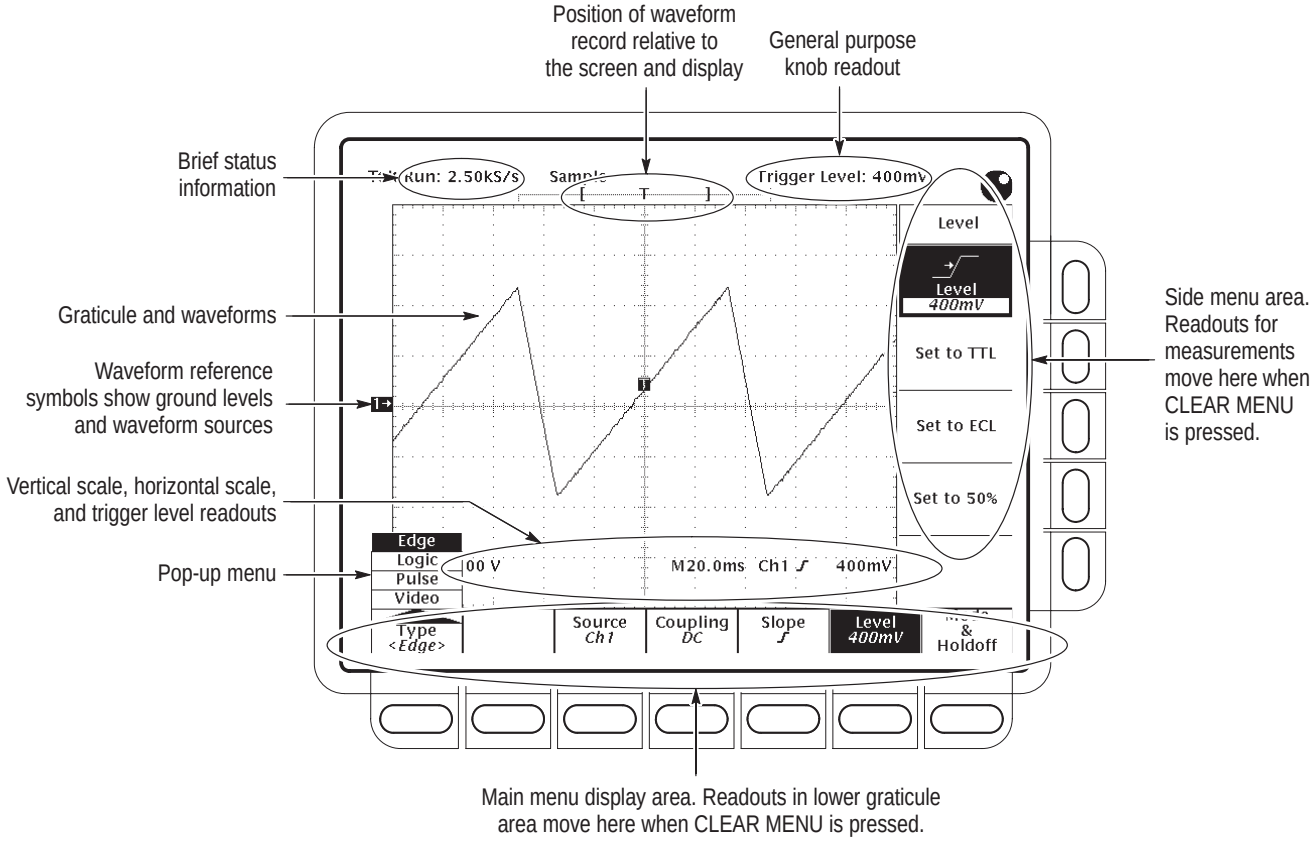



**Figure 4–1: Map of display functions**

# Brief Procedures

The *Self Tests* use internal routines to confirm basic functionality and proper adjustment. No test equipment is required to do these test procedures.

The *Functional Tests* utilize the probe-compensation output at the front panel as a test-signal source for further verifying that the oscilloscope functions properly. A probe is required to do these test procedures.

## Self Tests

This procedure uses internal routines to verify that the oscilloscope functions and was adjusted properly. No test equipment or hookups are required.

### Verify Internal Adjustment, Self Compensation, and Diagnostics

| | |
|---|---|
| **Equipment required** | None |
| **Prerequisites** | Power on the oscilloscope and allow a 20 minute warm-up before doing this procedure. |

1. *Verify that internal diagnostics pass:* Do the following substeps to verify passing of internal diagnostics.
   a. *Display the System diagnostics menu:*
      - Press **SHIFT**; then press **UTILITY**.
      - Repeatedly press the main-menu button **System** until **Diag/Err** is highlighted in the pop-up menu.
   b. *Run the System Diagnostics:*
      - First disconnect any input signals from all four channels.
      - Press the main-menu button **Execute**; then press the side-menu button **OK Confirm Run Test**.
   c. *Wait:* The internal diagnostics do an exhaustive verification of proper oscilloscope function. This verification will take up to three and a half minutes on some models. When the verification is finished, the resulting status will appear on the screen.
   d. *Verify that no failures are found and reported on-screen.* If any failures occur do step 1a**,** then press the main menu button **Error Log** for details.
   e. *Confirm the three adjustment sections have passed status:*

- Press **SHIFT**; then press **UTILITY**.
- Highlight **Cal** in the pop-up menu by repeatedly pressing the main-menu button **System**. See Figure 4–2.
- Verify that the word ***Pass*** appears in the main menu under the following menu labels: **Voltage Reference**, **Frequency Response**, and **Pulse Trigger**. See Figure 4–2.

**f.** *Run the signal-path compensation:* Press the main-menu button **Signal Path**; then press the side-menu button **OK Compensate Signal Paths**.

**g.** *Wait:* Signal-path compensation may take five to fifteen minutes to run. While it progresses, a "clock" icon (shown at left) is displayed on-screen. When compensation completes, the status message will be updated to *Pass* or *Fail* in the main menu. See step **h.**

**h.** *Confirm signal-path compensation returns passed status:* Verify that the word ***Pass*** appears under **Signal Path** in the main menu. See Figure 4–2.

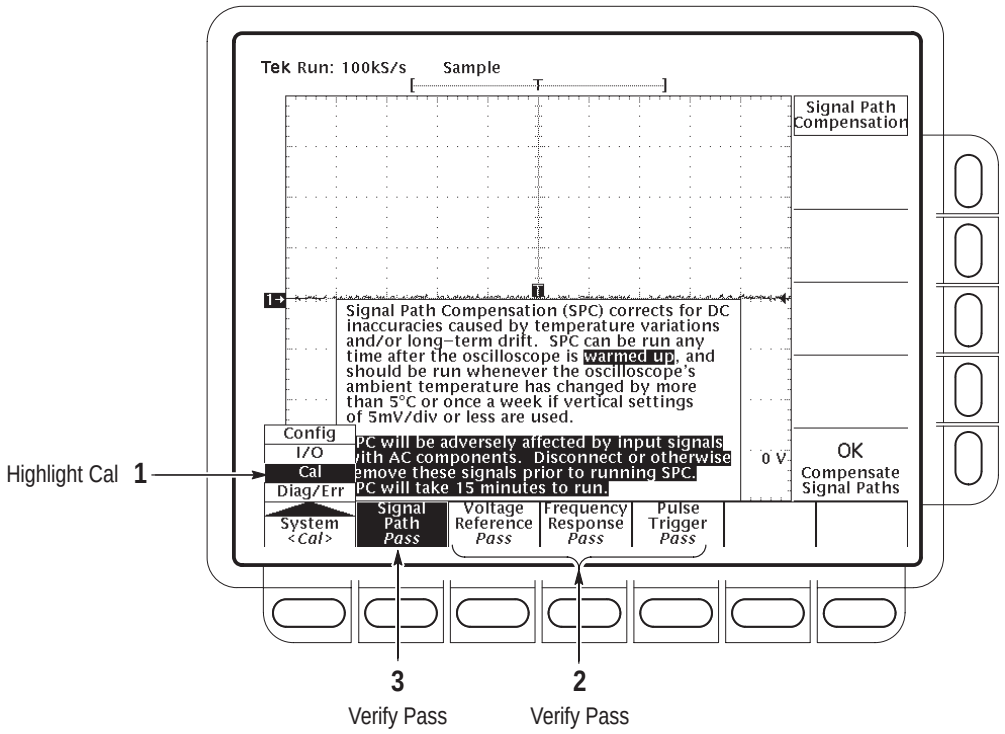



**Figure 4–2: Verifying adjustments and signal-path compensation**

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

## Functional Tests

The purpose of these procedures is to confirm that the oscilloscope functions properly. The only equipment required is one of the standard-accessory probes and, to check the file system, a 3.5 inch, 720 K or 1.44 Mbyte floppy disk.



***CAUTION.*** *The P6243, P6245, P6249 and probes that can be used with this oscilloscope provide an extremely low loading capacitance (<1 pF) to ensure the best possible signal reproduction. These probes should not be used to measure signals exceeding ±8 volts, or errors in signal measurement will be observed. Above 40 volts, damage to the probe may result. To make measurements beyond ±10 volts, use either the P6139A probe (good to 500 volts peak), the P6339A probe (for the TDS 694C & TDS 794D), or refer to the catalog for a recommended probe.*

***STOP****. These procedures verify functions; that is, they verify that the oscilloscope features operate. They do not verify that they operate within limits.*

*Therefore, when the instructions in the functional tests that follow call 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. Operation within limits is checked in* Performance Tests*, which begin on page 4–17.*

***STOP****. 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 oscilloscope 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****.*

*When you are instructed to press a menu button, the button may already be selected (its label will be highlighted). If this is the case, it is not necessary to press the button.*

## Verify All Input Channels

| | |
|---|---|
| **Equipment required** | One probe such as the P6243, P6245, P6249, P6139A[1], or P6339A |
| **Prerequisites** | None |

[1] **P6139A probe is not appropriate for the TDS694C/794D oscilloscopes.**

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

**a.** *Hook up the signal source:* Install the probe on **CH 1**. Connect the probe tip to **PROBE COMPENSATION SIGNAL** on the front panel; connect the probe ground (typically black) to **PROBE COMPENSATION GND**. If using a P6243, P6245 or P6249 probe, you may want to attach a Y-lead connector and two SMD KlipChips as shown in Figure 4–3.

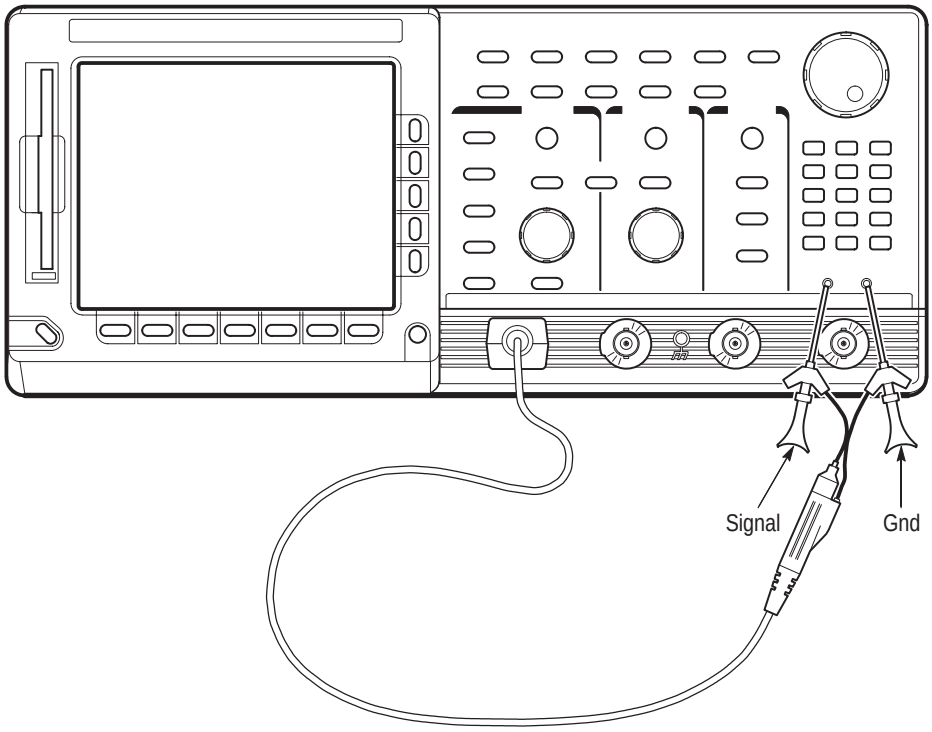



**Figure 4–3: Universal test hookup for functional tests – TDS 600C shown**

**b.** *Initialize the oscilloscope:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**2.** *Verify that all channels operate:* Do the following substeps — test CH 1 first, *skipping substep **a** and **b** since CH 1 is already set up for verification and as the trigger source from step **1**.*

**a.** *Select an unverified channel:*

- Press **WAVEFORM OFF** to remove the channel just verified from display.
- Press the front-panel button that corresponds to the channel you are to verify.
- Move the probe to the channel you selected.

**b.** *Match the trigger source to the channel selected:*

- Press **TRIGGER MENU**.
- Press the main-menu button **Source**.
- Press the side-menu button that corresponds to the channel selected, **Ch2**, **Ch3**, or **Ch4**. (Some TDS models use **Ax1** and **Ax2** instead of **Ch3** and **Ch4**).

**c.** *Set up the selected channel:*

- Set the vertical **SCALE** to 200 mV.
- Set the horizontal **SCALE** to 200 μs. Press **CLEAR MENU** to remove any menu that may be on the screen.
- Press **SET LEVEL TO 50%**.

**d.** *Verify that the channel is operational:* Confirm that the following statements are true.

- The vertical scale readout for the channel under test shows a setting of 200 mV, and a square-wave probe-compensation signal about 2.5 divisions in amplitude is on-screen. See Figure 4–1 on page 4–3 to locate the readout.
- The vertical **POSITION** knob moves the signal up and down the screen when rotated.
- Turning the vertical **SCALE** knob counterclockwise decreases the amplitude of the waveform on-screen, turning the knob clockwise increases the amplitude, and returning the knob to 200 mV returns the amplitude to about 2.5 divisions.

**e.** *Verify that the channel acquires in all acquisition modes:* Press **SHIFT**; then press **ACQUIRE MENU**. Use the side menu to select, in turn, each of the three hardware acquire 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).



- Peak Detect mode displays an actively acquiring waveform on-screen with the noise present in Sample mode "peak detected."



- Hi Res mode (TDS 500D and 700D/L only) displays an actively acquiring waveform on-screen with the noise that was present in Sample mode reduced.



- 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.

**f.** *Test all channels:* Repeat substeps **a** through **e** until all four input channels are verified.

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

## Verify the Time Base

| | |
|---|---|
| **Equipment required** | One probe such as the P6243, P6245, P6249, P6139A[1], or P6339A |
| **Prerequisites** | None |

[1] **P6139A probe is not appropriate for the TDS694C/794D oscilloscopes.**

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

**a.** *Hook up the signal source:* Install the probe on **CH 1**. Connect the probe tip to **PROBE COMPENSATION SIGNAL** on the front panel; connect the probe ground to **PROBE COMPENSATION GND**. See Figure 4–3 on page 4–8.

**b.** *Initialize the oscilloscope:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**; then press the side-menu button **OK Confirm Factory Init**.

**c.** *Modify default settings:*

- Set the vertical **SCALE** to 200 mV.
- Set the horizontal **SCALE** to 200 µs.
- Press **SET LEVEL TO 50%**.
- 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-compensation signal is about five horizontal divisions on-screen for the 200 µs horizontal scale setting (set in step **1c**).

   **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 200 µs returns the period to about five 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-compensation terminals.

## Verify the Main and Delayed Trigger Systems

| | |
|---|---|
| **Equipment required** | One probe such as the P6243, P6245, P6249, P6139A[1], or P6339A |
| **Prerequisites** | None |

[1] **P6139A probe is not appropriate for the TDS694C/794D oscilloscopes.**

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

   **a.** *Hook up the signal source:* Install the probe on **CH 1**. Connect the probe tip to **PROBE COMPENSATION SIGNAL** on the front panel; connect the probe ground to **PROBE COMPENSATION GND**. See Figure 4–3 on page 4–8.

   **b.** *Initialize the oscilloscope:*

   - Press save/recall **SETUP**.
   - Press the main-menu button **Recall Factory Setup**.
   - Press the side-menu button **OK Confirm Factory Init**.

   **c.** *Modify default settings:*

   - Set the vertical **SCALE** to 200 mV.
   - Set the horizontal **SCALE** for the **M** (main) time base to 200 µs.

- Press **SET LEVEL TO 50%**.
- Press **TRIGGER MENU**.
- Press the main-menu button **Mode & Holdoff**.
- Press the side-menu button **Normal**.
- Press **CLEAR MENU** to remove the menus from the screen.

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

- The trigger level readout for the main trigger system changes with the trigger-**LEVEL** knob.
- The trigger-**LEVEL** knob can trigger and untrigger the square-wave signal as you rotate it. (Leave the signal *un*triggered, which is indicated by the display not updating).
- 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.** *Select the delayed time base:*

- Press **HORIZONTAL MENU**.
- Press the main-menu button **Time Base**.
- Press the side-menu button **Delayed Triggerable**; then press the side-menu button **Delayed Only**.
- Set the horizontal **SCALE** for the **D** (delayed) time base to 200 µs.

**b.** *Select the delayed trigger level menu:*

- Press **SHIFT**; then press **DELAYED TRIG**.
- Press the main-menu button **Level**; then press the side-menu button **Level**.

**c.** *Confirm that the following statements are tru*e:

- The trigger-level readout for the delayed trigger system changes as you turn the general purpose knob.
- As you rotate the general purpose knob, the square-wave probe-compensation signal can become triggered and untriggered. (Leave the signal *un*triggered, which is indicated by the display not updating).

- Pressing the side-menu button **Set to 50%** triggers the probe-compensation signal that you just left untriggered. (Leave the signal triggered).

**d.** *Verify the delayed trigger counter:*

- Press the main-menu button **Delay by *Time***.
- Use the keypad to enter a delay time of 1 second. Press **1**, then press **ENTER**.
- Verify that the trigger **READY** indicator on the front panel flashes about once every second as the waveform is updated on-screen.

**4.** *Remove the test hookup:* Disconnect the probe from the channel input and the probe-compensation terminals.

## Verify the File System

| | |
|---|---|
| **Equipment required** | One probe such as the P6243, P6245, P6249, P6139A[1], or P6339A<br>One 720 K or 1.44 Mbyte, 3.5 inch DOS-compatible disk.<br>You can use a disk of your own or you can use the TDS Family Programmer Disk included in your user manual. |
| **Prerequisites** | None |

1 **P6139A probe is not appropriate for the TDS694C/794D oscilloscopes.**

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

**a.** *Hook up the signal source:* Install the probe on **CH 1**. Connect the probe tip to **PROBE COMPENSATION SIGNAL** on the front panel; connect the probe ground to **PROBE COMPENSATION GND**. See Figure 4–3 on page 4–8.

**b.** *Insert the test disk:* Insert the floppy disk in the floppy disk drive to the left of the monitor.

- Position the disk so the metal shutter faces the drive.
- Position the disk so the stamped arrow is on the top right side. In other words, place the angled corner in the front bottom location.
- Push the disk into the drive until it goes all the way in and clicks into place.

**c.** *Initialize the oscilloscope:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**d.** *Modify default settings:*

- Set the vertical **SCALE** to 200 mV.
- Set the horizontal **SCALE** for the **M** (main) time base to 200 µs. Notice the waveform on the display now shows two cycles instead of five.
- Press **SET LEVEL TO 50%**.
- Press **CLEAR MENU** to remove the menus from the screen.

**e.** *Save the settings:*

- Press **SETUP**.
- Press the main-menu button **Save Current Setup**; then press the side-menu button **To File**.
- Turn the general purpose knob to select the file to save. Choose `TEK?????.SET` (or **fd0:**, the floppy disk drive, **hd0:**, the optional hard disk drive, or **Zip:**, if an external Zip drive is connected). 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 oscilloscope will assign the name `TEK00000.SET` to your file. If you ran the procedure again, the oscilloscope would increment the name and call the file `TEK00001.SET`.

---

***NOTE.*** *If testing an external Zip drive, it must first be connected to the oscilloscope, then be powered on simultaneously with the oscilloscope, or immediately after the oscilloscope is powered-on. This ensures proper communications are set up between the oscilloscope and the Zip drive.*

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**f.** To test the optional hard disk drive or external Zip drive, choose either the hard disk drive (**hd0:**), or the external Zip drive (**Zip:**). Then use the general purpose knob to select the file to save. Save the file as in step **e.**

- Press the side-menu button **Save To Selected File**.

**2.** *Verify the file system works:*

- Press the main-menu button **Recall Factory Setup** and the side-menu button **OK Confirm Factory Init** to restore the 500 µs time base and the five cycle waveform.
- Press the main-menu button **Recall Saved Setup**; then press the side-menu button **From File**.

- Turn the general purpose knob to select the file to recall. For example, if you followed the instructions previously and saved the file to either the floppy disk drive (**fd0:**), or the optional hard disk drive (**hd0:**), you had the oscilloscope assign the name TEK00000.SET to your file.
- Press the side-menu button **Recall From Selected File**.
- Verify that the oscilloscope retrieved the saved setup from the disk. Do this by noticing the horizontal **SCALE** for the **M** (main) time base is again 200 µs and the waveform shows only two cycles just as it was when you saved the setup.

**3.** *Remove the test hookup:*

- Disconnect the probe from the channel input and the probe-compensation terminals.
- Remove the floppy disk from the floppy disk drive.

# Performance Tests

This section contains a collection of procedures for checking that the TDS 500D, TDS 600C, TDS 700D, and TDS 714L Oscilloscopes perform as warranted.

The procedures are arranged in four logical groupings: *Signal Acquisition System Check*s, *Time Base System Checks*, *Triggering System Checks*, and *Output Ports Checks*. They check all the characteristics that are designated as checked in *Specifications*. (The characteristics that are checked appear in **boldface** type under *Warranted Characteristics* in *Specifications*).

***STOP.*** *These procedures extend the confidence level provided by the basic procedures described on page 4–5. The basic procedures should be done first, then these procedures performed if desired.*

## Prerequisites

The tests in this section comprise an extensive, valid confirmation of performance and functionality when the following requirements are met:

- The cabinet must be installed on the oscilloscope.
- You must have performed and passed the procedures under *Self Tests*, found on page 4–5, and those under *Functional Tests*, found on page 4–7.
- A signal-path compensation must have been done within the recommended calibration interval and at a temperature within ±5° C of the present operating temperature. (If at the time you did the prerequisite *Self Tests*, the temperature was within the limits just stated, consider this prerequisite met).
- The oscilloscope 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 temperatures as follows: +4° C to +40° C for the TDS 694C, +4° C to +45° C for other TDS 600C and 0° C to +50° C for the TDS 500D, TDS 700D, and TDS 714L. (The warm-up requirement is usually met in the course of meeting the Self Tests and Functional Tests prerequisites listed above).

## Equipment Required

Procedures starting on page 4–35, use external, traceable signal sources to directly check warranted characteristics. Table 4–1 lists the required equipment.

**Table 4–1: Test equipment**

| Item number and description | Minimum requirements | Example | Purpose |
|---|---|---|---|
| 1. Attenuator,10X (two required) | Ratio: 10X; impedance 50 Ω; connectors: female BNC input, male BNC output | Tektronix part number 011-0059-02 | Signal Attenuation |
| 2. Attenuator, 5X | Ratio: 5X; impedance 50 Ω; connectors: female BNC input, male BNC output | Tektronix part number 011-0060-02 | Signal Attenuation |
| 3. Adapter, BNC female-to-Clip Leads | BNC female-to-Clip Leads | Tektronix part number 013-0076-00 | Signal Coupling for Probe Compensator Output Check |
| 4. 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 |
| 5. Cable, Precision 50 Ω Coaxial (three required) | 50 Ω, 36 in, male-to-male BNC connectors | Tektronix part number 012-0482-00 | Signal Interconnection |
| 6. Connector, Dual-Banana (two required) | Female BNC-to-dual banana | Tektronix part number 103-0090-00 | Various Accuracy Tests |
| 7. Connector, BNC "T" | Male BNC-to-dual female BNC | Tektronix part number 103-0030-00 | Checking Trigger Sensitivity |
| 8. Coupler, Dual-Input | Female BNC-to-dual male BNC | Tektronix part number 067-0525-02 | Checking Delay Between Channels |
| 9. Generator, DC Calibration | Variable amplitude to ±104 V; accuracy to 0.1% | Data Precision 8200[1] | Checking DC Offset, Gain, and Measurement Accuracy |
| 10. Generator, Calibration | 500 mV square wave calibrator amplitude; accuracy to 0.25% | Tegam/Tektronix PG 506A Calibration Generator[1,3] | To check accuracy of CH 3 Signal Out |
| 11. Generator, Time Mark (optional) | Variable marker frequency from 10 ms to 10 ns; accuracy within 2 ppm | Tegam/Tektronix TG 501A Time Mark Generator[1,3] | Checking Sample-Rate and Delay-time Accuracy |
| 12. Probe, 10X | A P6139A[2], P6243, P6249, P6245, or P6339A probe[4] | Tektronix part number P6139A or P6245 | Signal Interconnection |
| 13. 3.5 inch, 720 K or 1.44 Mbyte, DOS-compatible floppy disk | | TDS Family Programmer Disk (Tektronix part number 063–3120–00), included with User Manual (Tektronix part number 071–0130-XX) | Checking File System Basic Functionality |
| 14. Generator, Sine Wave | 250 kHz to at least 500 MHz (higher for higher-bandwidth scopes). Variable amplitude from 60 mV to 2 $V_{p-p}$ into 50 Ω. Frequency error >2.0% | Rohde & Schwarz SMT or SMY[1,5] | Checking Analog Bandwidth, Trigger Sensitivity, Sample-rate, External Clock, and Delay-Time Accuracy |

**Table 4–1: Test equipment (cont.)**

| Item number and description | Minimum requirements | Example | Purpose |
|---|---|---|---|
| 15. Meter, Level and Power Sensor | Frequency range:10 MHz to the oscilloscope bandwidth. Amplitude range: 6 $mV_{p-p}$ to 2 $V_{p-p}$ | Rohde & Schwarz URV 35, with NRV-Z8 power sensor[1,5] | Checking Analog Bandwidth and Trigger Sensitivity |
| 16. Splitter, Power | Frequency range: DC to 3 GHz. Tracking: >2.0% | Tektronix part number[1,5] 015-0565-00 | Checking Analog Bandwidth |
| 17. Adapter (four required) | Male N-to-female BNC | Tektronix part number 103-0045-00 | Checking Analog Bandwidth |
| 18. Adapter | Female N-to-male BNC | Tektronix part number 103-0058-00 | Checking Analog Bandwidth |
| 19. Adapter | 3 SMA male-to-male | Tektronix part number 015-1012-00 | Checking the delay between channels |
| 20. Adapter | 3 SMA female-to-male BNC | Tektronix part number 015-1018-00 | Checking the delay between channels |
| 21. Generator, Video Signal | Provides PAL compatible outputs | Tektronix TSG 121 | Used to Test Video Option 05 Equipped Instruments Only |
| 22. Oscillator, Leveled Sine wave Generator | 60 Hz Sine wave | Tegam/Tektronix SG 502 (if available)[1,3] | Used to Test Video Option 05 Equipped Instruments Only |
| 23. Pulse Generator | | Tektronix CFG280 (or Tegam/Tektronix PG 502)[3] | Used to Test Video Option 05 Equipped Instruments Only |
| 24. Cable, Coaxial (two required) | 75 Ω, 36 in, male-to-male BNC connectors | Tektronix part number 012-1338-00 | Used to Test Video Option 05 Equipped Instruments Only |
| 25. Terminator, 75 Ω (two required) | Impedance 75 Ω; connectors: female BNC input, male BNC output | Tektronix part number 011-0102-01 | Used to Test Video Option 05 Equipped Instruments Only |
| 26. Generator, Optical Impulse | 850 nm optical impulse | Tektronix OIG501 Optical Impulse Generator[3] | Checking Option 3C |
| 27. Generator, Optical Impulse | 1300 nm optical impulse | Tektronix OIG502 Optical Impulse Generator[3] | Checking Option 4C |
| 28. Cable, Coaxial (two required) | 50 Ω, 20 in, male-to-male SMA connectors | Tektronix part number 174-1427-00 | Used to Test Delta Time Measurement Accuracy |
| 29. Adapter | SMA "T", male to 2 SMA female | Tektronix part number 015-1016-00 | Used to Test Delta Time Measurement Accuracy |
| 30. Adapter | SMA female to BNC male | Tektronix part number 015-0572-00 | Used to Test Delta Time Measurement Accuracy |
| 31. Adapter | BNC male to female elbow | Tektronix part number 103-0031-00 | Used to Test Delta Time Measurement Accuracy |
| 32. Terminator | Short circuit, SMA connector | Tektronix part number 015-1021-00 | Used to Test Delta Time Measurement Accuracy |
| 33. Attenuator, 2X | Ratio: 2X; impedance 50 Ω; connectors: female BNC input, male BNC output | Tektronix part number 011-0069-02 | Used to Test Delta Time Measurement Accuracy |

**Table 4–1: Test equipment (cont.)**

| Item number and description | Minimum requirements | Example | Purpose |
|---|---|---|---|
| 34. Attenuator, Optical | 62.5 micron optical attenuator | Tektronix OA5022 Optical Attenuator[3] | Checking Option 3C and 4C |
| 35. Cable, Fiber Optic | FC-FC fiber cable | Tektronix part number 174-2322-00 | Checking Option 3C and 4C |
| 36. Optical-to-Electrical Converter | P6701B (used with Option 3C) or P6703B (used with Option 4C) optical-to-electrical converter | Tektronix part number P6701B or P6703B | Checking Option 3C and 4C |

**1 You may replace items 9, 10, 11, 14, 15, 16, and 22 with a Wavetek 9100 (with options 100 and 600) for 500 MHz oscilloscopes, or a Wavetek 9500 (with option 100) and output head appropriate for the bandwidth of the oscilloscope(s) being tested. For 3 GHz oscilloscopes use a Wavetek 9530 head.**

**2 P6139A probe is not appropriate for the TDS694C/794D oscilloscopes.**

**3 Requires a TM 500 or TM 5000 Series Power Module Mainframe. For Delta Time Measurement Accuracy use a Wavetek 9500 or a pulse generator with a rise time as shown in Table 4–6 on page 4–58.**

**4 Warning: The P6243 and P6245 probes that may be used with this oscilloscope provide an extremely low loading capacitance (<1 pF) to ensure the best possible signal reproduction. These probes should not be used to measure signals exceeding ±8 V, or errors in signal measurement will be observed. Above 40 V, damage to the probe may result. To make measurements beyond ±8 V, use either the P6139A probe (good to 500 V), or refer to the catalog for a recommended probe. P6139A is not an appropriate probe for the TDS 694C or TDS 794D oscilloscopes.**

**5 If available, you may replace items 14, 15, and 16 with the following set of equipment for bandwidths up to 1 GHz: a Tegam/Tektronix SG503 and SG504 with SG504 leveling head.**

# TDS 600C Test Record

Photocopy this and the next three pages and use them to record the performance test results for your TDS 600C. The TDS 694C Test Record begins on page 4–29.

### TDS 600C Test Record

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS 600C Performance Test | | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|---|
| Offset Accuracy | | | | | |
| CH1 Offset | +1 mV<br>+101 mV<br>+1.01 V | – 2.1 mV<br>– 75.6 mV<br>– 756 mV | _____<br>_____<br>_____ | _____<br>_____<br>_____ | + 2.1 mV<br>+ 75.6 mV<br>+ 756 mV |
| CH2 Offset | +1 mV<br>+101 mV<br>+1.01 V | – 2.1 mV<br>– 75.6 mV<br>– 756 mV | _____<br>_____<br>_____ | _____<br>_____<br>_____ | + 2.1 mV<br>+ 75.6 mV<br>+ 756 mV |
| CH3 or AX1 Offset | +1 mV<br>+101 mV<br>+1.01 V | – 2.1 mV<br>– 75.6 mV<br>– 756 mV | _____<br>_____<br>_____ | _____<br>_____<br>_____ | + 2.1 mV<br>+ 75.6 mV<br>+ 756 mV |
| CH4 or AX2 Offset | +1 mV<br>+101 mV<br>+1.01 V | – 2.1 mV<br>– 75.6 mV<br>– 756 mV | _____<br>_____<br>_____ | _____<br>_____<br>_____ | + 2.1 mV<br>+ 75.6 mV<br>+ 756 mV |
| DC Voltage Measurement Accuracy (Averaged) | | | | | |
| CH1 | 5 mV Vert scale setting, –5 Div position setting, +1 V offset | + 1.0329 V | _____ | _____ | + 1.0471 V |
| CH1 | 5 mV Vert scale setting, +5 Div position setting, –1 V offset | – 1.0471 V | _____ | _____ | – 1.0329 V |
| CH1 | 200 mV Vert scale setting, –5 Div position setting, +10 V offset | + 11.4165 V | _____ | _____ | + 11.7835 V |
| CH1 | 200 mV Vert scale setting, +5 Div position setting, –10 V offset | – 11.7835 V | _____ | _____ | – 11.4165 V |
| CH1 | 1.01 V Vert scale setting, –5 Div position setting, +10 V offset | + 17.102 V | _____ | _____ | + 18.899 V |
| CH1 | 1.01 V Vert scale setting, +5 Div position setting, –10 V offset | – 18.899 V | _____ | _____ | – 17.102 V |
| CH2 | 5 mV Vert scale setting, –5 Div position setting, +1 V offset | + 1.0329 V | _____ | _____ | + 1.0471 V |
| CH2 | 5 mV Vert scale setting, +5 Div position setting, –1 V offset | – 1.0471 V | _____ | _____ | – 1.0329 V |
| CH2 | 200 mV Vert scale setting, –5 Div position setting, +10 V offset | + 11.4165 V | _____ | _____ | + 11.7835 V |

**TDS 600C Test Record (cont.)**

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS 600C Performance Test | | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|---|
| CH2 | 200 mV Vert scale setting, +5 Div position setting, –10 V offset | – 11.7835 V | _____ | _____ | – 11.4165 V |
| CH2 | 1.01 V Vert scale setting, –5 Div position setting, +10 V offset | + 17.102 V | _____ | _____ | + 18.899 V |
| CH2 | 1.01 V Vert scale setting, +5 Div position setting, –10 V offset | – 18.899 V | _____ | _____ | – 17.102 V |
| CH3 or AX1 | 5 mV Vert scale setting, –5 Div position setting, +1 V offset | + 1.0329 V | _____ | _____ | + 1.0471 V |
| CH3 or AX1 | 5 mV Vert scale setting, +5 Div position setting, –1 V offset | – 1.0471 V | _____ | _____ | – 1.0329 V |
| CH3 or AX1 | 200 mV Vert scale setting, –5 Div position setting, +10 V offset | + 11.4165 V | _____ | _____ | + 11.7835 V |
| CH3 or AX1 | 200 mV Vert scale setting, +5 Div position setting, –10 V offset | – 11.7835 V | _____ | _____ | – 11.4165 V |
| CH3 or AX1 | 1.01 V Vert scale setting, –5 Div position setting, +10 V offset | + 17.102 V | _____ | _____ | + 18.899 V |
| CH3 or AX1 | 1.01 V Vert scale setting, +5 Div position setting, –10 V offset | – 18.899 V | _____ | _____ | – 17.102 V |
| CH4 or AX2 | 5 mV Vert scale setting, –5 Div position setting, +1 V offset | + 1.0329 V | _____ | _____ | + 1.0471 V |
| CH4 or AX2 | 5 mV Vert scale setting, +5 Div position setting, –1 V offset | – 1.0471 V | _____ | _____ | – 1.0329 V |
| CH4 or AX2 | 200 mV Vert scale setting, –5 Div position setting, +10 V offset | + 11.4165 V | _____ | _____ | + 11.7835 V |
| CH4 or AX2 | 200 mV Vert scale setting, +5 Div position setting, –10 V offset | – 11.7835 V | _____ | _____ | – 11.4165 V |
| CH4 or AX2 | 1.01 V Vert scale setting, –5 Div position setting, +10 V offset | + 17.102 V | _____ | _____ | + 18.899 V |
| CH4 or AX2 | 1.01 V Vert scale setting, +5 Div position setting, –10 V offset | – 18.899 V | _____ | _____ | – 17.102 V |
| Analog Bandwidth | | | | | |
| CH1 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH2 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH3 or AX1 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH4 or AX2 | 100 mV | 424 mV | _____ | _____ | N/A |

**TDS 600C Test Record (cont.)**

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS 600C Performance Test | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|
| Delay Between Channels | | | | |
| Delay Between Channels | N/A | _____ | _____ | 100 ps |
| Time Base System | | | | |
| Long Term Sample Rate/ Delay Time @ 500 ns/10 ms | –2.0 Div | _____ | _____ | +2.0 Div |
| Trigger System Accuracy | | | | |
| Pulse-Glitch or Pulse-Width, Hor. scale ≤ 1 µs | | | | |
| Lower Limit | 3.5 ns | _____ | _____ | 6.5 ns |
| Upper Limit | 3.5 ns | _____ | _____ | 6.5 ns |
| Pulse-Glitch or Pulse-Width, Hor. scale > 1 µs | | | | |
| Lower Limit | 1.9 µs | _____ | _____ | 2.1 µs |
| Upper Limit | 1.9 µs | _____ | _____ | 2.1 µs |
| CH1 Sensitivity, 50 MHz, Main | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, 50 MHz, Delayed | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 AUX Trigger Input | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, 1 GHz, Main | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, 1 GHz, Delayed | Pass/Fail | _____ | _____ | Pass/Fail |
| Output Signal Checks | | | | |
| MAIN TRIGGER OUTPUT, 1 MΩ | | | | |
| High | High ≥ 2.5 V | _____ | _____ | |
| Low | | _____ | _____ | Low ≤ 0.7 V |
| MAIN TRIGGER OUTPUT, 50 Ω | | | | |
| High | High ≥ 1.0 V | _____ | _____ | |
| Low | | _____ | _____ | Low ≤ 0.25 V |
| DELAYED TRIGGER OUTPUT, 50 Ω | | | | |
| | High ≥ 1.0 V | _____ | _____ | |
| | | _____ | _____ | Low ≤ 0.25 V |
| DELAYED TRIGGER OUTPUT, 1 MΩ | | | | |
| | High ≥ 2.5 V | _____ | _____ | |
| | | _____ | _____ | Low ≤ 0.7 V |

**TDS 600C Test Record (cont.)**

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

| TDS 600C Performance Test | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|
| CH 3 or AX1 SIGNAL OUTPUT, 1 MΩ | p-p ≥ 80 mV | _____ | _____ | p-p ≤ 120 mV |
| CH 3 or AX1 SIGNAL OUTPUT, 50 Ω | p-p ≥ 40 mV | _____ | _____ | p-p ≤ 60 mV |
| Probe Compensator Output Signal | | | | |
| Frequency (CH1 Freq). | 950 Hz | _____ | _____ | 1.050 kHz |
| Voltage (difference) | 495 mV | _____ | _____ | 505 mV |

# TDS 500D/700D/714L Test Record

Photocopy this and the next three pages and use them to record the performance test results for your TDS 500D/700D/714L. The TDS 794D Test Record begins on page 4–32.

### TDS 500D/700D/714L Test Record

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS 500D/700D/714L Performance Test | | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|---|
| Offset Accuracy | | | | | |
| CH1 Offset | +1 mV | – 1.6 mV | _____ | _____ | + 1.6 mV |
| | +101 mV | – 25.1 mV | _____ | _____ | + 25.1 mV |
| | +1.01 V | – 251 mV | _____ | _____ | + 251 mV |
| CH2 Offset | +1 mV | – 1.6 mV | _____ | _____ | + 1.6 mV |
| | +101 mV | – 25.1 mV | _____ | _____ | + 25.1 mV |
| | +1.01 V | – 251 mV | _____ | _____ | + 251 mV |
| CH3 or AX1 Offset | +1 mV | – 1.6 mV | _____ | _____ | + 1.6 mV |
| | +101 mV | – 25.1 mV | _____ | _____ | + 25.1 mV |
| | +1.01 V | – 251 mV | _____ | _____ | + 251 mV |
| CH4 or AX2 Offset | +1 mV | – 1.6 mV | _____ | _____ | + 1.6 mV |
| | +101 mV | – 25.1 mV | _____ | _____ | + 25.1 mV |
| | +1.01 V | – 251 mV | _____ | _____ | + 251 mV |
| DC Voltage Measurement Accuracy (Averaged) | | | | | |
| CH1 | 5 mV Vert scale setting, –5 Div position setting, +1 V offset | + 1.0355 V | _____ | _____ | + 1.0445 V |
| CH1 | 5 mV Vert scale setting, +5 Div position setting, –1 V offset | – 1.0445 V | _____ | _____ | – 1.0355 V |
| CH1 | 200 mV Vert scale setting, –5 Div position setting, +10 V offset | + 11.5195 V | _____ | _____ | + 11.6805 V |
| CH1 | 200 mV Vert scale setting, +5 Div position setting, –10 V offset | – 11.6805 V | _____ | _____ | – 11.5195 V |
| CH1 | 1.01 V Vert scale setting, –5 Div position setting, +10 V offset | + 17.621 V | _____ | _____ | + 18.379 V |
| CH1 | 1.01 V Vert scale setting, +5 Div position setting, –10 V offset | – 18.379 V | _____ | _____ | – 17.621 V |
| CH2 | 5 mV Vert scale setting, –5 Div position setting, +1 V offset | + 1.0355 V | _____ | _____ | + 1.0445 V |
| CH2 | 5 mV Vert scale setting, +5 Div position setting, –1 V offset | – 1.0445 V | _____ | _____ | – 1.0355 V |
| CH2 | 200 mV Vert scale setting, –5 Div position setting, +10 V offset | + 11.5195 V | _____ | _____ | + 11.6805 V |

**TDS 500D/700D/714L Test Record (cont.)**

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS 500D/700D/714L Performance Test | | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|---|
| CH2 | 200 mV Vert scale setting, +5 Div position setting, –10 V offset | – 11.6805 V | _____ | _____ | – 11.5195 V |
| CH2 | 1.01 V Vert scale setting, –5 Div position setting, +10 V offset | + 17.621 V | _____ | _____ | + 18.379 V |
| CH2 | 1.01 V Vert scale setting, +5 Div position setting, –10 V offset | – 18.379 V | _____ | _____ | – 17.621 V |
| CH3 or AX1 | 5 mV Vert scale setting, –5 Div position setting, +1 V offset | + 1.0355 V | _____ | _____ | + 1.0445 V |
| CH3 or AX1 | 5 mV Vert scale setting, +5 Div position setting, –1 V offset | – 1.0445 V | _____ | _____ | – 1.0355 V |
| CH3 or AX1 | 200 mV Vert scale setting, –5 Div position setting, +10 V offset | + 11.5195 V | _____ | _____ | + 11.6805 V |
| CH3 or AX1 | 200 mV Vert scale setting, +5 Div position setting, –10 V offset | – 11.6805 V | _____ | _____ | – 11.5195 V |
| CH3 or AX1 | 1.01 V Vert scale setting, –5 Div position setting, +10 V offset | + 17.621 V | _____ | _____ | + 18.379 V |
| CH3 or AX1 | 1.01 V Vert scale setting, +5 Div position setting, –10 V offset | – 18.379 V | _____ | _____ | – 17.621 V |
| CH4 or AX2 | 5 mV Vert scale setting, –5 Div position setting, +1 V offset | + 1.0355 V | _____ | _____ | + 1.0445 V |
| CH4 or AX2 | 5 mV Vert scale setting, +5 Div position setting, –1 V offset | – 1.0445 V | _____ | _____ | – 1.0355 V |
| CH4 or AX2 | 200 mV Vert scale setting, –5 Div position setting, +10 V offset | + 11.5195 V | _____ | _____ | + 11.6805 V |
| CH4 or AX2 | 200 mV Vert scale setting, +5 Div position setting, –10 V offset | – 11.6805 V | _____ | _____ | – 11.5195 V |
| CH4 or AX2 | 1.01 V Vert scale setting, –5 Div position setting, +10 V offset | + 17.621 V | _____ | _____ | + 18.379 V |
| CH4 or AX2 | 1.01 V Vert scale setting, +5 Div position setting, –10 V offset | – 18.379 V | _____ | _____ | – 17.621 V |
| Analog Bandwidth | | | | | |
| CH1 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH2 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH3 or AX1 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH4 or AX2 | 100 mV | 424 mV | _____ | _____ | N/A |

**TDS 500D/700D/714L Test Record (cont.)**

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS 500D/700D/714L Performance Test | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|
| Delay Between Channels | N/A | _____ | _____ | 50 ps |
| Time Base System | | | | |
| Long Term Sample Rate/ Delay Time @ 100 ns/10.0 ms | –2.5 Div | _____ | _____ | +2.5 Div |
| Trigger System Accuracy | | | | |
| Pulse-Glitch or Pulse-Width, Hor. scale ≤ 1 µs | | | | |
| Lower Limit | 3.5 ns | _____ | _____ | 6.5 ns |
| Upper Limit | 3.5 ns | _____ | _____ | 6.5 ns |
| Pulse-Glitch or Pulse-Width, Hor. scale > 1 µs | | | | |
| Lower Limit | 1.9 µs | _____ | _____ | 2.1 µs |
| Upper Limit | 1.9 µs | _____ | _____ | 2.1 µs |
| CH1 Sensitivity, 50 MHz, Main | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, 50 MHz, Delayed | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 AUX Trigger Input | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, full bandwidth, Main | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, full bandwidth, Delayed | Pass/Fail | _____ | _____ | Pass/Fail |
| Output Signal Checks | | | | |
| MAIN TRIGGER OUTPUT, 1 MΩ | | | | |
| High | High ≥ 2.5 V | _____ | _____ | |
| Low | | _____ | _____ | Low ≤ 0.7 V |
| MAIN TRIGGER OUTPUT, 50 Ω | | | | |
| High | High ≥ 1.0 V | _____ | _____ | |
| Low | | _____ | _____ | Low ≤ 0.25 V |
| DELAYED TRIGGER OUTPUT, 50 Ω | | | | |
| High | High ≥ 1.0 V | _____ | _____ | |
| Low | | _____ | _____ | Low ≤ 0.25 V |
| DELAYED TRIGGER OUTPUT, 1 MΩ | | | | |
| High | High ≥ 2.5 V | _____ | _____ | |
| Low | | _____ | _____ | Low ≤ 0.7 V |

**TDS 500D/700D/714L Test Record (cont.)**

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS 500D/700D/714L Performance Test | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|
| CH 3 or AX 1 SIGNAL OUTPUT, 1 MΩ | p-p ≥ 88 mV | _____ | _____ | p-p ≤ 132 mV |
| CH 3 or AX 1 SIGNAL OUTPUT, 50 Ω | p-p ≥ 44 mV | _____ | _____ | p-p ≤ 66 mV |
| Probe Compensator Output Signal | | | | |
| Frequency (CH1 Freq). | 950 Hz | _____ | _____ | 1.050 kHz |
| Voltage (difference) | 495 mV | _____ | _____ | 505 mV |

# TDS694C Test Record

Photocopy this and the next two pages and use them to record the performance test results for your TDS694C.

**TDS694C Test Record**

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS694C Performance Test | | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|---|
| Offset Accuracy | | | | | |
| CH1 Offset | +10 mV<br>+101 mV | – 2.5 mV<br>– 25.1 mV | _____<br>_____ | _____<br>_____ | + 2.5 mV<br>+ 25.1 mV |
| CH2 Offset | +10 mV<br>+101 mV | – 2.5 mV<br>– 25.1 mV | _____<br>_____ | _____<br>_____ | + 2.5 mV<br>+ 25.1 mV |
| CH3 Offset | +10 mV<br>+101 mV | – 2.5 mV<br>– 25.1 mV | _____<br>_____ | _____<br>_____ | + 2.5 mV<br>+ 25.1 mV |
| CH4 Offset | +10 mV<br>+101 mV | – 2.5 mV<br>– 25.1 mV | _____<br>_____ | _____<br>_____ | + 2.5 mV<br>+ 25.1 mV |
| DC Voltage Measurement Accuracy (Averaged) | | | | | |
| CH1 | 10 mV Vert scale setting,<br>–5 Div position setting, +.5 V offset | +0.5755 V | _____ | _____ | +0.5845 V |
| CH1 | 10 mV Vert scale setting,<br>+5 Div position setting, –.5 V offset | –0.5845 V | _____ | _____ | –0.5755 V |
| CH1 | 200 mV Vert scale setting,<br>0 Div position setting, +5 V offset | +4.828 V | _____ | _____ | +5.172 V |
| CH1 | 200 mV Vert scale setting,<br>0 Div position setting, –5 V offset | –5.172 V | _____ | _____ | –4.828 V |
| CH1 | 1 V Vert scale setting,<br>0 Div position setting, +2.5 V offset | +4.738 V | _____ | _____ | +5.263 V |
| CH1 | 1 V Vert scale setting,<br>0 Div position setting, –2.5 V offset | –5.263 V | _____ | _____ | –4.738 V |
| CH2 | 10 mV Vert scale setting,<br>–5 Div position setting, +.5 V offset | +0.5755 V | _____ | _____ | +0.5845 V |
| CH2 | 10 mV Vert scale setting,<br>+5 Div position setting, –.5 V offset | –0.5845 V | _____ | _____ | –0.5755 V |
| CH2 | 200 mV Vert scale setting,<br>0 Div position setting, +5 V offset | +4.828 V | _____ | _____ | +5.172 V |

**TDS694C Test Record (cont.)**

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS694C Performance Test | | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|---|
| CH2 | 200 mV Vert scale setting, 0 Div position setting, –5 V offset | –5.172 V | _____ | _____ | –4.828 V |
| CH2 | 1 V Vert scale setting, 0 Div position setting, +2.5 V offset | +4.738 V | _____ | _____ | +5.263 V |
| CH2 | 1 V Vert scale setting, 0 Div position setting, –2.5 V offset | –5.263 V | _____ | _____ | –4.738 V |
| CH3 | 10 mV Vert scale setting, –5 Div position setting, +.5 V offset | +0.5755 V | _____ | _____ | +0.5845 V |
| CH3 | 10 mV Vert scale setting, +5 Div position setting, –.5 V offset | –0.5845 V | _____ | _____ | –0.5755 V |
| CH3 | 200 mV Vert scale setting, 0 Div position setting, +5 V offset | +4.828 V | _____ | _____ | +5.172 V |
| CH3 | 200 mV Vert scale setting, 0 Div position setting, –5 V offset | –5.172 V | _____ | _____ | –4.828 V |
| CH3 | 1 V Vert scale setting, 0 Div position setting, +2.5 V offset | +4.738 V | _____ | _____ | +5.263 V |
| CH3 | 1 V Vert scale setting, 0 Div position setting, –2.5 V offset | –5.263 V | _____ | _____ | –4.738 V |
| CH4 | 10 mV Vert scale setting, –5 Div position setting, +.5 V offset | +0.5755 V | _____ | _____ | +0.5845 V |
| CH4 | 10 mV Vert scale setting, +5 Div position setting, –.5 V offset | –0.5845 V | _____ | _____ | –0.5755 V |
| CH4 | 200 mV Vert scale setting, 0 Div position setting, +5 V offset | +4.828 V | _____ | _____ | +5.172 V |
| CH4 | 200 mV Vert scale setting, 0 Div position setting, –5 V offset | –5.172 V | _____ | _____ | –4.828 V |
| CH4 | 1 V Vert scale setting, 0 Div position setting, +2.5 V offset | +4.738 V | _____ | _____ | +5.263 V |
| CH4 | 1 V Vert scale setting, 0 Div position setting, –2.5 V offset | –5.263 V | _____ | _____ | –4.738 V |
| Analog Bandwidth | | | | | |
| CH1 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH2 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH3 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH4 | 100 mV | 424 mV | _____ | _____ | N/A |
| Delay Between Channels | | N/A | _____ | _____ | 50 ps |

**TDS694C Test Record (cont.)**

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS694C Performance Test | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|
| Time Base System | | | | |
| Long Term Sample Rate/<br>Delay Time @ 100 ns/10.0 ms | –1.0 Div | _____ | _____ | +1.0 Div |
| Trigger System Accuracy | | | | |
| Pulse-Glitch or Pulse-Width,<br>Hor. scale ≤ 1 µs<br>Lower Limit<br>Upper Limit | <br><br>3.5 ns<br>3.5 ns | <br><br>_____<br>_____ | <br><br>_____<br>_____ | <br><br>6.5 ns<br>6.5 ns |
| Pulse-Glitch or Pulse-Width,<br>Hor. scale > 1 µs<br>Lower Limit<br>Upper Limit | <br><br>1.9 µs<br>1.9 µs | <br><br>_____<br>_____ | <br><br>_____<br>_____ | <br><br>2.1 µs<br>2.1 µs |
| CH1 Sensitivity, 50 MHz, Main | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, 50 MHz, Delayed | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 AUX Trigger Input | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, full bandwidth, Main | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, full bandwidth, Delayed | Pass/Fail | _____ | _____ | Pass/Fail |
| Output Signal Checks | | | | |
| MAIN TRIGGER OUTPUT, 50 Ω<br>High<br>Low | <br>High ≥ 1.0 V | <br>_____<br>_____ | <br>_____<br>_____ | <br><br>Low ≤ 0.25 V |
| DELAYED TRIGGER OUTPUT, 50 Ω<br>High<br>Low | <br>High ≥ 1.0 V | <br>_____<br>_____ | <br>_____<br>_____ | <br><br>Low ≤ 0.25 V |
| Probe Compensator Output Signal | | | | |
| Frequency (CH1 Freq). | 950 Hz | _____ | _____ | 1.050 kHz |
| Voltage (difference) | 495 mV | _____ | _____ | 505 mV |

# TDS794D Test Record

Photocopy this and the next two pages and use them to record the performance test results for your TDS794D.

### TDS794D Test Record

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS794D Performance Test | | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|---|
| Offset Accuracy | | | | | |
| CH1 Offset | +10 mV<br>+101 mV | – 2.5 mV<br>– 25.1 mV | _____<br>_____ | _____<br>_____ | + 2.5 mV<br>+ 25.1 mV |
| CH2 Offset | +10 mV<br>+101 mV | – 2.5 mV<br>– 25.1 mV | _____<br>_____ | _____<br>_____ | + 2.5 mV<br>+ 25.1 mV |
| CH3 Offset | +10 mV<br>+101 mV | – 2.5 mV<br>– 25.1 mV | _____<br>_____ | _____<br>_____ | + 2.5 mV<br>+ 25.1 mV |
| CH4 Offset | +10 mV<br>+101 mV | – 2.5 mV<br>– 25.1 mV | _____<br>_____ | _____<br>_____ | + 2.5 mV<br>+ 25.1 mV |
| DC Voltage Measurement Accuracy (Averaged) | | | | | |
| CH1 | 10 mV Vert scale setting,<br>–5 Div position setting, +.5 V offset | +0.5755 V | _____ | _____ | +0.5845 V |
| CH1 | 10 mV Vert scale setting,<br>+5 Div position setting, –.5 V offset | –0.5845 V | _____ | _____ | –0.5755 V |
| CH1 | 200 mV Vert scale setting,<br>0 Div position setting, +5 V offset | +4.9405 V | _____ | _____ | +5.0595 V |
| CH1 | 200 mV Vert scale setting,<br>0 Div position setting, –5 V offset | –5.0595 V | _____ | _____ | –4.9405 V |
| CH1 | 1 V Vert scale setting,<br>0 Div position setting, +2.5 V offset | +4.794 V | _____ | _____ | +5.206 V |
| CH1 | 1 V Vert scale setting,<br>0 Div position setting, –2.5 V offset | –5.206 V | _____ | _____ | –4.794 V |
| CH2 | 10 mV Vert scale setting,<br>–5 Div position setting, +.5 V offset | +0.5755 V | _____ | _____ | +0.5845 V |
| CH2 | 10 mV Vert scale setting,<br>+5 Div position setting, –.5 V offset | –0.5845 V | _____ | _____ | –0.5755 V |
| CH2 | 200 mV Vert scale setting,<br>0 Div position setting, +5 V offset | +4.9405 V | _____ | _____ | +5.0595 V |

**TDS794D Test Record (cont.)**

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS794D Performance Test | | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|---|
| CH2 | 200 mV Vert scale setting, 0 Div position setting, –5 V offset | –5.0595 V | _____ | _____ | –4.9405 V |
| CH2 | 1 V Vert scale setting, 0 Div position setting, +2.5 V offset | +4.794 V | _____ | _____ | +5.206 V |
| CH2 | 1 V Vert scale setting, 0 Div position setting, –2.5 V offset | –5.206 V | _____ | _____ | –4.794 V |
| CH3 | 10 mV Vert scale setting, –5 Div position setting, +.5 V offset | +0.5755 V | _____ | _____ | +0.5845 V |
| CH3 | 10 mV Vert scale setting, +5 Div position setting, –.5 V offset | –0.5845 V | _____ | _____ | –0.5755 V |
| CH3 | 200 mV Vert scale setting, 0 Div position setting, +5 V offset | +4.9405 V | _____ | _____ | +5.0595 V |
| CH3 | 200 mV Vert scale setting, 0 Div position setting, –5 V offset | –5.0595 V | _____ | _____ | –4.9405 V |
| CH3 | 1 V Vert scale setting, 0 Div position setting, +2.5 V offset | +4.794 V | _____ | _____ | +5.206 V |
| CH3 | 1 V Vert scale setting, 0 Div position setting, –2.5 V offset | –5.206 V | _____ | _____ | –4.794 V |
| CH4 | 10 mV Vert scale setting, –5 Div position setting, +.5 V offset | +0.5755 V | _____ | _____ | +0.5845 V |
| CH4 | 10 mV Vert scale setting, +5 Div position setting, –.5 V offset | –0.5845 V | _____ | _____ | –0.5755 V |
| CH4 | 200 mV Vert scale setting, 0 Div position setting, +5 V offset | +4.9405 V | _____ | _____ | +5.0595 V |
| CH4 | 200 mV Vert scale setting, 0 Div position setting, –5 V offset | –5.0595 V | _____ | _____ | –4.9405 V |
| CH4 | 1 V Vert scale setting, 0 Div position setting, +2.5 V offset | +4.794 V | _____ | _____ | +5.206 V |
| CH4 | 1 V Vert scale setting, 0 Div position setting, –2.5 V offset | –5.206 V | _____ | _____ | –4.794 V |
| Analog Bandwidth | | | | | |
| CH1 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH2 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH3 | 100 mV | 424 mV | _____ | _____ | N/A |
| CH4 | 100 mV | 424 mV | _____ | _____ | N/A |
| Delay Between Channels | | N/A | _____ | _____ | 50 ps |

**TDS794D Test Record (cont.)**

Instrument Serial Number: _____ Certificate Number: _____

Temperature: _____ RH %: _____

Date of Calibration: _____ Technician: _____

| TDS794D Performance Test | Minimum | Incoming | Outgoing | Maximum |
|---|---|---|---|---|
| Time Base System | | | | |
| Long Term Sample Rate/ Delay Time @ 100 ns/10.0 ms | –2.5 Div | _____ | _____ | +2.5 Div |
| Trigger System Accuracy | | | | |
| Pulse-Glitch or Pulse-Width, Hor. scale ≤ 1 µs | | | | |
| Lower Limit | 3.5 ns | _____ | _____ | 6.5 ns |
| Upper Limit | 3.5 ns | _____ | _____ | 6.5 ns |
| Pulse-Glitch or Pulse-Width, Hor. scale > 1 µs | | | | |
| Lower Limit | 1.9 µs | _____ | _____ | 2.1 µs |
| Upper Limit | 1.9 µs | _____ | _____ | 2.1 µs |
| CH1 Sensitivity, 50 MHz, Main | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, 50 MHz, Delayed | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 AUX Trigger Input | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, full bandwidth, Main | Pass/Fail | _____ | _____ | Pass/Fail |
| CH1 Sensitivity, full bandwidth, Delayed | Pass/Fail | _____ | _____ | Pass/Fail |
| Output Signal Checks | | | | |
| MAIN TRIGGER OUTPUT, 50 Ω | | | | |
| High | High ≥ 1.0 V | _____ | _____ | |
| Low | | _____ | _____ | Low ≤ 0.25 V |
| DELAYED TRIGGER OUTPUT, 50 Ω | | | | |
| High | High ≥ 1.0 V | _____ | _____ | |
| Low | | _____ | _____ | Low ≤ 0.25 V |
| CH 3 SIGNAL OUTPUT, 50 Ω | p-p ≥ 44 mV | _____ | _____ | p-p ≤ 66 mV |
| Probe Compensator Output Signal | | | | |
| Frequency (CH1 Freq). | 950 Hz | _____ | _____ | 1.050 kHz |
| Voltage (difference) | 495 mV | _____ | _____ | 505 mV |

## Signal Acquisition System Checks

These procedures check those characteristics that relate to the signal-acquisition system and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 4–1 on page 4–18 for test equipment specifications.

### Check Offset Accuracy (Zero Setting)

| | |
|---|---|
| **Equipment required** | None |
| **Prerequisites** | The oscilloscope must meet the prerequisites listed on page 4–17.<br>See *Input Channels versus Model* on page 4–2. |

1. *Preset the instrument controls:*
   a. *Initialize the oscilloscope:*
      - Press save/recall **SETUP**.
      - Press the main-menu button **Recall Factory Setup**.
      - Press the side-menu button **OK Confirm Factory Init**.
      - Press **CLEAR MENU** to remove the menus from the screen.

   b. *Modify the default settings:*
      - Press **SHIFT**; then press **ACQUIRE MENU**.
      - On the TDS 600C, press the main-menu button **Mode**; then press the side-menu button **Average 16**.
      - On the TDS 500D, 700D and 714L, press the main-menu button **Mode**; then press the side-menu button **Hi Res**.
      - Press **CURSOR**.
      - Press the main-menu button **Function**; then press the side-menu button **H Bars**.
      - Press **CLEAR MENU**.
      - Be sure to disconnect any input signals from all four channels.

2. *Confirm input channels are within limits for offset accuracy at zero offset:* Do the following substeps — test CH 1 first, *skipping substep a, since CH 1 is already set up to be checked from step 1.*
   a. *Select an unchecked channel:* Press **WAVEFORM OFF** to remove the channel just confirmed from the display. Then, press the front-panel button that corresponds to the channel you are to confirm.

**b.** *Set the vertical scale:* Set the vertical **SCALE** to one of the settings listed in Table 4–2 that is not yet checked. (Start with the first setting listed).

- Press **VERTICAL MENU**. Press the main-menu button **Fine Scale**.
- Use the keypad to enter the vertical scale. For the 1 mV setting, press **1**, **SHIFT**, **m**, then **ENTER**. For the 101 mV setting, press **101**, **SHIFT**, **m**, then **ENTER**. For the 1.01 V setting, press **1.01**, then **ENTER**.
- Press **CLEAR MENU**.

**Table 4–2: DC offset accuracy (zero setting)**

| Vertical scale setting | Vertical position and offset setting[1] | TDS 600C offset accuracy limits | TDS 500D/700D/714L (except TDS 794D) offset accuracy limits |
|---|---|---|---|
| 1 mV | 0 | ±2.1 mV | ±1.6 mV |
| 101 mV | 0 | ±75.6 mV | ±25.1 mV |
| 1.01 V | 0 | ±756 mV | ±251 mV |
| | | **TDS694C and TDS794D offset accuracy limits** | |
| 10 mV | 0 | ±2.5 mV | |
| 101 mV | 0 | ±25.1 mV | |

1 **Vertical position is set to 0 divisions and vertical offset to 0 V when the oscilloscope is initialized in step 1.**

**c.** *Display the test signal:* The waveform position and offset were initialized for all channels in step 1 and are displayed as you select each channel and its vertical scale.

**d.** *Measure the test signal:* Align the active cursor over the waveform by rotating the general purpose knob. Ignore the other cursor. See Figure 4–4.

**e.** Read the measurement results at the absolute (**@:**) cursor readout, not the delta (**Δ:**) readout on screen. That is, read the offset relative to the ground reference. See Figure 4–4.

**f.** *Check against limits:* Do the following subparts in the order listed.

- CHECK that the measurement results are within the limits listed for the current vertical scale setting.
- Enter voltage on test record.

- Repeat substeps b through f until all vertical scale settings listed in Table 4–2, are checked for the channel under test.

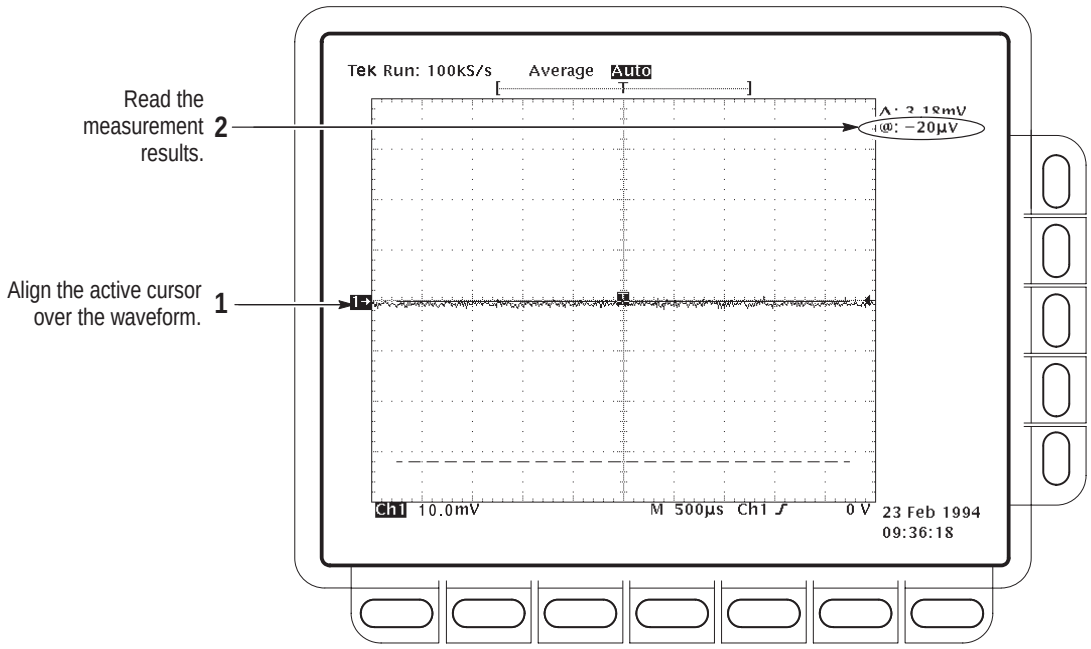



**Figure 4–4: Measurement of DC offset accuracy at zero setting – TDS 684C shown**

**g.** *Test all channels:* Repeat substeps a through f for all input channels.

## Check DC Voltage Measurement Accuracy



***WARNING.*** *The generator is capable of outputting dangerous voltages. Be sure to set the DC calibration generator to off or 0 volts before connecting, disconnecting, and/or moving the test hookup during the performance of this procedure. Also, check that the calibrator does not have shorting straps installed between the DC and sense outputs or grounds.*

| | |
|---|---|
| **Equipment required** | Two dual-banana connectors (Item 6)<br>One BNC T connector (Item 7)<br>One DC calibration generator (Item 9)<br>Two precision 50 Ω coaxial cables (Item 5) |
| **Prerequisites** | The oscilloscope must meet the prerequisites listed on page 4–17<br>See *Input Channels versus Model* on page 4–2. |

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

**a.** *Hook up the test-signal source:*

- Set the output of a DC calibration generator to off or 0 volts.
- Connect the output of a 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 4–5.
- 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 **CH 1**. See Figure 4–5.

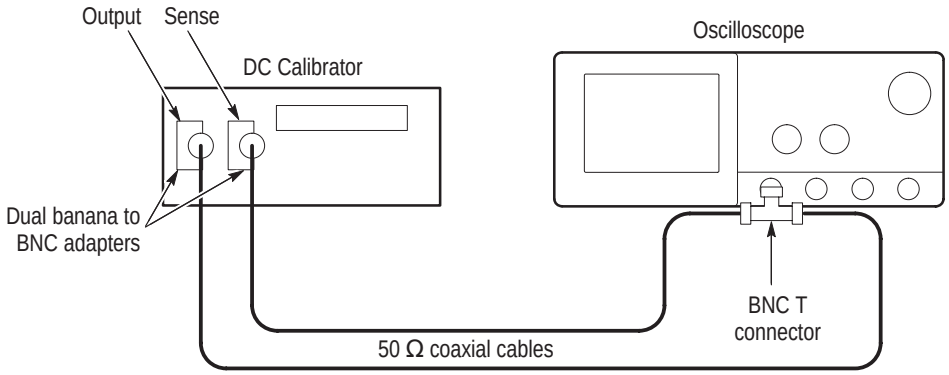



**Figure 4–5: Initial test hookup**

**b.** *Initialize the oscilloscope:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**c.** *Modify the default settings:*

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

**2.** *Confirm input channels are within limits for DC accuracy at maximum offset and position:* Do the following substeps — test CH 1 first, *skipping substep 2a since CH 1 is already selected from step 1*.

**a.** *Select an unchecked channel:*

- Press **WAVEFORM OFF** to remove the channel just confirmed from the display.
- Press the front-panel button that corresponds to the channel you are to confirm.
- *Set the generator output to 0 V.*
- Move the test hookup to the channel you selected.

**b.** *Turn on the measurement Mean for the channel:*

- Press **MEASURE**, then press the main-menu button **Select Measrmnt for *CHx***.
- 
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**.
- Press **CLEAR MENU**.

**c.** *Set the vertical scale:* Set the vertical **SCALE** to one of the settings listed in Table 4–3 that is not yet checked. (Start with the first setting listed).

**Table 4–3: DC Voltage measurement accuracy**

| Scale setting | Position setting (Divs) | Offset setting | Generator setting | TDS 600C (except TDS694C) Accuracy limits | TDS 500D/700D/714L (except TDS794D) Accuracy limits |
|---|---|---|---|---|---|
| 5 mV | –5 | +1 V | +1.040 V | +1.0329 V to +1.0471 V | +1.0355 V to +1.0445 V |
| | +5 | –1 V | –1.040 V | –1.0471 V to –1.0329 V | –1.0445 V to –1.0355 V |
| 200 mV | –5 | +10 V | +11.6 V | +11.4165 V to +11.7835 V | +11.5195 V to +11.6805 V |
| | +5 | –10 V | –11.6 V | –11.7835 V to –11.4165 V | –11.6805 V to –11.5195 V |
| 1.01 V | –5 | +10 V | +18V | +17.102 V to +18.899 V | +17.621 V to +18.379 V |
| | +5 | –10 V | –18 V | –18.899 V to –17.102 V | –18.379 V to –17.621 V |
| | | | | **TDS694C Accuracy limits** | **TDS794D Accuracy limits** |
| 10 mV | –5 | +0.5 V | +0.58 V | +575.5 mV to +584.5 mV | +575.5 mV to +584.5 mV |
| | +5 | –0.5 V | –0.58 V | –584.5 mV to –575.5 mV | –584.5 mV to –575.5 mV |
| 200 mV | 0 | +5 V | +5.0 V | +4.828 V to +5.172 V | +4.9405 V to +5.0595 V |
| | 0 | –5 V | –5.0 V | –5.172 V to –4.828 V | –5.0595 V to –4.9405 V |
| 1 V | 0 | +2.5 V | +5.0 V | +4.738 V to +5.263 V | +4.794 V to +5.206 V |
| | 0 | –2.5 V | –5.0 V | –5.263 V to –4.738 V | –5.206 V to –4.794 V |

**d.** *Display the test signal:*

- Press **VERTICAL MENU**. Press the main-menu button **Position**.
- Use the keypad to set vertical position to –5 divisions (press **–5**, then **ENTER**, on the keypad). The baseline level will move off screen.
- Press the main-menu button **Offset**.
- Use the keypad to set vertical offset to the positive-polarity setting listed in the table for the current vertical scale setting. The baseline level will remain off screen.
- Set the generator to the level and polarity indicated in the table for the vertical scale, position, and offset settings you have made. The DC test level should appear on screen. (If it doesn't return, the DC accuracy check has failed for the current vertical scale setting of the current channel).

**e.** *Measure the test signal:* Press **CLEAR MENU**. Read the measurement results at the **Mean** measurement readout. See Figure 4–6.

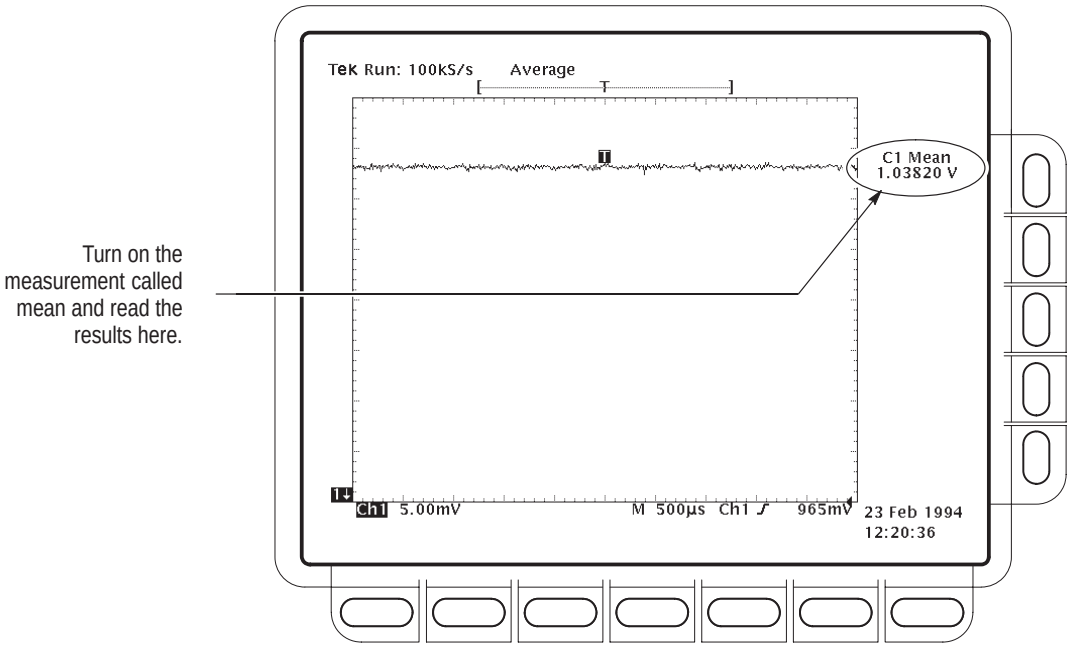



**Figure 4–6: Measurement of DC accuracy at maximum offset and position**

**f.** *Check against limits:*

- CHECK that the readout for the measurement **Mean** readout on screen is within the limits listed for the current vertical scale and position/offset/generator settings. Enter value on test record.
- Repeat substep d, reversing the polarity of the position, offset, and generator settings as is listed in the table.
- CHECK that the **Mean** measurement readout on screen is within the limits listed for the current vertical scale setting and position/offset/ generator settings. Enter value on test record.
- Repeat substeps c through f until all vertical scale settings, listed in Table 4–3, are checked for the channel under test.

**g.** *Test all channels:* Repeat substeps a through f for all four channels.

**3.** *Disconnect the hookup:*

**a.** *Set the generator output to 0 V.*

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

## Check Analog Bandwidth

| | |
|---|---|
| **Equipment required** | One sine wave generator (Item 14)<br>One level meter and power sensor (Item 15)<br>One power divider (Item 16)<br>One female N to male BNC adapter (Item 18)<br>Four male N to female BNC adapters (Item 17)<br>Two 50 Ω precision cables (Item 5)<br>Attenuators (Items 1 and 2)<br>Optional: One high-frequency leveled sine wave generator and its leveling head – replaces items 14, 15, 16, 17, and 18 |
| **Prerequisites** | See page 4–17 |

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

**a.** *Initialize the oscilloscope:*

- Press save/recall **SETUP**. Press the main-menu button **Recall Factory Setup**; then press the side-menu button **OK Confirm Factory Init**.

**b.** *Modify the default settings:*

- Turn the horizontal **SCALE** knob to 50 ns (TDS694C 40 ns). Press **SHIFT**; then press **ACQUIRE MENU**.
- Press the main-menu button **Mode**; then press the side-menu button **Average 16**.
- Press **MEASURE**. Press the main-menu button **Level Setup**; then press the side-menu button **Min-Max**.

***NOTE**. The sine wave generator output amplitude must be leveled to within 0.35 db of the reference frequency (10 MHz) through the bandwidth frequency listed in Table 4–4 on page 4–45. The 0.35 db requirement is necessary to ensure a bandwidth that meets Tektronix specifications.*

*You can perform bandwidth PV using an unleveled sine wave generator (with amplitude error > 0.35 db). Under these conditions, the bandwidth PV is subject to the flatness errors associated with the generator used.*

*Refer to the* Sine Wave Generator Leveling Procedure *on page 4–94 if your sine wave generator does not have automatic output amplitude leveling.*

**c.** *Hook up the test-signal source:* Connect the sine wave output of a leveled sine wave generator to **CH 1**. Set the output of the generator to a

reference frequency of 10 MHz or less. See Figure 4–7.
For the optional setup using a leveled sine wave generator with a leveling head, see Figure 4–8 and, if using this optional setup with the example Tektronix SG 504, set the generator output to 6 MHz.

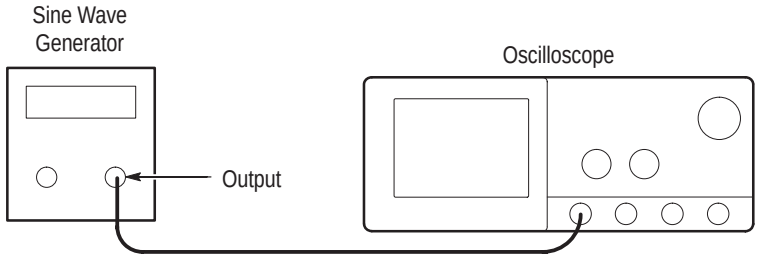



**Figure 4–7: Initial test hookup**

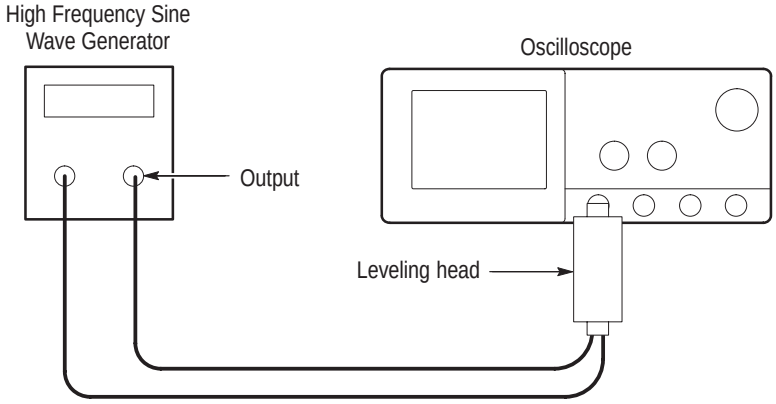



**Figure 4–8: Optional initial test hookup**

**2.** *Confirm the input channels are within limits for analog bandwidth:* Do the following substeps — test CH 1 first, *skipping substeps* a *and b since CH 1 is already set up for testing from step 1*.

**a.** *Select an unchecked channel:*

- Press **WAVEFORM OFF** to remove the channel just confirmed from display.
- Press the front-panel button that corresponds to the channel you are to confirm.
- Move the leveling output of the sine wave generator to the channel you selected.

**b.** *Match the trigger source to the channel selected:*

- Press **TRIGGER MENU**. Press the main-menu button **Source**; then press the side-menu button that corresponds to the channel selected.

**c.** *Set its input impedance: (This substep is not required on the TDS694C and TDS794D.)*

- Press **VERTICAL MENU**. Press the main-menu button **Coupling**, then press the side-menu **Ω** button to toggle it to the **50 Ω** setting.

**d.** *Set the vertical scale:* Set the vertical **SCALE** to one of the settings listed in Table 4–4 not yet checked. (Start with the 100 mV setting).

**e.** *Set the triggering coupling:*

- Press **TRIGGER MENU**.
- Press the main-menu button **Coupling**.
- For vertical settings of 1, 2, and 5 mV, press the side menu button **Noise Rej**. For all other settings, press side menu button **DC**.

**Table 4–4: Analog bandwidth**

| Vertical scale | Reference amplitude (6 divisions) | Horizontal scale | Test frequency | | | | | –3 db Limits |
|---|---|---|---|---|---|---|---|---|
| | | | TDS694C | TDS794D | TDS580D TDS680C TDS684C TDS784D | TDS654C | TDS520D TDS540D TDS714L TDS724D TDS754D | |
| 100 mV | 600 mV | 1 ns | 3 GHz | 2 GHz | 1 GHz | 500 MHz | 500 MHz | ≥424 mV |
| 1 mV | 6 mV | 1 ns | NA | NA | 500 MHz | 250 MHz | 450 MHz | ≥4.24 mV |
| 2 mV | 12 mV | 1 ns | NA | NA | 600 MHz | 300 MHz | 500 MHz | ≥8.48 mV |
| 5 mV | 30 mV | 1 ns | NA | NA | 750 MHz | 450 MHz | 500 MHz | ≥21.2 mV |
| 10 mV | 60 mV | 1 ns | 3 GHz | 2 GHz | 1 GHz | 500 MHz | 500 MHz | ≥42.4 mV |
| 20 mV | 120 mV | 1 ns | 3 GHz | 2 GHz | 1 GHz | 500 MHz | 500 MHz | ≥84.8 mV |
| 50 mV | 300 mV | 1 ns | 3 GHz | 2 GHz | 1 GHz | 500 MHz | 500 MHz | ≥212 mV |
| 200 mV | 1.2 V | 1 ns | 3 GHz | 2 GHz | 1 GHz | 500 MHz | 500 MHz | ≥848 mV |
| 500 mV | 3 V[1] | 1 ns | 3 GHz | 2 GHz | 1 GHz | 500 MHz | 500 MHz | ≥2.12 V[1] |
| 1 V | 6 V[1] | 1 ns | 3 GHz | 2 GHz | 1 GHz | 500 MHz | 500 MHz | ≥4.24 V[1] |

[1] **If your generator cannot output 6 divisions of amplitude, determine its maximum output at the Test frequency, and use this for the reference amplitude. The –3 db limit can be calculated as: 0.707 × reference amplitude.**

**f.** *Display the test signal:* Do the following subparts to first display the reference signal and then the test signal.

- Press **MEASURE**; then press the main-menu button **Select Measrmnt for *CHx***.
- Press the side-menu button **more**, if needed, until the menu label **Frequency** appears in the side menu (its icon is shown at the left). Press the side-menu button **Frequency**.



- 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**.



- Press **CLEAR MENU**.
- Set the generator output so the CHx Pk-Pk readout equals the reference amplitude in Table 4–4 that corresponds to the vertical scale set in substep d.
- Press the front-panel button **SET LEVEL TO 50%** as necessary to trigger a stable display. At full bandwidth, you may also want to make small, manual adjustments to the trigger level. You can use the

**TRIGGER LEVEL** knob to do this. (Full bandwidth varies with TDS model as is shown in Table 4–4).

**g.** *Measure the test signal:*

- Set the frequency of the generator, as shown on screen, to the test frequency in Table 4–4 that corresponds to the vertical scale set in substep **d**. See Figure 4–9.
- Set the horizontal **SCALE** to the horizontal scale setting in Table 4–4 that corresponds to the vertical scale set in substep **d**. Press **SET LEVEL TO 50%** as necessary to trigger the signal.
- Read the results at the CHx Pk-Pk readout, which will automatically measure the amplitude of the test signal. See Figure 4–9.

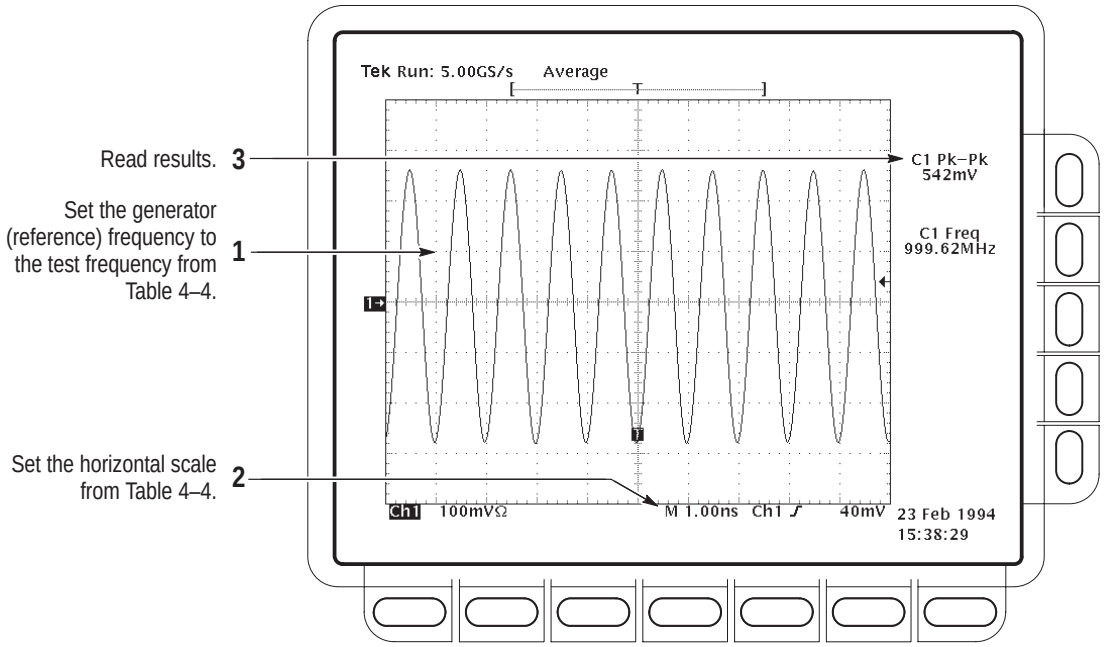



**Figure 4–9: Measurement of analog bandwidth**

**h.** *Check against limits:*

- CHECK that the **Pk-Pk** readout on screen is within the limits listed in Table 4–4 for the current vertical scale setting.
- Enter voltage on test record.
- When finished checking, set the horizontal **SCALE** back to the 50 ns (TDS694C 40 ns) setting.

***STOP.*** *Checking each channel's bandwidth at all vertical scale settings is time consuming and unnecessary. You may skip checking the remaining vertical scale settings in Table 4–4 (that is, skip the following substep, i) if this oscilloscope has performed as follows:*

- Passed the 100 mV vertical scale setting just checked in this procedure.
- Passed the *Verify Internal Adjustment, Self Compensation, and Diagnostics* procedure found under *Self Tests*, on page 4–5.

***NOTE.*** *Passing the signal path compensation confirms the signal path for all vertical scale settings for all channels. Passing the internal diagnostics ensures that the factory-set adjustment constants that control the bandwidth for each vertical scale setting have not changed.*

**i.** *Check remaining vertical scale settings against limits (optional):*

- If desired, finish checking the remaining vertical scale settings for the channel under test by repeating substeps d through h for each of the remaining scale settings listed in Table 4–4 for the channel under test.
- When doing substep f, skip the subparts that turn on the CHx Pk-Pk measurement until you check a new channel.
- Install/remove attenuators between the generator leveling head and the channel input as needed to obtain the six division reference signals listed in the table.

**j.** *Test all channels:* Repeat substeps a through h for all four channels.

**3.** *Disconnect the hookup:* Disconnect the test hook up from the input connector of the channel last tested.

## Check Delay Between Channels

| | |
|---|---|
| **Equipment required** | One sine wave generator (Item 14)<br>Three precision 50 Ω coaxial cables (Item 5)<br>One power divider (Item 16) or dual input coupler (item 8)<br>3 SMA male to male adapter connector (Item 19)<br>3 SMA female-to-male BNC adapter connector (Item 20) |
| **Prerequisites** | See page 4–17<br>See *Input Channels versus Model* on page 4–2. |

***STOP**. DO NOT use the vertical position knob to reposition any channel while doing this check. To do so invalidates the test.*

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

**a.** *Initialize the front panel:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**b.** *Modify the initialized front-panel control settings:*

- Do *not* adjust the vertical position of any channel during this procedure.
- Set the horizontal **SCALE** to 500 ps.
- Press **SHIFT**; then press **ACQUIRE MENU**.
- Press the main-menu button **Mode**, and then press the side-menu button **Average 16**.

**c.** *Hook up the test-signal source:*

- Connect the sine wave output of a sine wave generator to a 50 Ω precision coaxial cable followed by a 50 Ω termination and a dual-input coupler. (If checking a TDS694C or TDS794C, substitute a 50 Ω power divider and two 50 Ω coaxial cables for the 50 Ω termination and dual-input coupler).
- Connect the coupler to both **CH 1** and **CH 2**. See Figure 4–10.

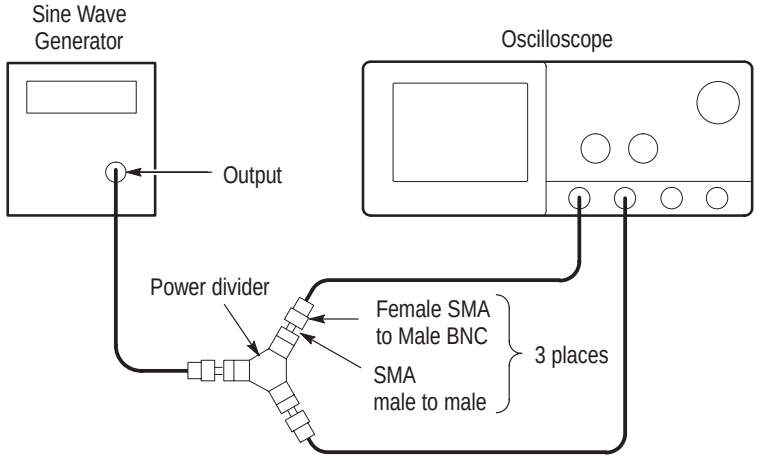



**Figure 4–10: Initial test hookup**

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

**a.** *Set up the generator:* Set the generator frequency to 250 MHz and the amplitude for six to eight divisions in CH 1.

Hint: As you are adjusting the generator amplitude, push **SET LEVEL TO 50%** frequently to speed up the updating of the waveform amplitude on screen.

**b.** The horizontal **SCALE** should already be set to 500 ps. On the TDS 580D, 784D, 794D, and all TDS 600C, now set it to 200 ps. On the TDS 520D, 540D, 714L, 724D, and 754D, push the front-panel **ZOOM** button, press the side-menu **On** button, set the horizontal **SCALE** to 250 ps, and be sure the vertical scale factor is kept at 1.0X and the horizontal scale factor is 2.0X for the remainder of this check.

**c.** *Save a CH 2 waveform:* Press **CH 2**. Press save/recall **WAVEFORM**. Now, press the main-menu button **Save Wfm**; then press the side-menu button
**To Ref 2**.

**d.** *Save CH 3 (AX1 on some TDS models) waveform:*

- Move the coupler from **CH 2** to **CH 3** (AUX1 on some TDS models), so that **CH 1** and **CH 3** are driven. Press **WAVEFORM OFF**. Press **CH 3**. Then press the side-menu button **To Ref 3**.

**e.** *Display all test signals:*

- Press **WAVEFORM OFF** to remove CH 3 (AX1 on some TDS models) from the display.

- Display the live waveform. Move the coupler from **CH 3** to **CH 4**, so that CH 1 and CH 4 are driven. (Use AUX1 and AUX2 instead of CH3 and CH4 if your TDS model is so equipped). Press **CH 4** to display. See Figure 4–11 on page 4–51.
- Display the reference waveforms. To do this, press the front-panel button **MORE**. Press the main-menu buttons **Ref 2** and **Ref 3**. You may notice their overlapping ground reference indicators. See Figure 4–11 on page 4–51.

**f.** *Measure the test signal:*

- Locate the time reference points for these waveforms. Do this by first identifying the point where the rising edge of the left-most waveform crosses the center horizontal graticule line. Next, note the corresponding *time reference point* for the right-most waveform. See Figure 4–11 on page 4–51.
- Press **CURSOR**.
- Press the main-menu button **Function**; then press the side-menu button **V Bars**.
- Press **CLEAR MENU**.
- Align one V bar 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 by rotating the General Purpose knob. (Press **SELECT** to switch between the two cursors). See Figure 4–11 on page 4–51.
- Read the measurement results at the **Δ:** cursor readout, not the **@:** readout on screen.

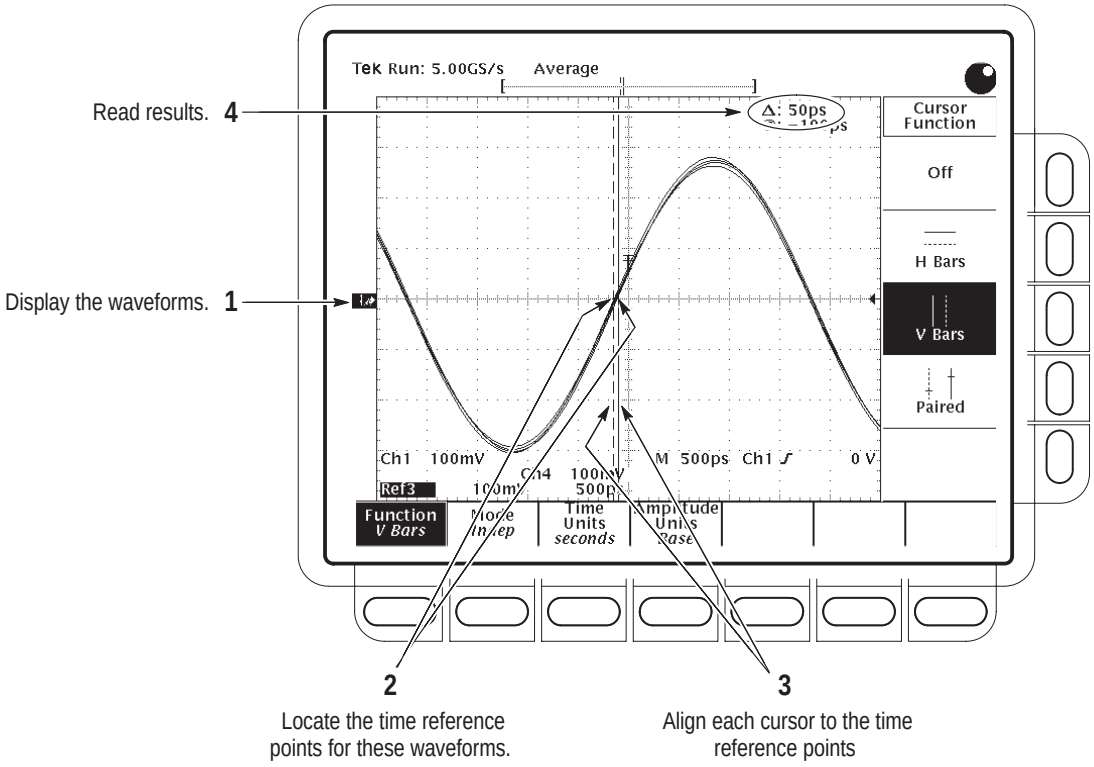



**Figure 4–11: Measurement of channel delay – TDS 684C shown**

**g.** *Check against limits:* CHECK that the cursor readout on screen is ≤100 ps for the TDS600C or ≤50 ps for the TDS 500D, TDS694C, TDS700D, and TDS714L.

**h.** If the channel skew is within the limits, enter time on the test record and proceed to step 3. Otherwise, proceed with steps **i** through **p**.

**i.** Use the cursors to measure the skew from CH1 to CH2, CH1 to CH3, and CH1 to CH4 (use AX1 and AX2 instead of CH3 and CH4 if your TDS model is so equipped). Write down these three numbers in the first measurement column of Table 4–5. Note that these numbers may be either positive or negative.

**j.** Repeat the procedure from step 1.c through 2.e.

**k.** Again use the cursors to measure the skew from CH1 to CH2, CH1 to CH3, and CH1 to CH4. Write down these numbers in the second measurement column of Table 4–5. Note that these numbers may be either positive or negative.

**l.** Add the first CH1 to CH2 skew measurement to the second CH1 to CH2 skew measurement and divide the result by 2. Use Table 4–5.

**m.** Add the first CH1 to CH3 (AX1 on some TDS models) skew measurement to the second CH1 to CH3 skew measurement and divide the result by 2. Use Table 4–5.

**n.** Add the first CH1 to CH4 (AX2 on some TDS models) skew measurement to the second CH1 to CH4 skew measurement and divide the result by 2. Use Table 4–5.

**o.** Check against limits: CHECK that the largest of the three results from steps l, m, and n is between –100 ps and + 100 ps for the TDS600C or between –50 ps and + 50 ps for the TDS500D, TDS694C, TDS700D, and TDS714L.

**p.** Enter time on the test record.

**Table 4–5: Delay between channels worksheet**

| Coupling | First measurement | Second measurement | Add first and second measurements | Divide sum by 2 |
|---|---|---|---|---|
| CH1 to CH2 skew | | | | |
| CH1 to CH3 skew | | | | |
| CH1 to CH4 skew | | | | |

**3.** *Disconnect the hookup:* Disconnect the cable from the generator output at the input connectors of the channels.

## Time Base System Checks

These procedures check those characteristics that relate to the Main and Delayed time base system and are listed as checked under *Warranted Characteristics* in *Specifications*.

### Check Accuracy for Long-Term Sample Rate and Delay Time

| | |
|---|---|
| **Equipment required** | One time-mark generator (Item 11), or<br>Sine wave generator (Item 14)<br><br>One 50 Ω, precision coaxial cable (Item 5) |
| **Prerequisites** | See page 4–17 |

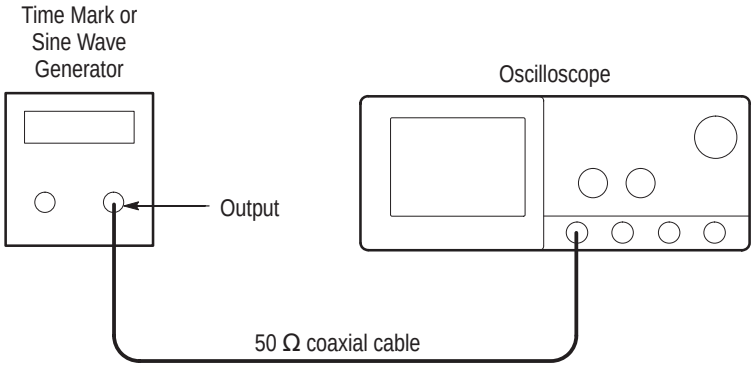



**Figure 4–12: Initial test hookup**

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

   a. *Hook up the test-signal source*: Connect, through a 50 Ω precision coaxial cable, the output of the generator to **CH 1** (see Figure 4–12).

      - If using a time-mark generator, set the output for 10 ms markers.
      - If using a sine wave generator, set the output for 1.2 V and 500 kHz.

   b. *Initialize the oscilloscope:*

      - Press save/recall **SETUP**. Press the main-menu button **Recall Factory Setup**. Press the side-menu button **OK Confirm Factory Init**.

   c. *Modify the initialized front-panel control settings:*

      - Set the vertical **SCALE** to 200 mV (or 500 mV with the optional Tektronix TG 501A Time Mark Generator).
      - Set the horizontal **SCALE** of the Main time base to 2 μs.

- Press **VERTICAL MENU**; then press the main-menu button **Coupling**. Press the side-menu button **Ω** to toggle it to the **50 Ω** setting. (This step is not required on theTDS694C or TDS794D.)
- Press **SET LEVEL TO 50%**.
- Use the vertical **POSITION** knob to center the test signal on screen.
- Press **TRIGGER MENU**; then press the main-menu button **Mode & Holdoff**. Press the side-menu button **Normal**.

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

**a.** *Display the test signal:*

- Press **HORIZONTAL MENU**.
- Set horizontal modes. To do this, press the main-menu button **Time Base**. Press the side-menu buttons **Delayed Only** and **Delayed Runs After Main**. See Figure 4–13 on page 4–55.

**b.** *Measure the test signal*:

- Set the horizontal **SCALE** of the **D** (delayed) time base to 500 ns for the TDS600C or to 100 ns for the TDS694C, TDS500D, TDS700D, or TDS714L.
- If using a time-mark generator, align the trigger **T** to the center vertical graticule line by adjusting the horizontal **POSITION**. See Figure 4–13 on page 4–55.
- If using a sine wave generator, align the rising edge of the sine wave on the center graticule crosshairs by adjusting the horizontal **POSITION**.
- Set delayed time to 10.000016 ms. Do this on the keypad by pressing **10.000016**, then **SHIFT**, then **m** followed by **ENTER**).

**c.** *Check long-term sample rate and delay time accuracies against limits:*

- CHECK that the rising edge of the marker (or sine wave) crosses the center horizontal graticule line at a point within either ±1.0 divisions for the TDS694C, ±2.0 divisions for the TDS600C, ±2.5 divisions for the TDS500D, TDS700D, or TDS714L, of center graticule.
  See Figure 4–13 on page 4–55.
- Enter number of divisions on the test record.

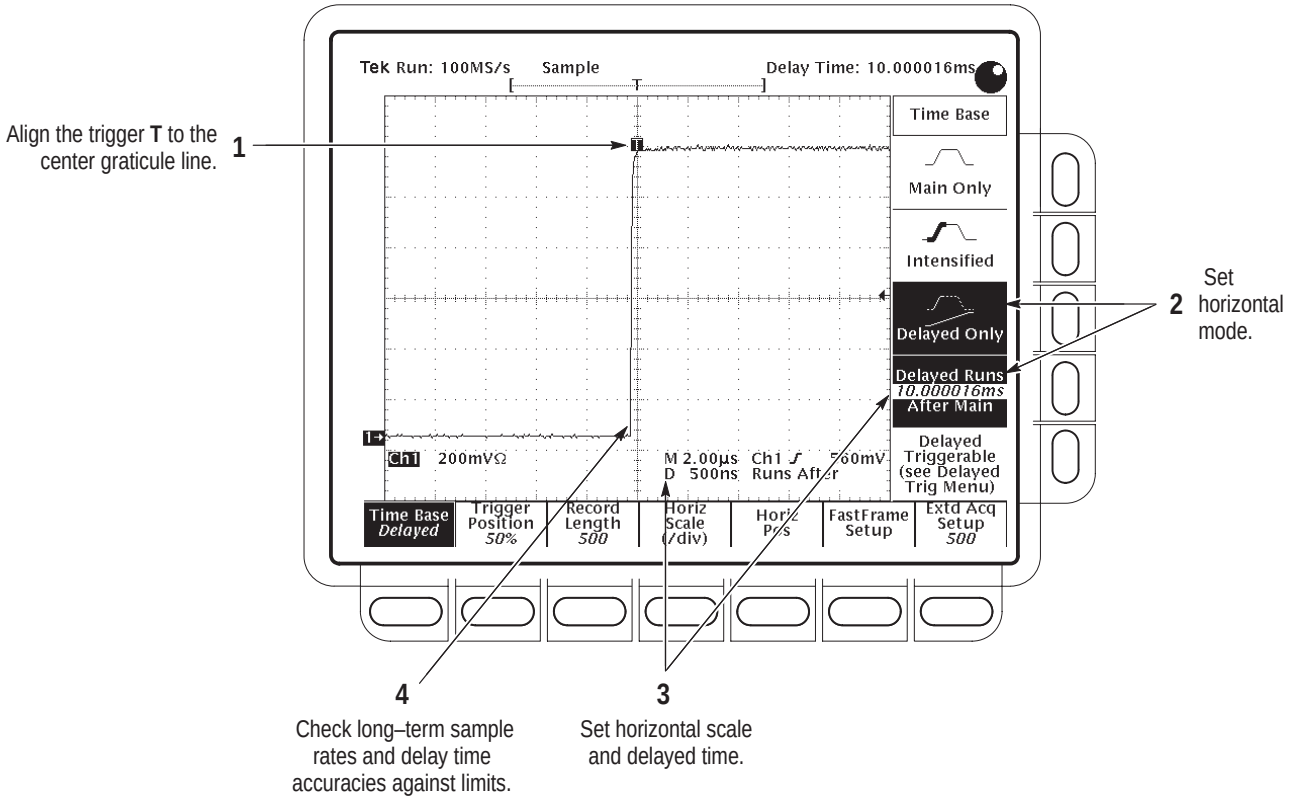



**Figure 4–13: Measurement of accuracy – long-term and delay time**

3. *Disconnect the hookup:* Disconnect the cable from the generator output at the input connector of **CH 1**.

## Check Accuracy for Delta Time Measurement (Skip for Option 1G and TDS 714L)

| | |
|---|---|
| **Equipment required** | One 50 Ω, precision coaxial cable (Item 5)<br>One Connector, BNC "T", male BNC-to-dual female BNC (Item 7)<br>One Pulse Generator, Wavetek 9500 or equivalent (Item 23)<br>Two 50 Ω, coaxial cable, male-to-male SMA connectors (Item 28)<br>One SMA female to BNC male connector (Item 30)<br>One BNC elbow connector (Item 31)<br>One SMA "T", male to two SMA female connectors (Item 29)<br>Two SMA terminator connectors, short circuit, (Item 32)<br>One 2X attenuator, 50 Ω, female BNC-to- male BNC (Item 33) |
| **Prerequisites** | See page 4–17 |

This procedures checks the "sample rate" portion of the Delta Time Measurement Accuracy as listed under *Warranted Characteristics* in *Specifications.* The previous procedure, *Check Accuracy for Long-Term Sample Rate and Delay Time,* see page 4–53, verified the "PPM" portion of the delta time specification.

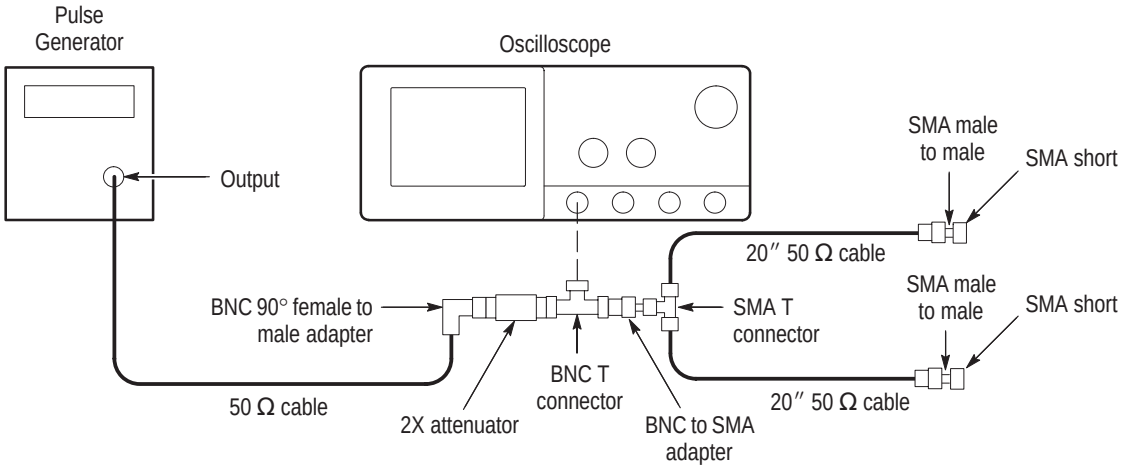



**Figure 4–14: Delta time accuracy test hookup**

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

   a. *Initialize the oscilloscope:*

      - Press save/recall **SETUP**. Press the main-menu button **Recall Factory Setup**. Press the side-menu button **OK Confirm Factory Init**.

**b.** *Hook up the pulse generator (see Figure 4–14 on page 4–56):*

- Connect the pulse generator output to a **50 Ω** precision coaxial cable followed by a 90˚right-angle female to male BNC adapter, then a **50 Ω** 2X attenuator. The attenuator is connected to one side of the female BNC T connector. The other side of the BNC T is connected to BNC male to SMA adapter. The SMA side is connected to male side of the SMA T connector. (Keep the distance between the BNC T and SMA T as short as possible). Connect 20 inch **50 Ω** coaxial cables to each female side of the SMA T connector. Connect a female to female SMA adapter to both male coaxial connectors. Connect the SMA short, to the remaining female SMA adapter. Now connect the male BNC T connector to **CH 1**.
- Set the pulse generator output for a positive-going pulse with a rise–time as shown in Table 4–6 on page 4–58 for your oscilloscope, and for the fastest possible rep rate (at least 1 kHz).
- Set the pulse generator output for about 500 mV. (This amplitude can be adjusted later to get a 5–division pulse on screen.)

**c.** *Modify the initialized front-panel control settings:*

- *(This substep is not required on the TDS694C or TDS794D.)* Press **VERTICAL MENU**. Press the main-menu button **Coupling**, then press the side-menu **Ω** button to toggle it to the **50 Ω** setting.
- Press **AUTOSET**. You may see both positive and negative pulses. Adjust the trigger **MAIN LEVEL** knob so the trigger level is about 50% of the rising edge of the **positive** pulse.
- *(TDS 500D/700D/714L only.)* Press **SHIFT**; then press **ACQUIRE MENU**. Press the main-menu button **Repetitive Signal**, then press the side-menu **OFF (Real Time Only)**.
- Set the horizontal SCALE of the Main time base to 2 ns/division. The pulse width should be about **6 ns**.
- Adjust pulse amplitude and oscilloscope vertical scale and position as necessary to obtain about **5 divisions** of the **positive** pulse.

**d.** *Set up for statistics measurements:*

- Re-adjust the trigger **MAIN LEVEL** knob so the trigger level is about 50% of the rising edge of the **positive** pulse.
- Press **RUN/STOP** button to freeze the display.
- Press **MEASURE** to bring up the Measure menu.

- Press **MEASURE →Select Measurmnt for Ch1** (main menu) **→Positive Width** (side menu).
- Press **Statistics →Statistics OFF** (side menu) to reset the statistics, then press **→Statistics Mean/StdDev** (side menu).
- Press **Statistics Weights** (side menu). On the keypad press **1000**, then **ENTER**.
- Press **RUN/STOP** button to start the acquisitions.
- Wait about 30 seconds.
- Press **RUN/STOP** button to freeze the display.
- Record the mean, μ (value).
- Press **Statistics Min/Max** (side menu) to display those values.
- Calculate the difference of the Max minus the mean.
- Calculate the difference of the mean minus the Min.
- Both differences must be less than or equal to the Delta-time accuracy limit shown in Table 4–6 for your oscilloscope.

**Table 4–6: Delta time measurement**

| Oscilloscope type | Pulse rise time range | Delta time accuracy limit |
|---|---|---|
| TDS520D, TDS540D, TDS724D, TDS754D | ≤ 2 ns | ≤ 0.075 ns |
| TDS580D, TDS784D | ≤ 900 ps | ≤ 0.038 ns |
| TDS794D | 300 ps – 1 ns | ≤ 0.038 ns |
| TDS654C | ≤ 150 ps | ≤ 0.040 ns |
| TDS680C, TDS684C | ≤ 700 ps | ≤ 0.040 ns |
| TDS694C | 50 ps – 400 ps | ≤ 0.015 ns |

**e.** *Repeat for all other channels:*

- Note the vertical scale setting of the channel just confirmed.
- Press **WAVEFORM OFF** to remove the channel just confirmed from display.
- Press the front-panel button that corresponds to the channel you are to confirm.
- Set vertical SCALE to the setting noted in step **e**, first bullet**.**

- Press **TRIGGER MENU**. Press the main-menu button **Source**; then press the side-menu button that corresponds to the channel selected.
- Move the test hookup to the channel you selected.
- *(This substep is not required on the TDS694C or TDS794D.)* Press **VERTICAL MENU**. Press the main-menu button **Coupling**, then press the side-menu **Ω** button to toggle it to the **50 Ω** setting.
- Press **RUN/STOP** button to start the display.
- Repeat step **d**.

**2.** *Disconnect all test equipment from the oscilloscope:*

## Trigger System Checks

These procedures check those characteristics that relate to the Main and Delayed trigger systems and are listed as checked in *Specifications.*

### Check Accuracy (Time) for Pulse-Glitch or Pulse-Width Triggering

| | |
|---|---|
| **Equipment required** | One sine wave generator (Item 14)<br>One 10X attenuator (Item 1)<br>One 50 Ω, precision coaxial cable (Item 5) |
| **Prerequisites** | See page 4–17 |

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

**a.** *Initialize the instrument:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**b.** *Modify the default setup:*

- Set the horizontal **SCALE** to 10 ns on the TDS 600C and 12.5 ns on the TDS 500D/700D/714L.
- Press **VERTICAL MENU**; then press the main-menu button **Coupling**. Now press the side-menu button **Ω** to toggle it to the 50 Ω setting. (This step is not required on the TDS694C or TDS794D.)

**c.** *Hook up the test-signal source:* Connect the output of the sine wave generator (Item 14) to CH 1.

Do this through a 50 Ω precision coaxial cable, followed by a 10X attenuator. See Figure 4–15. The 10X attenuator is optional if the SG503 is used.

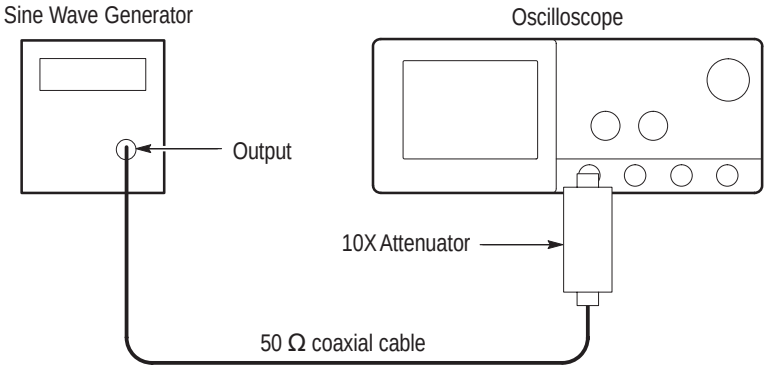



**Figure 4–15: Initial test hookup**

**2.** *Confirm the trigger system is within time-accuracy limits for pulse-glitch or pulse-width triggering (time range ≤500 n*s*):*

**a.** *Display the test signal:* Set the output of the sine wave generator for a 100 MHz, five-division sine wave on screen. Press **SET LEVEL TO 50%**.

**b.** *Set the trigger mode:* Press **TRIGGER MENU**. Now press the main-menu button **Mode & Holdoff**; then press the side-menu button **Normal**.

**c.** *Set upper and lower limits that ensure triggering:* See Figure 4–16.

- Press the main-menu button **Type**; then repeatedly press the same button until **Pulse** is highlighted in the menu that pops up.
- Press the main-menu button **Class**; then repeatedly press the same button until **Width** is highlighted in the menu that pops up.
- Press the main-menu button **Trig When**; then press the side-menu button **Within Limits.**
- Press the side-menu button **Upper Limit**. Use the keyboard to set the upper limit to 10 ns: press **10**, then **SHIFT**, then **n**, and **ENTER**.
- Press the side-menu button **Lower Limit**. Use the keypad to set the lower limit to 2 ns.

**d.** *Change limits until triggering stops:*

- Press **SET LEVEL TO 50%**.
- While doing the following subparts, monitor the display (it will stop acquiring) and the front-panel light **TRIG** (it will extinguish) to determine when triggering is lost.
- Press the side-menu button **Lower Limit**.
- Use the general purpose knob to *increase* the **Lower Limit** readout until triggering is lost.
- CHECK that the **Lower Limit** readout, after the oscilloscope loses triggering, is within 3.5 ns to 6.5 ns, inclusive.
- Enter time on test record.
- Use the keypad to return the **Lower Limit** to 2 ns and reestablish triggering.
- Press the side-menu button **Upper Limit**; then use the general purpose knob to slowly *decrease* the **Upper Limit** readout until triggering is lost.
- CHECK that the **Upper Limit** readout, after the oscilloscope loses triggering, is within 3.5 ns to 6.5 ns, inclusive.
- Enter time on test record.

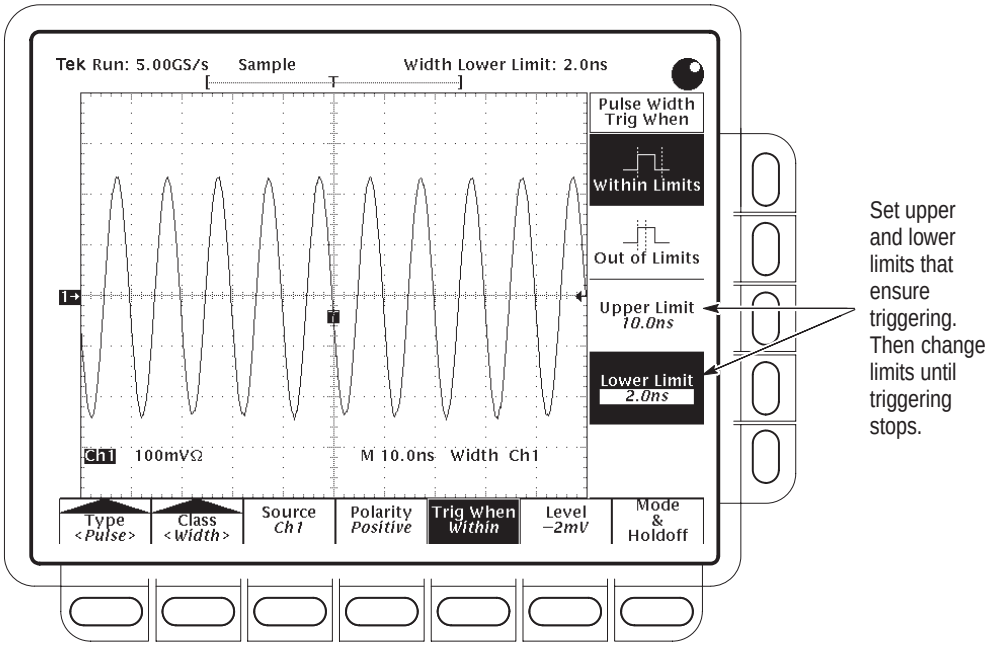



**Figure 4–16: Measurement of time accuracy for pulse and glitch triggering**

3. *Confirm the trigger system is within time-accuracy limits for pulse-glitch or pulse-width triggering (time range >520 ns):*

   a. *Set upper and lower limits that ensure triggering at 250 kHz:*

      - Press the side-menu button **Upper Limit**. Use the keyboard to set the upper limit to 4 μs.
      - Press the side-menu button **Lower Limit**. Use the keypad to set the lower limit to 500 ns.

   b. *Display the test signal:*

      - Set the horizontal **SCALE** to 5 μs.
      - Set the output of the sine wave generator for a 250 kHz, five-division sine wave on screen. Set the vertical **SCALE** to 20 mV (the waveform will overdrive the display).
      - Press **SET LEVEL TO 50%**.

   c. *Check against limits:* Do the following subparts in the order listed.

      - Press the side-menu button **Lower Limit**.
      - Use the general purpose knob to *increase* **Lower Limit** readout until triggering is lost.
      - CHECK that the **Lower Limit** readout, after the oscilloscope stops triggering, is within 1.9 μs to 2.1 μs, inclusive.
      - Enter time on test record.
      - Use the keypad to return the **Lower Limit** to 500 ns and reestablish triggering.
      - Press the side-menu button **Upper Limit**; then use the general purpose knob to slowly *decrease* the **Upper Limit** readout until triggering stops.
      - CHECK that the **Upper Limit** readout, after the oscilloscope loses triggering, is within 1.9 μs to 2.1 μs, inclusive.
      - Enter time on test record.

4. *Disconnect the hookup:* Disconnect the cable from the generator output at the input connector of **CH 1**.

## Sensitivity, Edge Trigger, DC Coupled

| | |
|---|---|
| **Equipment required** | One sine wave generator (Item 14)<br>Two precision 50 Ω coaxial cables (Item 5)<br>One 10X attenuator (Item 1)<br>One BNC T connector (Item 7)<br>One 5X attenuator (Item 2) |
| **Prerequisites** | See page 4–17. |

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

   a. *Initialize the oscilloscope:*

   - Press save/recall **SETUP**.
   - Press the main-menu button **Recall Factory Setup**.
   - Press the side-menu button **OK Confirm Factory Init**.

   b. *Modify the initialized front-panel control settings:*

   - Set the horizontal **SCALE** for the **M** (main) time base to 20 ns on the TDS 600C or 25 ns on the TDS 500D/700D/714L.
   - Press **HORIZONTAL MENU**; then press the main-menu button **Time Base**.
   - Press the side-menu button **Delayed Only**; then press the side-menu button **Delayed Triggerable**.
   - Set the horizontal **SCALE** for the **D** (delayed) time base to 20 ns on the TDS 600C or 25 ns on the TDS 500D/700D/714L; then press the side-menu button **Main Only**.
   - Press **TRIGGER MENU**; then press the main-menu button **Mode & Holdoff**. Press the side-menu button **Normal**.
   - Press **VERTICAL MENU**; then press the main-menu button **Coupling**. Press the side-menu button **Ω** to select the 50 Ω setting. (This step is not required on the TDS694C TDS794D.)
   - Press **SHIFT**; then press **ACQUIRE MENU**. Press the main-menu button **Mode**; then press the side-menu button **Average 16**.

   c. *Hook up the test-signal source:*

   - Connect the signal output of the generator to a BNC T connector. Connect one output of the T connector to **CH 1** through a 50 Ω precision coaxial cable. Connect the other output of the T connector to the **AUX TRIG INPUT** at the rear panel. See Figure 4–17.

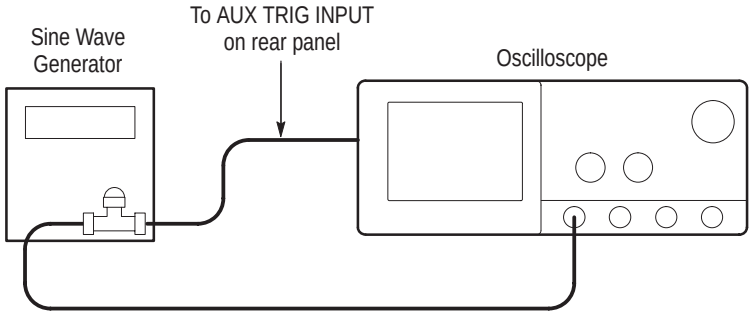



**Figure 4–17: Initial test hookup**

**2.** *Confirm Main and Delayed trigger systems are within sensitivity limits (50 MHz):*

**a.** *Display the test signal:*

- Set the generator frequency to 50 MHz.
- Press **MEASURE**.
- Press the main-menu button **Level Setup**; then press the side-menu button **Min-Max**.
- Press the main-menu button **Select Measrmnt for *Ch1***.
- 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**.
- Press **SET LEVEL TO 50%**.
- Press **CLEAR MENU**.
- Set the test signal amplitude for about three and a half divisions on screen. Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 350 mV. Readout may fluctuate around 350 mV.
- Disconnect the 50 Ω precision coaxial cable at **CH 1** and reconnect it to **CH 1** through a 10X attenuator.

**b.** *Check the Main trigger system for stable triggering at limits:*

- Read the following definition: A stable trigger is one that is consistent; that is, one that results in a uniform, regular display triggered on the selected slope (positive or negative). This display should *not* have its trigger point switching between opposite slopes, nor should it roll across the screen. At horizontal scale settings of

2 ms/division and faster, **TRIG'D** will remain constantly lighted. It will flash for slower settings.

- Press **TRIGGER MENU**; then press the main-menu button **Slope**.
- Adjust the **TRIGGER LEVEL** knob so that there is a stable trigger. CHECK that the trigger is stable for the test waveform on the positive slope.
- Use the side menu to select the negative slope. Adjust the **TRIGGER LEVEL** knob so that there is a stable trigger. CHECK that the trigger is stable for the test waveform on the negative slope.
- Enter pass/fail result for main trigger on the test record.
- Leave the Main trigger system triggered on the positive slope of the waveform before continuing to the next step.

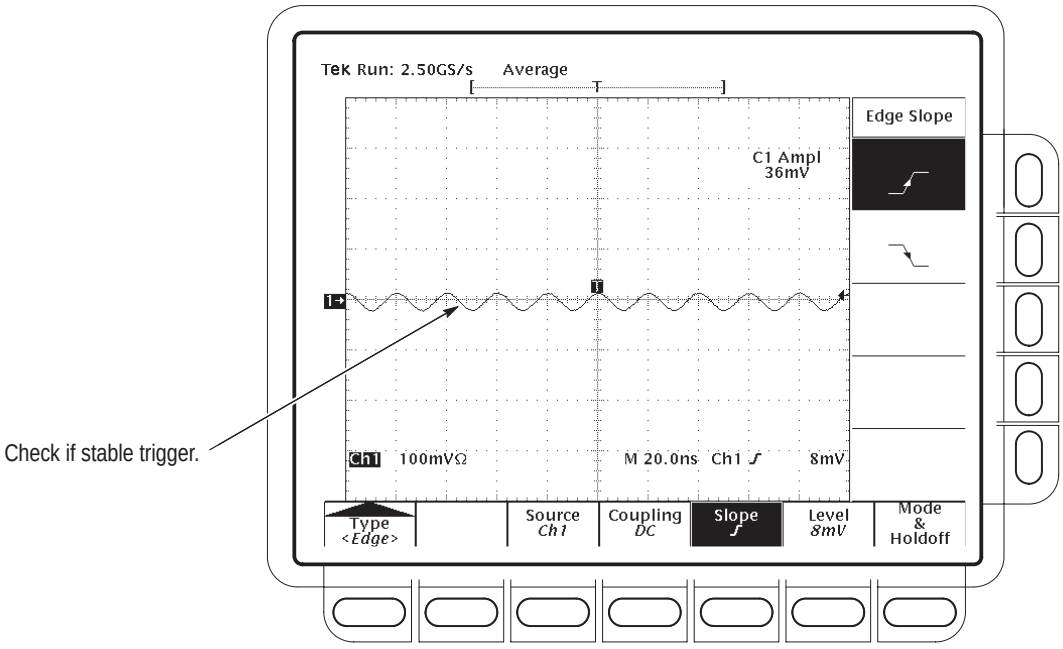



**Figure 4–18: Measurement of trigger sensitivity – 50 MHz results shown on a TDS 684C screen**

**c.** *Check Delayed trigger system for stable triggering at limits:* Do the following subparts in the order listed.

- Press **HORIZONTAL MENU**; then press the main-menu button **Time Base**. Press the side-menu button **Delayed Only**; then press **Delayed Triggerable** in the same menu.

- Press **SHIFT**; then press **DELAYED TRIG**. Press the main-menu button **Level**.
- Press the side-menu button **SET TO 50%**.

  CHECK that a stable trigger is obtained for the test waveform for both the positive and negative slopes of the waveform. Use the **TRIGGER LEVEL** knob to stabilize the Main trigger. Use the general purpose knob to stabilize the Delayed trigger. Press the main-menu button **Slope**; then use the side menu to switch between trigger slopes. See Figure 4–18 on page 4–65.
- Enter pass/fail result for delayed trigger on the test record.
- Leave the Delayed trigger system triggered on the positive slope of the waveform before continuing to the next step. Also, return to the main time base: Press **HORIZONTAL MENU**; then press the main-menu button **Time Base**. Press the side-menu button **Main Only**.
- Press **CLEAR MENU**.

**3.** *Confirm the AUX Trigger input:*

**a.** *Display the test signal:*

- Remove the 10X attenuator and reconnect the cable to **CH 1**.
- Set the test signal amplitude for about 2.5 divisions on screen.
- Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 250 mV. (Readout may fluctuate around 250 mV).

**b.** *Check the AUX trigger source for stable triggering at limits:* Do the following in the order listed.

- Use the definition for stable trigger from step 2.
- Press **TRIGGER MENU**; then press the main-menu button **Source**.
- Press the side-menu button **–more–** until the side-menu label **DC Aux** appears; then press **DC Aux**.
- Press **SET LEVEL TO 50%**. CHECK that a stable trigger is obtained 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 **TRIGGER LEVEL** knob to stabilize the trigger if required.
- Enter the pass/fail result on the test record.

- Leave the Main trigger system triggered on the positive slope of the waveform before proceeding to the next check.
- Press the main-menu button **Source**; then press the side-menu button **–more–** until **CH 1** appears. Press **CH 1**.

**4.** *Confirm that the Main and Delayed trigger systems are within sensitivity limits (full bandwidth):*

**a.** *Hook up the test-signal source:* Disconnect the hookup installed in step 1. Connect the signal output of a high-frequency sine wave generator to **CH 1**. Some TDS models need a high frequency (>500 MHz) generator; see footnotes 1 and 5 in Table 4–1 on page 4–18.

**b.** *Set the Main and Delayed Horizontal Scales:*

- Set the horizontal **SCALE** to 500 ps for the **M** (Main) time base.
- Press **HORIZONTAL MENU**. Now press the main-menu button **Time base**; then press the side-menu button **Delayed Triggerable**.
- Press the side-menu button **Delayed Only**.
- Set the horizontal **SCALE** to 500 ps for the **D** (Delayed) time base. Press the side-menu button **Main Only**.

**c.** *Display the test signal:*

- Set the generator frequency to full bandwidth as follows:

| | |
|---|---|
| TDS694C: | **3 GHz** |
| TDS794D: | **2 GHz** |
| TDS580D, TDS680C, TDS684C, & TDS784D: | **1 GHz** |
| TDS520D, TDS540D, TDS654C, TDS714L, TDS724D, & TDS754D: | **500 MHz** |

- Set the test signal amplitude for about five divisions on screen. Now fine adjust the generator output until the **CH 1 Amplitude** readout indicates the amplitude is 500 mV. (Readout may fluctuate around 500 mV). TDS694C only: Press the set level to 50% and check that a stable trigger is obtained.
- Disconnect the leveling head at **CH 1** and reconnect it to **CH 1** through a 5X attenuator. Check that a stable trigger is obtained.

**d.** Repeat step 2, substeps **b** and **c** only, for the full bandwidth selected. TDS694C or TDS794D exception: Perform step 2, substep **c** (Delayed trigger) with the generator frequency set to **1.5 GHz**.

***NOTE**. You just checked the trigger sensitivity. If desired, you may repeat steps 1 through 4 for the other channels (CH2, CH3, and CH4).*

**5.** *Disconnect the hookup:* Disconnect the cable from the channel last tested.

## Output Signal Checks

The procedure that follows checks those characteristics of the output signals that are listed as checked under *Warranted Characteristics* in *Specifications.* The oscilloscope outputs these signals at its front and rear panels.

### Check Outputs — CH 3 (AUX 1 on some models) Main and Delayed Trigger

| | |
|---|---|
| **Equipment required** | Two precision 50 Ω coaxial cables (Item 5)<br>One calibration generator (Item 10) |
| **Prerequisites** | See page 4–17. Also, the oscilloscope must have passed *Check DC Voltage Measurement Accuracy* on page 4–38.<br>See *Input Channels versus Model* on page 4–2. |

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

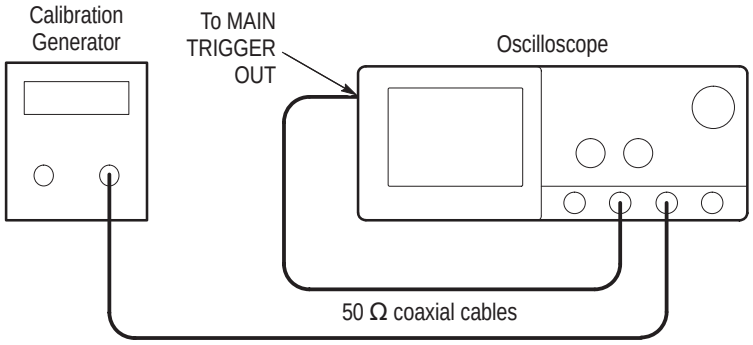



**Figure 4–19: Initial test hookup**

**a.** *Hook up test-signal source 1 (See Figure 4–19):*

- Connect the standard amplitude output of a calibration generator through a 50 Ω precision coaxial cable to **CH 3** (**AUX1** on some TDS models).
- Set the output of the calibration generator to 0.500 V.

**b.** *Hook up test-signal source 2:* Connect the **Main Trigger Out** at the rear panel to **CH 2** through a 50 Ω precision cable.

**c.** *Initialize the oscilloscope:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**d.** *Modify the initialized front-panel control settings:*

- Press **WAVEFORM OFF** to turn off CH 1.
- Press **CH 3** (**AUX 1** on some TDS models) to display that channel.
- TDS694C only: Press trigger menu, select Ch 3 as trigger, set to 50%.
- If necessary, adjust the calibration generator output for 5 divisions of amplitude. (With the 50Ω input of the TDS694C and TDS794D, you may need to double the output of the generator to get 5 divisions of amplitude.)
- Set the horizontal **SCALE** to 200 μs.
- Press **SHIFT**; then press **ACQUIRE MENU**.
- Press the main-menu button **Mode**; then press the side-menu button **Average**.
- Select **64** averages. Do this with the keypad or the general purpose knob.

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

**a.** *Display the test signal:*

- Press **WAVEFORM OFF** to turn off CH 3.
- Press **CH 2** to display that channel.
- Set the vertical **SCALE** to 1 V, 500 mV for TDS694C or TDS794D.
- Use the vertical **POSITION** knob to center the display on screen.

**b.** *Measure logic levels:*

- Press **MEASURE**; then press the main-menu button **Select Measurement for Ch2**.





- Select high and low measurements. To do this, 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**.

**c.** *Check Main Trigger output against limits:(Skip the first three subparts of this substep for the TDS694C and TDS794D only.)*

- CHECK that the **Ch2 High** readout is ≥2.5 volts and that the **Ch2 Low** readout is ≤0.7 volts. See Figure 4–20.
- Enter high and low voltages on test record.
- Press **VERTICAL MENU**; then press the main-menu button **Coupling**. Now press the side-menu button **Ω** to toggle it to the 50 Ω setting.
- CHECK that the **Ch2 High** readout is ≥1.0 volt and that the **Ch2 Low** readout ≤0.25 volts.
- Enter high and low voltages on the test record.

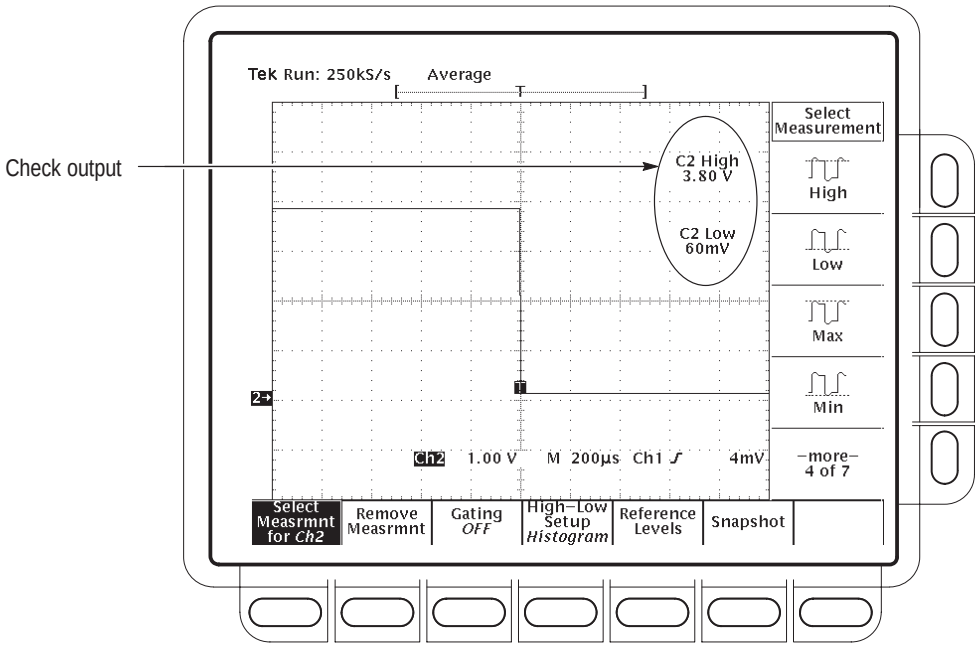



**Figure 4–20: Measurement of main trigger out limits**

**d.** *Check Delayed Trigger output against limits:* See Figure 4–20.

- Move the precision 50 Ω cable from the rear-panel **Main Trigger Output** BNC to the rear-panel **Delayed Trigger Output** BNC.
- CHECK that the **Ch2 High** readout is ≥1.0 volt and that the **Ch2 Low** readout ≤0.25 volts.
- Enter high and low voltages on test record.

- Press the side-menu button **Ω** to select the 1 MΩ setting. (This step is not required on the TDS794D – proceed to step 3. TDS694C skip the following steps and proceed to step 4.)
- Press **CLEAR MENU**.
- CHECK that the **Ch2 High** readout is ≥2.5 volts and that the **Ch2 Low** readout is ≤0.7 volts.
- Enter high and low voltages on test record.

**3.** *Confirm CH 3 (AUX 1 on some TDS models except TDS694C) output is within limits for gain:*

**a.** *Measure gain:*

- Move the precision 50 Ω cable from the rear-panel **DELAYED TRIGGER OUTPUT** BNC to the rear-panel **CH 3/AUX 1** BNC (**SIGNAL OUT** on some models).
- Push **TRIGGER MENU**.
- Press the main-menu button **Source**.
- Press the side-menu button **Ch3**. (**Ax1** on some TDS models)
- Set vertical **SCALE** to 100 mV.
- Press **SET LEVEL TO 50%**.
- Press **MEASURE**; then press the main-menu button **Select Measrmnt for Ch2**.
- Repeatedly press the side-menu button **–more–** until **Pk-Pk** appears in the side menu (its icon is shown at the left). Press the side-menu button **Pk-Pk**.



- Press **CLEAR MENU**.

**b.** *Check against limits: (Skip the first four subparts of this substep for the TDS 794D only.)*

- CHECK that the readout **Ch2 Pk-Pk** is between 80 mV and 120 mV, inclusive, for the TDS 600C or is between 88 mV and 132 mV, inclusive, for the TDS 500D/700D/714L.
- Enter voltage on test record.
- Press **VERTICAL MENU**; then press the side-menu button **Ω** to toggle to the 50 Ω setting.
- Press **CLEAR MENU**.

- CHECK that the readout **Ch2 Pk-Pk** is between 40 mV and 60 mV, inclusive, for the TDS 600C or is between 44 mV and 66 mV, inclusive, for the TDS 500D/700D/714L.
- Enter voltage on test record.

**4.** *Disconnect the hookup:* Disconnect the cables from the channel inputs and the rear panel outputs.

## Check Probe Compensator Output

| | |
|---|---|
| **Equipment required** | One female BNC to clip adapter (Item 3)<br>Two dual-banana connectors (Item 6)<br>One BNC T connector (Item 7)<br>Two precision 50 Ω coaxial cables (Item 5)<br>One DC calibration generator (Item 9) |
| **Prerequisites** | See page 4–17. Also, the oscilloscope must have passed *Check Accuracy For Long-Term Sample Rate, Delay Time, and Delta Time Measurement* on page 4–56. |

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

**a.** *Hook up test-signal:*

- Connect one of the 50 Ω cables to **CH 1**. See Figure 4–21.
- Connect the other end of the cable just installed to the female BNC-to-clips adapter. See Figure 4–21.
- Connect the red clip on the adapter just installed to the **PROBE COMPENSATION SIGNAL** on the front panel; connect the black clip to **PROBE COMPENSATION GND**. See Figure 4–21.

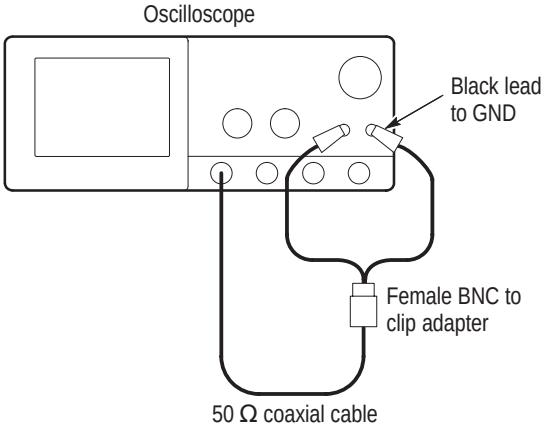



**Figure 4–21: Initial test hookup**

**b.** *Initialize the oscilloscope:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**c.** *Modify the initialized front-panel control settings:*

- Set the horizontal **SCALE** to 200 μs.
- Press **SET LEVEL TO 50%**.
- Use the vertical **POSITION** knob to center the display on screen.
- Press **SHIFT**; then press **ACQUIRE MENU**.
- Press the main-menu button **Mode**; then press the side-menu button **Average**.
- Select **128** averages with the keypad or the general purpose knob.

**2.** *Confirm that the Probe Compensator signal is within limits for frequency:*

**a.** *Measure the frequency of the probe compensation signal:*

- Press **MEASURE**; then press the main-menu button **Select Measrmnt for *Ch1***.



- 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**.

**b.** *Check against limits:*

- CHECK that the **CH 1 Freq** readout is within 950 Hz to 1.050 kHz, inclusive. See Figure 4–22.
- Enter frequency on test record.
- Press **MEASURE**; then press the main-menu button **Remove Measrmnt**. Press the side-menu **Measurement 1**.

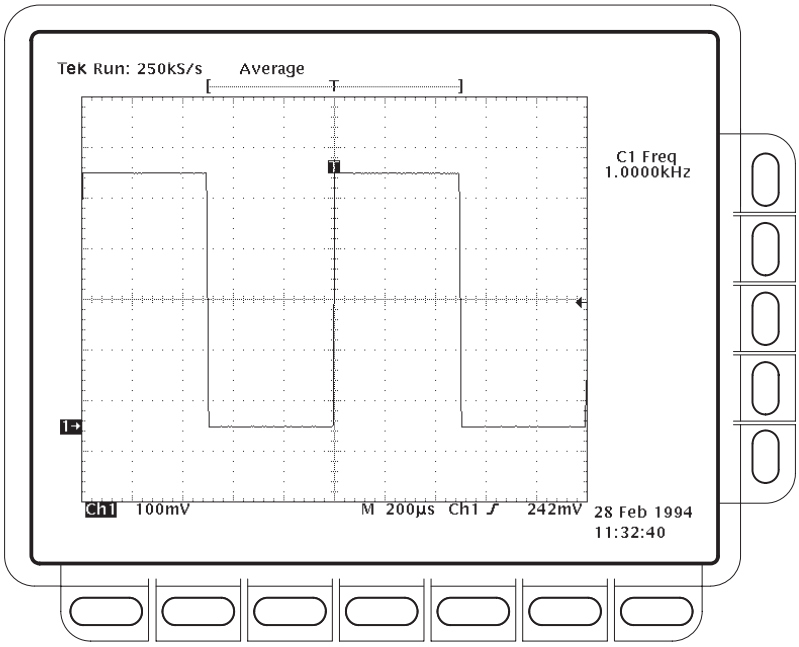



**Figure 4–22: Measurement of probe compensator frequency**

**c.** *Save the probe compensation signal in reference memory:*

- Press save/recall **WAVEFORM**; then press the main-menu button **Save Wfm *Ch 1***.
- Press the side-menu button **To Ref 1** to save the probe compensation signal in reference 1.
- Disconnect the cable from **CH 1** and the clips from the probe compensation terminals.
- Press **MORE**; then press the main-menu button **Ref 1** to displayed the stored signal.
- Press **CH 1**.

**d.** *Hook up the DC standard source:*

- Set the output of a DC calibration generator to off or 0 volts.
- Connect the output of a 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 4–23.
- 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 **CH 1**. See Figure 4–23.

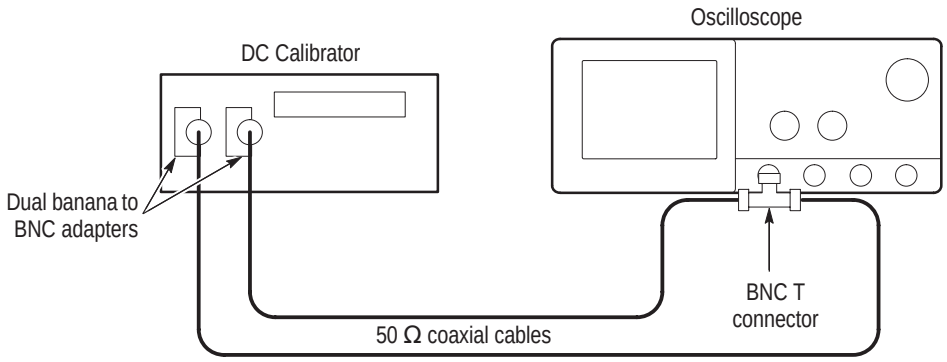



**Figure 4–23: Subsequent test hookup**

**e.** *Measure amplitude of the probe compensation signal:*

- Press **SHIFT**; then press **ACQUIRE MENU**. Press the side-menu button **AVERAGE** then enter 16 using the keypad or the general purpose knob.
- Adjust the output of the DC calibration generator until it precisely overlaps the top (upper) level of the stored probe compensation signal. (This value will be near 500 mV).
- Record the setting of the DC generator.
- Adjust the output of the DC calibration generator until it precisely overlaps the base (lower) level of the stored probe compensation signal. (This value will be near zero volts).
- Record the setting of the DC generator.

**f.** Press **CLEAR MENU** to remove the menus from the display. See Figure 4–24.

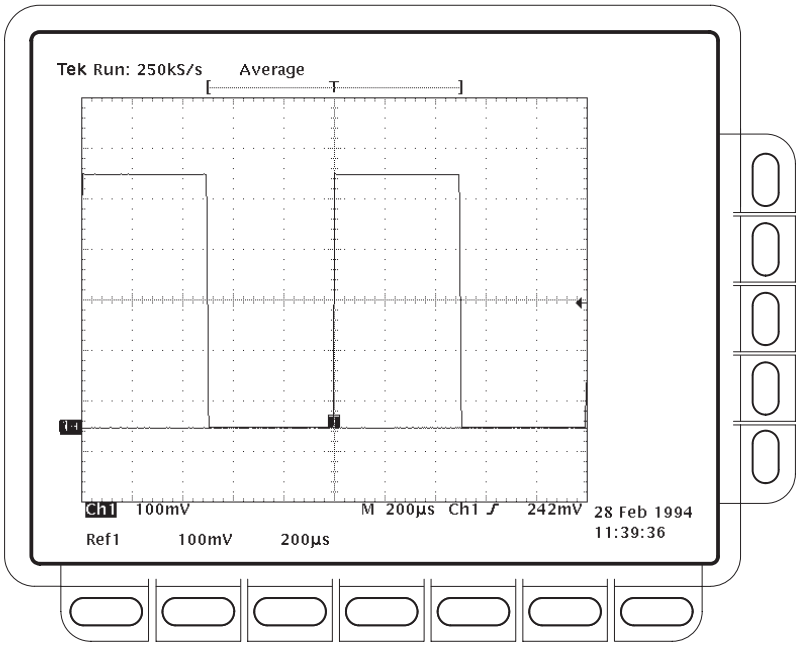



**Figure 4–24: Measurement of probe compensator amplitude**

**g.** *Check against limits:*

- Subtract the value just obtained (base level) from that obtained previously (top level).
- CHECK that the difference obtained is within 495 mV to 505 mV, inclusive.
- Enter voltage difference on test record.

**3.** *Disconnect the hookup:* Disconnect the cable from **CH 1**.

# Option 05 Video Trigger Checks (Not Available on TDS694C or TDS794D)

## Check Video Trigger

| | |
|---|---|
| **Equipment required** | PAL signal source (Item 21)<br>60 Hz sine wave generator (Item 22)<br>Pulse generator (Item 23)<br>Two 75 Ω cables (Item 24)<br>Two 75 Ω terminators (Item 25)<br>One BNC T connector (Item 7)<br>One precision 50 Ω coaxial cable (Item 5)<br>50 Ω terminator (Item 4) |
| **Prerequisites** | See page 4–17. These prerequisites include running the signal path compensation routine. |

1. *Set up the oscilloscope to factory defaults by completing the following steps:*
   - **a.** Press save/recall **SETUP**.
   - **b.** Press the main-menu **Recall Factory Setup**.
   - **c.** Press the side-menu **OK Confirm Factory Init**.
   - **d.** Wait for the Clock Icon to leave the screen.
   - **e.** CONFIRM the oscilloscope is setup as shown below.

     Channel: CH1

     Volt/div: 100 mV

     Horizontal scale: 500 µs/div
2. *Set up the oscilloscope for TV triggers by completing the following steps:*
   - **a.** Press **TRIGGER MENU**.
   - **b.** Press the main-menu **Type** pop-up until you select **Video**.
   - **c.** Press the main-menu **Standard** pop-up until you select **625/PAL**.
   - **d.** Press the main-menu **Line**.
   - **e.** Use the keypad to set the line number to 7 (press **7**, then **ENTER**).
   - **f.** Press **VERTICAL MENU**.
   - **g.** Press the main-menu **Bandwidth**.

**h.** Select **250 MHz** from the side menu.

**i.** Press the main-menu **Fine Scale**.

**j.** Press **HORIZONTAL MENU**.

**k.** Press the main-menu **Horiz Scale**.

**l.** Use the keypad to set the horizontal scale to 200 ns (press **200**, **SHIFT**, **n,** then **ENTER**).

**m.** Use the Vertical Position knob to center the waveform on screen.

**3.** *Check Jitter vs. Signal Amplitude*

**a.** Set up equipment for Jitter Test. See Figure 4–25.

- Connect one of the rear panel composite outputs marked **COMPST** on the TSG121 through a 75 Ω cable and a 75 Ω terminator to the CH1 input of the oscilloscope.
- Press the **100% FIELD** control (the fourth TSG121 front-panel button from the left) of the PAL signal source.

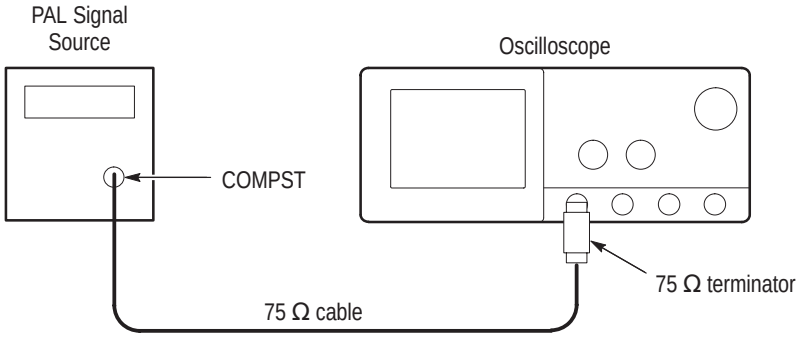



**Figure 4–25: Jitter test hookup**

**b.** CHECK that the oscilloscope lights up its front panel **TRIG'D** LED and it displays the waveform on screen. See Figure 4–26.

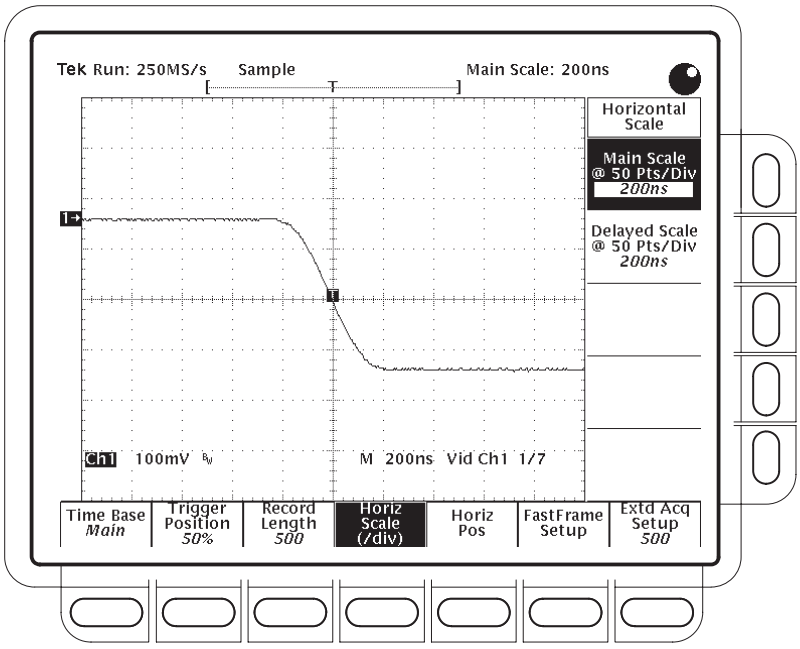



**Figure 4–26: Jitter test displayed waveform – TDS 754D shown**

**c.** Press **SHIFT**; then press **ACQUIRE MENU**.

**d.** Press the main-menu **Mode**.

**e.** Press the side-menu **Envelope**.

**f.** Use the keypad to set envelope to use 100 acquisitions (press **100**, then **ENTER**).

**g.** Press the main-menu **Stop After** button.

**h.** Press the side-menu **Single Acquisition Sequence.**

**i.** Wait for the word **Run** in the top left corner of the display to change to **STOP**.

**4.** *Perform Check Trigger Jitter.*

Set up Oscilloscope for the Trigger Jitter Test.

**a.** Press **DISPLAY**.

**b.** Press the main-menu **Format/RO**.

**c.** Press the side-menu **Display 'T' @ Trigger Point** until you select **OFF**.

**d.** Press **CURSOR**.

**e.** Press the side-menu **V-Bars**.

**f.** Use the general purpose knob to move the left cursor to the right until the @ measurement reads -32 ns.

**g.** Press **SELECT**.

**h.** Use the General Purpose knob to adjust the right cursor until the delta measurement reads 60 ns.

**i.** CONFIRM that the width of the falling edge of the trace (at the center crossings) falls between the cursors. See Figure 4–27.

**j.** Press **DISPLAY**.

**k.** Press the main-menu **Format/RO**.

**l.** Press the side–menu **Display 'T' @ Trigger Point** until you select **ON**.

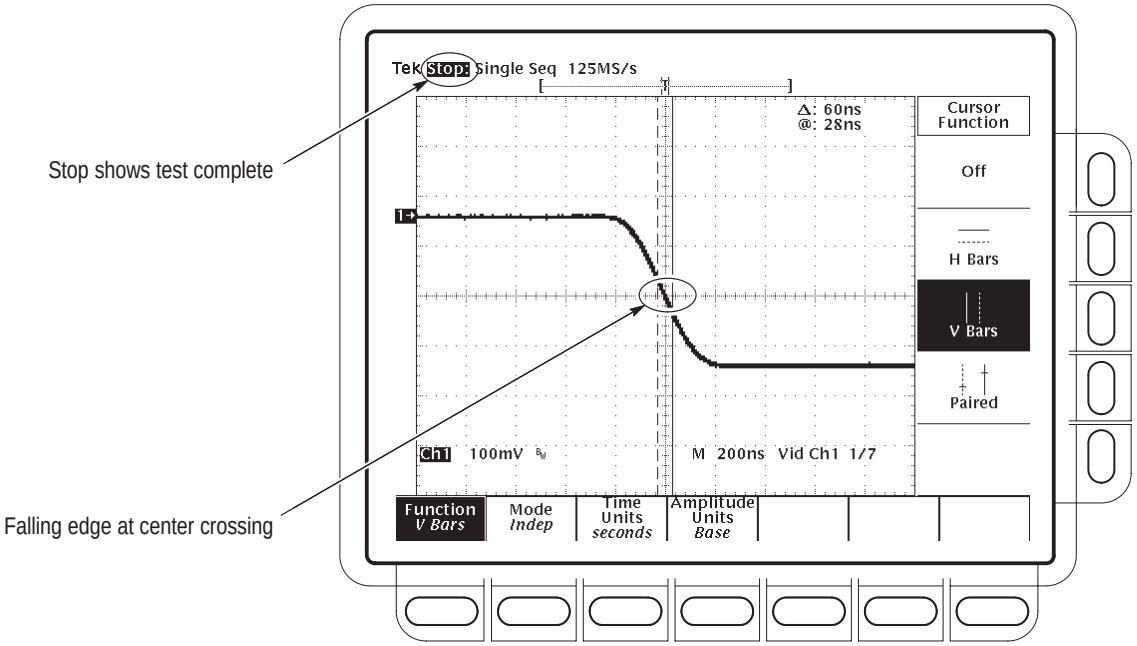



**Figure 4–27: Jitter test when completed – TDS 754D shown**

**5.** *Check Triggered Signal Range.*

Set up oscilloscope for Triggered Signal Test.

**a.** Press **MORE**.

**b.** Press **WAVEFORM OFF**.

**c.** Press **HORIZONTAL MENU**.

**d.** Use the keypad to set horizontal scale (/div) to 50 µs (press **50**, **SHIFT**, **µ**, then **ENTER**).

**e.** Press **SHIFT**; then press **ACQUIRE MENU**.

**f.** Press the main-menu **Stop After**.

**g.** Press the side-menu **RUN/STOP button only**.

**h.** Press the main-menu **Mode**.

**i.** Press the side-menu **Sample**.

**j.** Press **RUN/STOP**.

**k.** Press **VERTICAL MENU**.

**l.** Use the keypad to set fine scale to 300 mV (press **300**, **SHIFT**, **m,** then **ENTER**).

**m.** CONFIRM that the **TRIG'D** LED stays lighted and that the waveform on screen is stable. Also, CONFIRM that the waveform on the screen has one positive pulse and a number of negative pulses. See Figure 4–28.

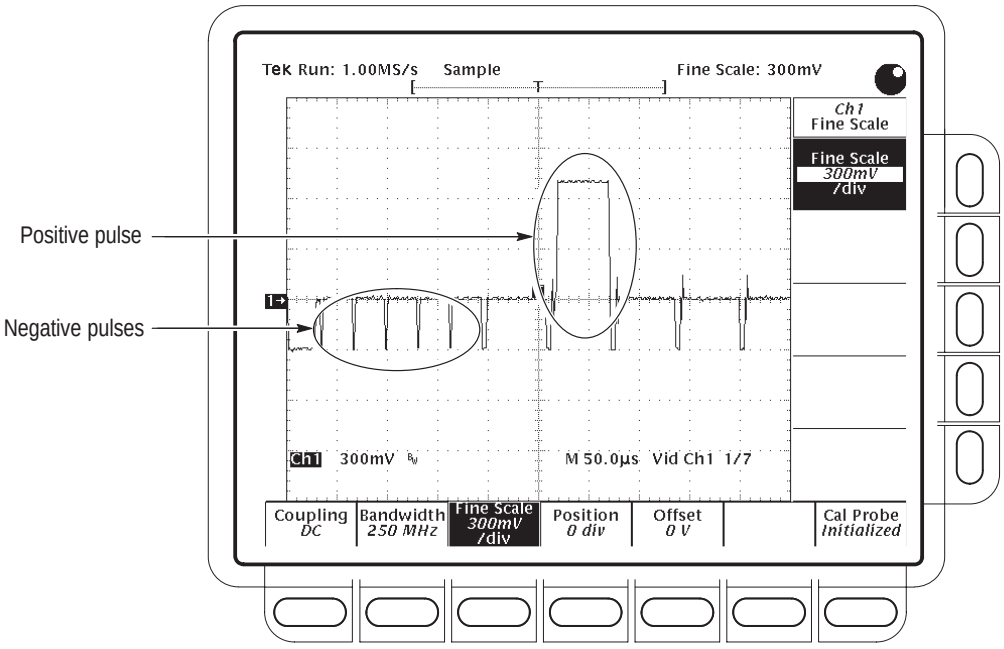



**Figure 4–28: Triggered signal range test – 300 mV**

**n.** Use the keypad to set the fine scale to 75 mV (press **75**, **SHIFT**, **m**, then **ENTER**).

**o.** CONFIRM that the **TRIG'D** LED stays lighted and that the waveform on screen is stable. That is, it does not move horizontally or vertically. Also, CONFIRM that the waveform on the screen has one positive pulse and a number of negative pulses. See Figure 4–29.

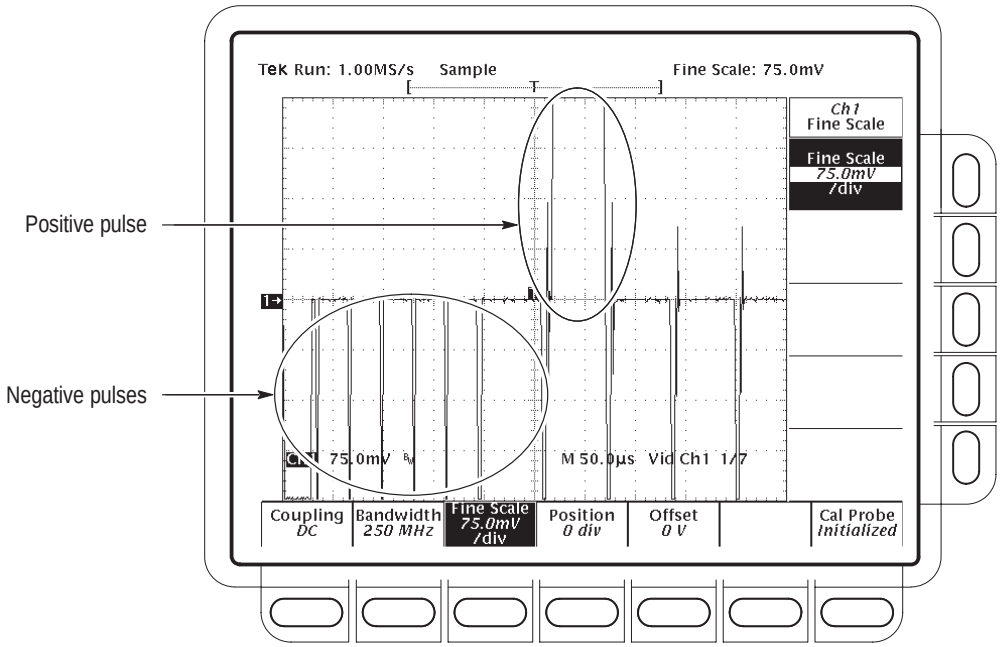



**Figure 4–29: Triggered signal range test – 75 mV**

**p.** Disconnect all test equipment (TSG121) from the oscilloscope.

**6.** *Check 60 Hz Rejection.*

**a.** *Set up oscilloscope for 60 Hz Rejection Test:*

- Use the keypad to set the Ch1 Fine Scale to 282 mV (press **282**, **SHIFT m**, then **ENTER**).
- Press **WAVEFORM OFF**.
- Press **CH2**.
- Press **VERTICAL MENU**.
- Use the keypad set the fine scale to 2 V (press **2**, then **ENTER**).
- Press **HORIZONTAL MENU**.

- Use the keypad to set the horizontal scale (/div) to 5 ms (press **5**, **SHIFT**, **m**, then **ENTER**).

**b.** *Set up 60 Hz signal generator:*

- Connect the output of the signal generator to the CH2 input through a 50 Ω cable. See Figure 4–30.

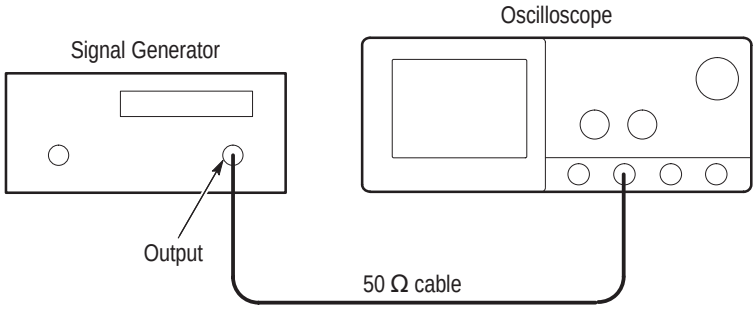



**Figure 4–30: 60 Hz Rejection test hookup**

- Adjust the signal generator for three vertical divisions of 60 Hz signal. See Figure 4–31. The signal will not be triggered. That is, it will run free.

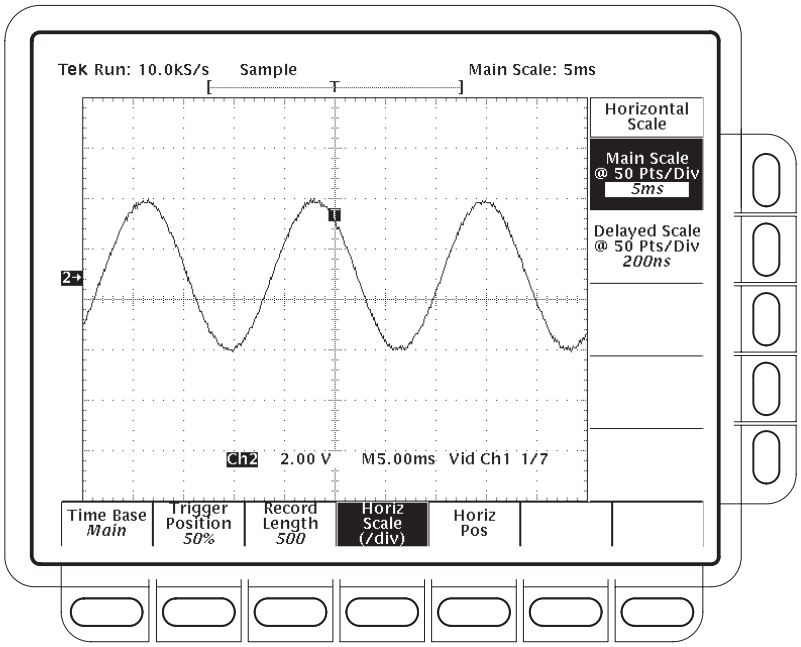



**Figure 4–31: 60 Hz Rejection test setup signal**

**c.** *Check 60 Hz rejection:*

- Use the keypad to set the horizontal scale (/div) to 50 µs (press **50**, **SHIFT**, **µ**, then **ENTER**).
- Reconnect the output of the signal generator. Connect the composite signal connector of the PAL signal source (labeled **COMPST** on the TSG 121) to a 75 Ω cable and a 75 Ω terminator. Connect both signals to the CH1 input through a BNC T. See Figure 4–32.
- Press **VERTICAL MENU**.
- If needed, press the main-menu **Fine Scale**.
- Use the keypad to set fine scale to 500 mV (press **500**, **SHIFT**, **m**, then **ENTER**).
- Connect another composite signal connector of the PAL signal source (labeled **COMPST** on the TSG 121) through a 75 Ω cable and a 75 Ω terminator to the CH2 input. See Figure 4–32.

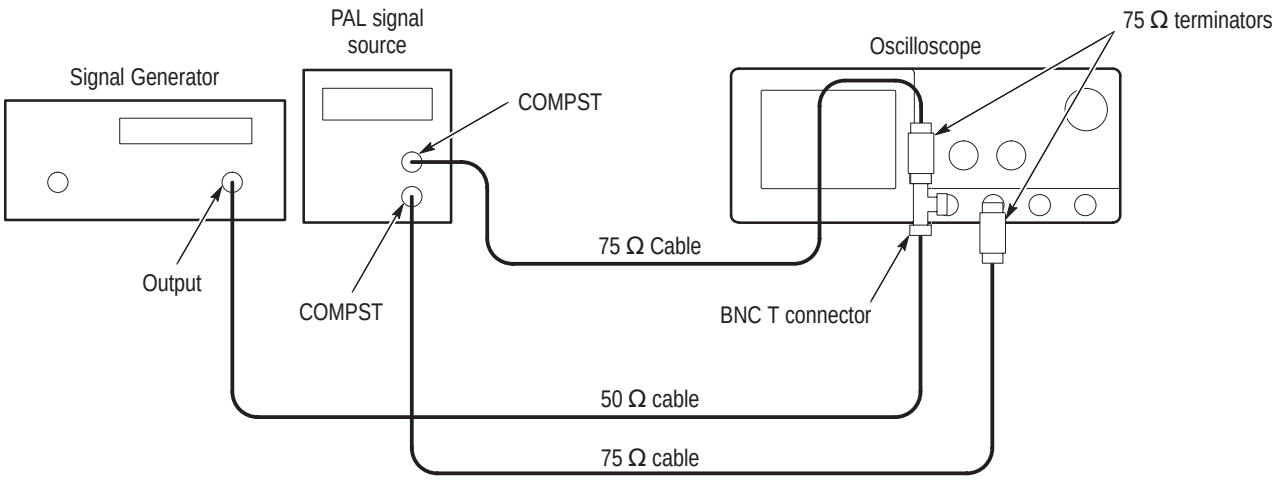



**Figure 4–32: Subsequent 60 Hz Rejection test hookup**

- CONFIRM that the **TRIG'D** LED stays lighted and that the waveform on screen is stable. In other words, be sure the waveform does not move horizontally or vertically. Also, confirm that the waveform on the screen has one positive pulse and a number of negative pulses. See Figure 4–33.
- Disconnect all test equipment from the oscilloscope.

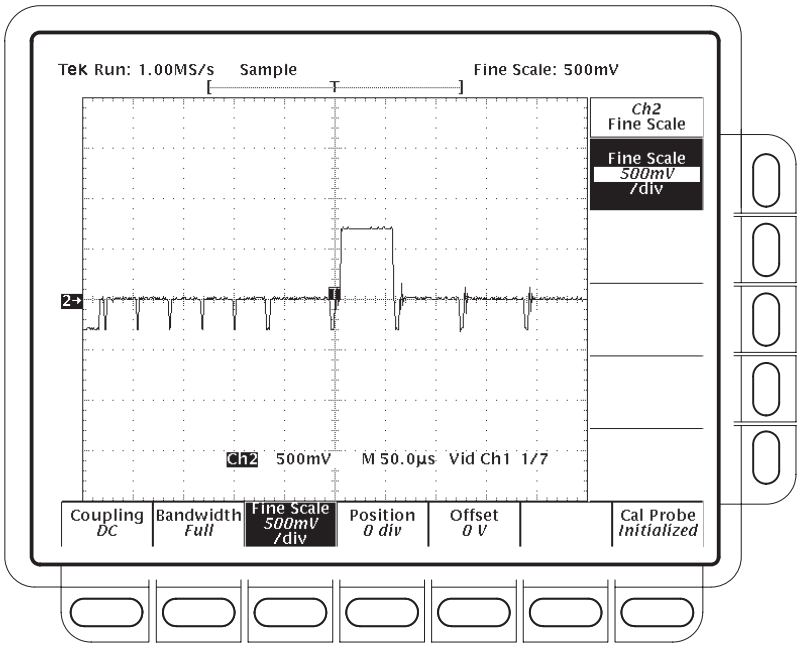



**Figure 4–33: 60 Hz Rejection test result – TDS 684C shown**

**7.** *Check Line Count Accuracy.*

**a.** *Set up oscilloscope for Line Count Accuracy Test:*

- Press **WAVEFORM OFF**.
- Press **CH1**.
- Press **HORIZONTAL MENU**.
- Press the main-menu **Record Length**.
- Press the side-menu **–more–** until you see the appropriate menu.
- Press the side-menu **5000 points in 100divs**.
- Press the main-menu **Horiz Scale (/div)**.
- Use the keypad to set the horizontal scale to 200 ns (press **200**, **SHIFT**, **n**, then **ENTER)**.

**b.** *Check Line Count Accuracy:*

- Connect a composite output signal from the rear of the PAL signal source (labeled **COMPST** on the TSG 121) to the CH1 input through a 75 Ω cable and a 75 Ω terminator. See Figure 4–34.

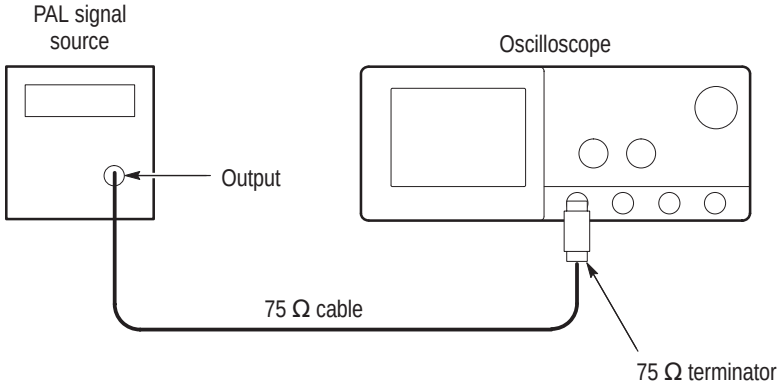



**Figure 4–34: Line count accuracy test hookup**

- Press the main-menu **Trigger Position**.
- Press the side-menu to **Set to 50%**.
- Press the main-menu to **Horiz Pos**.
- Press the side-menu to **Set to 50%**.
- Use the **HORIZONTAL POSITION** knob to move the falling edge of the sync pulse to two divisions to the left of center screen. See Figure 4–35.

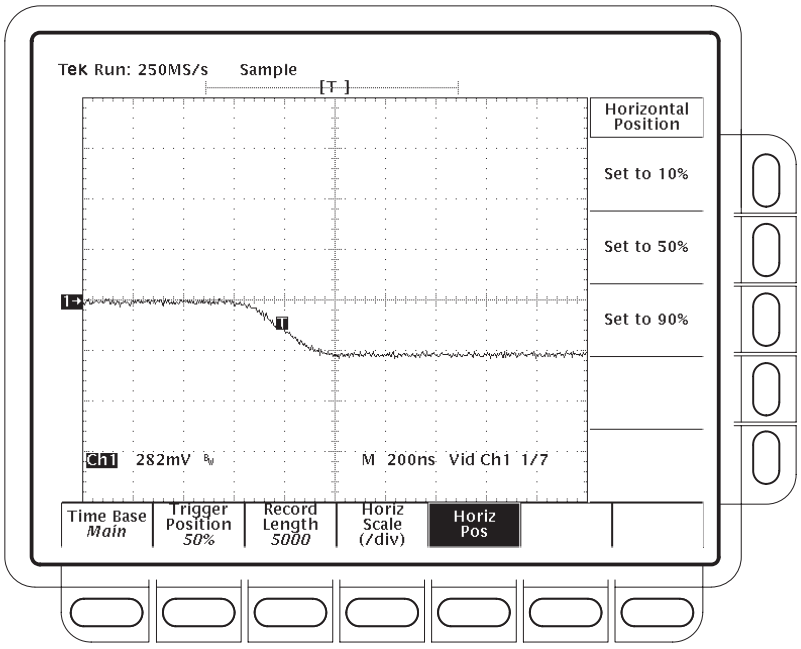



**Figure 4–35: Line count accuracy test setup waveform – TDS 684C shown**

- Press **CURSOR**.
- Press the main-menu **Function**.
- Press the side-menu **V Bars**.
- Using the General Purpose knob, place the left cursor directly over the trigger ‘T’ icon.
- Press **SELECT**.
- Turn the General Purpose knob to adjust the right cursor for a cursor delta reading of **6.780us**.
- Use the **HORIZONTAL POSITION** knob to position the right cursor to center screen.
- Verify that the cursor is positioned on a positive slope of the burst signal. See Figure 4–36.

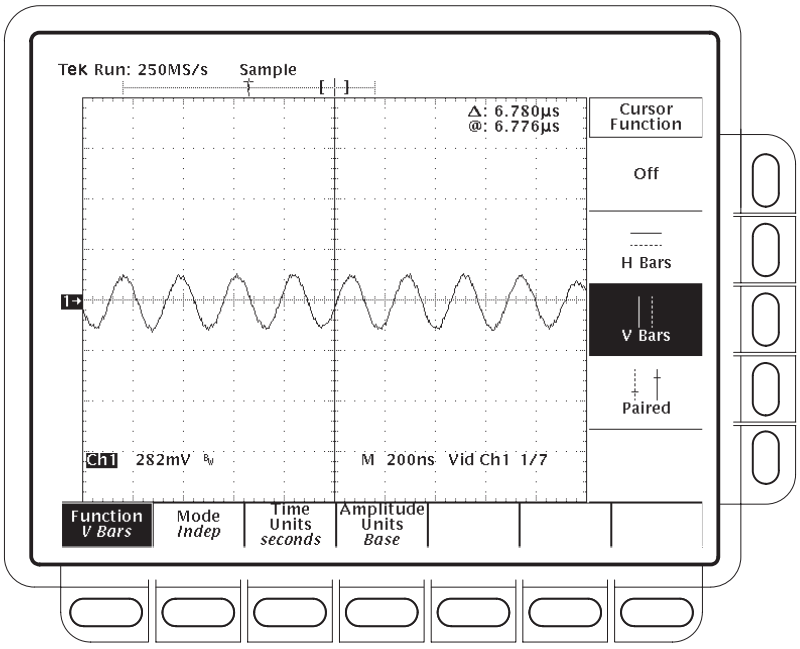



**Figure 4–36: Line count accuracy correct result waveform**

- Disconnect all test equipment (TSG 121) from the oscilloscope.
- Turn off cursors by pressing **CURSOR**, then the main-menu **Function** button, and, finally, **Off** from the side menu.

**8.** *Check the Sync Duty Cycle.*

**a.** *Set up oscilloscope for Sync Duty Cycle Test:*

- Press **TRIGGER MENU**.
- Press the **Standard** pop-up to select **FlexFmt**. Trigger **Type** should already be set to **Video**.
- Press the main-menu **Setup**.
- Press the side-menu **Field Rate**.
- Use the keypad to set the field rate to 60.05 Hz (press **60.05**, then **ENTER**).
- Press the side-menu **Lines**.
- Use the keypad to set the field rate to 793 lines (press **793**, then **ENTER**).
- Press the side-menu **Fields**.

- Use the keypad to set the number of fields to 1 (press **1**, then **ENTER**).
- Press the side-menu **Sync Width**.
- Use the keypad to set the width to 400 ns (press **400**, **SHIFT**, **n**, then **ENTER**).
- Press the side-menu **–more– 1 of 2**. Then press **V1 Start Time**.
- Use the keypad to set V1 start time to 10.10 µs (press **10.10**, **SHIFT**, **µ**, then **ENTER**).
- Press the side-menu **V1 Stop Time**.
- Use the keypad to set V1 stop time to 10.50 µs (press **10.50**, **SHIFT**, **µ**, then **ENTER**).
- Press the main-menu **Type** pop-up to select **Edge**.
- Press **HORIZONTAL MENU**.
- Press the main-menu **Record Length**.
- Select the side-menu **1000 points in 20div**. If needed, first press the side-menu **–more–** until you see the appropriate side-menu item.
- Turn the **HORIZONTAL POSITION** knob to position the trigger 'T' two divisions to the left of the center screen.
- Press **MEASURE**.
- If needed, press the main-menu **Select Measrmnt**.
- Press the side-menu **Negative Width**.
- Press the side-menu **Period**.

**b.** *Set up the pulse generator for Sync Duty Cycle Test:*

- Set **PULSE DURATION** to 50 ns.
- Set **PERIOD** to 10 µs.
- Set **OUTPUT (VOLTS)** to **–1** for **LOW LEVEL** and **+1** for **HIGH LEVEL**.
- Depress the **COMPLEMENT** button.
- Be sure **BACK TERM** is depressed (in).

**c.** *Check Sync Duty Cycle:*

- Connect the pulse generator through a 50 Ω cable and a 50 Ω terminator to the oscilloscope CH1 input. See Figure 4–37.

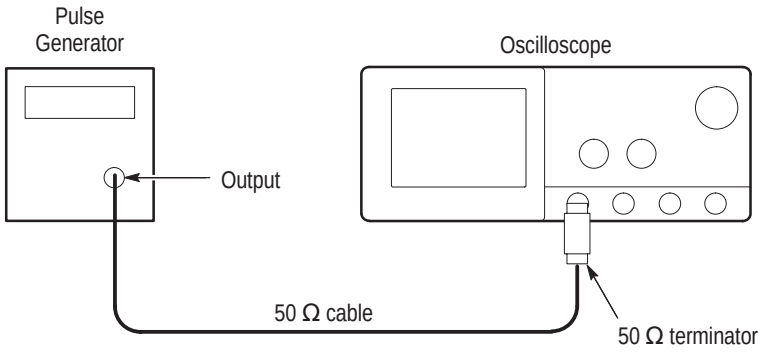



**Figure 4–37: Setup for sync duty cycle test**

- Turn the pulse generator **OUTPUT (VOLTS)** control until the signal on the oscilloscope shows a one division negative-going pulse. See Figure 4–38.

***NOTE.*** *You may need to adjust the trigger level control to obtain a stable trigger.*

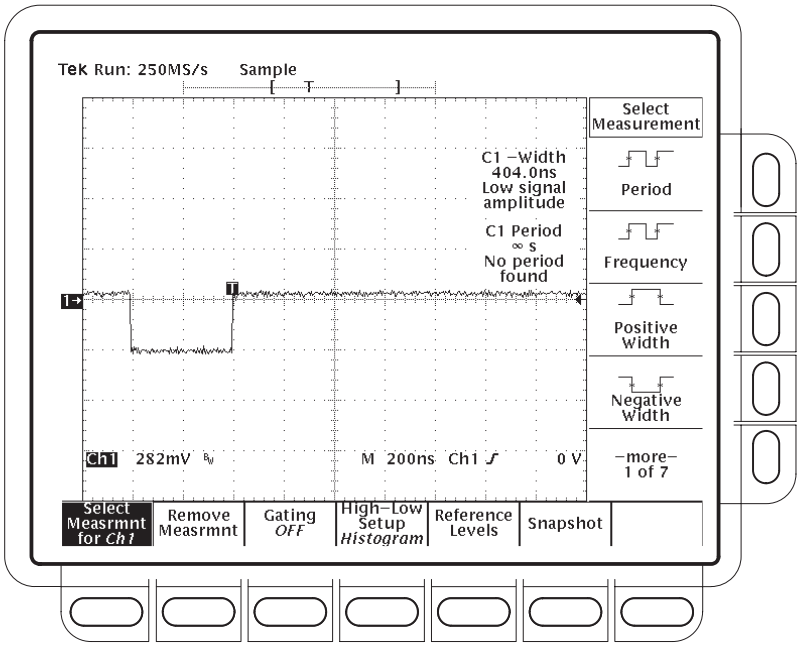



**Figure 4–38: Sync duty cycle test: one-div neg pulse waveform**

- Turn the pulse generator **PULSE DURATION** variable control to adjust the negative pulse so the oscilloscope's **CH1 – Width** measurement displays **400ns +/–10 ns**.
- Turn the **HORIZONTAL SCALE** knob to set the oscilloscope time base to **5µs/div**.
- Turn the pulse generator **PERIOD** variable control to adjust the period until the oscilloscope **CH1 Period** measurement reads **21.000µs –25/+50 ns**. See Figure 4–39. Read note shown below.

***NOTE.*** *The pulse duration and period adjustments are critical in making this measurement. If the pulse duration and/or the duty cycle are not stable, the FLEXFMT function may not function. You must take care when making these adjustments.*

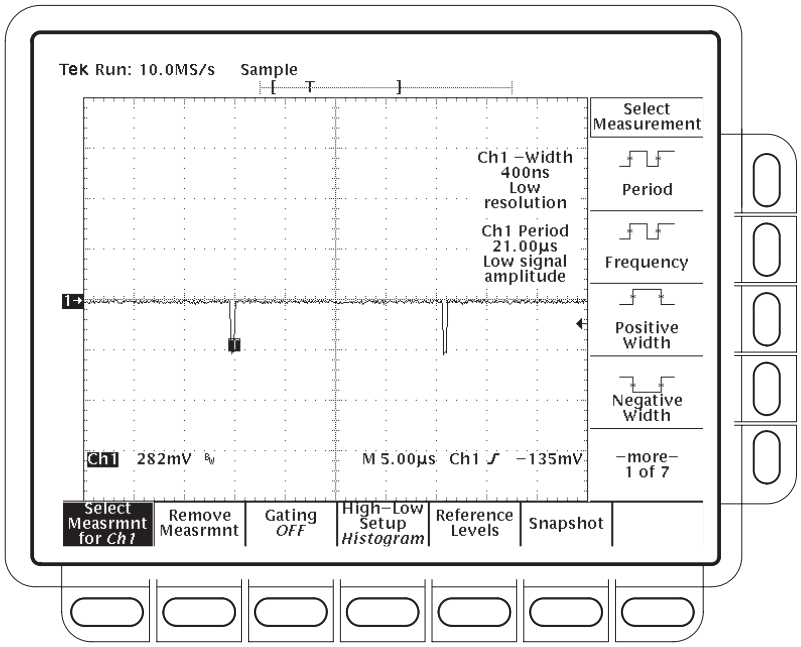



**Figure 4–39: Sync duty cycle test: critically adjusted pulse**

- Press **TRIGGER MENU**.
- Press the main-menu **Type** pop-up until you select **Video**.

  If the **TRIG'D** LED is not lighted, check that the **CH1 – Width** and **CH1 Period** measurements are adjusted correctly. See note above. CONFIRM that the setup is correct and the oscilloscope will trigger.
- CONFIRM that the **TRIG'D** LED is lighted and the waveform is stable.
- Disconnect the signal source from CH1, wait a few seconds, then reconnect the signal.
- CONFIRM that the **TRIG'D** LED is lighted and the waveform is stable.
- Press **Sync Polarity**.
- Press **Pos Sync**.
- Push the pulse generator **COMPLEMENT** button out.
- CONFIRM that the **TRIG'D** LED is lighted and the waveform is stable.

- Disconnect the signal source from CH1, wait a few seconds, then reconnect the signal.
- CONFIRM that the **TRIG'D** LED is lighted and the waveform is stable.
- Disconnect all test equipment from the oscilloscope.
- Press save/recall **SETUP**, the main-menu button **Recall Factory Setup**, and the side-menu **OK Confirm Factory Init**.

## Sine Wave Generator Leveling Procedure

Some procedures in this manual require a sine wave generator to produce the necessary test signals. If you do not have a leveled sine wave generator, use one of the following procedures to level the output amplitude of your sine wave generator.

| | |
|---|---|
| **Equipment required** | Sine wave generator (Item 14)<br>Level meter and power sensor (Item 15)<br>Power divider (Item 16)<br>Two male N to female BNC adapters (Item 17)<br>One precision coaxial cable (Item 5) |
| **Prerequisites** | See page 4–17 |

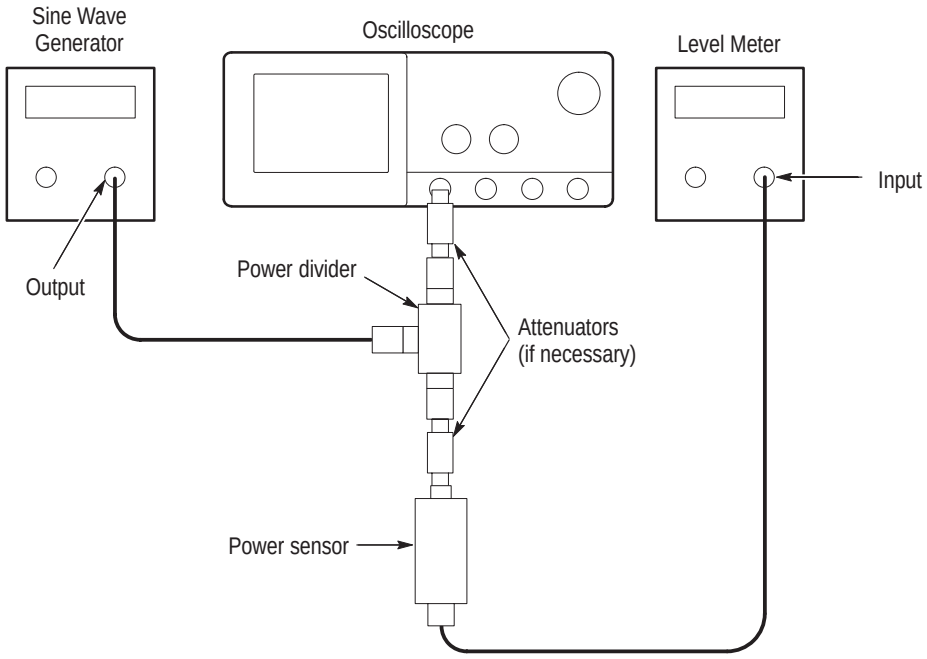



**Figure 4–40: Sine wave generator leveling equipment setup**

1. *Install the test hookup:* Connect the equipment as shown in Figure 4–40.
2. *Set the Generator:*
   - Set the sine wave generator to a reference frequency of 10 MHz.

- Adjust the sine wave generator amplitude to the required number of divisions as measured by the oscilloscope.

3. *Record the reference level:* Note the reading on the level meter.
4. *Set the generator to the new frequency and reference level:*
   - Change the sine wave generator to the desired new frequency.
   - Input the correction factor and/or the new frequency into the level meter.
   - Adjust the sine wave generator amplitude until the level meter again reads the value noted in step 3. The signal amplitude is now correctly set for the new frequency.

| | |
|---|---|
| **Equipment required** | Sine wave generator (Item 14)<br>Level meter and power sensor (Item 15)<br>Two male N to female BNC adapters (Item 17)<br>Two precision coaxial cables (Item 5) |
| **Prerequisites** | See page 4–17 |

1. *Install the test hookup:* Connect the equipment as shown in Figure 4–41 (start with the sine wave generator connected to the oscilloscope).

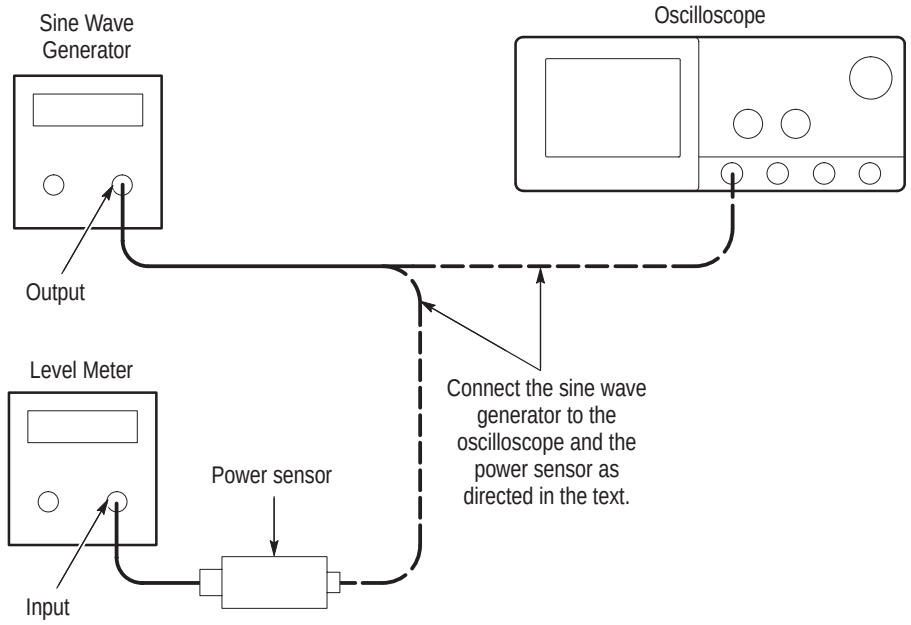



**Figure 4–41: Equipment setup for maximum amplitude**

**2.** *Set the Generator:*

- Set the sine wave generator to a reference frequency of 10 MHz.
- Adjust the sine wave generator amplitude to the required number of divisions as measured by the oscilloscope.

**3.** *Record the reference level:*

- Disconnect the sine wave generator from the oscilloscope.
- Connect the sine wave generator to the power sensor.
- Note the level meter reading.

**4.** *Set the generator to the new frequency and reference level:*

- Change the sine wave generator to the desired new frequency.
- Input the correction factor and/or the new frequency into the level meter.
- Adjust the sine wave generator amplitude until the level meter again reads the value noted in step 3. The signal amplitude is now correctly set for the new frequency.
- Disconnect the sine wave generator from the power sensor.
- Connect the sine wave generator to the oscilloscope.

## Optical Filter Checks (Options 2C, 3C & 4C Only)

The procedure that follows verifies that the frequency response of the combined P670xB and TDS500D/700D oscilloscope system is a Fourth Order Bessel Thompson Filter which is within limits.

### Filter Availability

Nominal Filters are available with Option 2C. Reference Receiver Filters are available with Options 3C and 4C. Options 3C and 4C are not available without 2C, and 3C and 4C are not available on the TDS 794D.

You can verify Option 2C is enabled on the TDS 794D by pressing **MEASURE**, then selecting **Masks** from the Measure pop-up menu. Table 4–7 lists the available vertical scale factors for each option. Tables 4–8, 4–9, and 4–10 list the available filters and their specifications.

**Table 4–7: Available filters**

| Nominal Filters (Option 2C) | Reference Receivers Filters (Options 3C, 4C) |
|---|---|
| 1 µW per division | |
| 2 µW per division | |
| 5 µW per division | |
| 10 µW per division | 10 µW per division |
| 20 µW per division | 20 µW per division |
| 50 µW per division | 50 µW per division |
| 100 µW per division | |
| 200 µW per division | |
| 500 µW per division | |
| 1 mW per division | |

**Table 4–8: Reference receiver filter options**

| Option 4C – SONET (P6703B 1300nm) | Option 3C – Fibre Channel (P6701B 850nm) |
|---|---|
| 52Mbit OC1 | FC133Mbit |
| | FC266Mbit |
| | FC531Mbit |
| 155Mbit OC3 | 155Mbit OC3 |
| 622Mbit OC12 | 622Mbit OC12 |
| FC1063 (TDS 784D Only) | FC1063 (TDS 784D Only) |

**Table 4–9: Option 3C and 4C specifications**

| Name | Description |
|---|---|
| Calibration Range, Reference Receiver | 10 µW per division<br>20 µW per division<br>50 µW per division |
| Temperature Range, Warranted Filter | 23° C, ±5° C |
| Calibration Range, Controlled | Up to 2X the data rate for all filters except FC1063 filter<br>Up to 1.5X the data rate for FC1063 filter |

**Table 4–10: Available receivers**

| | Option 4C[1] | | | | Option 3C[2] | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | OC1[4] | OC3 | OC12 | FC1063[3] | FC133 | FC266 | FC531 | FC1063[3] | OC3 | OC12 |
| TDS 520D | ✓ | ✓ | | | ✓ | | | | ✓ | |
| TDS 540D | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| TDS 580D | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| TDS 724D | ✓ | ✓ | | | ✓ | | | | ✓ | |
| TDS 754D | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| TDS 784D | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

1 Requires Tektronix P6703B, 1300 nm Optical to Electrical Converter.

2 Requires Tektronix P6701B, 850 nm Optical to Electrical Converter.

3 Reference receivers are warranted to 2.0 times the bit rate except for FC1063 which is warranted to 1.5 times the bit rate.

4 OC1 is type tested

## Reference Receiver Verification

| | |
|---|---|
| **Equipment required** | OIG501 (use with P6701B) (Item 26)<br>OIG502 (use with P6703B) (Item 27)<br>Optical Attenuator OA5022 (Item 34)<br>Fiber Optic Cable (Item 35)<br>Optical-to-Electrical Converter (item 36) |
| **Prerequisites** | See page 4–17. Also, the probe and the oscilloscope channel it is attached to must have been calibrated as a reference receiver. |

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

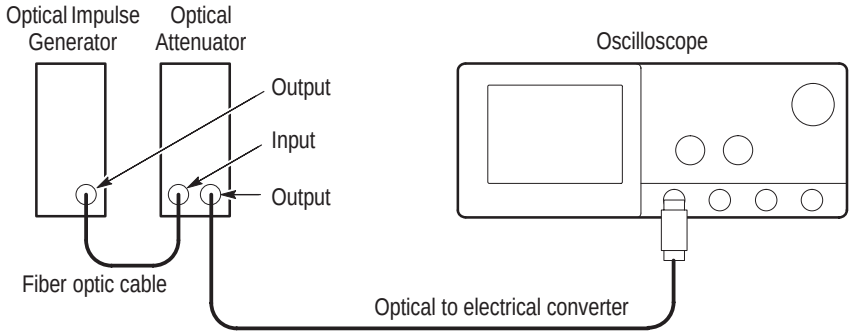



**Figure 4–42: Reference-receiver performance-verification set up**

**a.** *Initialize the oscilloscope:*

- Press SAVE/RECALL **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**b.** *Connect the probe, oscilloscope, optical impulse generator (OIG), and the optical attenuator:*

- Connect the optical probe to CH 1 of the oscilloscope under test (see Figure 4–42).
- See Table 4–10. If using a P6701B probe, connect the OIG501 (Item 26) OPTICAL OUTPUT to the optical attenuator (Item 34) OPTICAL INPUT using a fiber-optic cable (Item 35). If using a P6703B probe, connect the OIG502 (Item 27) OPTICAL OUTPUT to the optical attenuator (Item 34) OPTICAL INPUT using a fiber-optic cable (Item 35).

- Connect the optical probe on CH 1 of the oscilloscope to the OPTICAL OUTPUT of the optical attenuator using the fiber-optic cable of the probe. Set an optical impulse level that does not clip the vertical channel of the oscilloscope.

**c.** Set up the OIG to run with LOW impulse energy.

- Keep the impulse below 100 μW peak level because high-energy impulses into the P670x probe will cause major changes in the frequency response of the probe.
- Set the OIG for 1 MHz internal trigger.
- Set the OIG for the wavelength shown in Table 4–10 that is required for the standard and option you are verifying.

**d.** Enable the laser.

**e.** Set the VERTICAL **SCALE** of the oscilloscope to either 10 μW, 20 μW or 50 μW/division**.**

---

***NOTE***. These are the only scale settings for which the reference receivers have calibrated filters.

---

**f.** *Set the trigger type to edge:*

- Press **TRIGGER MENU**; then select **Edge** from the Type pop-up menu.
- Press **SET LEVEL TO 50%**.

**g.** Set the HORIZONTAL **SCALE** to 500 ps.

**h.** Set the Optical Attenuator for several divisions of display on the oscilloscope.

**i.** *Set the horizontal controls:*

- Press **HORIZONTAL MENU**; then press the main-menu button **Record Length**. If Fit To Screen is not OFF, press **Fit to Screen** to toggle it to the **OFF** setting. Fit to Screen needs to be OFF so that the FFT waveform horizontal scale can be adjusted to obtain the desired display of the frequency response.
- To obtain a 10000 point FFT in step 3, press **HORIZONTAL MENU**; then press the main-menu button **Record Length**. Then repeatedly press the side-menu button **–more–** until **15000** appears in the side menu. Press the side-menu button **15000**.

- Press **HORIZONTAL MENU**; then press the main-menu button **Trigger Position**. Set the Trigger Position to **20%** using the general purpose knob or keypad.

***NOTE.*** *Press **SHIFT** to change the horizontal position speed. The position moves faster when SHIFT is lighted.*

- Adjust the **HORIZONTAL POSITION** to move the 20% trigger point onto the display (see Figure 4–43).

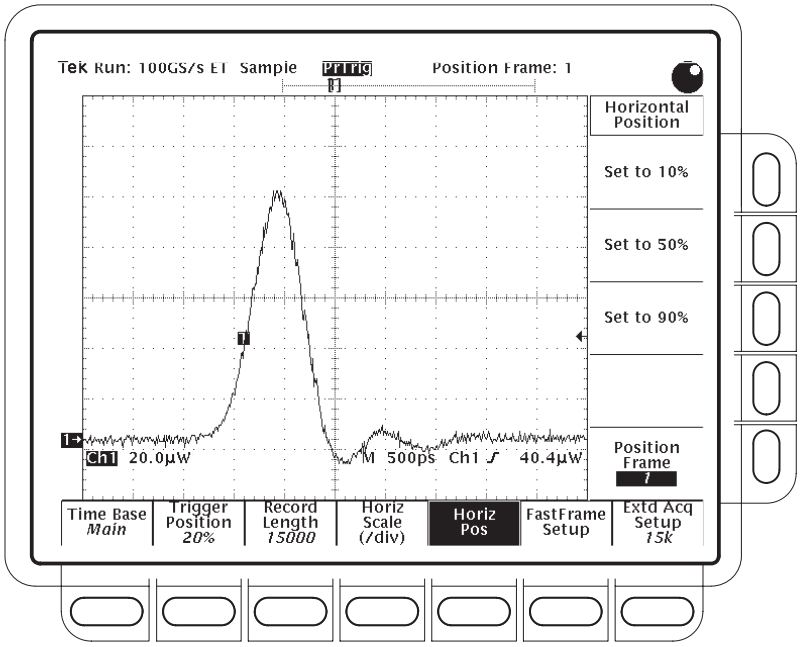



**Figure 4–43: Optical impulse of Ch1 input from OA5022 Optical Attenuator (OIG501 / OIG502 fed into optical attenuator in Step 1)**

**j.** *Select linear interpolation:*

- If SHIFT is lighted, press **SHIFT**.
- Press **DISPLAY**; then press the main-menu button **Filter**.
- Press the side-menu button **Linear Interpolation**.

**2.** *Select the desired Mask standard and turn it on:*

- Press **MEASURE**; then select **Masks** from the Measure pop-up menu.

***NOTE***. <xxx> is the standard that you are verifying (such as OC1, OC3, OC12, FC1063; see Table 4–11 on page 4–106).

- From the Mask Type pop-up menu, select the mask type (<xxx>) of your reference receiver.
- Press the **Standard Mask** main menu; then select your reference receiver mask (<xxx>) from the side menu.

***NOTE***. *For the* Bessel Thompson (*BT) filter to be active, the VERTICAL MENU deskew must be set to zero on all four channels. Also, the ACQUIRE MENU Acquisition Mode must be Sample. If you did the Factory Setup specified in Step 1a, you selected these modes.*

- If checking a reference receiver, verify that RR is displayed to the right of the vertical scale factor (see Figure 4–44 on page 4–104).
- Press **TRIGGER MENU**; then select **Edge** from the Type pop-up menu.

**3.** *Turn on an FFT of the optical impulse [*the Impulse Response (or Frequency Response) of the P670xB and oscilloscope system*] (Refer to Figure 4–45 on page 4–105):*

**a.** Press the front panel **MORE** button; then press the main-menu button **Math2**. This turns on a math waveform.

**b.** *If the math waveform is not set to FFT, create an FFT waveform:*

- Press **Change Math waveform definition**; then press the main-menu button **FFT**.
- Press the side-menu button **Set FFT source to Ch1**.

***NOTE***. *Verify the FFT window is set to Rectangular. Also verify the FFT Vert Scale is set to dBV RMS. If you did the Factory Setup in Step 1a, you selected these modes.*

- Press the side-menu button **OK Create Math Waveform**.
- Press the side menu button **Average**, then set the number of averages to **16** using the general purpose knob or keypad.

**4.** *Move the beginning of the FFT data record onto the screen:*

***NOTE**. Press **SHIFT** to change the horizontal position speed. The position moves faster when SHIFT is lighted.*

- Adjust the **HORIZONTAL POSITION** control to move the beginning of the FFT data record onto the display.

***NOTE**. Expanding the horizontal scale of the FFT waveform gives greater resolution when making cursor measurements. Expand the FFT to display DC to the highest frequency listed in Table 4–11 for the standard being verified.*

- Adjust the HORIZONTAL **SCALE** and VERTICAL **SCALE** to view the frequency response of the BT filter. The large spike around DC is due to DC offset in the signal and should be ignored.

**5.** *Observe the desired response characteristics using the vertical paired cursors (see figures 4–44 and 4–45):*

**a.** Press **CURSOR**.

**b.** Press the main-menu button **Function**; then press the side-menu button **Paired**.

**c.** Press **CLEAR MENU**.

***NOTE**. Pressing SHIFT will change cursor speed. Use the select key to alternate between cursors.*

**d.** Position one cursor at the beginning of the FFT record.

**e.** Position the other cursor at the bit rate (the frequency closest to the bit rate) of the mask that is turned on (see Table 4–11 and Figure 4–44).

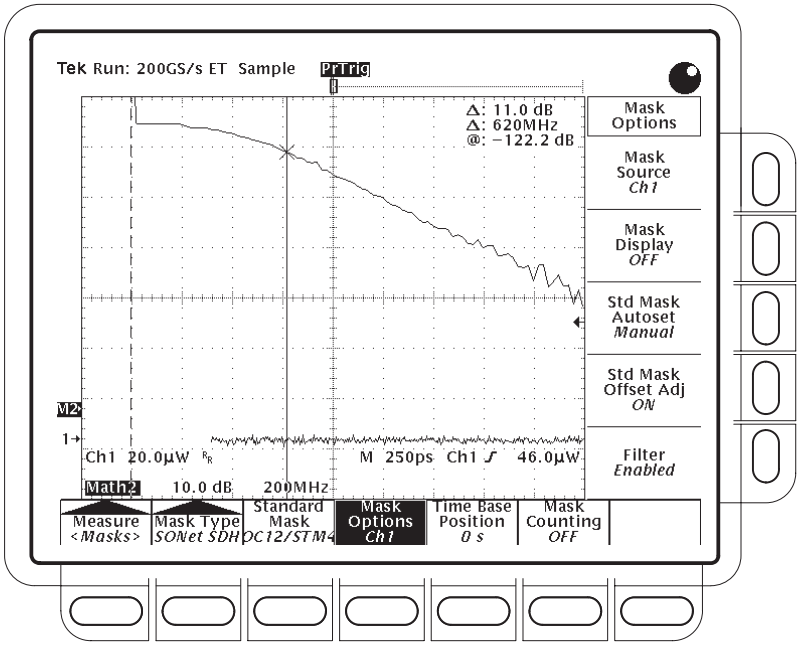



**Figure 4–44: Optical impulse response for OC–12 SONET Reference Receiver**

***NOTE**. In Figure 4–44, the left cursor is at the DC frequency. The right cursor is at the OC-12 data rate of 622 MHz ±4 MHz. Also, note that the reference receiver, RR, designation is beside the 20 µW vertical scale factor.*

**f.** Next, move the cursor currently positioned at the beginning of the record until the cursor is just right of the DC spike in the response (see Figure 4–45 on page 4–105). The unsigned Δ dB readout should be at or between the upper and lower limits shown in Table 4–11 on page 4–106 (note that the entries in the table are signed numbers, but the Δ dB readout is not) for the mask that is turned on.

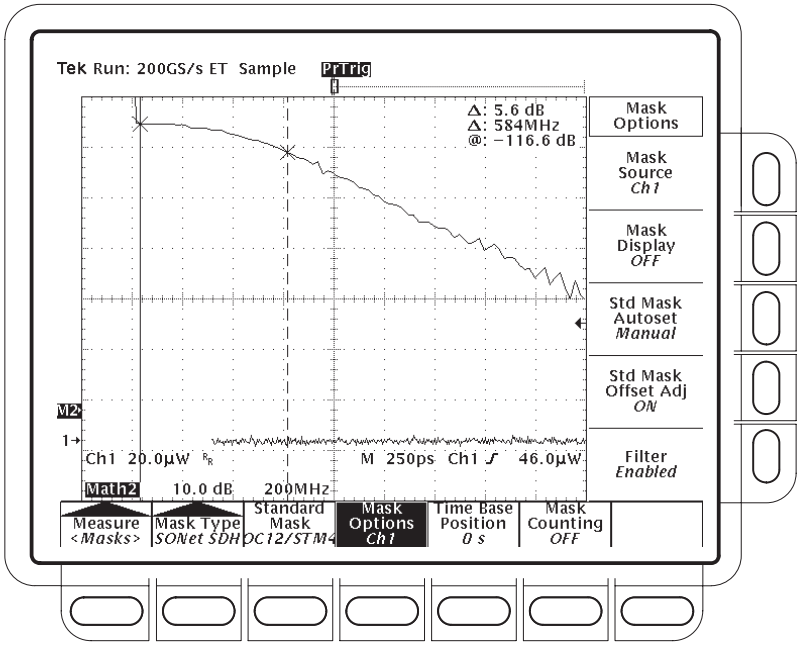



**Figure 4–45: Optical impulse response for OC–12 SONET Reference Receiver**

***NOTE.*** *In Figure 4–45 the left cursor has been moved to the zero dB level. The right cursor remains at the OC–12 data rate of 622 MHz ±4 MHz (the delta frequency is 584 MHz because the right cursor is no longer referenced to DC). The delta attenuation from the zero dB level to the 622 MHz Cursor is 5.6 dB.*

6. Repeat steps 5d through 5f, starting on page 4–103, moving the second cursor to twice the bit rate (1.5 times the bit rate for the FC1063 standard).
7. For an exhaustive test of the reference receiver, repeat steps 5d through 5f for each frequency shown in Table 4–11 on page 4–106 for the standard.
8. If verifying additional standards, repeat this procedure for each standard.

**Table 4–11: Bessel Thompson frequency response and reference receiver limits**

| Standard | Frequency (MHz) | Lower Limit (dB) | Nominal (dB) | Upper Limit (dB) | Measured (delta dB) |
|---|---|---|---|---|---|
| **OC–12 SONET or STM–4 SDH, Data Rate: 622.08 Mb/s** | | | | | |
| | 0.0 | –0.3 | 0.0 | 0.3 | |
| | 93.31 | –0.41 | –0.11 | 0.19 | |
| | 186.6 | –0.75 | –0.45 | –0.15 | |
| | 279.9 | –1.32 | –1.02 | –0.72 | |
| | 373.2 | –2.16 | –1.86 | –1.56 | |
| | 466.7 | –3.31 | –3.00 | –2.71 | |
| | 5.60.0 | –5.15 | –4.51 | –3.87 | |
| | **622.08** | **–6.58** | **–5.71** | **–4.84** | |
| | 653.2 | –7.35 | –6.37 | –5.39 | |
| | 746.5 | –9.86 | –8.54 | –7.22 | |
| | 839.8 | –12.59 | –10.93 | –9.27 | |
| | 933.1 | –15.41 | –13.41 | –11.41 | |
| | **1244.2** | **–24.58** | **–21.44** | **–18.31** | |
| **OC–3 SONET or STM–1 SDH, Data Rate: 155.52 Mb/s** | | | | | |
| | 0.0 | –0.3 | –0.0 | 0.3 | |
| | 23.327 | –0.41 | –0.11 | 0.19 | |
| | 46.65 | –0.75 | –0.45 | –0.15 | |
| | 69.975 | –1.32 | –1.02 | –0.72 | |
| | 93.3 | –2.16 | –1.86 | –1.56 | |
| | 116.88 | –3.31 | –3.00 | –2.71 | |
| | 139.97 | –5.15 | –4.51 | –3.87 | |
| | **155.52** | **–6.58** | **–5.71** | **–4.84** | |
| | 163.3 | –7.35 | –6.37 | –5.39 | |
| | 209.95 | –9.86 | –8.54 | –7.22 | |
| | 209.95 | –12.59 | –10.93 | –9.27 | |
| | 233.27 | –15.41 | –13.41 | –11.41 | |
| | **311.04** | **–24.58** | **–21.44** | **–18.31** | |

**Table 4–11: Bessel Thompson frequency response and reference receiver limits (cont.)**

| Standard | Frequency (MHz) | Lower Limit (dB) | Nominal (dB) | Upper Limit (dB) | Measured (delta dB) |
|---|---|---|---|---|---|
| **FC133 Fibre Channel, Data Rate: 132.8125 Mb/s** | | | | | |
| | 0.00 | –0.5 | 0.0 | 0.5 | |
| | 19.922 | –0.6 | –0.1 | 0.4 | |
| | 38.440 | –0.9 | –0.4 | –0.1 | |
| | 59.765 | –1.5 | –1.0 | –0.5 | |
| | 79.690 | –2.4 | –1.9 | –1.4 | |
| | 99.610 | –3.5 | –3.0 | –2.5 | |
| | 119.53 | –5.5 | –4.5 | –3.5 | |
| | **132.81** | **–7.03** | **–5.7** | **–4.37** | |
| | 139.45 | –7.9 | –6.4 | –4.9 | |
| | 159.37 | –10.5 | –8.5 | –6.5 | |
| | 179.29 | –13.4 | –10.9 | –8.4 | |
| | 199.22 | –16.4 | –13.4 | –10.4 | |
| | **265.62** | **–26.17** | **–21.5** | **–16.5** | |
| **FC266 Fibre Channel, Data Rate: 265.625 Mb/s** | | | | | |
| | 0.0 | –0.5 | 0.0 | 0.5 | |
| | 39.844 | –0.6 | –0.1 | 0.4 | |
| | 79.688 | –0.9 | –0.4 | –0.1 | |
| | 119.53 | –1.5 | –1.0 | –0.5 | |
| | 159.38 | –2.4 | –1.9 | –1.4 | |
| | 199.22 | –3.5 | –3.0 | –2.5 | |
| | 239.06 | –5.5 | –4.5 | –3.5 | |
| | **265.62** | **–7.03** | **–5.7** | **–4.37** | |
| | 278.91 | –7.9 | –6.4 | –4.9 | |
| | 318.75 | –10.5 | –8.5 | –6.5 | |
| | 358.59 | –13.4 | –10.9 | –8.4 | |
| | 398.44 | –16.4 | –13.4 | –10.4 | |
| | **531.25** | **–26.17** | **–21.5** | **–16.5** | |

**Table 4–11: Bessel Thompson frequency response and reference receiver limits (cont.)**

| Standard | Frequency (MHz) | Lower Limit (dB) | Nominal (dB) | Upper Limit (dB) | Measured (delta dB) |
|---|---|---|---|---|---|
| **FC531 Fibre Channel, Data Rate: 531.25 Mb/s** | | | | | |
| | 0.0 | –0.5 | –0.0 | 0.5 | |
| | 79.688 | –0.6 | –0.1 | 0.4 | |
| | 159.38 | –0.9 | –0.4 | –0.1 | |
| | 239.06 | –1.5 | –1.0 | –0.5 | |
| | 318.76 | –2.4 | –1.9 | –1.4 | |
| | 398.44 | –3.5 | –3.0 | –2.5 | |
| | 478.12 | –5.5 | –4.5 | –3.5 | |
| | **531.24** | **–7.03** | **–5.7** | **–4.37** | |
| | 557.82 | –7.9 | –6.4 | –4.9 | |
| | 637.50 | –10.5 | –8.5 | –6.5 | |
| | 717.18 | –13.4 | –10.9 | –8.4 | |
| | 796.88 | –16.4 | –13.4 | –10.4 | |
| | **1062.5** | **–26.17** | **–21.5** | **–16.3** | |
| **FC1063 Fibre Channel (Controlled to 1.5X Data Rate), Data Rate: 1062.5 Mb/s** | | | | | |
| | 0.0 | –0.5 | 0.0 | 0.5 | |
| | 159.38 | –0.6 | –0.1 | 0.4 | |
| | 318.75 | –0.9 | –0.4 | 0.1 | |
| | 478.12 | –1.5 | –1.0 | –0.5 | |
| | 637.50 | –2.4 | –1.9 | –1.4 | |
| | 796.87 | –3.5 | –3.0 | –2.5 | |
| | 956.25 | –5.5 | –4.5 | –3.5 | |
| | **1062.5** | **–7.03** | **–5.7** | **–4.37** | |
| | 1115.63 | –7.9 | –6.4 | –4.9 | |
| | 1275.0 | –10.5 | –8.5 | –6.5 | |
| | 1434.37 | –13.4 | –10.9 | –8.4 | |
| | **1593.75** | **–16.4** | **–13.4** | **–10.4** | |

# Adjustment Procedures

This section contains information needed to adjust the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes.

**Description** The *Adjustment Procedures* are divided into six subsections:

- General information about adjusting the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes.
- A list of equipment required to perform the adjustments.
- The written procedures for installing and using both the *TDS 600C Adjustment Software* and the *TDS 700D Adjustment Software.* The *TDS 700D Adjustment Software* works with both the TDS 500D, TDS 700D and TDS 714L oscilloscopes.
- The TDS 600C and the TDS 700D *Adjustment Software* included with this manual. The material found in the subsections listed above should be read before using the adjustment software.
- A written procedure for manually adjusting the optional P6139A probe.
- A written procedure for manually adjusting the display assembly.

**Purpose** This procedure is used to return the oscilloscope to conformance with its *Warranted Characteristics* as listed in Section 1, *Specifications*. It can also be used to optimize the performance of the oscilloscope.

**Adjustment Interval** As a general rule, these adjustments should be done every 2000 hours of operation or once a year if the oscilloscope is used infrequently.

## Requirements for Performance

Before you do this procedure, you need to address the following requirements.

**Personnel** This procedure is only to be performed by trained service technicians.

**Warm-Up Period** This oscilloscope requires a 20 minute warm-up time in a 20° C to 30° C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance.

### Access

Except when adjusting the display assembly, the cabinet is not removed. Instead, you enable the internal adjustment constants of the oscilloscope to be written. Two small holes in the chassis allow service personnel to insert a tool and push a switch to enable or disable the writing of new adjustment constants to nonvolatile RAM.

The procedure that follows will tell you how and when to enable and disable the writing of adjustment constants. Be sure to disable the switch when you have finished adjusting the oscilloscope.

### System

Adjustment of this oscilloscope requires a computer with hard drive, 3.5 inch 1.44 MByte floppy drive, and the following items:

For DOS software:

- An IBM® PC™ compatible computer running DOS 3.2 or higher. A math coprocessor is strongly recommended.
- 640K resident RAM with 580 K available RAM.
- A GPIB board — National Instruments® GPIB-PCII, GPIB-PCIIA or GPIB-PCII/IIA. (A PC-GPIB Package that includes the PCII/IIA is available — Tektronix part number S3FG210)

For Windows NT software:

- An Intel compatible computer running Windows NT.
- A GPIB board and software — National Instruments® AT–GPIB/TNT, Windows NT (INTEL).

### Test Equipment

The equipment list, starting on page 5–5, lists all test equipment required to adjust this oscilloscope.

## Usage

The following topics cover what is required of you when adjusting the oscilloscope and what is done by the software. Also, the performance of individual adjustments is discussed.

### Performing the Adjustments

When using the adjustment software, you will not be required to manually adjust any circuits. As you run the calibration tests, the software adjusts the circuits using external standards you provide in response to prompts on the computer screen. Your role, then, is to provide those test signals and to prompt the computer to continue.

Since the display-assembly and P6139A probe adjustment require manual adjustment of circuit components, they are not part of the adjustment software. Written procedures for these adjustments start on page 5–6.

If you are using the optional P6139A probe, do the manual adjustment procedures found at the end of this section.

## Complete Adjustment

A complete adjustment is the performance of all adjustments on the *TDS 600C Adjustment Software* and the *TDS 700D Adjustment Software,* in sequence, plus the P6139A probe adjustment (if you are using the P6139A probe).

Throughout this section, "complete adjustment" is used as just defined.

## Individual Adjustments

The adjustment software contains three classes of adjustments as shown in Table 5–1. Each class contains one or more individual calibration tests and an internal compensation routine (SPC). The *Adjustment Software* and the release notes (on disk), provide you with instructions for running each of the tests.

All these software-based adjustments are made internally by the adjustment software, and all adjustments can be done without removal of the oscilloscope cabinet.

**Signal Path Compensation (SPC).** This internal routine is not an adjustment. It is a temperature compensation routine that compensates for the current operating temperature to optimize oscilloscope performance.

**Table 5–1: Calibration tests**

| Class of Adjustment | TDS 600 Tests | TDS 500/700 Tests |
|---|---|---|
| Voltage Reference | CVR_CAL<br>SPC<br>PROBE_COMP_CAL | COLD_START<br>SPC<br>CVR_CAL<br>POWER_CYCLE<br>SPC<br>PROBE_COMP_CAL |
| Frequency Response | HF_CAL | SPC<br>HF_CAL<br>INTERLEAVE<br>SPC |
| Pulse Trigger | GLITCH_TRIG_CAL<br>PNP_LATENCY_CAL<br>SKEW_CALS | GLITCH_TRIG_CAL<br>PNP_LATENCY_CAL<br>TRIG_POS_CAL |

## Adjustment Dependencies

Some adjustments depend on successful prior completion of other adjustments. For example, all the tests associated with the Voltage Reference Adjustment class must be passed before any other adjustments can be successfully completed. Table 5–2 lists the adjustments and their dependencies.

**Table 5–2: Adjustments and dependencies**

| Class of Adjustment | Prior Completion Requirements |
|---|---|
| Voltage Reference Adjustment | None |
| Frequency Response Adjustment | Voltage Reference (SPC and all tests) |
| Pulse Trigger Adjustment | Voltage Reference (SPC and all tests) |
| P6139A Probe Adjustment | Voltage Reference and Frequency Response (SPC and all tests) |
| Display Adjustment | None |

## Partial Adjustment

The adjustment software will allow you to make individual adjustments. However, usually all adjustments are made unless you are adjusting circuits in the course of troubleshooting the oscilloscope. Read the information under *Complete Adjustment*, *Adjustment After Repair,* and *Adjustment Dependencies* before doing an individual adjustment.

## Adjustment After Repair

After the removal and replacement of a module due to electrical failure, you must either do a complete adjustment or no adjustment at all, depending on the module replaced. See Table 5–3.

**Table 5–3: Adjustments required for module replaced**

| Module Replaced | Adjustment Required |
|---|---|
| Acquisition Board | Complete Adjustment |
| Front Panel Assembly | None Required |
| Low Voltage Power Supply | Complete Adjustment[1] |
| Processor Board | Complete Adjustment |
| Display Assembly | Display Adjustment Only |

1 **Optionally, you may first do the complete performance verification (all procedures in Chapter 4). If all procedures are passed, you can skip the complete adjustment; if any procedures fail, you must do a complete adjustment.**

## Equipment Required

Table 5–4 lists the test equipment required to adjust the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes.

**Table 5–4: Test equipment, fixtures, and supplies**

| Item Number and Description | Minimum Requirements | Example | Purpose |
|---|---|---|---|
| 1. Adapter, BNC-Female-to-BNC-Female | Tektronix part number 013-0028-00 | Tektronix part number 013-0028-00 | Probe Adjustment |
| 2. Adapter, Probe Tip-to-BNC, 50 Ω termination | Tektronix part number 013-0227-00 | Tektronix part number 013-0227-00 | Probe Adjustment |
| 3. Adapter, BNC female-to-Clip Leads | BNC female-to-Clip Leads | Tektronix part number 013-0076-00 | Signal Coupling for Probe Compensator Output Check |
| 4. Adjustment Tool | Less than 1/8 inch diameter and over 2 inches long | Tektronix part number 003-0675-00 | Software-based Adjustments (used as a probe) and Manual Adjustments |
| 5. Attenuator, 10X (Two required) | Ratio: 10X; impedance 50 Ω; connectors: female BNC input, male BNC output | Tektronix part number 011-0059-02 | Software-based Adjustments |
| 6. Attenuator, 2X | Ratio: 2X; impedance 50 Ω; connectors: female BNC input, male BNC output | Tektronix part number 011-0069-02 | Software-based Adjustments |
| 7. Cable GPIB | IEEE Std 488.1–1987/ IEEE Std 488.2–1987 | Tektronix part number 002-0991-01 | Software-based Adjustments |
| 8. Coupler, Dual-Input | Female BNC to dual male BNC | Tektronix part number 067-0525-02 | Software-based Adjustments |
| 9. Cable, Precision Coaxial | 50 Ω, 36 in, male to male BNC connectors | Tektronix part number 012-0482-00 | Software-based Adjustments |
| 10. Connector, Dual-Banana | Female BNC to dual banana | Tektronix part number 103-0090-00 | Software-based Adjustments |
| 11. Generator, Calibration | High Amplitude pulse with variable amplitude of at least 60 V. | Tegam/Tektronix PG 506A Calibration Generator[1,2] | Probe Adjustment |
| 12. Generator, DC Calibration | Variable amplitude to ±104 V; accuracy to 0.1% | Data Precision 8200[1] | Software-based Adjustments |
| 13. Generator, Sine Wave | 250 kHz to 1 GHz; Variable amplitude from 60 mV to 2 $V_{p-p}$ into 50 Ω; 6 MHz reference | Rohde & Schwarz SMT or SMY[1,3] | Software-based Adjustments |
| 14. Meter, Level and Power Sensor | Frequency range:10 MHz to 1 GHz. Amplitude range: 6 $mV_{p-p}$ to 2 $V_{p-p}$ | Rohde & Schwarz URV 35, with NRV-Z8 power sensor[1,3] | Sinewave leveling during software-based adjustments |
| 15. Splitter, Power | Frequency range: DC to 1 GHz. Tracking: >2.0% | Rohde & Schwarz RVZ[1,3] | Sinewave leveling during software-based adjustments |

**Table 5–4: Test equipment, fixtures, and supplies (Cont.)**

| Item Number and Description | Minimum Requirements | Example | Purpose |
|---|---|---|---|
| 16. Magnifier, 6X | Standard Tool | | Brightness and Focus Adjustment |
| 17. Photometer | 0.1 to 200 Footlamberts | Tektronix J17 Photometer with J1803 Luminance Probe | Contrast Adjustment |
| 18. Probe, 10X, optional accessory | A P6139A Probe | Tektronix P6139A | Probe Adjustment |
| 19. Pulser, Tunnel Diode | Tektronix part number 067-0681-01 | Tektronix part number 067-0681-01 | Probe Adjustment |
| 20. Generator, Optical Impulse | 850 nm optical impulse | Tektronix OIG501 Optical Impulse Generator[2] | Option 3C Software-based Adjustments |
| 21. Generator, Optical Impulse | 1300 nm optical impulse | Tektronix OIG502 Optical Impulse Generator[2] | Option 4C Software-based Adjustments |
| 22. Attenuator, Optical | 62.5 micron optical attenuator | Tektronix OA5022 Optical Attenuator[2] | Option 3C and 4C Software-based Adjustments |
| 23. Cable, Fibre Optic | FC-FC fiber cable | Tektronix part number 174-2322-00 | Option 3C and 4C Software-based Adjustments |
| 24. Optical-to-Electrical Converter | P6701B (used with Option 3C) or P6703B (used with Option 4C) optical-to-electrical converter | Tektronix P6701B or P6703B | Option 3C and 4C Software-based Adjustments |

**1 You may replace items 11, 12, 13, 14, and 15 with a Wavetek 9100 (with options 100 and 600) for 500 MHz oscilloscopes, or a Wavetek 9500 (with option 100) and output head appropriate for the bandwidth of the oscilloscope(s) being tested.**

**2 Requires a TM 500 or TM 5000 Series Power Module Mainframe.**

**3 If available, you may replace items 13, 14, and 15 with a Tegam/Tektronix SG5030 and its leveling head for bandwidths up to 500MHz, or a Tegam/Tektronix SG503 and SG504 with SG504 leveling head for bandwidths up to 1 GHz.**

## Adjustment Instructions

The following instructions describe installing the software on your system, setting up the oscilloscope for adjustment, and starting the adjustment of the oscilloscope by the software.

### Hardware Installation

1. *Install the proper GPIB card (see* System *on page 5–2):* Use the manual accompanying your GPIB card to install and configure that card.
2. *Configure the GPIB card:*
   a. The adjustment software is compatible with cards configured for PCII and PCIIA operation (DOS) or AT-GPIB/TNT (Windows NT). The following table lists the default card settings.

**b.** If these settings conflict with your hardware setup, see your GPIB card manual for alternate settings.

**c.** If you have more than one GPIB card installed, this adjustment software assumes the first card (referenced 0). See your GPIB card manual for information on how to determine which card is your "0" card.

**Table 5–5: GPIB board configuration[1]**

| Board Settings | GPIB-PCII | GPIB-PCIIA | AT-GPIB/TNT |
|---|---|---|---|
| Base I/O Address (hex) | 2B8 | 2E1 | 2C0 |
| DMA Channel | 1 | 1 | 5 |
| Interrupt Line | 7 | 7 | 11 |

1 **Systems using the combination card (GPIB-PCII/IIA) can be configured as either a GPIB-PCII or a GPIB-PCIIA (preferred).**

## Software Installation

***STOP.*** *ALWAYS use this installation procedure when installing this software on a new computer. This installation program uses parameters you supply (see step 2, substep b) to create a custom start-up file on your hard disk directory. After installation, the software will instruct you to run this start-up batch file whenever you do software-based adjustments, so it can configure your computer properly before it runs the adjustment program. Do not simply copy the software files from one computer to another, since the start-up batch file you copy may not match the computer you copy it to.*

**1.** *Create a working disk:* Copy the *Adjustment Software* disk to a working disk.

**2.** *Install the software to the hard disk:*

**a.** Read the README and RELEASE.NTS files.

**b.** Insert your working disk in a floppy drive, change to that drive, and run *install*. The software will ask you to specify the hard disk on which to install the adjustment software. It will also prompt you to specify several GPIB-card configuration parameters.

**c.** The adjustment software will be installed in a directory called *TDS600C.ADJ* or *TDS700D.ADJ* on your hard drive.

**3.** *Store your installation disks:* Remove your working disk and store it and the master disk in a secure place.

## Software-Based Adjustments

| | |
|---|---|
| **Equipment required** | All items that are listed for "Software-based Adjustments" under the "Purpose" column in Table 5–4 starting on page 5–5.<br><br>If you intend to perform the adjustments for Options 3C and 4C, you also need the equipment listed for Option 3C and 4C software-based adjustments. |

1. *Hook up the oscilloscope:*
   - **a.** Connect the GPIB cable (Item 7) to the GPIB port at the computer rear panel. (When multiple GPIB cards are installed, connect to the GPIB0 card.)
   - **b.** Connect the GPIB cable (Item 7) to the GPIB port at the oscilloscope rear panel.
   - **c.** Power on the oscilloscope.
2. *Set up the oscilloscope:*
   - **a.** Press **SHIFT**; then press **UTILITY**.
   - **b.** Repeatedly press the main-menu button **System** until **I/O** is highlighted in the pop-up menu.
   - **c.** Press the side-menu button **TALK/LISTEN**.
   - **d.** Use the keypad to set the address to 1.
3. *Let the oscilloscope warm up:* Allow a 20 minute warm-up period before you begin step 4.
4. *Start the adjustment software:*
   - **a.** Change drives to your hard drive (typically *C:*).
   - **b.** Change directories to TDS600C.ADJ for any TDS 600C oscilloscope or TDS700D.ADJ for any TDS 500D, 700D or 714L oscilloscope.
   - **c.** Type *ADJ600C* for any TDS 600C oscilloscope or type *ADJ700D* for any TDS 500D, 700D or TDS 714L oscilloscope.

***NOTE**. If you are adjusting an Option 3C or 4C equipped oscilloscope, read the RELEASE.NTS file and refer to Figure 4–42 on 4–99 to set up the equipment.*

   - **d.** Follow the instructions as prompted on your computer screen. This will include the actions listed in step 5 shown below.
5. *Enable the adjustment constants to be written –when prompted on your computer screen in step 4 above:*

**a.** Locate the two small access holes on the right side of the oscilloscope cabinet near the front.

**b.** Insert the adjustment tool (Item 2) in the hole nearest the front of the oscilloscope about 1/2 inch to engage the rocker switch.

**c.** Push to rock the switch to its unprotected (enabled) position. See Figure 5–1.

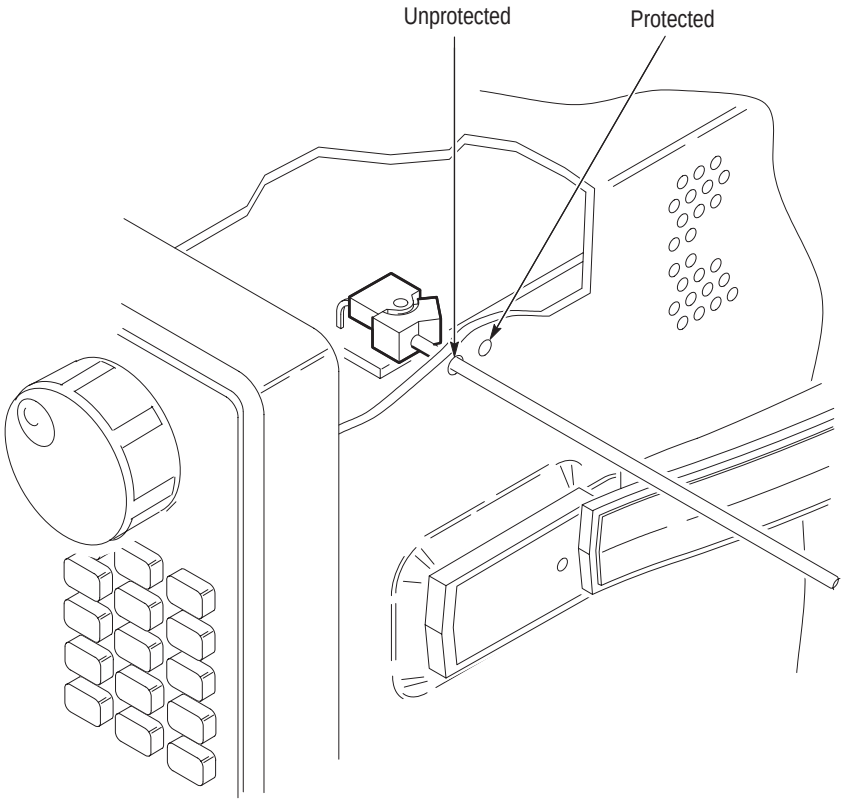



**Figure 5–1: Accessing the protection switch**

**6.** *When adjustment has been completed:*

***CAUTION.*** *Be sure to disable the NVRAM Protection switch as instructed below to protect the adjustment constants against alteration.*

**a.** Locate the two small access holes on the right side of the oscilloscope cabinet near the front. (See Figure 5–1.)

**b.** Insert the adjustment tool (Item 2) in the hole nearest the *rear* of the oscilloscope about 1/2 inch to engage the rocker switch.

**c.** Push to rock the switch to its protected (disabled) position.

**d.** To do a complete adjustment as defined on page 5–3, you must also do the procedure *Compensate the Probe* on page 5–10 if you are using the optional P6139A probe.

## Probe Adjustment for the P6139A Probe

***STOP****. It is not necessary to do this procedure to perform a complete adjustment unless you are using the optional P6139A probe.*

This probe adjustment is divided into three parts: *Compensate the Probe*, *Measure the Probe Bandwidth*, and *Adjust the Probe — High Frequency Response*. If probe bandwidth is within required limits, you will be instructed to *not* do the high frequency response adjustment.

### Compensate the Probe

| | |
|---|---|
| **Equipment required** | One P6139A probe (Item 18). |

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

**a.** *Hook up test-signal source:* Install the optional-accessory probe to **CH 1**. Connect the probe tip to **PROBE COMPENSATION SIGNAL** on the front panel; connect the probe ground to **PROBE COMPENSATION GND** (See Figure 5–2).

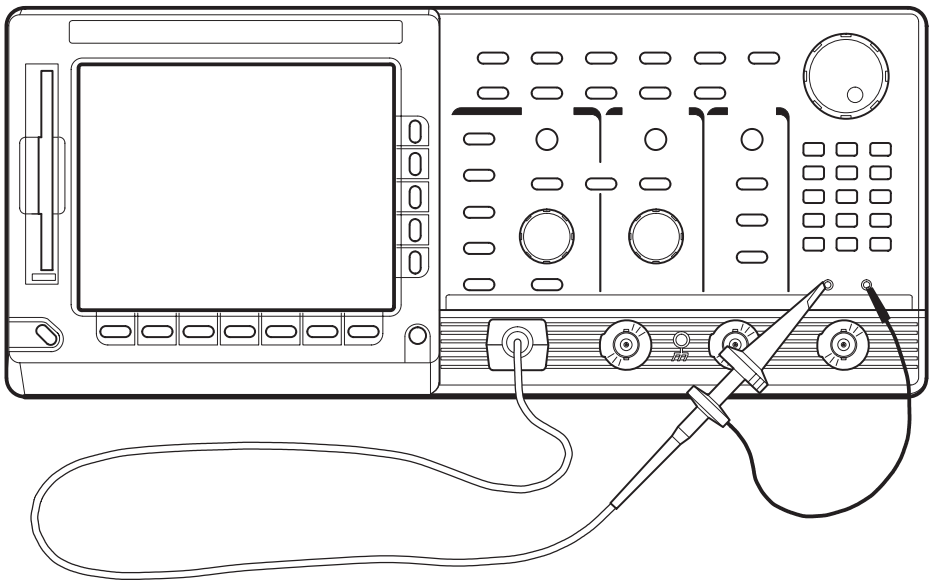


**Figure 5–2: Hookup for probe compensation**

**b.** *Initialize the oscilloscope:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**c.** *Modify the initialized front-panel control settings:*

- Press **AUTOSET**. Set the horizontal **SCALE** to 250 μs.
- Press **SET LEVEL TO 50%** as required to trigger the signal.
- Press **SHIFT**; then press **ACQUIRE MENU**.
- Press the main-menu button **Mode**. Then press the side-menu button **Average 16**.

**2.** *Compensate the Probe:*

**a.** Locate the probe compensation hole in the side of the probe body.

**b.** Using the probe compensation tool, adjust the probe for best square wave compensation (flat as possible across its top) (See Figures 5–3 and 5–4).

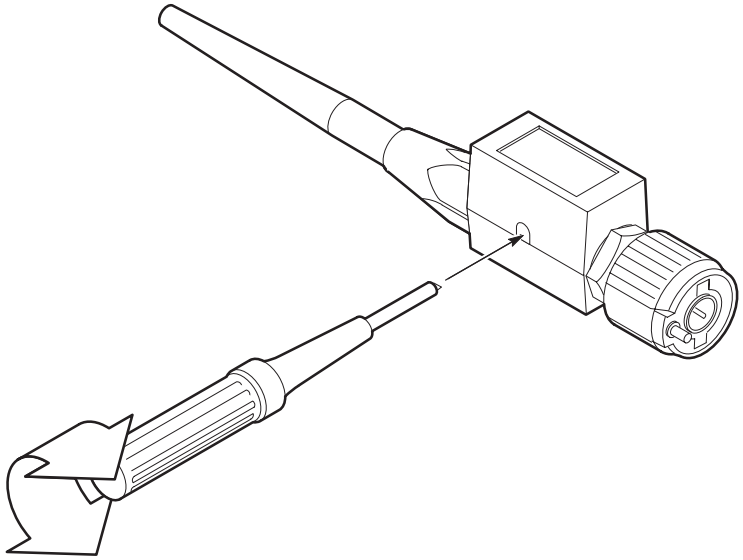


**Figure 5–3: Performing probe compensation**

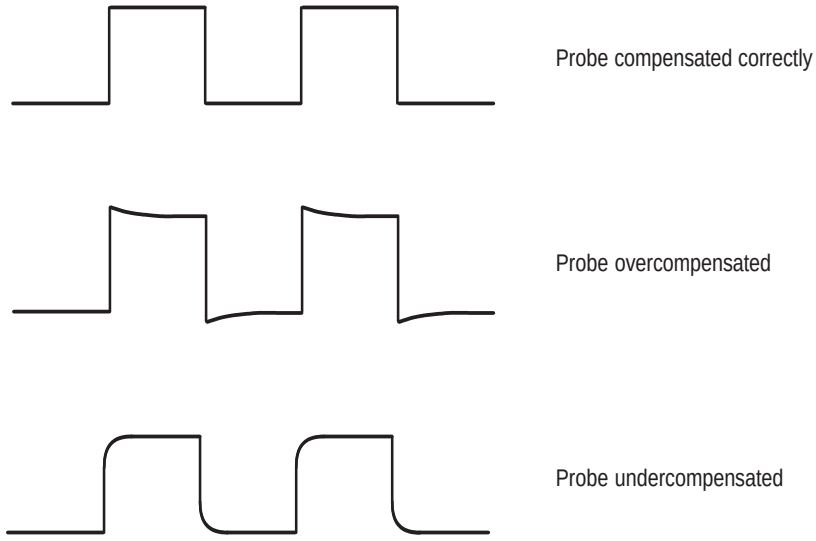



**Figure 5–4: Proper and improper probe compensation**

**3.** *Disconnect the hookup:* Disconnect the probe from the probe compensator terminals; leave probe installed on CH 1 and leave the oscilloscope control setup as is for doing the next part of probe adjustment.

## Measure Probe Bandwidth

| | |
|---|---|
| **Equipment required** | One high-frequency sine wave generator with its leveling head (Item 13) |
| | One BNC-female-to-female BNC adapter (Item 1) |
| | One BNC-to-probe tip adapter (Item 2) |
| | One P6139A 10X probe (Item 18) |

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

   a. *Expose the Inner Probe Tip:* Follow the instructions in Figure 5–5.

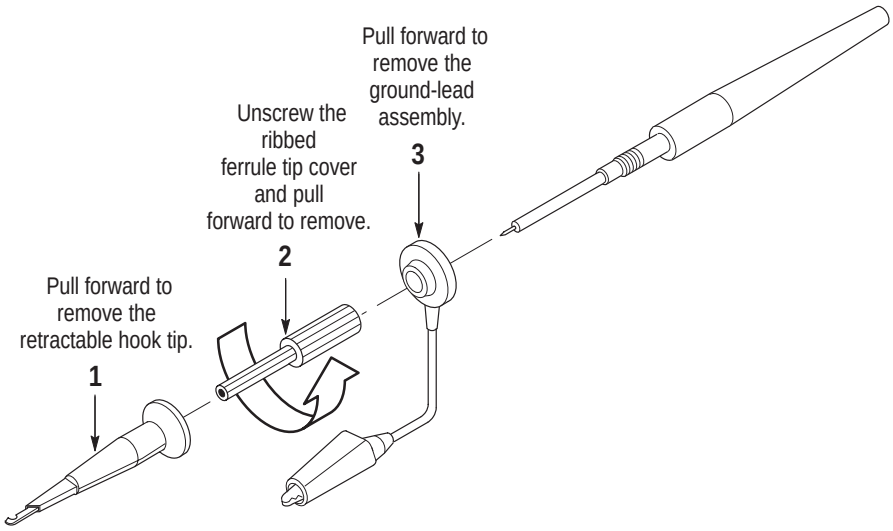



**Figure 5–5: Exposing the inner probe tip**

   b. *Hook up test-signal source:*

   - Connect the output of a high-frequency sine wave generator, through its leveling head, to a female-to-female adapter. See Figure 5–6.
   - Connect the female-to-female adapter to a BNC-to-probe tip adapter.
   - Plug the probe tip from the probe on CH 1 into the BNC-to-probe tip adapter.

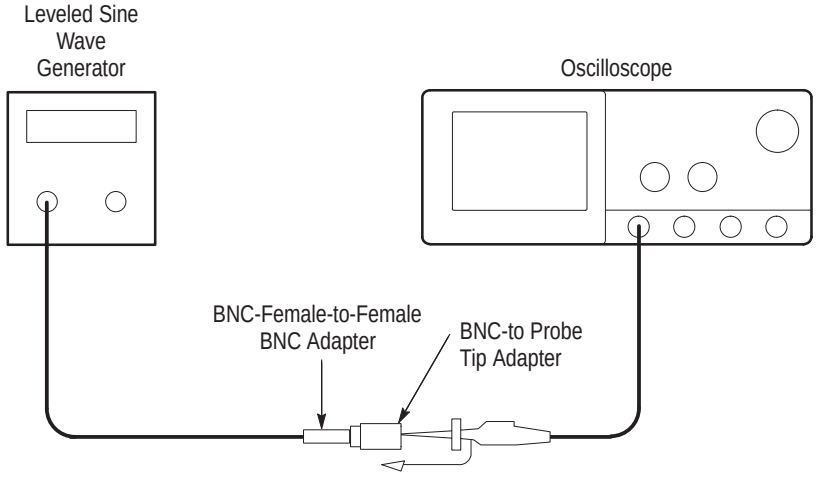



**Figure 5–6: Initial test hookup**

**c.** *Initialize the oscilloscope:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**d.** *Modify the initialized front-panel control settings:*

- Set the vertical **SCALE** to 500 mV.
- Set the horizontal **SCALE** to 100 ns.
- Push **SET LEVEL TO 50%** as required to trigger the signal.
- Press **SHIFT**. Then press **ACQUIRE MENU**.
- Press the main-menu button **Mode**. Then press the side-menu button **Average 16**.
- Press **MEASURE**.
- Press the main-menu button **Hi-Low Setup**. Then press the side-menu button **Min-Max**.
- Press the main-menu button **Select Measrmnt for *Ch1***.
- Repeatedly press the side-menu button **–more–** until **Pk-Pk** appears in the side menu. Press the side-menu button **Pk-Pk**.
- Press **CLEAR MENU**.

2. *Confirm that the Probe Compensator signal is within limits for bandwidth:*

   a. *Display and measure the test signal:*

      - Monitor the **CH 1 Pk-Pk** readout while you set the output of the generator for a 3.0 V (6 division), 6 MHz reference signal.
      - Set the horizontal **SCALE** to 1 ns and set the frequency of the generator to 500 MHz.
      - Read the measurement results at the CH 1 Pk-Pk readout on screen.

   b. *Check against limits:* CHECK that the **CH 1 Pk-Pk** readout is greater than or equal to 2.1 V.

3. *Disconnect the hookup:*

   a. Unplug the probe from BNC-to-probe tip adapter.

   b. If substep 2b was passed, the probe adjustment is finished. Reverse the instructions in Figure 5–5, page 5–13, to reinstall the retractable hook probe tip.

   c. If substep 2b was *not* passed, leave the probe tip exposed. Remove the probe from CH 1 and go on to the next procedure *Adjust the Probe — High Frequency Response*.

## Adjust the Probe — High Frequency Response

Do not perform this procedure until you have first completed the procedures *Compensate the Probe* and *Measure Probe Bandwidth* on pages 5–10 and 5–13, respectively.

Do not perform this procedure if you have successfully completed *Measure Probe Bandwidth.* Probe adjustment is complete.

| | |
|---|---|
| **Equipment required** | One calibration generator (Item 11) |
| | One 50 Ω precision cable (Item 9) |
| | One tunnel diode pulser (Item 19) |
| | One BNC female-to-female adapter (Item 1) |
| | One BNC to probe adapter (Item 2) |
| | One 10X attenuator (Item 5) |
| | One P6139A 10X probe (Item 18) |

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

**a.** *Access Inner Probe Tip and Adjustment Ports:*

- The probe tip should be exposed from the procedure *Measure Probe Bandwidth.* If not, follow the instructions in Figure 5–5 to expose the probe tip.
- Follow the instructions in Figure 5–7 to remove the probe body covers.

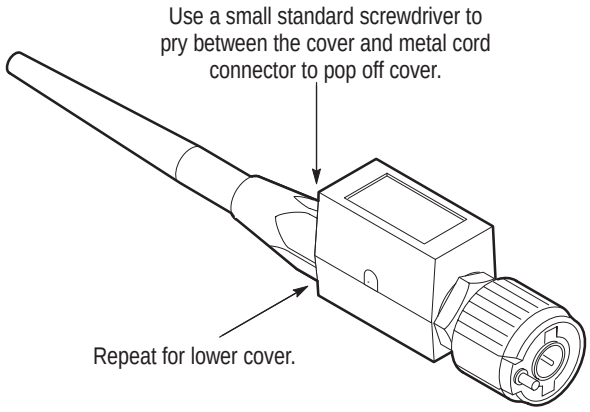



**Figure 5–7: Exposing the probe body**

**b.** *Hook up test-signal source:*

- Connect the high-amplitude output of a calibration generator, through a 50 Ω precision cable, to the input of a tunnel diode pulser. See Figure 5–8.
- Connect the output of the tunnel diode pulser through a 10X attenuator to CH 1.
- Set the triggering level of the tunnel diode pulser to minimum.

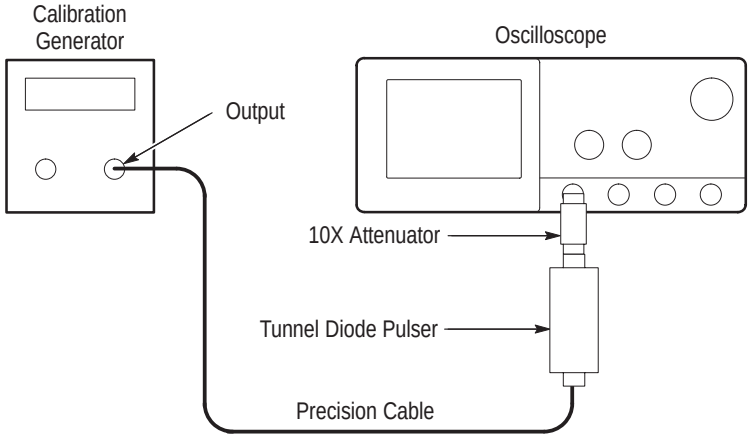



**Figure 5–8: Initial test hookup**

**c.** *Initialize the oscilloscope:*

- Press save/recall **SETUP**.
- Press the main-menu button **Recall Factory Setup**.
- Press the side-menu button **OK Confirm Factory Init**.

**d.** *Modify the initialized front-panel control settings:*

- Set vertical **SCALE** to 5 mV.
- Push **SET LEVEL TO 50%** as required to trigger the signal.
- Press **VERTICAL MENU**. Then press the main-menu button **Coupling**. Press the side-menu button **Ω** to toggle to 50 Ω coupling.
- Press **CLEAR MENU**.

**2.** *Adjust the Probe:*

**a.** *Display and store the reference signal:*

- Set the high-amplitude output of the generator to ≥60 V *at the input to the tunnel diode pulser.*
- Set the **Period** (repetition rate) to 10 kHz.
- Advance the triggering level of the tunnel diode pulser until a five to six division square wave appears on screen. Do not advance the knob any further than required to achieve stable amplitude.
- Use the vertical **POSITION** to center the displayed waveform on screen.

- Press **SHIFT**; then press **ACQUIRE MENU**.
- Press the main-menu button **Mode**. Then press the side-menu button **Average 16**.
- Push **SET LEVEL TO 50%** as required to trigger the signal.
- Advance the horizontal **SCALE** to 5 ns.
- Press **HORIZONTAL MENU**.
- Press the main-menu button **Trigger Position**; press the side-menu button **Set to 20%**.
- Press **SAVE WAVEFORM**.
- Press the main-menu button **Save Waveform**. Then press the side-menu button **To Ref 1**.
- Press **MORE**. Then push the main-menu button **Ref 1**.

**b.** *Display the test signal:*

- Disconnect the tunnel diode pulser at CH 1 and remove the 10X attenuator.
- Connect the output of the tunnel diode pulser through a BNC-female-to-BNC-female adapter to a BNC-to-probe tip adapter.
- Install the probe on CH 1.
- Plug the probe tip from the probe into the BNC-to-probe tip adapter.
- Press **VERTICAL MENU**; then press **CH 1**.
- Press the main-menu button **Coupling**. Then press the side-menu button **Ω** to toggle to 1 MΩ coupling.
- Push **SET LEVEL TO 50%** as required to trigger the signal.
- Adjust the triggering level of the tunnel diode pulser until a five to six division square wave appears on screen. Do not advance the knob any further than required to achieve stable amplitude.

**c.** *Make the adjustments:*

- Locate the various adjustments in Figure 5–9.
- Manually adjust the front-corner response of the probe to best match the response of the Ref 1 waveform. It is more important to match the response during the first 5 ns than during the entire first 20 ns the adjustments affect.

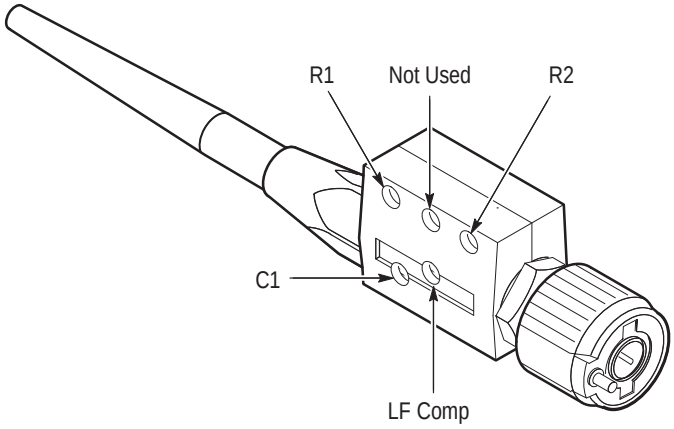



**Figure 5–9: Locations of P6139A probe adjustments**

- See Figure 5–10 to see the areas on the front corner that the various adjustments affect.

**d.** *Recheck Probe Bandwidth:*

- Redo the procedure *Adjust Probe — High Frequency Response* to check if probe now meets its bandwidth requirement.
- If the bandwidth requirement is met, adjustment is complete. Skip to step 3.
- If the bandwidth requirement is *not* met, redo this procedure, increasing front corner overshoot slightly relative to the stored waveform.
- Repeat this step (d) until the bandwidth requirement is met.

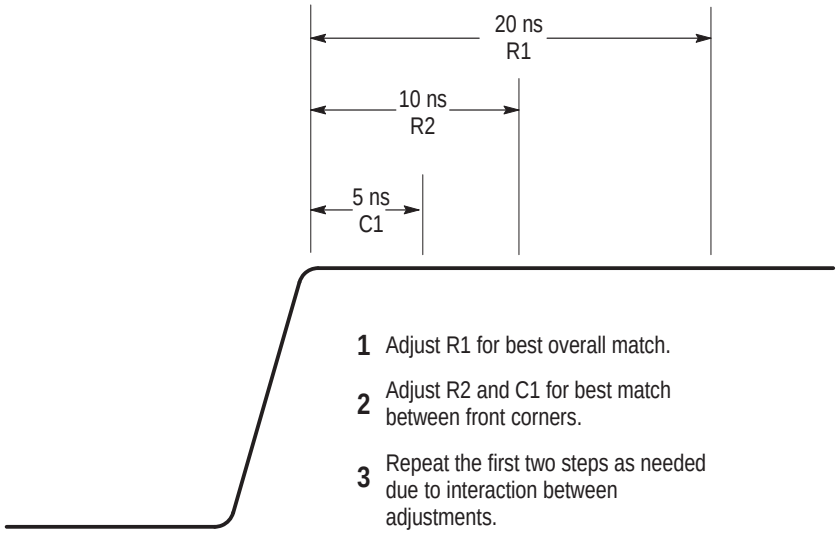



**Figure 5–10: Adjustments versus front-corner response**

3. *Disconnect the hookup:* Unplug the probe from the BNC-to-probe tip adapter. Reverse the instructions in Figure 5–5, page 5–13, to reinstall the retractable probe tip.

# Display Assembly Adjustment

***STOP.*** *It is not necessary to do this procedure to perform a complete adjustment. Only use this procedure to adjust the display assembly if it has been repaired or if brightness and contrast have become unsatisfactory.*

## Brightness, and Contrast Adjustment (TDS 500D and 680C – Monochrome Only)

| | |
|---|---|
| **Equipment required** | One 6X magnifier (Item 16)<br>One J17 Photometer with a J1803 Luminance Probe (Item 17) |

1. *Access the inside of the oscilloscope:* See *Removal and Installation Procedures* in Section 6 to remove the cabinet.
2. *Adjust the display brightness:*
   a. *Display the Composite test pattern:*
      - Leave the oscilloscope powered off.
      - Set the DIP switch, located near the front of the A11 DRAM Processor/Display, as follows:

| Switch No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Open | | | | | | X | X | |
| Closed | X | X | X | X | X | | | X |

      - Power on the oscilloscope.
      - Press **SHIFT**; then press **UTILITY**.
      - Repeatedly press the main-menu button **System** until **Diag/Err** is highlighted in the pop-up menu.
      - Repeatedly press the main-menu button **Area** until **Display** is highlighted in the pop-up menu.
      - Repeatedly press the side-menu button **–more–** until **Composite** appears in the side menu. Push **Composite**.
      - Press the main-menu button **EXECUTE**; then press the side-menu button **Ok Confirm Run Test**.

**b.** *Make the brightness adjustment:*

- Locate R569 (BRIGHTNESS). It is one of the two adjustments on the left side of the instrument located just ahead of the fan. It is the adjustment nearest the fan.
- Observe the luminance patches using a 6X magnifier.
- Adjust R569 (BRIGHTNESS) until the background raster lines in the 5% luminance patch (see Figure 5–11) just disappear, while the lines in the 10% luminance patch are just visible, when both are viewed through the magnifier.

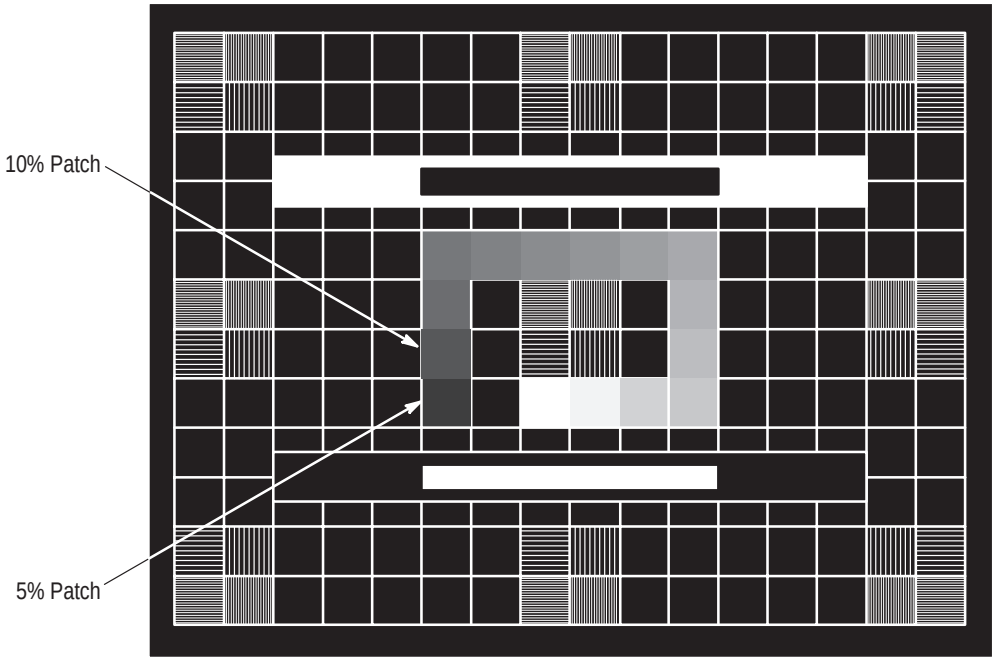



**Figure 5–11: Five and ten percent luminance patches**

**3.** *Adjust the display contrast:*

**a.** *Display the White Field test pattern:*

- Press the center main-menu button to display the main menu.
- Press the main-menu button **Tests**.
- Repeatedly press the side-menu button **–more–** until **White Field** appears in the side menu. Push **White Field**.
- Press the main-menu button **EXECUTE**; then press the side-menu button **Ok Confirm Run Test**.

**b.** *Make the contrast adjustment:*

- Locate R572. It is one of two adjustments on the left side of the instrument located just ahead of the fan. It is the adjustment nearest the front of the oscilloscope.
- Monitor the luminance at center screen using a J17 photometer and a luminance probe.
- Adjust R572 (CONTRAST) for a reading of 50 foot lamberts if the gray display shield is installed; adjust for 110 foot lamberts if the shield is missing.

**4.** *Restore the oscilloscope to normal operation:*

**a.** Restore the dip switch to the settings that follow:

| Switch No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Open | | | | | | | | |
| Closed | X | X | X | X | X | X | X | X |

**b.** Power off the oscilloscope.

**c.** See *Removal and Installation Procedures* in Section 6 to reinstall the cabinet and other modules removed in step 1.

## Rotation, Brightness, and Contrast Adjustment (TDS 654C, 684C, 700D, 714L – Color Only)

| | |
|---|---|
| **Equipment required** | One 6X magnifier (Item 16) |
| | One J17 Photometer with a J1803 Luminance Probe (Item 17) |

**1.** *Access the inside of the oscilloscope:* See *Removal and Installation Procedures* in Section 6 to remove the cabinet.

**2.** *Adjust the display rotation:*

**a.** *Display the Composite test pattern:*

- Leave the oscilloscope powered off.

- Set the DIP switch, located near the front of the A11 DRAM Processor/Display, as follows:

| Switch No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Open | | | X | | | X | X | |
| Closed | X | X | | X | X | | | X |

- Power on the oscilloscope.
- Press **SHIFT**; then press **UTILITY**.
- Repeatedly press the main-menu button **System** until **Diag/Err** is highlighted in the pop-up menu.
- Repeatedly press the main-menu button **Area** until **Display** is highlighted in the pop-up menu.
- Repeatedly press the side-menu button **–more–** until **Composite** appears in the side menu. Push **Composite**.
- Press the main-menu button **EXECUTE**; then press the side-menu button **Ok Confirm Run Test**.

**b.** Adjust R401 (TRACE ROTATION) to minimize the display's tilt. Use the frame around the display as a reference. R401 is the second adjustment from the fan.

**3.** *Adjust the display brightness:*

- Locate R403 (BRIGHTNESS). It is one of the adjustments on the left side of the instrument located just ahead of the fan. It is the fourth adjustment from the fan.
- Observe the luminance patches using a 6X magnifier.
- Adjust R403 (BRIGHTNESS) until the background raster lines in the 5% luminance patch (see Figure 5–11) just disappear, while the lines in the 10% luminance patch are just visible, when both are viewed through the magnifier.

**4.** *Adjust the display contrast:*

**a.** *Display the White Field test pattern:*

- Press the center main-menu button to display the main menu.
- Press the main-menu button **Tests**.

- Repeatedly press the side-menu button **–more–** until **White Field** appears in the side menu. Push **White Field**.
- Press the main-menu button **EXECUTE**; then press the side-menu button **Ok Confirm Run Test**.

**b.** *Make the contrast adjustment:*

- Locate R404. It is one of the adjustments on the left side of the instrument located just ahead of the fan. It is the fifth adjustment from the fan.
- Monitor the luminance at center screen using a J17 photometer and a luminance probe.
- Adjust R404 (CONTRAST) for a reading of 36 foot lamberts for 640–0077–XX display assemblies where –XX equals –06 or above. Use a reading of 40 foot lamberts for 640–0077–XX assemblies where –XX equals –05 or below.

***NOTE****. The adjustments for contrast and brightness interact with each other.*

**5.** *Restore the oscilloscope to normal operation:*

**a.** Restore the dip switch to the settings that follow:

| Switch No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Open | | | X | | | | | |
| Closed | X | X | | X | X | X | X | X |

**b.** Power off the oscilloscope.

**c.** See *Removal and Installation Procedures* in Section 6 to reinstall the cabinet and other modules removed in step 1.

# Maintenance

This section contains the information needed to do periodic and corrective maintenance on the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes. The following subsections are included:

- *Preparation* — Introduction plus general information on preventing damage to internal modules when doing maintenance.
- *Inspection and Cleaning* — Information and procedures for inspecting the oscilloscope and cleaning its external and internal modules.
- *Removal and Installation Procedures* — Procedures for the removal of defective modules and replacement of new or repaired modules. Also included is a procedure for disassembly of the oscilloscope for cleaning.
- *Troubleshooting* — Information for isolating failed modules. Included are instructions for operating the oscilloscope's internal diagnostic routines and troubleshooting trees. Most of the trees make use of these internal diagnostic routines to speed fault isolation to a module.

## Related Maintenance Procedures

The following sections contain information and procedures related to maintenance.

- Section 2, *Operating Information*, covers instructions useful when operating the oscilloscope in order to troubleshoot it. It also details the service strategy and lists options for obtaining maintenance service and for replacing failed modules.
- Section 3, *Theory of Operation*, contains a circuit description at the module, or block, level.
- Section 4, *Performance Verification*, contains procedures that may be useful in isolating problems to modules by testing oscilloscope performance.
- Section 5, *Adjustment Procedures*, addresses after repair adjustment and the interval between periodic adjustments. It contains a procedure for adjusting the internal circuits of the oscilloscope.
- Section 9, *Diagrams*, contains a block diagram using individual modules as blocks and an interconnection diagram showing connections between the modules.
- Section 10, *Mechanical Parts List*, lists all field replaceable modules by part number.

# Preparation

Before servicing this product, read the *Safety Summary* and *Introduction* at the front of the manual and the ESD information below.



***CAUTION.*** *Static discharge can damage any semiconductor component in this oscilloscope.*

## Preventing ESD

When performing any service which requires internal access to the oscilloscope, adhere to the following precautions to avoid damaging internal modules and their components due to electrostatic discharge (ESD).

1. Minimize handling of static-sensitive modules.
2. Transport and store static-sensitive modules in their static protected containers or on a metal rail. Label any package that contains static-sensitive modules.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules. Do service of static-sensitive modules only at a static-free work station.
4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Handle circuit boards by the edges when possible.
6. Do not slide the modules over any surface.
7. Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.

## Susceptibility to ESD

Table 6–1 lists the relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

**Table 6–1: Relative susceptibility to static-discharge damage**

| Semiconductor classes | Relative susceptibility levels[1] |
|---|---|
| MOS or CMOS microcircuits or discrete circuits, or linear microcircuits with MOS inputs (most sensitive) | 1 |
| ECL | 2 |
| Schottky signal diodes | 3 |
| Schottky TTL | 4 |
| High-frequency bipolar transistors | 5 |
| JFET | 6 |
| Linear microcircuits | 7 |
| Low-power Schottky TTL | 8 |
| TTL (least sensitive) | 9 |

1 **Voltage equivalent for levels (voltage discharged from a 100 pF capacitor through resistance of 100 ohms**):

**1 = 100 to 500 V**
**2 = 200 to 500 V**
**3 = 250 V**
**4 = 500 V**
**5 = 400 to 600 V**
**6 = 600 to 800 V**
**7 = 400 to 1000 V (est.)**
**8 = 900 V**
**9 = 1200 V**

# Inspection and Cleaning

*Inspection and Cleaning* describes how to inspect for dirt and damage. It also describes how to clean the exterior and interior of the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes. Inspection and cleaning are done as preventive maintenance. Preventive maintenance, when done regularly, may prevent oscilloscope malfunction and enhance its reliability.

Preventive maintenance consists of visually inspecting and cleaning the oscilloscope and using general care when operating it.

How often to do maintenance depends on the severity of the environment in which the oscilloscope is used. A proper time to perform preventive maintenance is just before oscilloscope adjustment.

## General Care

The cabinet helps keep dust out of the oscilloscope and should normally be in place when operating the oscilloscope. The oscilloscope's front cover protects the front panel and display from dust and damage. Install it when storing or transporting the oscilloscope.

## Inspection and Cleaning Procedures

Inspect and clean the oscilloscope as often as operating conditions require. The collection of dirt on components inside can cause them to overheat and break-down. (Dirt acts as an insulating blanket, preventing efficient heat dissipation.) Dirt also provides an electrical conduction path that could cause an oscilloscope failure, especially under high-humidity conditions.



***CAUTION.*** *Avoid the use of chemical cleaning agents which might damage the plastics used in this oscilloscope. Use only deionized water when cleaning the menu buttons or front-panel buttons. Use a 75% isopropyl alcohol solution as a cleaner and rinse with deionized water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.*

**Inspection — Exterior.** Inspect the outside of the oscilloscope for damage, wear, and missing parts, using Table 6–2 as a guide. Oscilloscopes that appear to have been dropped or otherwise abused should be checked thoroughly to verify correct operation and performance. Immediately repair defects that could cause personal injury or lead to further damage to the oscilloscope.

**Table 6–2: External inspection check list**

| Item | Inspect For | Repair Action |
|---|---|---|
| Cabinet, front panel, and cover | Cracks, scratches, deformations, damaged hardware or gaskets. | Repair or replace defective module. |
| Front-panel knobs | Missing, damaged, or loose knobs. | Repair or replace missing or defective knobs. |
| Connectors | Broken shells, cracked insulation, and deformed contacts. Dirt in connectors. | Repair or replace defective modules. Clear or wash out dirt. |
| Carrying handle, bail, cabinet feet. | Correct operation. | Repair or replace defective module. |
| Accessories | Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors. | Repair or replace damaged or missing items, frayed cables, and defective modules. |

**Cleaning Procedure — Exterior.** To clean the oscilloscope exterior, do the following steps:

1. Remove loose dust on the outside of the oscilloscope with a lint free cloth.
2. Remove remaining dirt with a lint free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.
3. Clean the light filter protecting the monitor screen with a lint-free cloth dampened with either isopropyl alcohol or, preferably, a gentle, general purpose detergent-and-water solution.



***CAUTION.*** *To prevent getting moisture inside the oscilloscope during external cleaning, use only enough liquid to dampen the cloth or applicator.*

**Inspection — Interior.** To access the inside of the oscilloscope for inspection and cleaning, refer to the *Removal and Installation Procedures* in this section.

Inspect the internal portions of the oscilloscope for damage and wear, using Table 6–3 as a guide. Defects found should be repaired immediately.

If any electrical module is replaced, check Table 5–3 in Section 5 to see if it is necessary to adjust the oscilloscope.



***CAUTION.*** *To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the oscilloscope.*

**Table 6–3: Internal inspection check list**

| Item | Inspect For | Repair Action |
|---|---|---|
| Circuit boards | Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating. | Remove failed module and replace with a fresh module. |
| Resistors | Burned, cracked, broken, blistered condition. | Remove failed module and replace with a fresh module. |
| Solder connections | Cold solder or rosin joints. | Resolder joint and clean with isopropyl alcohol. |
| Capacitors | Damaged or leaking cases. Corroded solder on leads or terminals. | Remove damaged module and replace with a fresh module from the factory. |
| Semiconductors | Loosely inserted in sockets. Distorted pins. | Firmly seat loose semiconductors. Remove devices that have distorted pins. Carefully straighten pins (as required to fit the socket), using long-nose pliers, and reinsert firmly. Ensure that straightening action does not crack pins, causing them to break off. |
| Wiring and cables | Loose plugs or connectors. Burned, broken, or frayed wiring. | Firmly seat connectors. Repair or replace modules with defective wires or cables. |
| Chassis | Dents, deformations, and damaged hardware. | Straighten, repair, or replace defective hardware. |

**Cleaning Procedure — Interior.** To clean the oscilloscope interior, do the following steps:

1. Blow off dust with dry, low-pressure, deionized air (approximately 9 psi).
2. Remove any remaining dust with a lint-free cloth dampened in isopropyl alcohol (75% solution) and rinse with warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)

***STOP.*** *If, after doing steps 1 and 2, a module is clean upon inspection, skip the remaining steps.*

3. If steps 1 and 2 do not remove all the dust or dirt, the oscilloscope may be spray washed using a solution of 75% isopropyl alcohol by doing steps 4 through 8.

4. Gain access to the parts to be cleaned by removing easily accessible shields and panels (see *Removal and Installation Procedures*).
5. Spray wash dirty parts with the isopropyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate.
6. Use hot (120° F to 140° F) deionized water to thoroughly rinse them.
7. Dry all parts with low-pressure, deionized air.
8. Dry all components and assemblies in an oven or drying compartment using low-temperature (125° F to 150° F) circulating air.

**Lubrication.** There is no periodic lubrication required for this oscilloscope.

# Removal and Installation Procedures

This subsection contains procedures for removal and installation of all mechanical and electrical modules. Any electrical or mechanical module, assembly, or part listed in Section 10 of this manual is a module.

## Preparation — Please Read



***WARNING.*** *Before doing this or any other procedure in this manual, read the Safety Summary found at the beginning of this manual. Also, to prevent possible injury to service personnel or damage to this oscilloscope's components, read* Installation *in Section 2, and* Preventing ESD *in this section.*

This subsection contains the following items:

- This preparatory information that you need to properly do the procedures that follow.
- List of tools required to remove all modules.
- Three module locator diagrams for finding the External Modules (see Figure 6–1), Outer-Chassis Modules (see Figure 6–2), and Inner-Chassis Modules (see Figure 6–3) in this oscilloscope.
- Procedures for removal and reinstallation of the electrical and mechanical modules.
- A disassembly procedure for removal of all the major modules from the oscilloscope at one time and for reassembly of those modules into the oscilloscope. Such a complete disassembly is normally only done when completely cleaning the oscilloscope. (Instructions for doing the actual cleaning are found under *Inspection and Cleaning* at the beginning of this section.)



***WARNING.*** *Before doing any procedure in this subsection, disconnect the power cord from the line voltage source. Failure to do so could cause serious injury or death.*

### List of Modules

Section 10 lists all modules.

## General Instructions

***STOP. READ THESE GENERAL INSTRUCTIONS BEFORE REMOVING A MODULE.***

*First read over the* Summary of Procedures *that follows to understand how the procedures are grouped. Then read* Equipment Required *for a list of the tools needed to remove and install modules in this oscilloscope.*

*If you are disassembling this oscilloscope for cleaning, go to the procedure* Disassembly for Cleaning *on page 6–55.*

*If you are removing a module for service, begin by doing the procedure* Access Procedure *(page 6–15). By following the instructions in that procedure, you remove the module to be serviced while removing the minimum number of additional modules.*

## Summary of Procedures

The procedures are described in the order in which they appear in this section. In addition, you can look up any procedure for removal and reinstallation of any module in the *Table of Contents* of this manual.

- The *Access Procedure* on page 6–15 first directs you to the procedure(s) (if any) that are required to access the module to be serviced, then it directs you to the procedure to remove that module.
- *Procedures for External Modules* on page 6–16 are procedures for removing modules the removal of which do not require internal access to the oscilloscope.
- *Procedures for Outer-Chassis Modules* on page 6–28 are procedures for removing modules the removal of which require access internal to the instrument but external to the chassis.
- *Procedures for Inner-Chassis Modules* on page 6–48 are procedures for removing modules the removal of which require access internal to the instrument and internal to the chassis.
- *Disassembly for Cleaning* on page 6–55 is a procedure, based on the removal procedures just described, that removes all modules for cleaning. Instructions for cleaning are found in *Inspection and Cleaning*, which begins this section.

***NOTE****. Read the cleaning procedure before disassembling the oscilloscope for cleaning.*

**Equipment Required, see Table 6–4.** Most modules in this oscilloscope can be removed with a screwdriver handle mounted with a size T-15, Torx® screwdriver tip. *Use this tool whenever a procedure step instructs you to remove or install a screw unless a different size screwdriver is specified in that step.* All equipment required to remove and reinstall each module is listed in the first step of its procedure.

**Table 6–4: Tools required for module removal**

| Item No. | Name | Description | Tektronix Part Number |
|---|---|---|---|
| 1 | Screwdriver handle | Accepts Torx®-driver bits | 003-0301-00 |
| 2 | T-15 Torx tip | Torx®-driver bit for T-15 size screw heads | 003-0966-00 |
| 3 | T-20 Torx tip | Torx®-driver bit for T-20 size screw heads | 003-0866-00 |
| 4 | T-20 Torx tip | Special Tool: Narrow Torx®-driver bit for T-20 size screw heads (fan removal only) | 003-1457-01 |
| 5 | Flat-bladed screwdriver | Screwdriver for removing standard-headed screws | |
| 6 | Needle-Nose Pliers | Standard tool | |
| 7 | Nutdriver, 1/4 inch | Standard tool | |
| 8 | Retaining Ring Pliers | Standard tool; 1 1/8 inch minimum throw | |
| 9 | Angle-Tip Tweezers | Standard tool | |
| 10 | Soldering Iron | Standard tool | |
| 11 | Pliers | Standard tool | |
| 12 | Solder Wick | Standard tool | |
| 13 | 8/32 hex tip | Bit for 8/32 hex set screw | |
| 14 | Adhesive | TRA-CON: Tra-Bond #BA-2114 | |

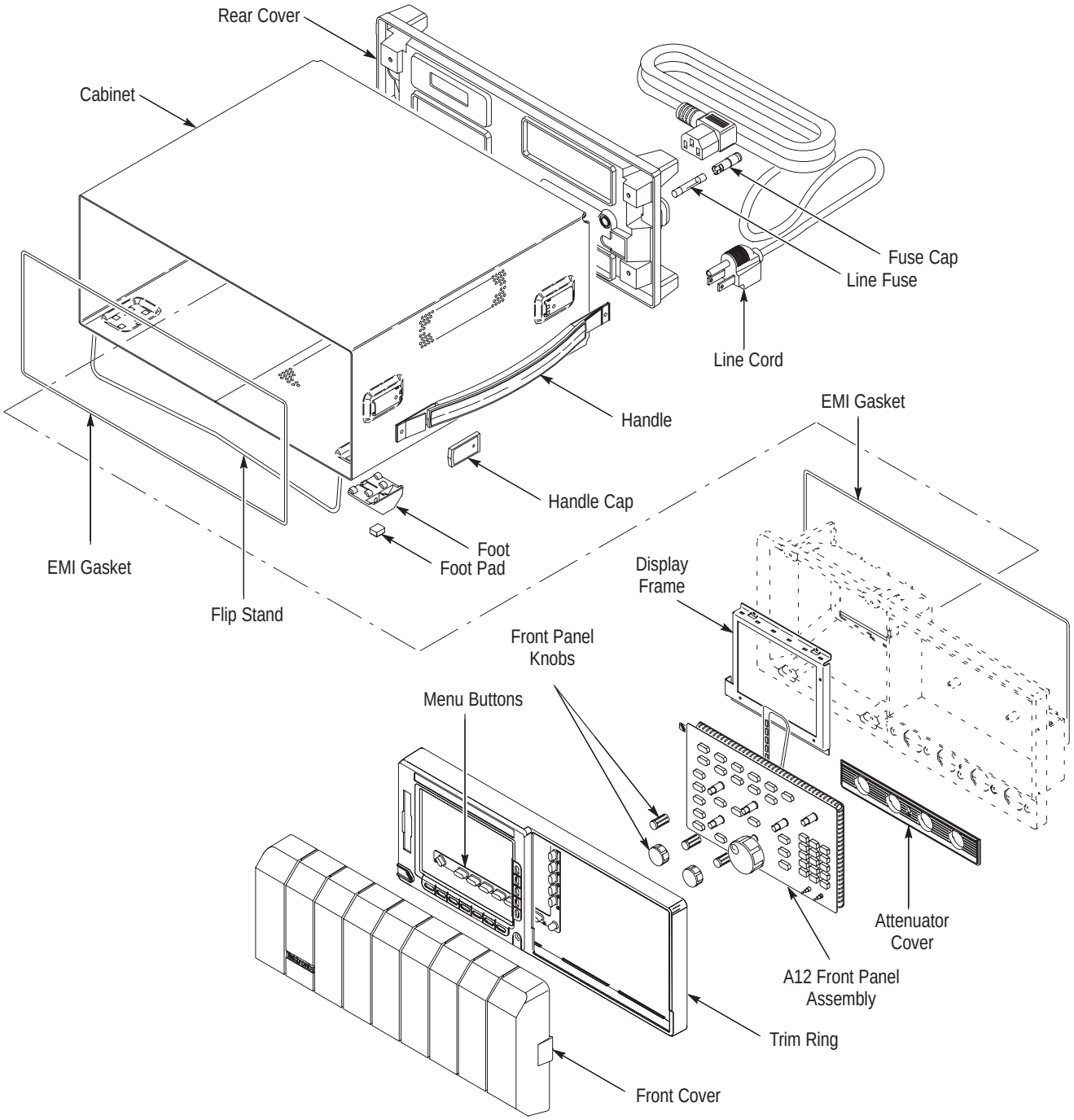



**Figure 6–1: External modules**

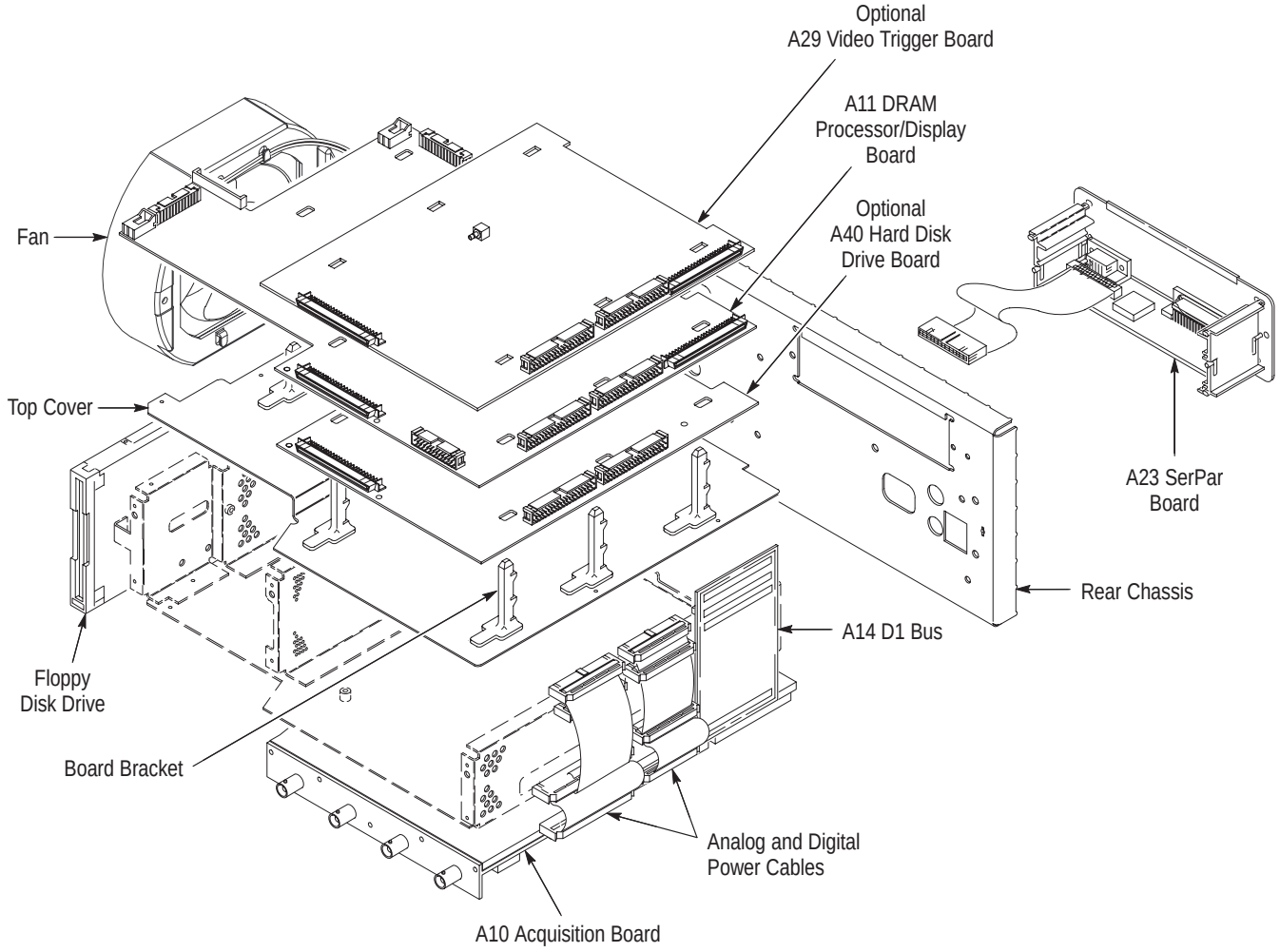



**Figure 6–2: Outer-chassis modules**

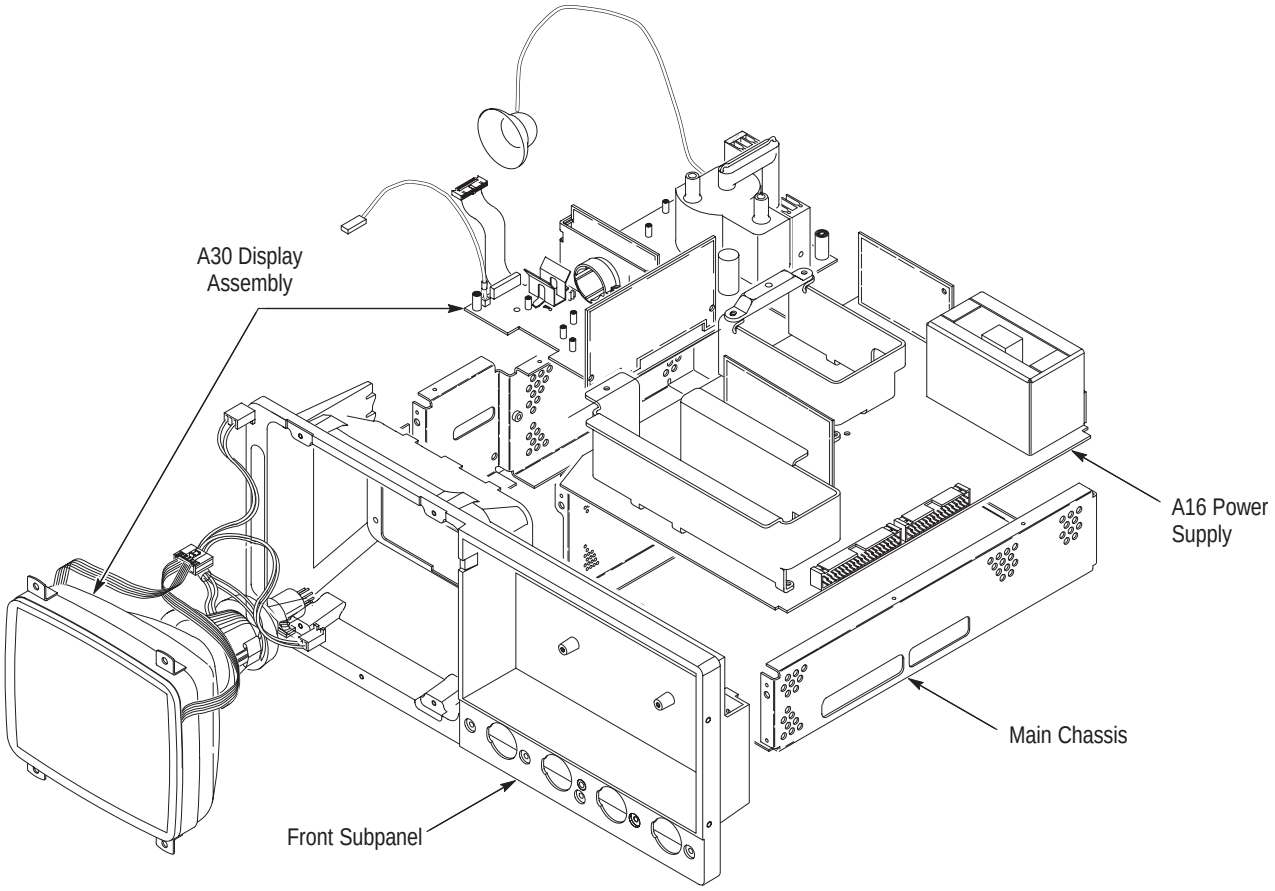



**Figure 6–3: Inner-chassis modules**

## Access Procedure

Begin with this procedure when you have identified a module to be removed for service and have read *General Instructions* found earlier in this section.

1. *Locate module to be removed:*

   a. Find the module to be removed in the module locator diagrams, Figures 6–1 through 6–3.

   b. Once the module is found, note from the title of the figure whether the module is an external, outer-chassis mounted, or inner-chassis mounted part.

2. *If the module is externally mounted, no internal access is required; remove the module:* Find and do the procedure whose title matches the name of the module to be removed under *Procedures for External Modules* (page 6–16).

3. *If the module is an outer- or inner-chassis module, access the inside of the instrument:*

   a. First do the procedure *Line Fuse and Line Cord*; then do the procedure *Rear Cover and Cabinet.* Both are found under *Procedures for External Modules* immediately following this procedure.

   b. After completing those procedures, return to this procedure and continue with step 4.

4. *If the module is an outer-chassis module, remove it:*

   a. If removing the attenuator or display-frame assembly, first do the procedure *Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel,* found under *Procedures for External Modules* (page 6–16).

   b. Find and do the procedure whose title matches the name of the module to be removed under *Procedures for Outer-Chassis Modules,* on page 6–28.

5. *If the module is an inner-chassis module, access the inner-chassis:*

   a. If removing the display tube, display-driver board, or the front subpanel, first do the procedure *Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel,* found under *Procedures for External Modules.* Also remove the display-frame assembly found under *Procedures for External Modules,* on page 6–16.

   b. Also, if removing the front subpanel, do *A12 Front-Panel Assembly* also found under *Procedures for External Modules.*

   c. Do, in the order listed, the three procedures *A14 D1 Bus and Analog-Power and Digital-Power Cables*, *A11 Processor/Display Board* and *Top Cover* found under *Procedures for Outer-Chassis Modules,* page 6–28.

**d.** Find and do the procedure whose title matches the name of the module to be removed under *Procedures for Inner-Chassis Modules*, page 6–48.

**6.** *Reinstall all modules removed:* Read the instructions found at the end of the procedure that removes the module to be serviced — they will guide you in reinstalling all modules removed.

## Procedures for External Modules

Do the *Access Procedure* (page 6–15) before doing any procedure in this collection.

The following procedures are found here and are listed in order presented.

- Front-Panel Knobs
- Line Fuse and Line Cord
- EMI Gaskets
- Rear Cover and Cabinet
- Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel
- A12 Front-Panel Assembly
- Display Frame Assembly
- Cabinet Modules

### Front-Panel Knobs

**1.** *Assemble equipment and locate modules to be removed:* Have an angled-tip tweezers (Item 9) handy. Find the knob(s) to be removed on the front panel.

**2.** *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its front is facing you.

**3.** *Remove the knob(s):* Grasp any knob you want to remove and pull it straight out from the front panel slightly to create some clearance between the base of the knob and the front panel. Insert the tweezers between the knob and front panel and use them to remove the knob. See Figure 6–4.

**4.** *Reinstallation:* To reinstall, align knob to shaft and push it in until it snaps.

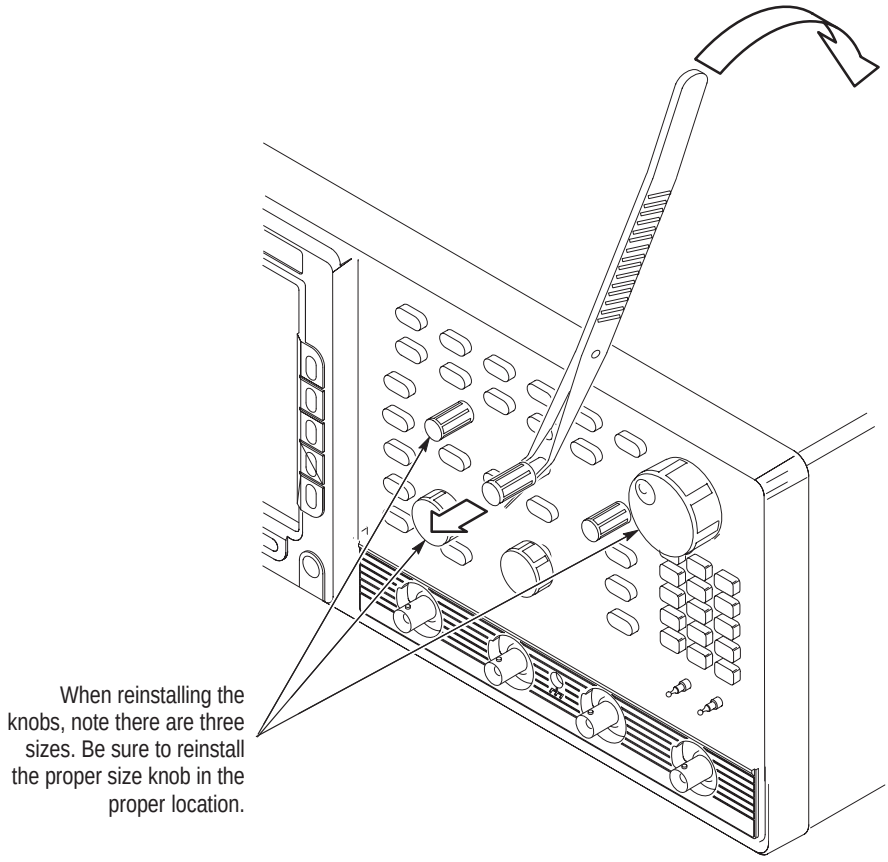



**Figure 6–4: Knob removal**

## Line Fuse and Line Cord

1. *Assemble equipment and locate modules to be removed:* Have a flat-bladed screwdriver (Item 5) handy. Locate the line fuse and line cord in the locator diagram *External modules*, Figure 6–1.
2. *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its rear is facing you. If you are servicing the line fuse, do the next step; if you are servicing the line cord, skip to step 4.
3. *Remove line fuse:* Find the fuse cap on the rear panel. (See Figure 6–5.) Now, remove the fuse cap by turning it counterclockwise using a flat-bladed screwdriver, and remove the line fuse. Reverse procedure to reinstall.
4. *Remove line cord:* Find the line cord on the rear cover. (See Figure 6–5.) Now, remove the line-cord retaining clamp by first unplugging the line cord from its receptacle. Next, grasp both the line cord and the retaining clamp and rotate it 90 degrees counterclockwise. Pull the line cord and clamp away to complete the removal. Reverse procedure to reinstall.

5. *Reinstallation:* Do in reverse steps 3 and 4 to reinstall the line cord and then the line fuse.

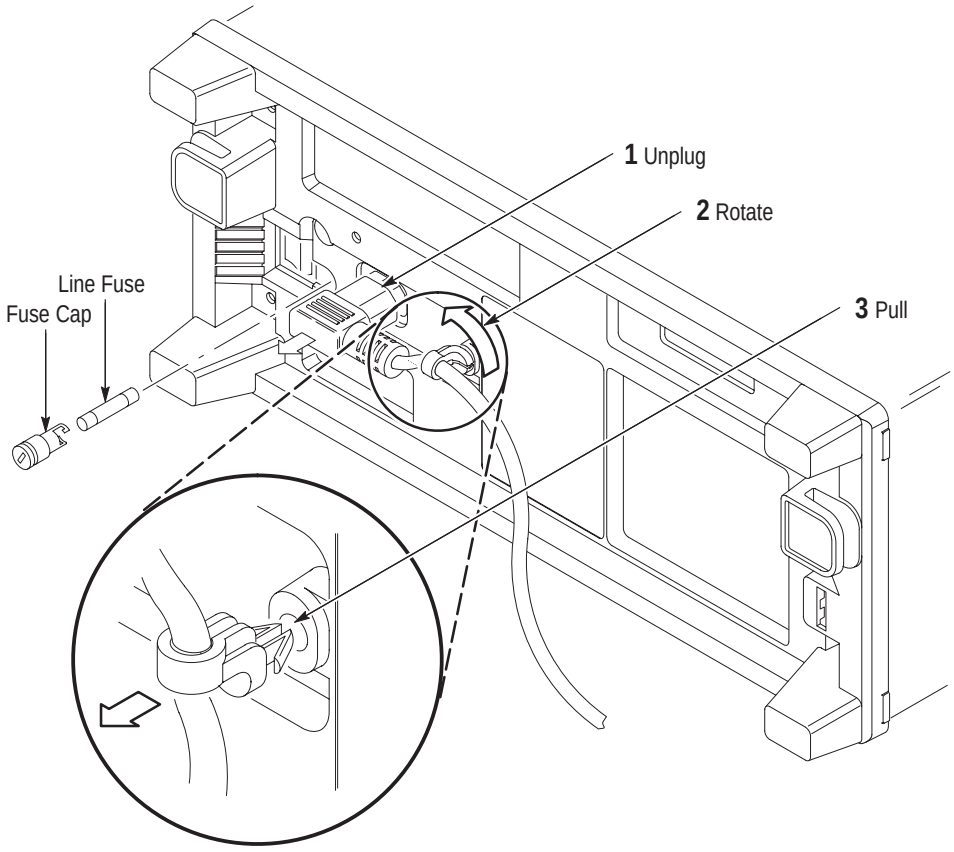



**Figure 6–5: Line fuse and line cord removal**

## EMI Gaskets

See *Rear Cover and Cabinet* procedure on page 6–18.

## Rear Cover and Cabinet

1. *Assemble equipment and locate modules to be removed:*
   - **a.** Have handy a screwdriver with a size T-20 Torx® tip (Items 1 and 3).
   - **b.** Make sure the oscilloscope's front cover is installed; if it's not, install it by snapping its edges over the trim ring.
   - **c.** Locate the rear cover and cabinet in the locator diagram *External modules*, Figure 6–1 on page 6–12.
2. *Orient the oscilloscope:* Set the oscilloscope so its face is down with its front cover on the work surface and its bottom facing you.

3. *Disconnect the line cord:* Unplug the line cord from its receptacle at the rear cover.

4. *Remove rear cover:* Remove the four screws securing the rear cover to the oscilloscope. Lift off the rear cover.

5. *Remove the cabinet:*

   a. At the rear of the cabinet, grasp its left and right edges.

   b. Pull upward to slide the cabinet off the oscilloscope. Take care not to bind or snag the cabinet on the oscilloscope's internal cabling as you remove it.

---

***STOP**. DO NOT do steps 6 through 8 to remove the EMI gasket(s) unless they must be replaced due to damage. If you are not replacing those gaskets, skip to step 9.*

*When reinstalling EMI gaskets and/or the oscilloscope cabinet, carefully follow the instructions given. Unless they are performed properly, the oscilloscope may not meet its emissions requirements (EMI).*

---

6. *Assemble equipment and locate modules to be removed:*

   a. Have handy a pair of needle-nose pliers (Item 6).

   b. Locate the modules to be removed in the locator diagram *External modules*, Figure 6–1 on page 6–12.

7. *Remove the EMI gaskets:*

   a. Look for the point where the ends of the gasket touch in the channel at the rear edge of the cabinet.

   b. Use a pair of needle-nose pliers to pry up one of the ends.

   c. Grasp the EMI gasket, and gently pull it out of the its channel.

   d. Repeat substeps a through c to remove the gasket from its channel on the front casting.

8. *Reinstallation of EMI gaskets:* Press each EMI gasket back into its groove at the rear edge of the cabinet or front casting. Make sure the ends of the gasket touch, but do not overlap, when installing. (Cut off excess length if required to prevent overlap.)

**9.** *Reinstallation of cabinet and rear cover:*

***CAUTION.*** *To avoid excessive heat retention and circuit damage in instruments with serial number B040100 and above, use the proper cabinet. If you have several instruments apart for servicing, the proper cabinet for instruments with serial number B040100 and above can be identified by the larger ventilation areas, as shown in Figure 6–6.*

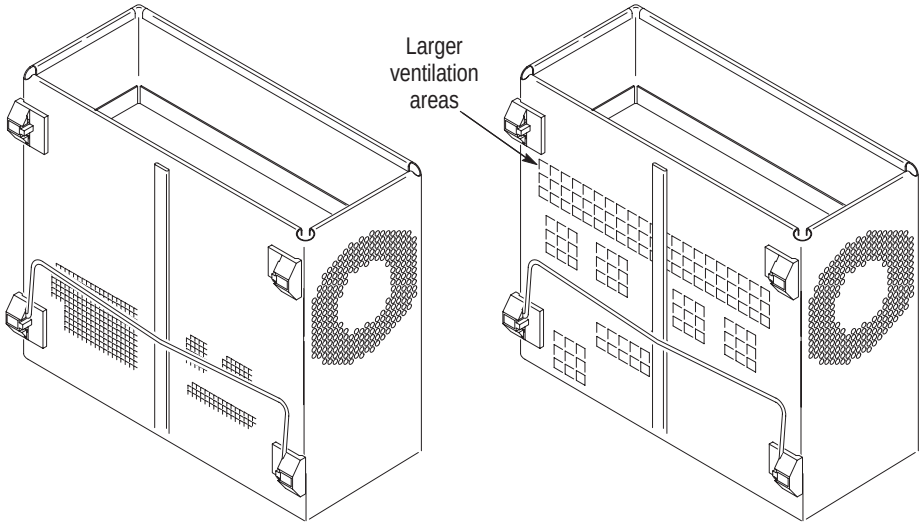



**Figure 6–6: Cabinet identification**

**a.** Do in reverse order steps 3 and 4 to reinstall the cabinet.

**b.** Take care not to bind or snag the cabinet on internal cabling; redress cables an necessary.

**c.** When sliding the cabinet, be sure that the front edge of the cabinet aligns with the groove containing the EMI shield on the front casting.

**d.** Be sure that the ridge around the rear chassis slides into the groove containing a second EMI cable on the rear of the cabinet.

**e.** When reinstalling the four screws at the rear panel, tighten them to 16 foot-lbs torque.

**f.** See the procedure *Line Fuse and Line Cord* to reinstall the line cord, which completes the oscilloscope reassembly.

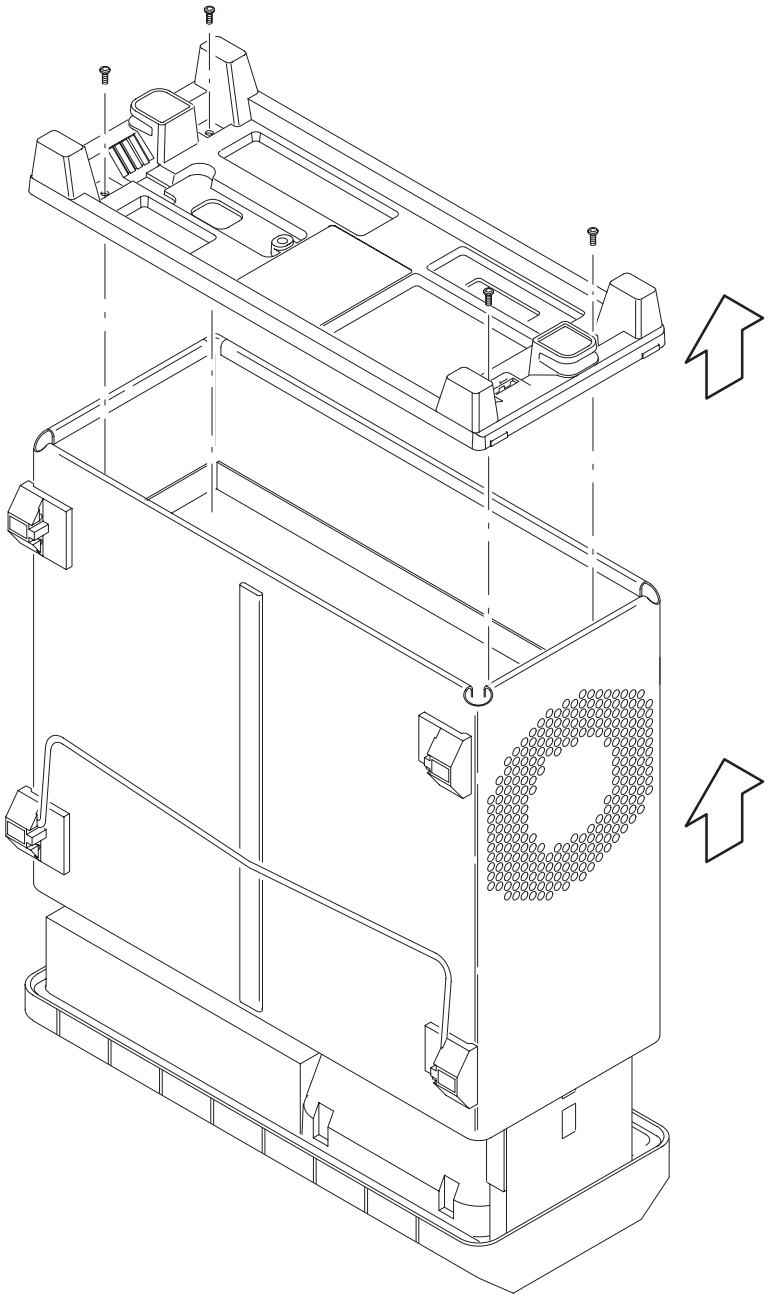


**Figure 6–7: Rear cover and cabinet removal**

### Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel

1. *Assemble equipment and locate modules to be removed:* No tools are needed. Locate the modules to be removed in the locator diagram *External modules*, Figure 6–1 on page 6–12.
2. *Orient the oscilloscope:* Set the oscilloscope so its rear is down on the work surface and its bottom is facing you.
3. *Remove the front cover:* Grasp the front cover by its left and right edges and snap it off of the front subpanel. When reinstalling, align and snap back on.
4. *Remove the trim ring:* Grasp the trim ring by its top edge and pry it up and lift it forward to snap it off of the front subpanel. If servicing the menu buttons, lift them out of the trim ring. (When reinstalling, reinsert the menu buttons, align the trim ring to the front subpanel and press it back on.) See Figure 6–8.

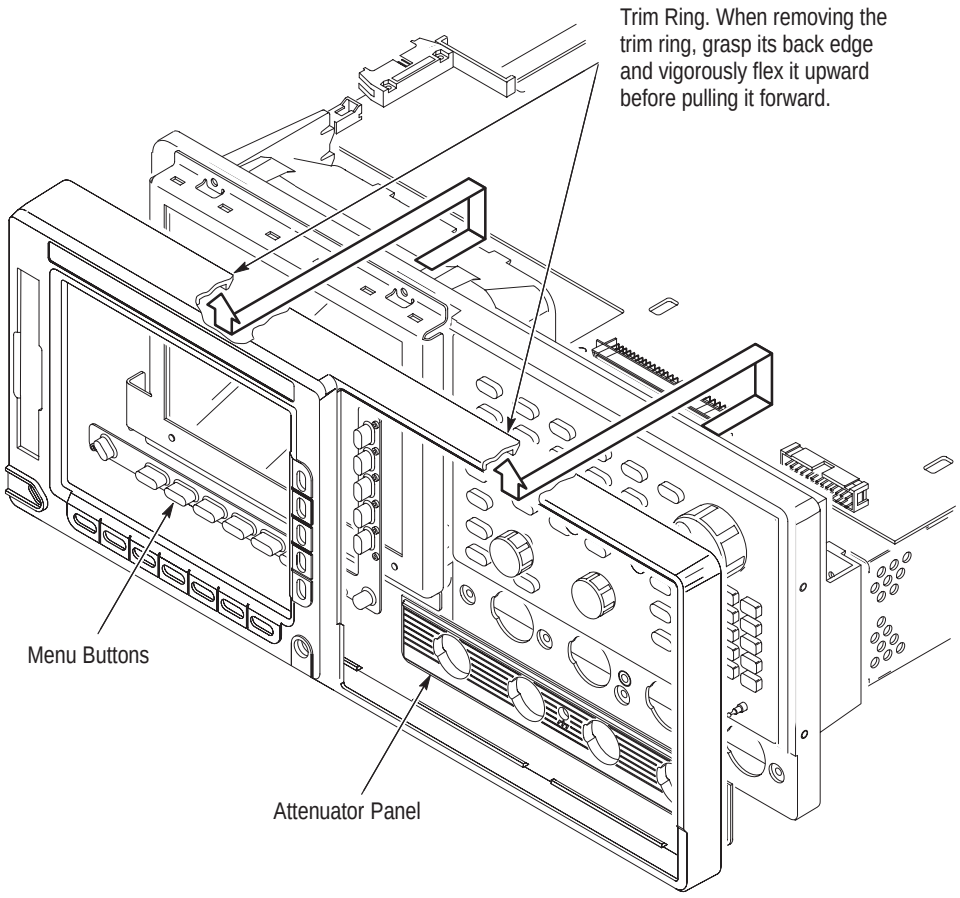



**Figure 6–8: Front cover, trim ring, menu buttons, and attenuator panel removal (front cover not shown)**

***STOP.*** *DO NOT touch the carbon contact points on the menu buttons installed in the trim ring. Also, do not touch the contacts on the flex circuit exposed when you remove the trim ring.*

5. *Remove the attenuator panel:* Gently pry, using your fingers, the snap-off/snap-on attenuator panel away from the front subpanel to remove it. (When reinstalling, use your hands to press it back on.)

6. *Reinstallation:* Do in reverse steps 3–5 to reinstall the attenuator panel, menu buttons, trim ring, and the front cover, following the reinstallation instructions found in each step.

## A12 Front-Panel Assembly

***NOTE.*** *This procedure includes removal and reinstallation instructions for the front panel and front panel buttons. Unless either of those modules are being serviced, do not do step 4, "Further disassembly of front-panel assembly."*

1. *Assemble equipment and locate modules to be removed:*

   a. Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2).

   b. Locate the modules to be removed in the locator diagram *External modules*, Figure 6–1 on page 6–12.

   c. Do the procedure *Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel*, steps 1–5, immediately preceding this procedure.

2. *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its front is facing you.

3. *Remove the front-panel assembly:*

   a. Lift the front-panel assembly out of the front subpanel until you can reach the interconnect cable connecting it to the processor/display board.

   b. Disconnect that cable at J2 of the processor/display board. Disconnect the flex-board connector at P3 of the front-panel assembly. (The flex board is part of the display-frame assembly.) Disconnect cable W76. See Figure 6–9 on page 6–24.

   c. Finally, lift the front-panel assembly out of the front subpanel to complete the removal.

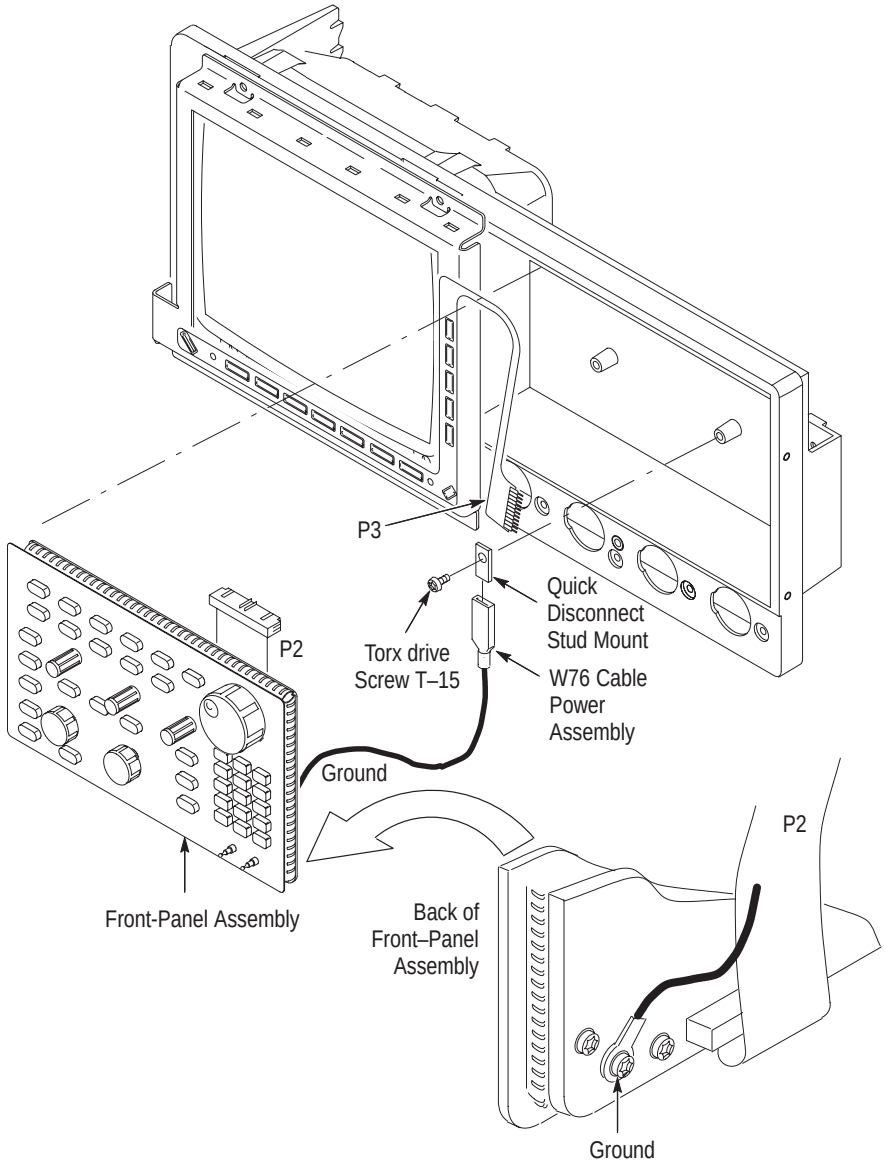



**Figure 6–9: A12 Front-panel assembly removal**

## Display-Frame Assembly

1. *Assemble equipment and locate modules to be removed:* Have handy a screwdriver with a size T-15 Torx® (Items 1 and 2). Locate the modules to be removed in the locator diagram *Outer-chassis modules*, Figure 6–2, page 6–13.
2. *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its front is facing you.

3. *Remove the display-frame assembly:*

   a. Do the procedure *Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel* (page 6–22) to remove the front cover and trim ring.

   b. Lift the front-panel assembly out of the front subpanel until you can reach J2 on the front-panel assembly. Disconnect the flex cable coming from the display-frame assembly at J39 of the front-panel assembly.

   c. Do the procedure *Floppy Disk Drive* (page 6–44) to remove the floppy disk drive.

   d. Remove the three screws securing the display-frame assembly to the front subpanel and remove that assembly.

4. *Reinstallation:*

   a. Do, in reverse order, substeps 3b–3d, reversing each step to reinstall the display-frame assembly. Then see the procedure *Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel* (page 6–22) to complete reassembly of the oscilloscope.

## Cabinet Modules

1. *Assemble equipment and locate modules to be removed:* Have handy a pair of needle-nose pliers (Item 6). Locate the modules to be removed in the locator diagram *External modules* (see Figure 6–1 on page 6–12).

2. *Orient the oscilloscope:* Set the oscilloscope so the left side is down on the work surface and its handle is facing upwards.

3. *Remove the handle (see Figure 6–10 on page 6–27) :*

   a. Insert the tips of a pair of needle-nose pliers (Item 6) into the hole of either handle cap. Push and hold to depress the handle release.

   b. While holding the handle released, pull it out of the slot in the handle cap. Repeat procedure to remove the handle from the other handle cap.

   c. Reverse procedure to reinstall.

4. *Remove the handle caps:*

   a. Insert the retaining ring pliers (Item 8) into the opening created in the handle cap when you removed the handle.

   b. While using the pliers to expand the handle cap outward, grasp it and snap it off.

   c. Repeat procedure to remove the remaining cap as needed; push the cap(s) back on to reinstall.

5. *Remove the flip stand:* Grasp the flip stand by both sides near where it joins each flip stand foot. Now compress the flip stand until the flip stand ends clear the flip stand feet to complete the removal.

6. *Remove the flip stand foot (or feet):*

   a. Do *Rear Cover and Cabinet* procedure (page 6–18) to gain access to inside of the cabinet.

   b. Working from inside the cabinet, push the two retainers to release the flip stand foot you wish to remove and lift it away from the outside of the cabinet.

   c. Repeat procedure to remove as many of the remaining feet as needed; insert the two retainers back in their slots in the cabinet and snap into place any flip stand foot removed.

7. *Reinstallation:* If any flip stand feet were removed, reinstall as directed in step 6c; then see *Rear Cover and Cabinet* procedure (page 6–18) to reinstall the rear cover and cabinet. Do in reverse order steps 3 and 5, reversing each step, to reinstall the flip stand, then the handle caps (if removed), then the handle.

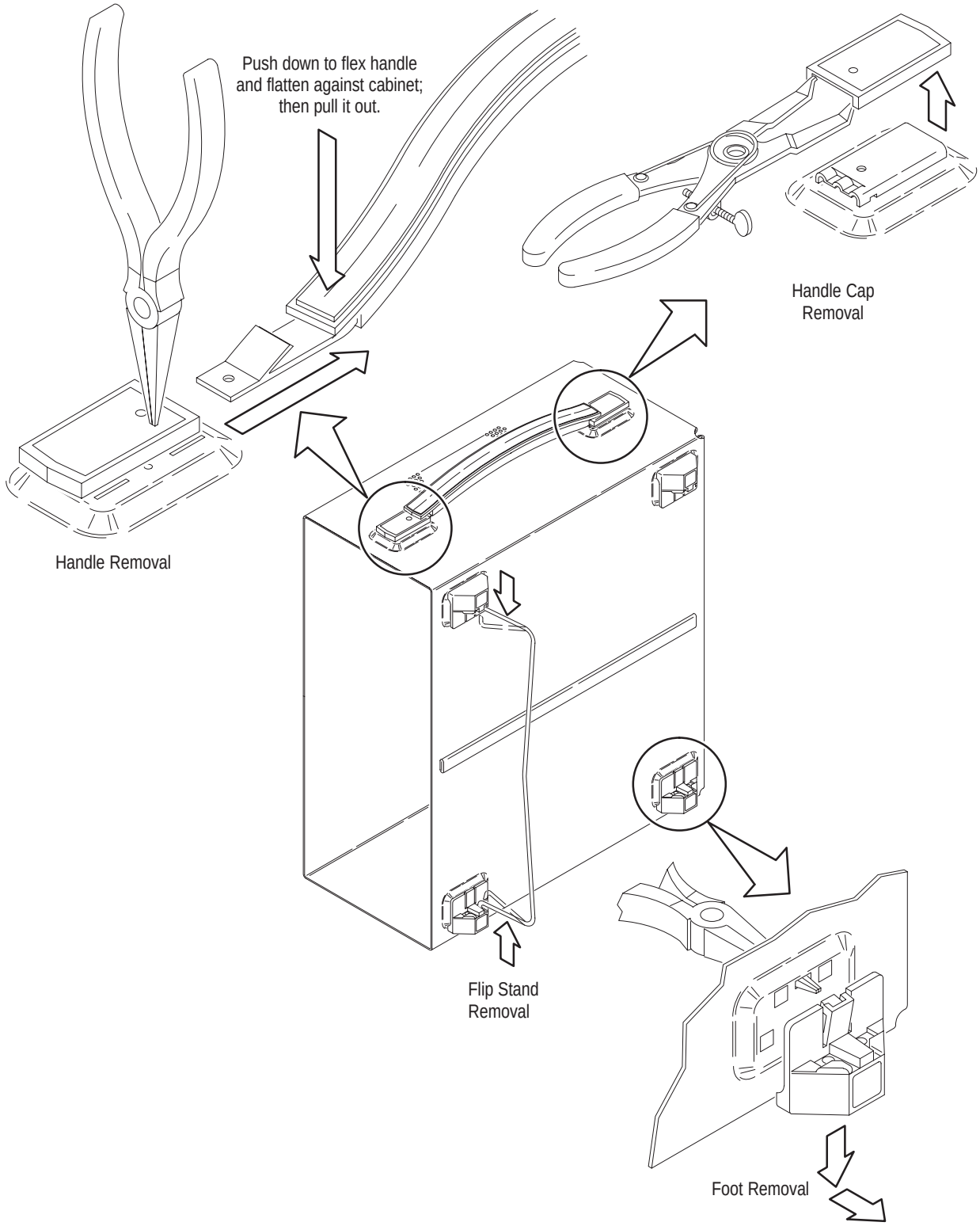



**Figure 6–10: Cabinet modules removal**

## Procedures for Outer-Chassis Modules

You should have completed the *Access Procedure* (page 6–15), before doing any procedure in this collection. The procedures found here, listed in order presented, follow.

- Fan
- A14 D1 Bus and Analog-Power and Digital-Power Cables
- A23 SerPar Board
- A29 Video Trigger Board
- A11 Processor/Display Board
- Hard Disk Drive
- Top Cover and Board Brackets
- Rear-Panel Cables
- A10 Acquisition Board
- Floppy Disk Drive
- Rear Chassis

### Fan

1. *Assemble equipment and locate module to be removed:* Have handy a screwdriver with a size T-20 Torx® tip (Items 1 and 3). Locate the fan in the locator diagram *Outer-Chassis Modules*, Figure 6–2, page 6–13.
2. *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its left side is facing you.
3. *Disconnect the fan from processor/display board:* Unplug the fan's power cable from J20.
4. *Remove the fan:* Remove the two screws securing the fan to the main chassis, and lift the fan away from the chassis.
5. *Reinstallation:* Do in reverse order substeps 3 and 4, reversing the removal instructions in each substep to reinstall the assembly. See the procedure *Rear Cover and Cabinet* (page 6–18) to complete reassembly of the oscilloscope.

### A14 D1 Bus and Analog-Power and Digital-Power Cables

1. *Assemble equipment and locate modules to be removed:* Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2). Find the modules to be removed in the locator diagram *Outer-Chassis Modules*, Figure 6–2, page 6–13.

2. *Orient the oscilloscope:* Set the oscilloscope so its left side is down on the work surface and its front is facing you.

3. *Remove the D1 bus:* Grasp the D1 bus and pull it up from the oscilloscope to unplug it from its two plug-in connectors. (J28 is the connector on the processor/display board; J100 is on the acquisition board.) Reverse these removal instructions to reinstall.

4. *Remove the analog-power and digital-power interconnect cables:*

   a. Unplug the analog-power cable at J26 on the display processor board, at J5 on the low-voltage power supply, and at J700 on the acquisition board.

   b. Unplug the digital-power cable at J27 on the display processor board, at J6 on the low-voltage power supply, and at J101 on the acquisition board.

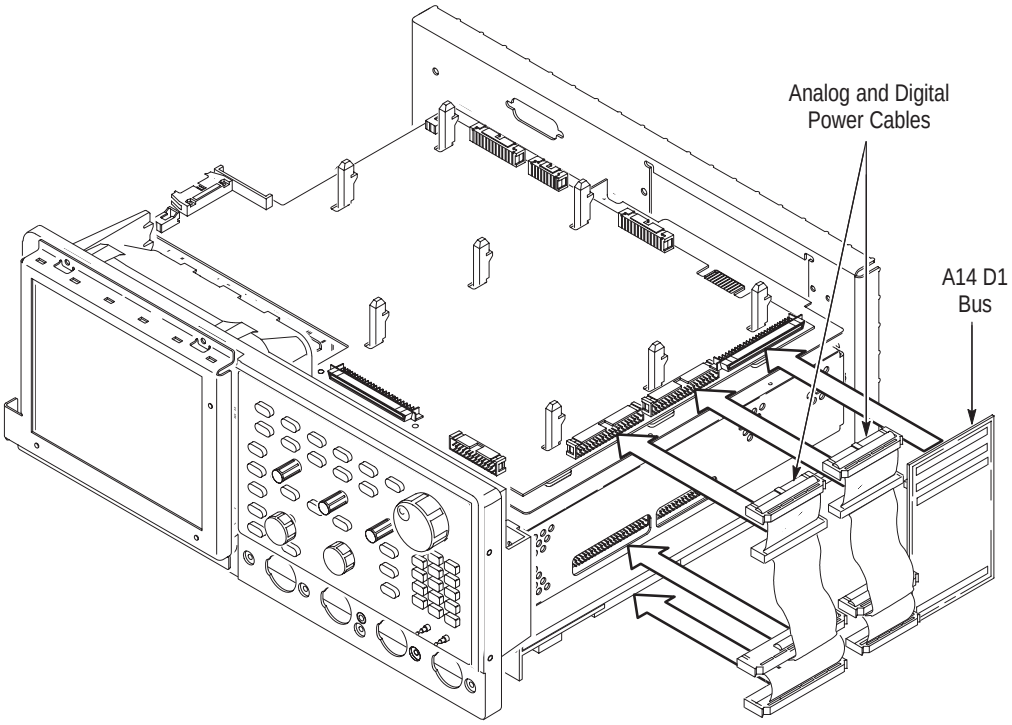



**Figure 6–11: A14 D1 bus and analog-power and digital-power cables removal**

5. *Reinstallation:*

   a. Do in reverse order steps 3 and 4, reversing the procedure outlined in each step to reinstall the assembly.

   b. When installing the D1 bus be sure to orient it so the single connector at the bottom of the bus plugs into the acquisition board.

**c.** See the procedure *Rear Cover and Cabinet* (page 6–18) to complete reassembly of the oscilloscope.

## A23 SerPar Board — RS232/Centronics Hardcopy Interface (Optional on Some Models)

**1.** *Remove circuit board assembly:*

**a.** Using a screwdriver with size T-15 Torx® tip, remove the two screws (number 4 in Figure 6–12) securing the rear plate of the circuit board assembly.

**b.** Disconnect the cable connector (number 2) from the processor-display circuit board connector (number 1).

**c.** Pull out the A23 SerPar Board assembly (number 3).

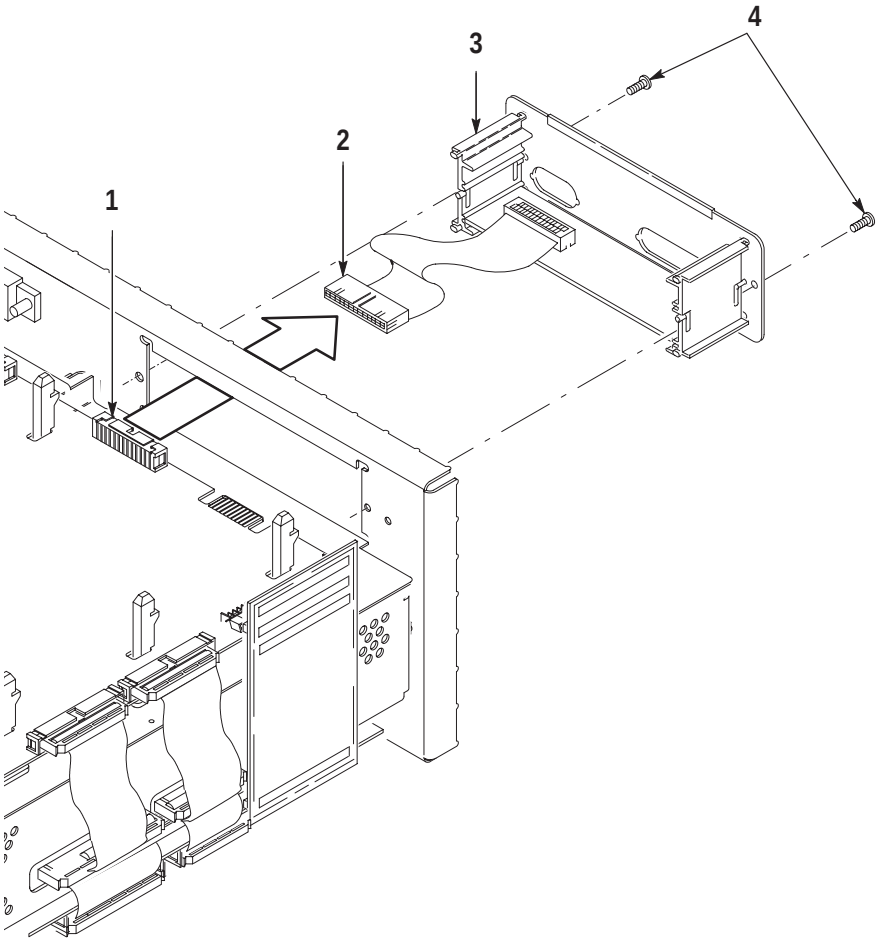



**Figure 6–12: Remove circuit board assembly from oscilloscope**

2. *Remove circuit board from assembly:*

   a. Using a 3/16 inch nutdriver, remove the four lock connectors (number 3 in Figure 6–13) securing the circuit board to the rear plate.

   b. Separate the circuit board with attached cable (number 1), from the rear plate with attached brackets (number 2).

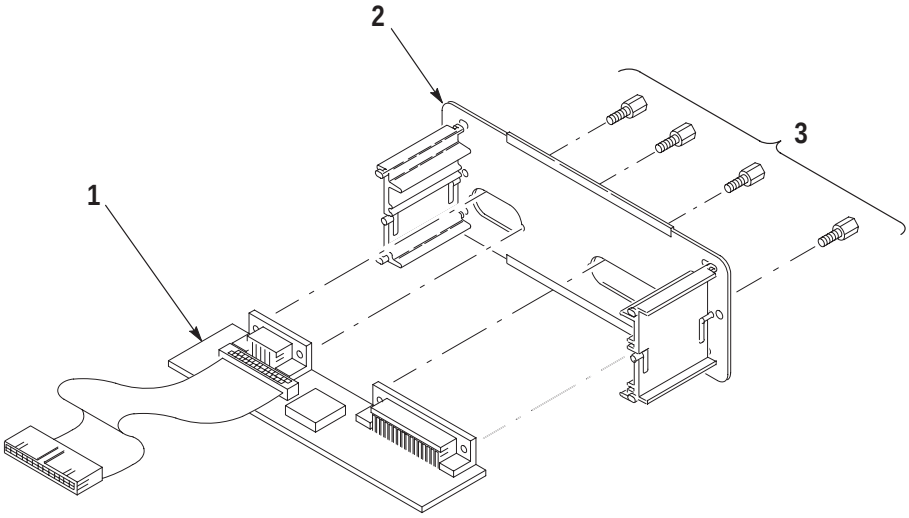



**Figure 6–13: Remove circuit board from assembly**

3. *Replace circuit board:*

**Equipment Required:** One 3/16 inch nutdriver.

   a. Replace the failed circuit board with a replacement A23 SerPar Board ordered from the factory (see *Replaceable Parts List* for detailed ordering information). Do in reverse order steps a and b of the *Circuit Board Removal From Assembly* procedure on the previous page.

   b. Reinstall the A23 SerPar Board assembly in the oscilloscope. Do in reverse order steps a and b of the *Remove circuit board from assembly* procedure shown above.

   c. Then see the following procedure to complete reassembly of the oscilloscope:

      - *Rear Cover and Cabinet* (page 6–18).

   d. To ensure the A23 SerPar Board is working correctly, perform the power-up short diagnostics procedure described on page 6–59.

## A29 Video Trigger Board

*Additional modules Removed:* D1 bus and analog-and digital-power cables.

1. *Assemble equipment and locate modules to be removed*

   a. Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2).

   b. Locate the modules to be removed in the locator diagram *Outer-Chassis Modules*, Figure 6–2, page 6–13. See also the A29 Video Trigger Board on Figure 6–15, page 6–34.

   c. Do the procedures *A14 D1 Bus and Analog-Power and Digital-Power Cables* and *A23 SerPar Board* that precede this procedure to remove those items. It is **not** necessary to pull the A23 board assembly out entirely nor is it necessary to remove the cable connector from the A23 SerPar board to the A11 Processor/Display board

2. *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its front is facing you.

3. *Remove the A29 Video Trigger board:* Figure 6–14 shows the A29 Video Trigger board (option 05) installed.

   a. Remove (or pull loose) the A27 Connector board (see number 3 on Figure 6–15).

   b. Slide back and lift up the Video Trigger circuit board (see Figure 6–15).

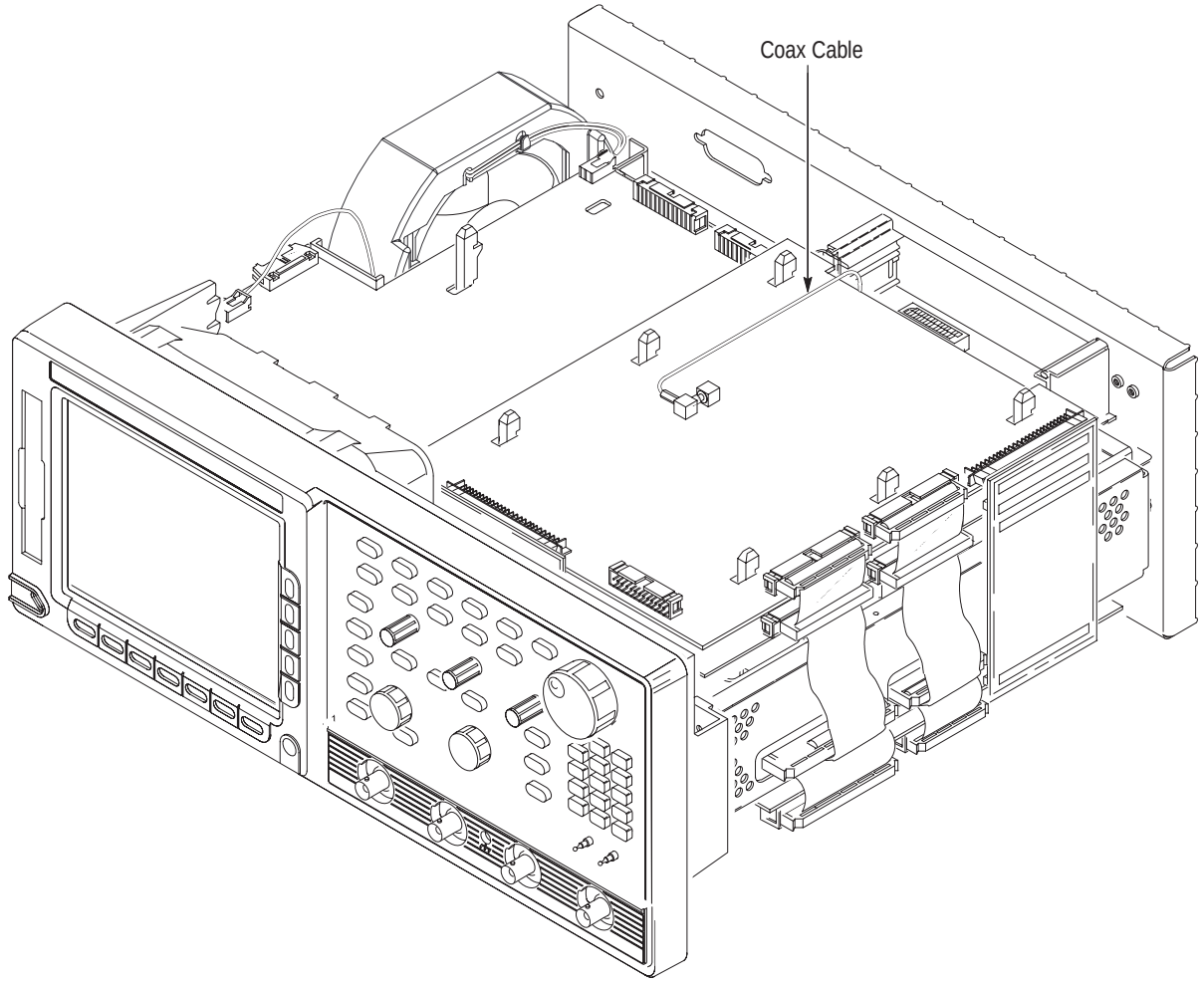



**Figure 6–14: Circuit board installed**

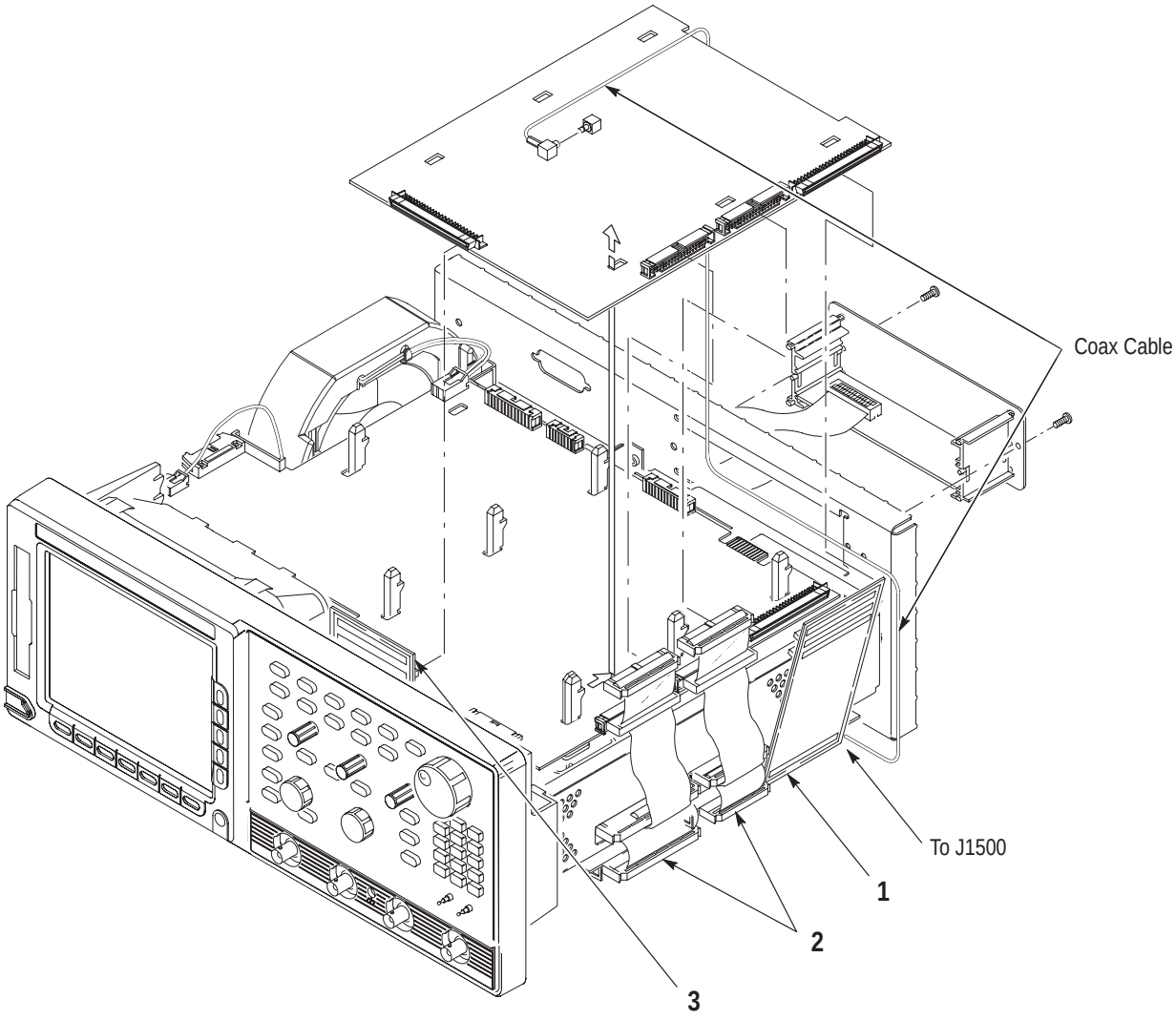



**Figure 6–15: Circuit board removal**

4. *Reinstallation:*

   a. Do, in reverse order, steps a through e. Reverse the removal instructions of each step to reinstall the A29 Video Trigger Board.

***NOTE****. For the TDS 600C, be sure to arrange the coax cable as shown in figures 6–14 and 6–15. Failure to do this may impair performance.*

*Also, when plugging in the digital bus boards, 1 and 3 in Figure 6–15, make sure that they remain plugged in on both ends.*

**b.** See the procedures *A14 D1 Bus and Analog-Power and Digital-Power Cables* (page 6–28), *A23 SerPar Board* (page 6–30) and *Rear Cover and Cabinet* (page 6–18) to complete reassembly of the oscilloscope.

**c.** To ensure the Video Trigger is working correctly, perform the *Diagnostics* procedure on page 6–59.

### A11 Processor/Display Board

*Additional Modules Removed:* D1 bus and analog-and digital-power cables, A23 SerPar Board, and, if option 05 is installed, A29 Video Trigger Board.

**1.** *Assemble equipment and locate modules to be removed*

**a.** Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2).

**b.** Locate the modules to be removed in the locator diagram *Outer-Chassis Modules*, Figure 6–2, page 6–13.

**c.** Do the procedure *A14 D1 Bus and Analog-Power and Digital-Power Cables* that precedes this procedure to remove those interconnect cables.

**d.** Do the procedure A23 SerPar Board and, if option 05 is installed, do the procedure A29 Video Trigger Board.

**2.** *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its rear is facing you.

**3.** *Disconnect the fan from processor/display board:* Unplug the fan's power cable from J20.

**4.** *Remove the processor/display board:* Use Figure 6–16 as a guide while doing the following substeps:

**a.** Unplug the interconnect cable from the GPIB connector on the rear cover at J35 of the processor/display board. Disconnect the monitor cable at J5. Unplug J62 video signal connector, J51 RS-232 connector, and J38 floppy driver connector.

**b.** Grasp the board by its right and left sides and pull it towards the rear of the oscilloscope. This will disconnect the processor/display board from the eight board mounts securing the board above the top cover.

**c.** Lift the board up away from the oscilloscope chassis to complete the removal.

**5.** *Reinstallation:*

**a.** Do, in reverse order, steps 3 through 4 reversing the removal instructions of each step to reinstall the processor/display board.

**b.** See the procedures *A14 D1 Bus and Analog-Power and Digital-Power Cables* (page 6–28), *A23 SerPar Board* (page 6–30), if option 05 is

installed, *A29 Video Trigger Board*, and *Rear Cover and Cabinet* (page 6–18) to complete reassembly of the oscilloscope.

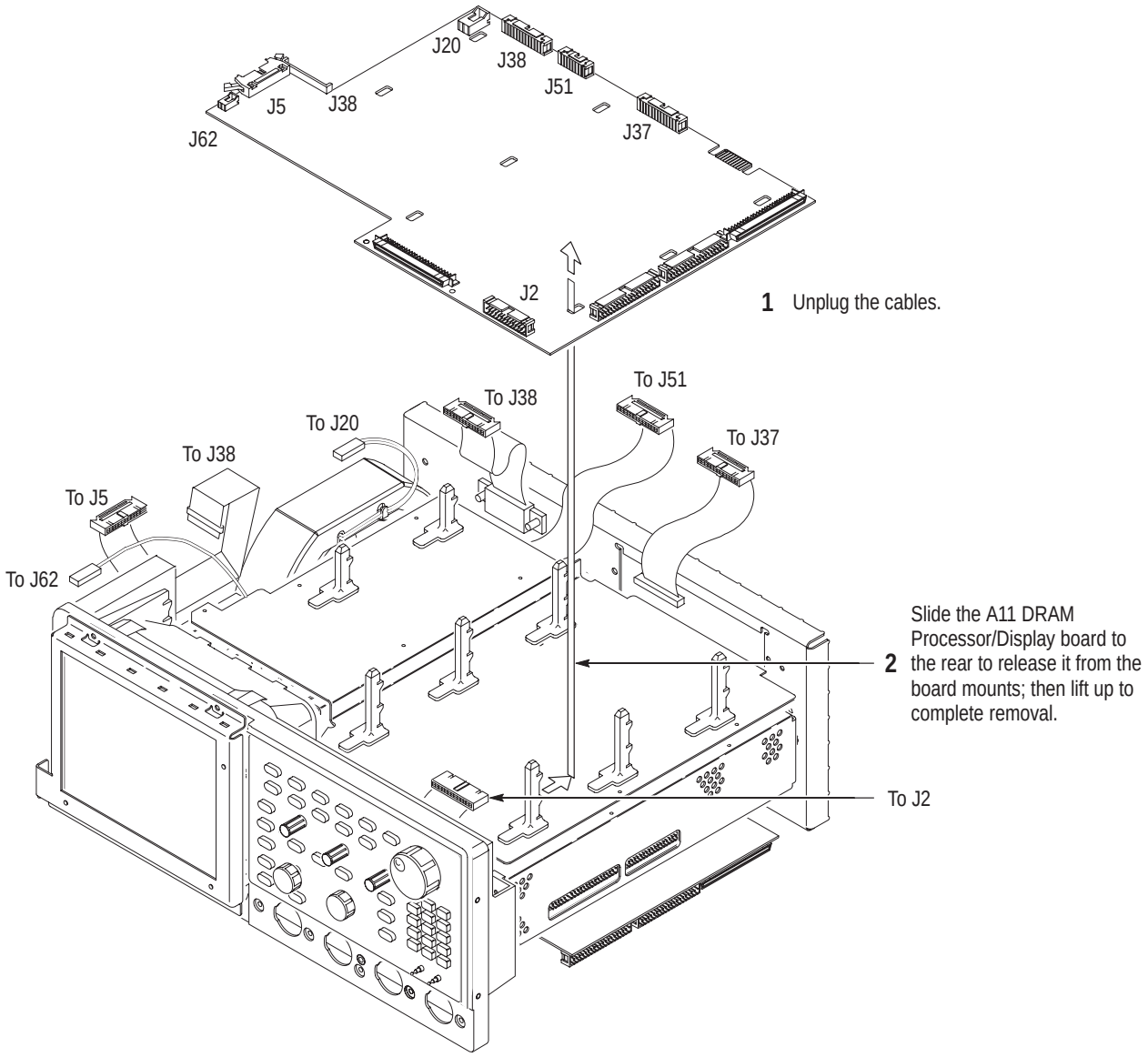



**Figure 6–16: A11 Processor/display removal**

## Hard Disk Drive (Optional)

1. *Assemble equipment and locate modules to be removed:*

   a. Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2).

   b. Locate the modules to be removed in the locator diagram *Outer-Chassis Modules*, Figure 6–2, page 6–13.

   c. Do the procedures *A14 D1 Bus and Analog-Power and Digital-Power Cables* (page 6–28), *A23 SerPar Board* (page 6–30), if option 05 is installed A29 Video Trigger Board (page 6–32) and A11 Processor/Display Board (page 6–35) to remove those modules.

2. *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its rear is facing you.

3. *Remove the hard disk drive:* Use Figure 6–17 as a guide.

   a. Slide the retainer bracket toward the rear of the oscilloscope. Lift the bracket up and away from the oscilloscope to complete the removal.

   b. Grasp the board by its right and left sides and pull it towards the rear of the oscilloscope. This will disconnect the hard disk board from the board mounts securing the board above the top cover.

   c. Lift the board up away from the oscilloscope chassis to complete the removal.

4. *Reinstallation:*

   a. Do, in reverse order, steps 3a through 3c. Reverse the removal instructions of each step to reinstall the hard disk drive.

   b. See the procedures A11 Processor/Display Board (page 6–35), if option 05 is installed A29 Video Trigger Board (page 6–32), *A23 SerPar Board* (page 6–30), *A14 D1 Bus and Analog-Power and Digital-Power Cables* (page 6–28), and *Rear Cover and Cabinet* (page 6–18) to complete reassembly of the oscilloscope.

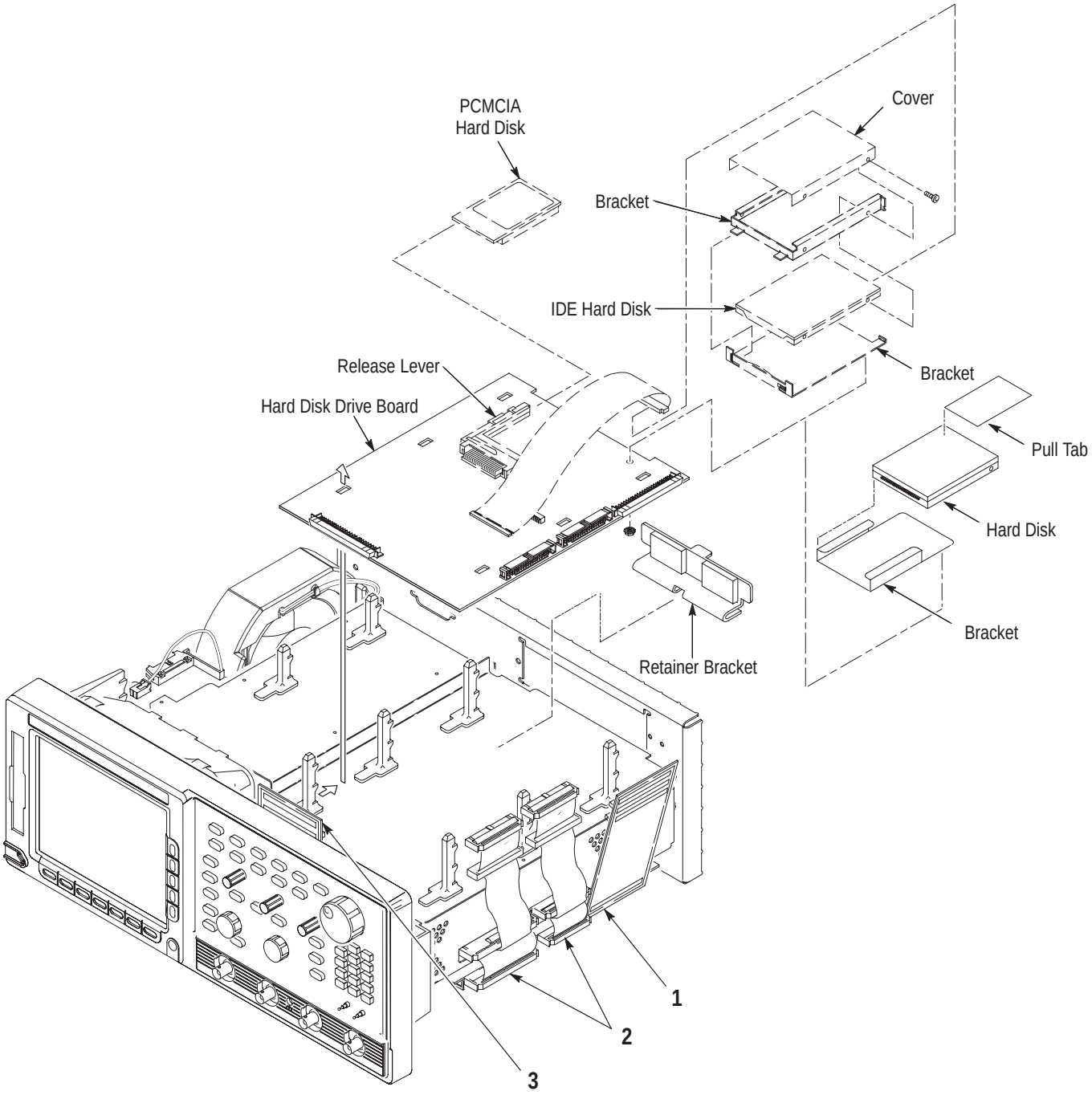



**Figure 6–17: Hard disk removal**

**Top Cover and Board Brackets**

1. *Assemble equipment and locate modules to be removed:*

**a.** Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2) and, if removing any *board mount*, a flat-bladed screwdriver (Item 5).

**b.** Locate the modules to be removed in the locator diagram *Outer-Chassis Modules*, Figure 6–2, page 6–13.

**c.** Do the procedures *A14 D1 Bus and Analog-Power and Digital-Power Cables* (page 6–28), *A23 SerPar Board* (page 6–30), if option 05 is installed A29 Video Trigger Board (page 6–32) and A11 Processor/Display Board (page 6–35) to remove those modules.

**2.** *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its front is facing you.

**3.** *Remove the top cover:* Remove the 12 screws securing the top cover to the main chassis, then slide it back until its front edge clears the retainers in the front subpanel. Lift the top cover away to complete removal.

**4.** *Remove the board mount(s):* From the top side of the top cover, use the flat-bladed screwdriver to pry up the retainer lug until it clears the slot in the front cover. While holding the lug clear of the slot, push the mount towards the rear until it releases. (When reinstalling, be sure to align the lug properly and be sure it snaps into its slot.)

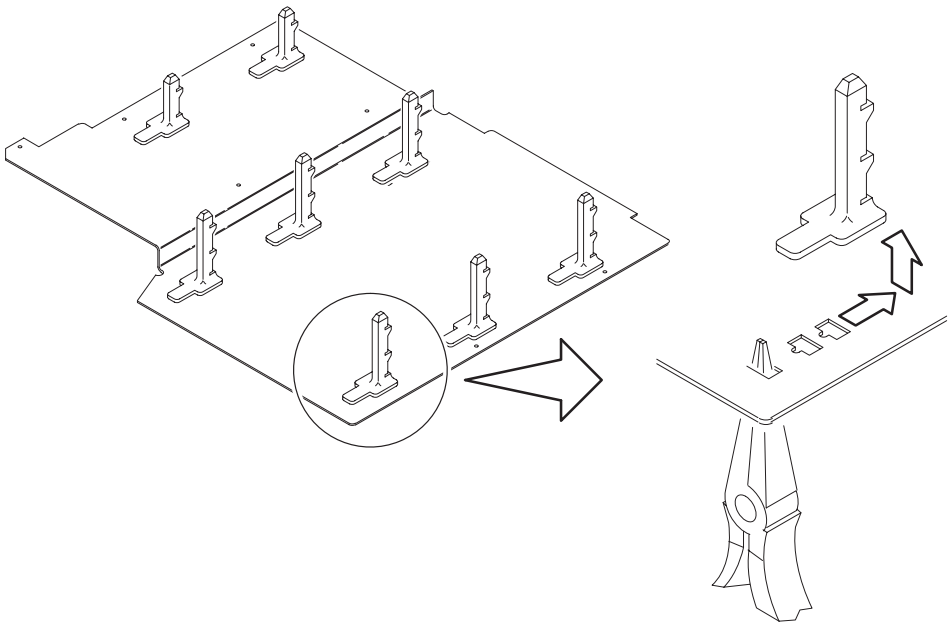


**Figure 6–18: Board bracket removal**

**5.** *Reinstallation:*

**a.** Do in reverse order steps 3 and 4, reversing the procedure outlined in each step to reinstall the assembly. Then see the following procedures, in the order listed, to complete reassembly of the oscilloscope.

- A11 Processor/Display Board (page 6–35)
- If option 05 is installed, *A29 Video Trigger Board* (page 6–32)
- *A14 D1 Bus and Analog-Power and Digital-Power Cables* (page 6–28)
- *A23 SerPar Board* (page 6–30)
- *Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel* (page 6–22)
- *Rear Cover and Cabinet* (page 6–18)

### Rear-Panel Cables

1. *Assemble equipment and locate modules to be removed:* Have available a pair of needle-nose pliers (Item 6) and a ¼ inch nut driver (Item 7).
2. *If removing the GPIB cable, do the following substeps:*
   - **a.** Unplug the GPIB cable from its jack (J35) on the processor/display board.
   - **b.** Working from the rear panel and using the ¼ inch nut driver, unscrew the two hex-headed mounting posts that secure the cable to the rear chassis.
   - **c.** Working from inside the oscilloscope, lift the cable out of the rear chassis.
3. *If removing any cable connected to the rear panel BNC connectors, do the following substeps:*
   - **a.** Do the procedure *A10 Acquisition Board,* on page 6–40.
   - **b.** Pull out the cables for SIGNAL OUTPUT, AUX TRIGGER INPUT, MAIN TRIGGER OUTPUT, and DELAYED TRIGGER OUTPUT from J1201, J1001, J1000, and J1550 on A10.
4. *Reinstallation:* Reverse substeps in step 2 and 3 to reinstall any cables removed.

### A10 Acquisition Board

1. *Assemble equipment and locate modules to be removed:*
   - **a.** Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2).
   - **b.** Locate the modules to be removed, including those listed under *Additional Modules Removed* in the locator diagram *Outer-Chassis Modules,* Figure 6–2, page 6–13.

**c.** Do the procedure *A14 D1 Bus and Analog-Power and Digital-Power Cables* (page 6–28) to remove the D1 bus and the interconnect cables.

**d.** Do the procedure *Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel* (page 6–22)

**2.** *Orient the oscilloscope:* Set the oscilloscope so its top is down on the work surface and its front is facing you.

**3.** *Remove the Acquisition Board:* Use Figure 6–19 or 6–20 as a guide.

**a.** Disconnect the cables from (CH 3) SIGNAL OUT (except TDS 694C, at J1201), AUX TRIG INPUT (at J1550), MAIN TRIG OUTPUT (at J1000), DELAYED TRIG OUTPUT (at J1001), TDS 694C (J124).

**b.** If the option 05 video board is installed, disconnect the coax cable attached to J1500.

**c.** Remove the six screws (seven screws for TDS 694C) that mount the acquisition board to the main chassis.



***CAUTION.*** *Use care not to damage SMT components when removing or installing the screws that mount the acquisition board to the main chassis.*

**d.** Remove the four or five front-panel screws that attach the frame to the attenuator portion of the A10 Acquisition board. Lift the board away from the main chassis to complete removal.

**4.** *Reinstallation:* Do, in reverse order, substeps 3a to 3d, reversing each step to reinstall the *acquisition board*. Then see the following procedures, in the order listed, to complete reassembly of the oscilloscope:

- *A14 D1 Bus and Analog-Power and Digital-Power Cables* (page 6–28).
- *Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel* (page 6–22).
- *Rear Cover and Cabinet* (page 6–18).

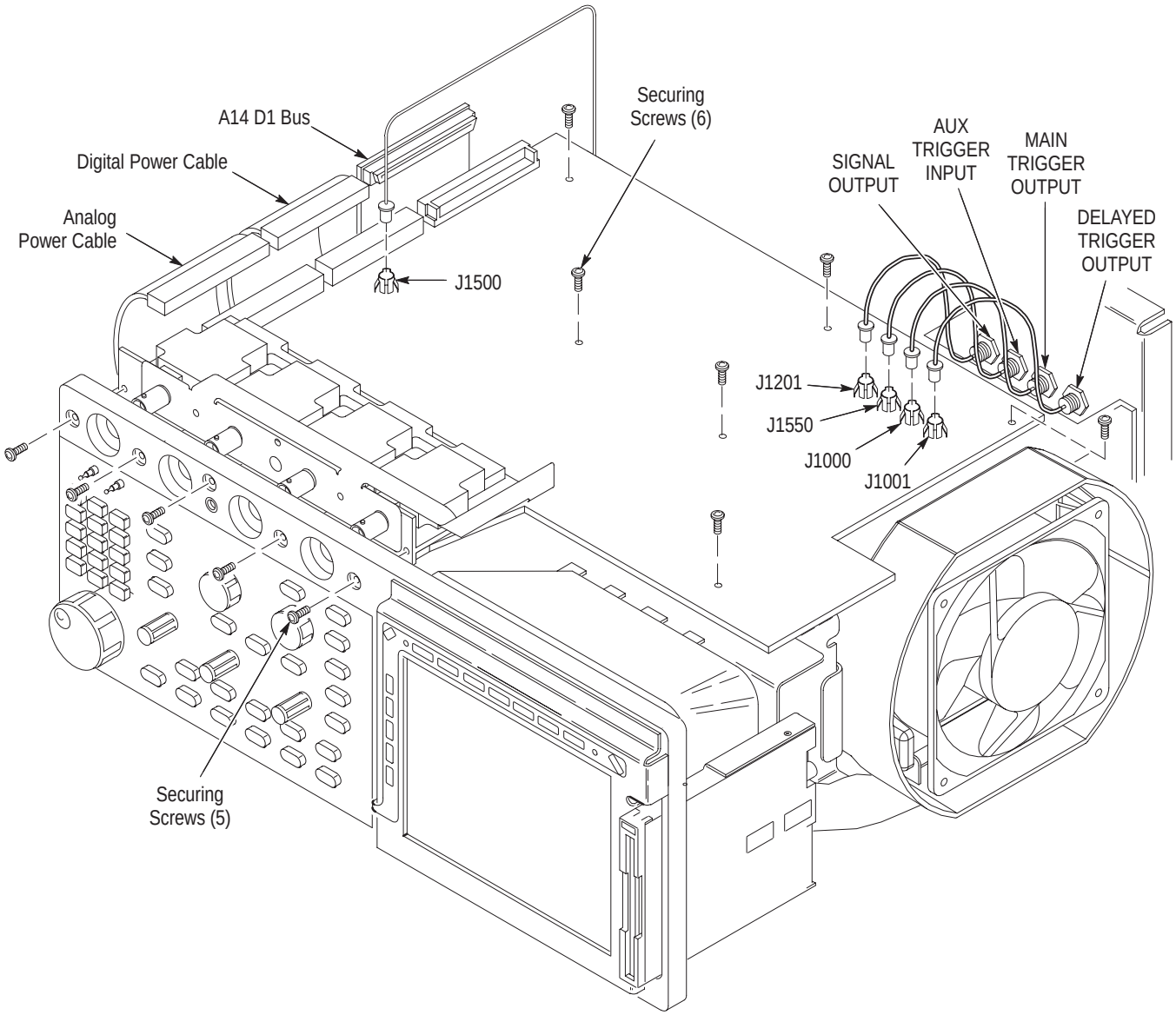



**Figure 6–19: A10 Acquisition board removal**

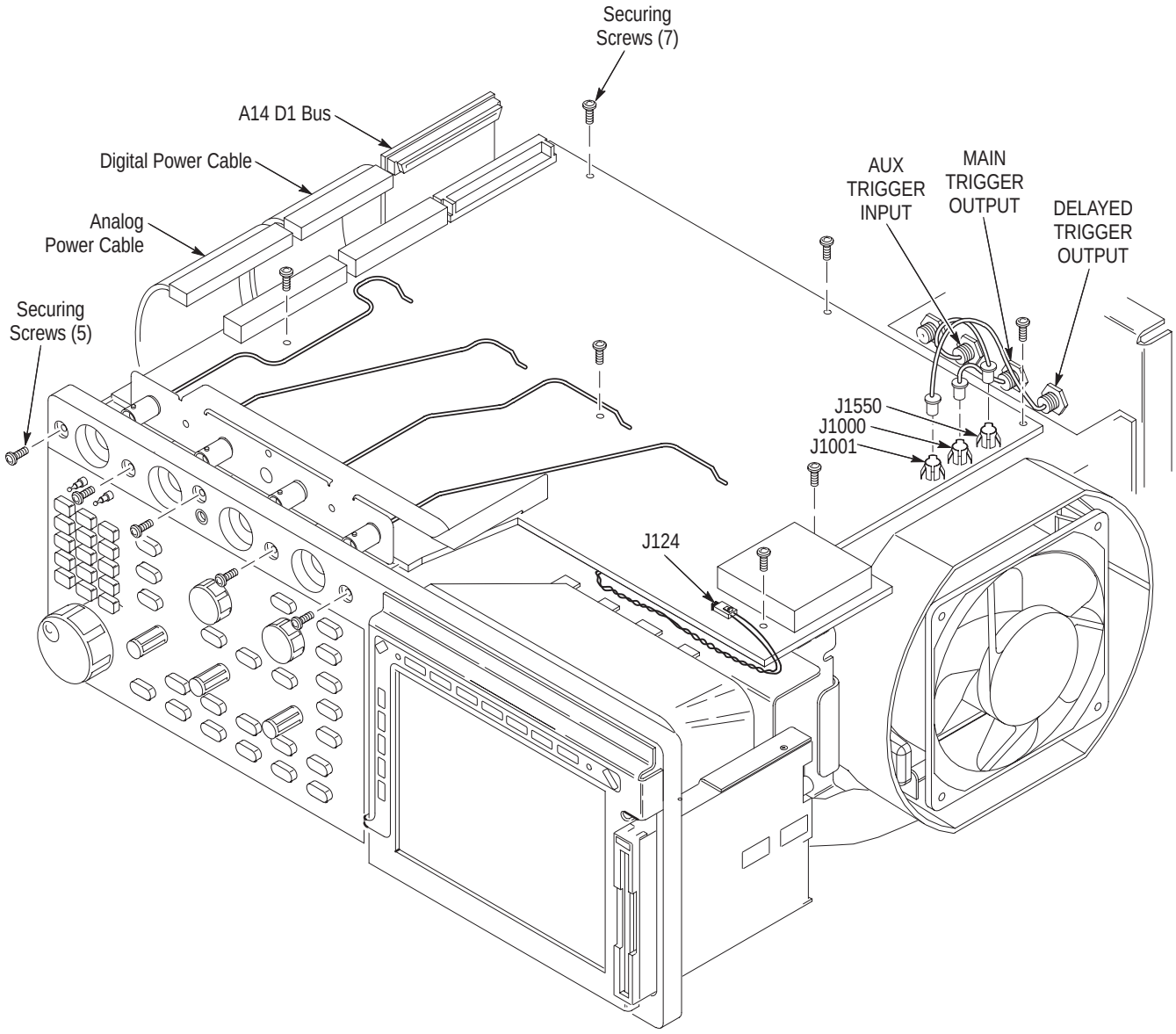



**Figure 6–20: TDS 694C, A10 Acquisition board removal**

## Floppy Disk Drive

1. *Assemble equipment and locate modules to be removed:*
   - **a.** Have handy a screwdriver with a small Phillips head.
   - **b.** Locate the modules to be removed, including those listed under *Additional Modules Removed* in the locator diagram *Outer-Chassis Modules*, Figure 6–2, page 6–13.
2. Do the procedure *Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel* (page 6–22)
3. *Orient the oscilloscope:* Set the oscilloscope so its top is down on the work surface and its front is facing you.
4. *Remove the floppy disk drive:* Use Figure 6–21 as a guide.
   - **a.** Unplug the J38 connector (ribbon interconnect cable) that connects the disk drive to the A11 Processor/Display board.
   - **b.** Remove the disk drive by unscrewing the two retaining Phillips screws on the sides of the disk drive. Then pull out the drive.

***NOTE.*** *Due to vendor differences in floppy disk drive dimensions, your instrument may include an adapter bracket on the bottom of the drive. If this is the case, use the inset in Figure 6–21 as a guide for installation.*

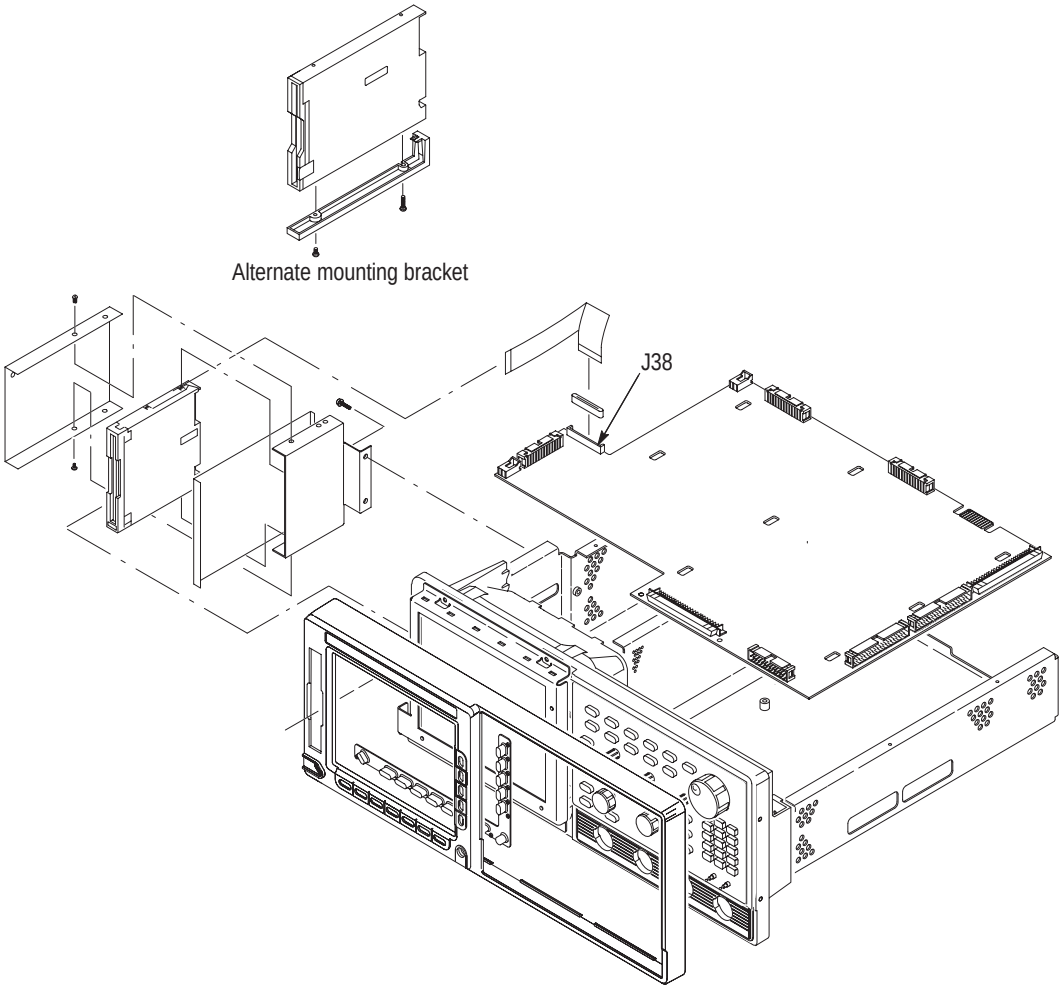



**Figure 6–21: Floppy disk drive removal**

5. *Reinstallation:* Do, in reverse order, substeps 4b then 4a to reinstall the *floppy disk drive*. Then see the following procedures, in the order listed, to complete reassembly of the oscilloscope:

   - Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel (page 6–22).
   - Rear Cover and Cabinet (page 6–18).

## Rear Chassis

1. *Assemble equipment and locate modules to be removed:*
   - **a.** Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2).
   - **b.** Locate the modules to be removed, including those listed under *Additional Modules Removed* in the locator diagram *Outer-Chassis Modules*, Figure 6–2, page 6–13.
   - **c.** Install the front cover if it is not already installed.
2. *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its rear is facing you.
3. *Remove the rear chassis:* Use Figure 6–22 as a guide when doing the following substeps:
   - **a.** Unplug the GPIB interconnect cable at J35 of the processor/display board.
   - **b.** Unplug the video cable at J51 of the processor/display board.
   - **c.** Remove the 6 screws securing the rear chassis to the main chassis and the two screws securing it to the low-voltage power-supply shield.
   - **d.** Lift the rear chassis up slightly to access the cables connected to it. Disconnect those cables from (CH 3) SIGNAL OUT (at J1201), AUX TRIG IN (at J1550), MAIN TRIG OUT (at J1000), DELAYED TRIG OUT (at J1001), all found on the acquisition board.
4. *Reinstallation:* Do, in reverse order, substeps 3a–3c, reversing each step to reinstall the rear chassis. Then see the following procedures, in the order listed, to complete reassembly of the oscilloscope.
   - A14 D1 Bus and Analog-Power and Digital-Power Cables (page 6–28)
   - Rear Cover and Cabinet (page 6–18)

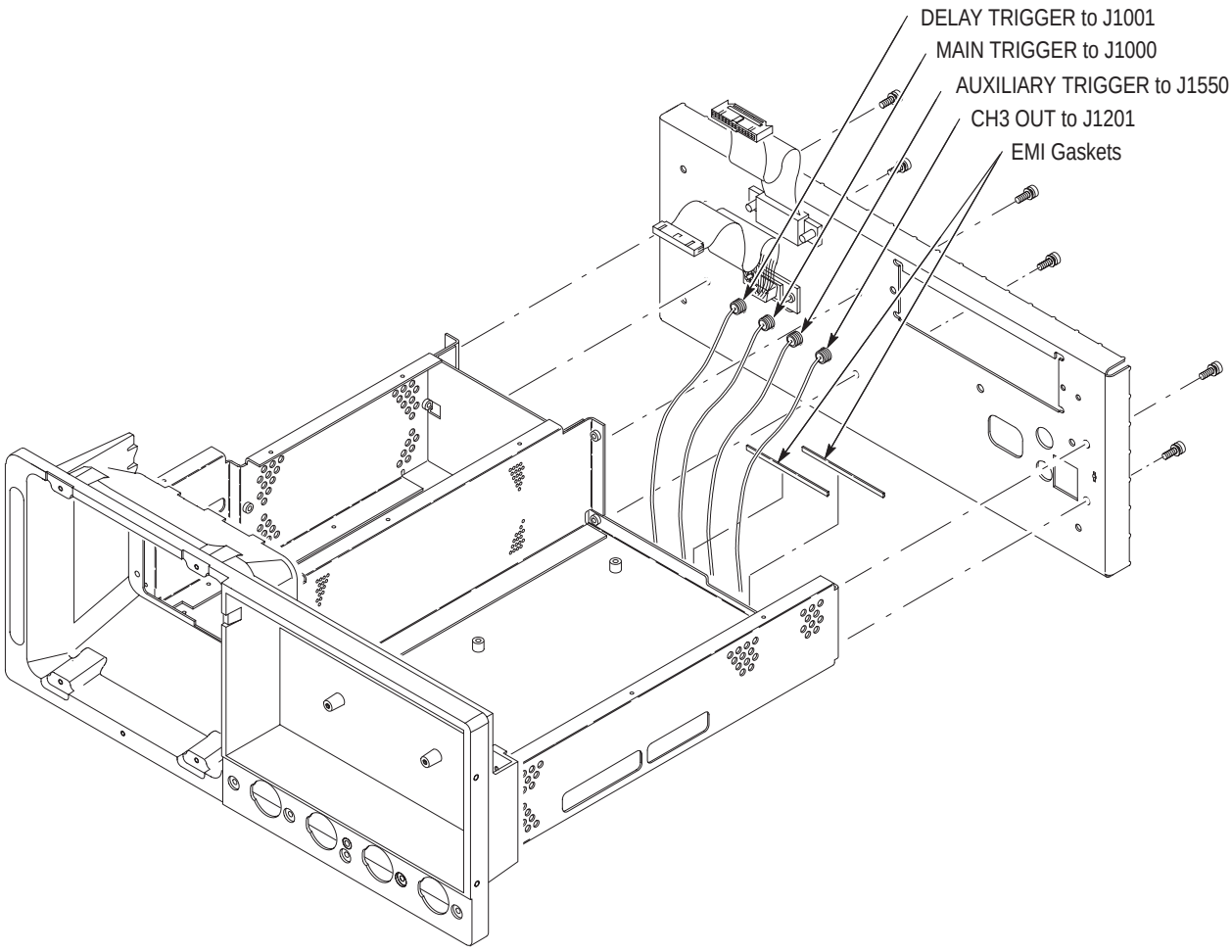



**Figure 6–22: Rear chassis removal**

## Procedures for Inner-Chassis Modules,

You should have completed the *Access Procedure* (page 6–15) before doing any of the procedures for the Inner-Chassis modules. The procedures are presented in the following order:

*A16 Low Voltage Power Supply*

*A30 Display Assembly and Supply Fuse*

*Front Subpanel*

*Main Chassis*

### A16 Low Voltage Power Supply

1. *Assemble equipment and locate modules to be removed:* Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2). Locate the modules to be removed in the locator diagram *Inner-Chassis Modules*, Figure 6–2, page 6–13.
2. *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its rear is facing you.
3. *Remove the low-voltage power supply:*
   - **a.** Working from the rear of the oscilloscope, remove the two screws securing the low-voltage power supply to the rear chassis. See Figure 6–23.
   - **b.** Now, working from the top of the oscilloscope, remove the seven screws, indicated in Figure 6–23, that mount the supply to the main chassis.
   - **c.** Grasp the supply at the points indicated in Figure 6–23 and lift the board up out of the oscilloscope to complete removal.
4. *Reinstallation:* Do, in reverse order, substeps **3a** through **3c** reversing each step to reinstall the low-voltage power supply. Then see the following procedures to complete the reassembly:
   - Top Cover and Board Brackets (page 6–38)
   - A11 Processor/Display Board (page 6–35)
   - If option 05 is installed, *A29 Video Trigger Board* (page 6–32)
   - A14 D1 Bus and Analog-Power and Digital-Power Cables (page 6–28)
   - Rear Cover and Cabinet (page 6–18)

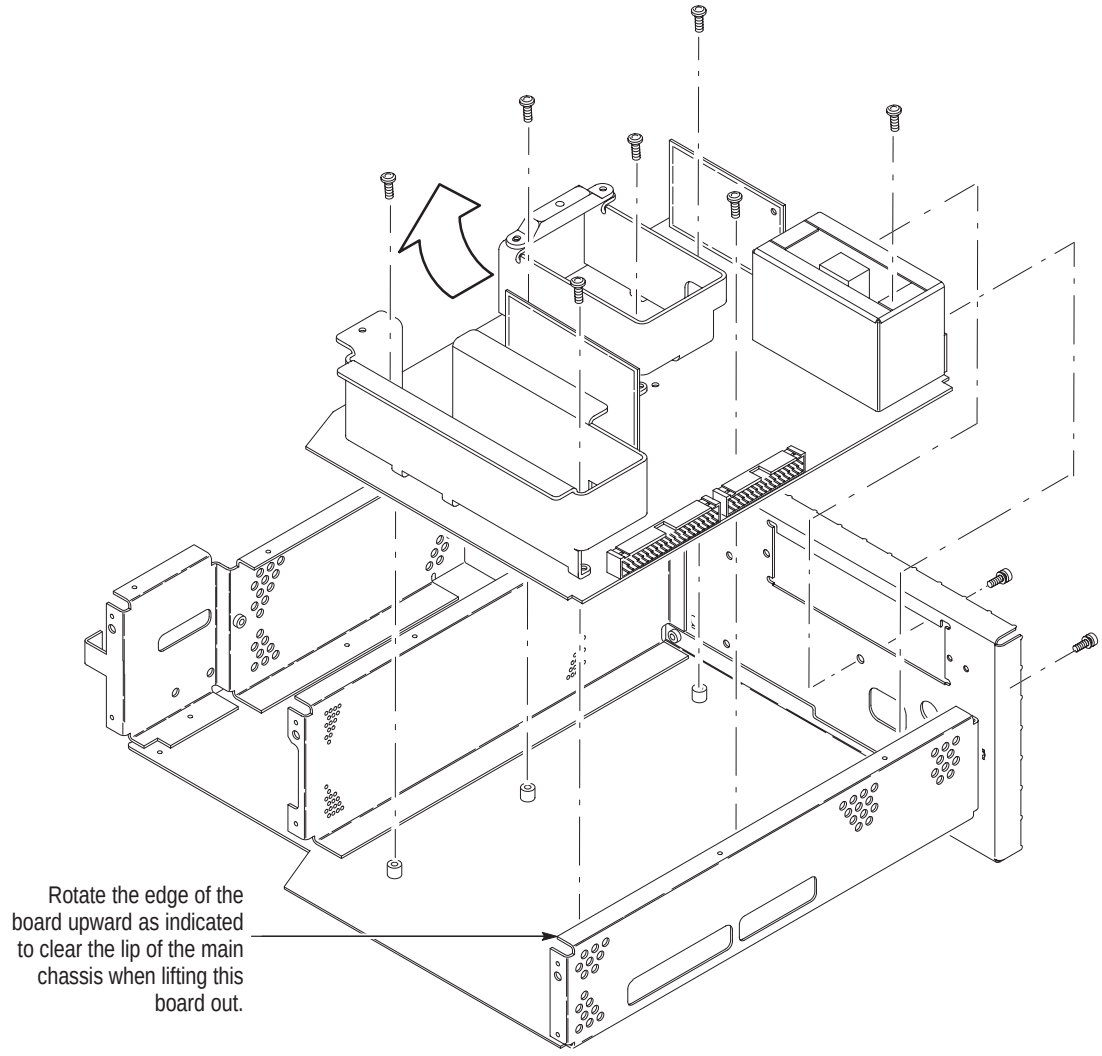



**Figure 6–23: A16 Low voltage power supply removal**

## A30 Display Assembly and Supply Fuse

***NOTE**. The display and the display-driver board are a single module and must be removed and replaced as such. They are listed as a single module in the* Replaceable Parts List.

1. *Assemble equipment and locate modules to be removed:* Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2). Locate the modules to be removed in the locator diagram *Inner-Chassis Modules*, Figure 6–2, page 6–13.

2. *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its rear is facing you.

3. *Remove the high-voltage fuse:* If you are servicing this fuse, remove the fuse from its fuse holder. Reverse the procedure to reinstall.



***WARNING. Display tube handling:*** *Use care when handling a display tube. If you break a display tube it may implode, scattering glass fragments with high velocity and possibly injuring you. Wear protective clothing, including safety glasses (preferably a full-face shield). Avoiding striking the display tube with or against any object.*

***Display tube storage:*** *Store the display tube face down in a protected location, placing it on a soft, nonabrasive surface to prevent scratching the face plate.*

4. *Remove the display tube:*

   **a.** Take the precautions outlined in the warning above. Reference Figure 6–24 while doing the following substeps.

   **b.** Unplug the display tube connector from the back of the display tube and the display tube yoke connector from the display circuit board (J170, J305 and J570). Loosen the screw on the video board that holds the CRT sockets. Then pull back on the video board slightly. This separates the board from the socket.

   **c.** Remove the two screws that secure the band circling the front of display tube to the front subpanel. Carefully guide display tube forward to partially remove it from the front subpanel and to access the anode lead connected to the display tube.



***WARNING.*** *High-voltage is present on the anode lead. Before unplugging the anode in the following substep, you must discharge it: ground a flat-bladed screwdriver (Item 5) with an insulated handle to the chassis through a suitable grounding strap. Next, probe under the insulating cap of the anode lead and touch the lead's metal conductor to discharge. Repeat. After unplugging the anode in substep d, touch its metal conductor to the chassis for a few minutes to further ensure discharge.*

   **d.** Discharge the anode lead as described in the immediately proceeding ***WARNING,*** unplug it from the display tube, and discharge that lead (again, see ***WARNING***).

   **e.** Be sure you have read the ***WARNING*** on display tube handling and storage found at the start of this display tube removal procedure. Then pull the display tube out through the front subpanel to complete removal. Store as directed in the previous ***WARNING*** message.

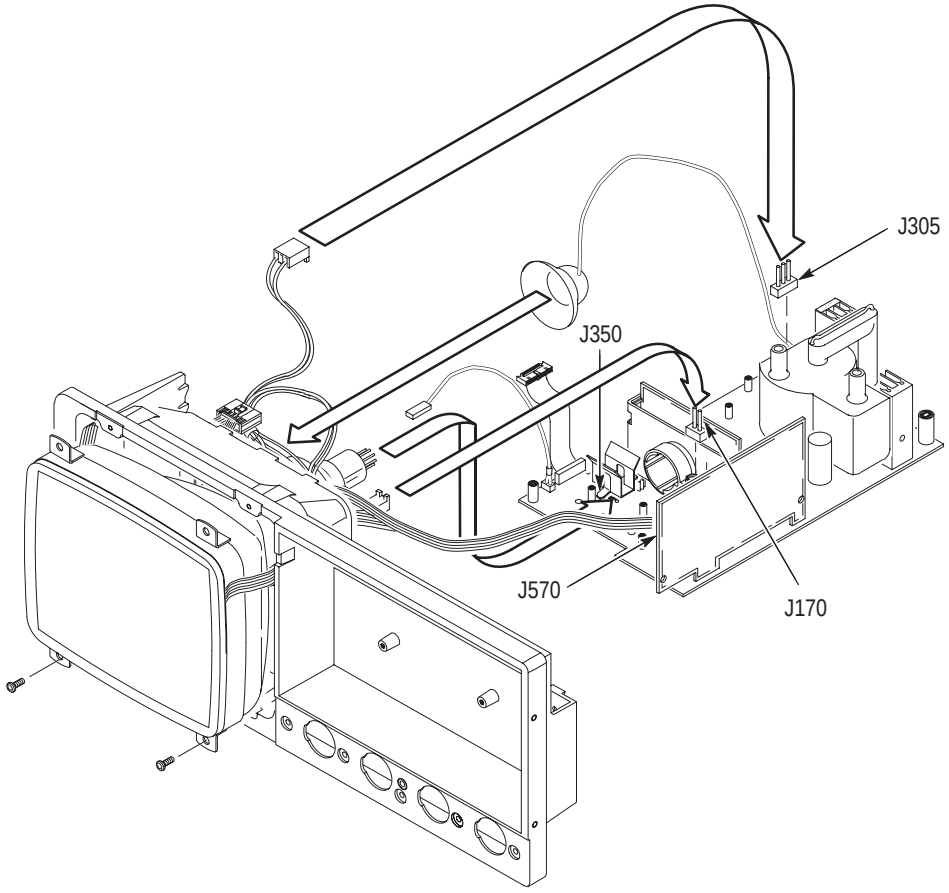



**Figure 6–24: Display assembly removal**

**5.** *Remove the display supply board:* Use Figure 6–25 as a guide.

**a.** Remove the six screws that mount the display-driver board to the main chassis.

**b.** Grasp the display driver board. Work from the front and top to tilt the board so its right edge is up and its left side is down and lift it out of the top of the oscilloscope's main chassis.

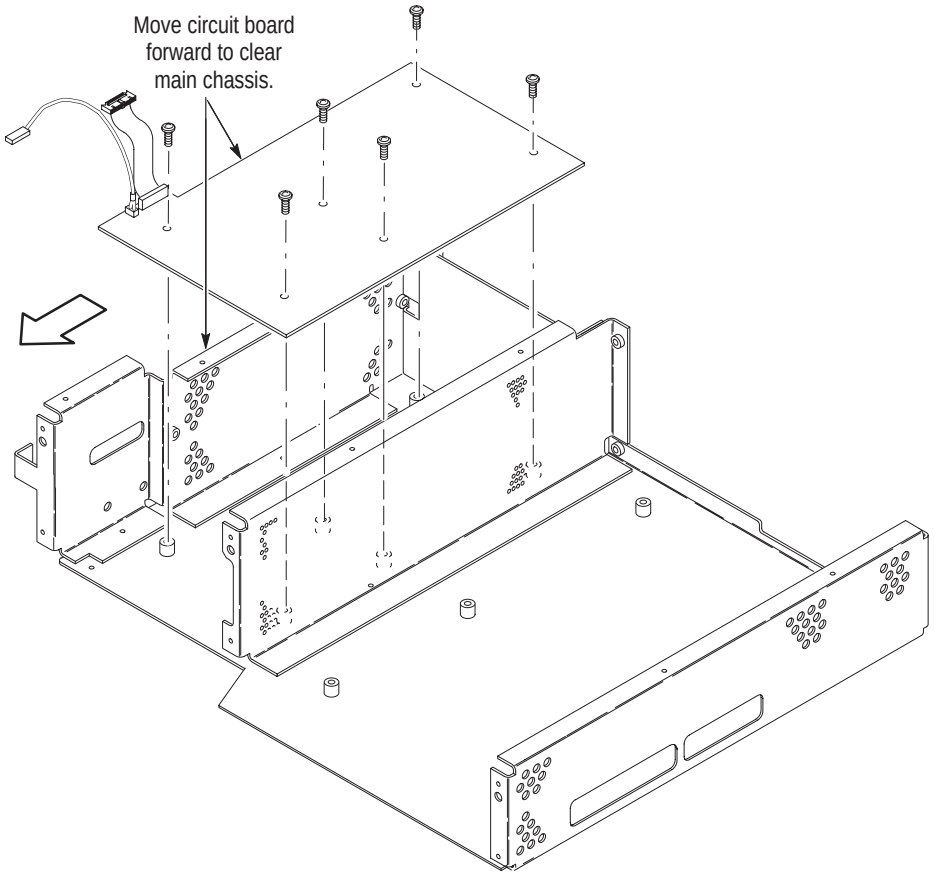



**Figure 6–25: Display driver board removal**

**6.** *Reinstallation:*

**a.** Do, in reverse order, substeps 5a–5b, reversing each step to reinstall Display-Driver board.

**b.** Do, in reverse order, substeps 4a–4e, reversing each step to reinstall the display tube if removed.

**c.** See step 3 to reinstall the supply fuse if it was removed.

**d.** See the following procedures, in order, to complete reassembly of the oscilloscope:

- Top Cover and Board Brackets (top cover only) on page 6–38
- A11 Processor/Display Board (page 6–35)
- If option 05 is installed, A29 Video Trigger Board (page 6–32)
- A14 D1 Bus and Analog-Power and Digital-Power Cables (page 6–28)

- Display-Frame Assembly
- Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel (page 6–22)
- Rear Cover and Cabinet (page 6–18) (completes reassembly)

## Front Subpanel

1. *Assemble equipment and locate modules to be removed:*
   - **a.** Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2).
   - **b.** Do the procedure *A30 Display Assembly and Supply Fuse* (page 6–49). Do not remove the display-driver board.
   - **c.** Locate the modules to be removed in the locator diagram *Inner-Chassis Modules*, Figure 6–2, page 6–13.
2. *Orient the oscilloscope:* Set the oscilloscope so its rear is down on the work surface and its bottom is facing you.
3. *Remove the front subpanel:* Remove the six screws securing the front subpanel to the main chassis. (See Figure 6–26 for screw locations.) Lift the front subpanel up away from the main chassis to complete the removal.
4. *Reinstallation:* Do the following substeps to reinstall the front subpanel and reassemble the remainder of the oscilloscope:
   - **a.** Align the front subpanel to the main chassis, taking care to ensure that the main chassis slips into its alignment slot on the front subpanel (see magnified view, Figure 6–26.) Then reinstall the six screws removed in step 3.
   - **b.** See the procedure *A30 Display Assembly and Supply Fuse* (page 6–49) to reinstall the display-frame assembly and display tube.
   - **c.** See the following procedures, in the order listed, for instructions for reinstalling the remaining modules.
     - Top Cover and Board Brackets (page 6–38)
     - A11 Processor/Display Board (page 6–35)
     - If option 05 is installed, A29 Video Trigger Board (page 6–32)
     - A14 D1 Bus and Analog-Power and Digital-Power Cables (page 6–28)
     - Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel (page 6–22)
     - *Rear Cover and Cabinet* (page 6–18)

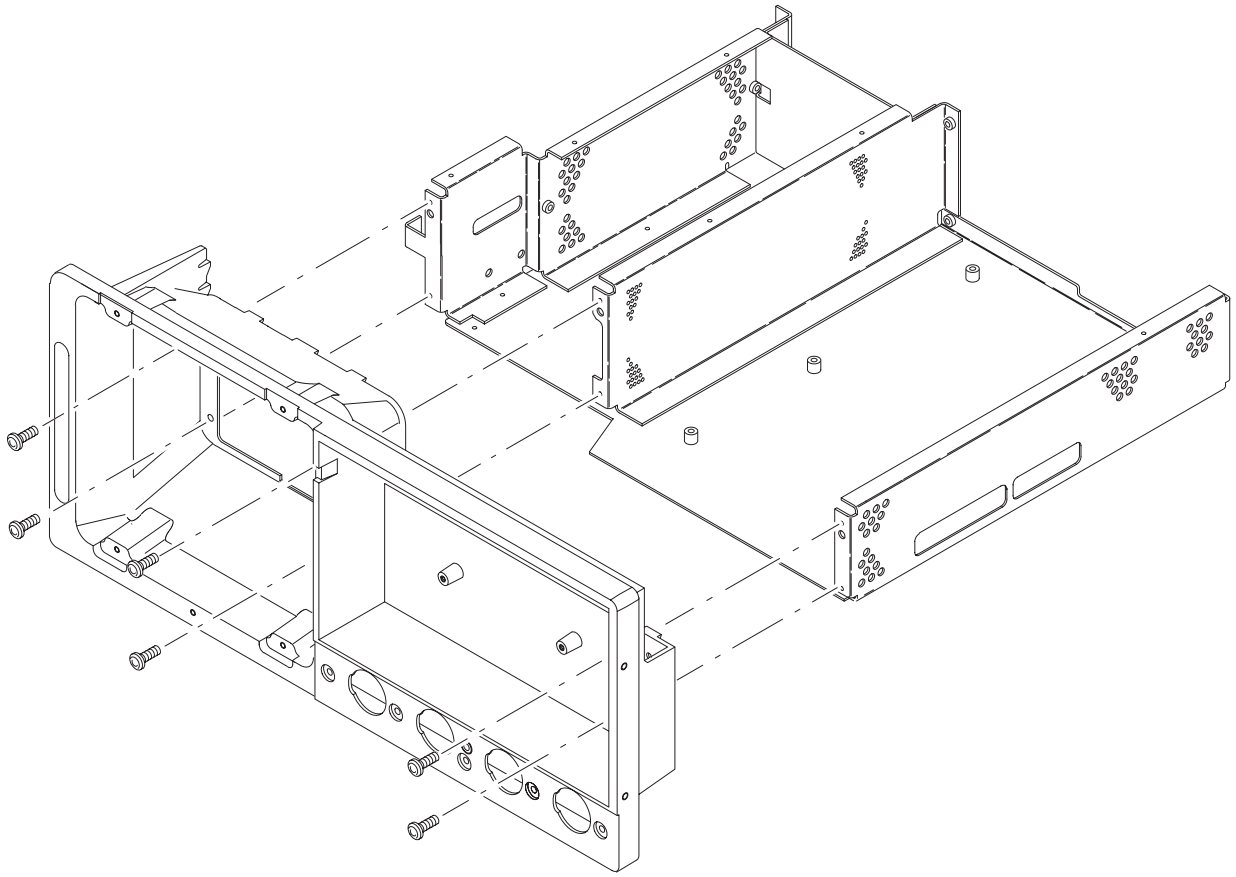


**Figure 6–26: Front subpanel removal**

### Main Chassis

*Additional Modules Removed:* All.

1. *Remove the main chassis:* Since the removal of the main chassis requires the removal of virtually all modules, do the procedure *Disassembly for Cleaning* that follows. While doing *Disassembly for Cleaning*, you will remove the front-panel assembly. Ignore the instructions to disassemble that assembly.
2. *Reinstallation:* See reinstallation instructions in *Disassembly for Cleaning.*

## Disassembly for Cleaning

This procedure is for disassembly of the digitizing oscilloscope into its individual modules so they can be cleaned. For the cleaning instructions, see *Inspection and Cleaning*, which begins this section.

1. *Assemble equipment and locate modules to be removed:*
   - **a.** Have handy a screwdriver with a size T-15 Torx® tip (Items 1 and 2), a T-20 Torx® tip (Item 3), a flat-bladed screwdriver (Item 6–11), and a pair of angle-tip tweezers (Item 6–11).
   - **b.** Familiarize yourself with the modules illustrated in figures 6–1 through 6–3.
2. *Remove external modules:* Do in order the following procedures. They are found under *Procedures for External Modules* which starts on page 6–16.
   - **a.** Line Fuse and Line Cord (page 6–17)
   - **b.** Rear Cover and Cabinet (page 6–18)
   - **c.** Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel (page 6–22)
   - **d.** A12 Front-Panel Assembly (page 6–23)
   - **e.** Front Subpanel (page 6–53) and Display-Frame Assembly
3. *Remove the outer-chassis modules:* Do in order the following procedures. They are found under *Procedures for Outer-Chassis Modules* which start on page 6–28.
   - **a.** Fan (page 6–28)
   - **b.** A14 D1 Bus and Analog-Power and Digital-Power Cables (page 6–28)
   - **c.** A23 SerPar Board (page 6–30)
   - **d.** A29 Video Trigger Board – with option 05 (page 6–32)
   - **e.** A11 Processor/Display Board (page 6–35)
   - **f.** Hard Disk Drive (page 6–37)
   - **g.** Top Cover and Board Brackets (page 6–38)
   - **h.** A10 Acquisition Board (page 6–40)
   - **i.** Floppy Disk Drive (page 6–44)

4. *Remove the inner-chassis modules:* Do in order the following procedures. They are found under *Procedures for Inner-Chassis Modules*, which start on page 6–48.

   a. A16 Low Voltage Power Supply (page 6–48)

   b. A30 Display Assembly and Supply Fuse (page 6–49)

5. *Disassemble the chassis:*

   a. Set the assembly so its bottom is down on the work surface and its front is facing you.

   b. Remove the six screws securing the front subpanel to the main chassis. (See Figure 6–26 for screw location.)

   c. Lift the front subpanel up away from the main chassis.

   d. Now remove the five screws securing the rear chassis to the main chassis and separate the two chassis. (See Figure 6–22 on page 6–47 for screw location.)

6. *Reassembly:* Do the following substeps:

   a. *Reassemble the chassis:* Align the rear chassis to the main chassis and reinstall the five screws removed in step 5; align the front subpanel to the main chassis and reinstall the six screws removed in step 5.

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***NOTE****. The following substeps refer you to procedures for installing each module removed. When reinstalling the modules, ignore any instructions that require connecting a cable or bus to an module that you have not yet installed. The necessary connections will be made when you install the missing module later.*

---

   b. *Reinstall the inner-chassis modules:* Do in the order listed below. When reinstalling, do the removal steps in reverse order. These procedures are found under *Procedures for Inner-Chassis Modules*, which start on page 6–48.

      - A30 Display Assembly and Supply Fuse (page 6–49)
      - A16 Low Voltage Power Supply (page 6–48)

   c. *Reinstall the outer-chassis modules:* Do in the order listed in the following procedures. When doing these procedures, do their steps in reverse order. These procedures are found under *Procedures for Outer-Chassis Modules* which start on page 6–28.

      - Top Cover and Board Brackets (page 6–38)
      - Hard Disk Drive (page 6–37)

- A11 Processor/Display Board (page 6–35)
- A23 SerPar Board (page 6–30)
- A29 Video Trigger Board – with option 05 (page 6–32)
- A14 D1 Bus and Analog-Power and Digital-Power Cables (page 6–28)
- Fan (page 6–28)
- Floppy Disk Drive (page 6–44)
- A10 Acquisition Board (page 6–40)

**d.** *Reinstall external modules:* Do in the order listed in the following procedures. When doing these procedures, do the steps in reverse order. These procedures are found under *Procedures for External Modules* which starts on page 6–16.

- Front Subpanel (page 6–53)
- Display-Frame Assembly (page 6–49)
- A12 Front-Panel Assembly (page 6–23)
- Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel (page 6–22)
- Rear Cover and Cabinet (page 6–18)
- Line Fuse and Line Cord (page 6–17)

# Troubleshooting

This subsection contains information and procedures designed to help you isolate faulty modules in the oscilloscope. If a module needs to be replaced, follow the *Removal and Installation Procedures* located in this section.

## Diagnostics

The oscilloscope has two levels of internal diagnostics that focus on verifying, adjusting, and if need be, isolating faulty modules.

Both levels of internal diagnostics report any bad modules and/or interfaces. If a bad module and/or interface is found, use the troubleshooting procedures in this section to determine which module needs to be replaced.

The two levels of diagnostics are the short confidence set and the extended set that tests the oscilloscope circuitry in depth and takes more time. At power on, the oscilloscope automatically executes the short set. The extended set is optional and is executed by using the following procedure:

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

1. *Display the System diagnostics menu:*
   a. Press **SHIFT**; then press **UTILITY**.
   b. Repeatedly press the main-menu button **System** until **Diag/Err** is highlighted in the pop-up menu.
2. *Run the System Diagnostics:* Press the main-menu button **Execute**; then press the side-menu button **OK Confirm Run Test**.
3. *Wait:* The internal diagnostics do an exhaustive verification of proper oscilloscope function. This verification will take about two minutes. When finished, the oscilloscope will display a report of any bad modules and/or interfaces.

## Firmware Updates

Oscilloscope firmware updates are easy to do. Simply install the firmware disks on your PC and follow the instructions in the README file located on the first disk.

***NOTE**. You must set the Protection switch to the unprotected position before updating the Firmware. Figure 6–27 shows how to set the switch. After loading the Firmware, be sure you set the switch back to the protected position and cycle power.*

If you want to order a firmware update, contact your Tektronix service center.

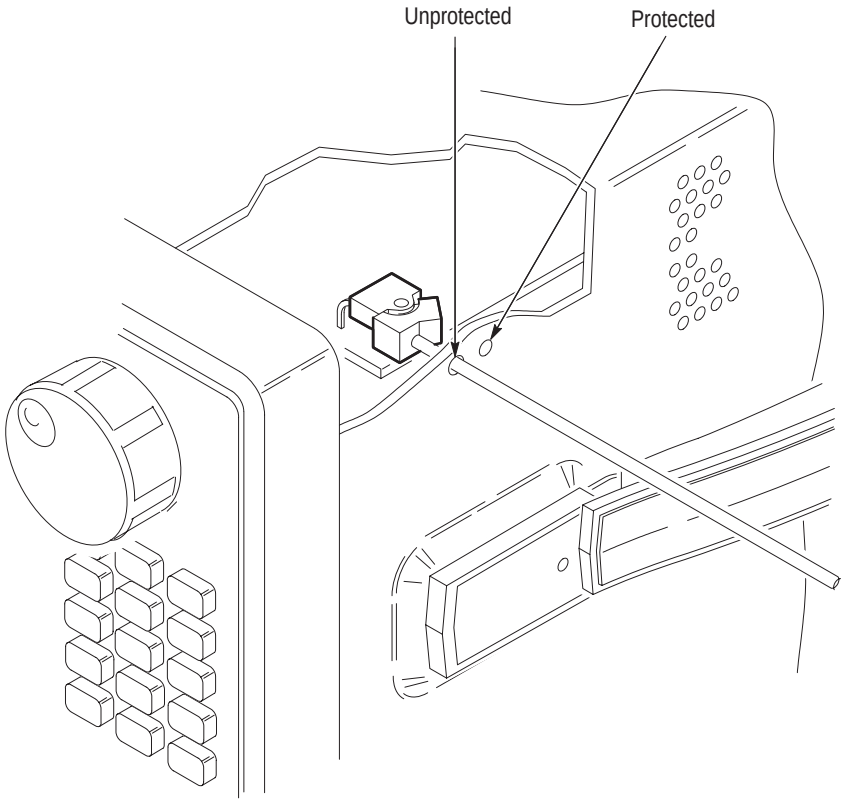



**Figure 6–27: Accessing the protection switch**

## Hard Disk Drive Maintenance

Use the same procedures to maintain the oscilloscope hard disk drive that you use to maintain a hard disk drive in a personal computer.

The easiest procedure is to format the disk using the File Utilities Format command. Format will destroy all data currently on the disk.

Using ScanDisk on a personal computer will attempt to fix the disk without destroying data on the disk. If ScanDisk does not repair the disk, replace the disk drive. To use ScanDisk, perform the following steps:

1. Remove the hard disk drive from the oscilloscope.
2. Install the hard disk drive into a Type III PCMCIA card slot.
3. Power up the computer and run ScanDisk. Set Scandisk to perform a thorough surface scan and to automatically fix errors.
   - Using Microsoft Windows 95: select Start\Programs\Accessories\System Tools\ScanDisk
   - Using Microsoft Windows 3.1: exit Windows and use the MSDOS procedure
   - Using Microsoft MSDOS: enter SCANDISK *drive*: /SURFACE /AUTOFIX
4. If ScanDisk will not repair the disk, install a new hard disk drive.

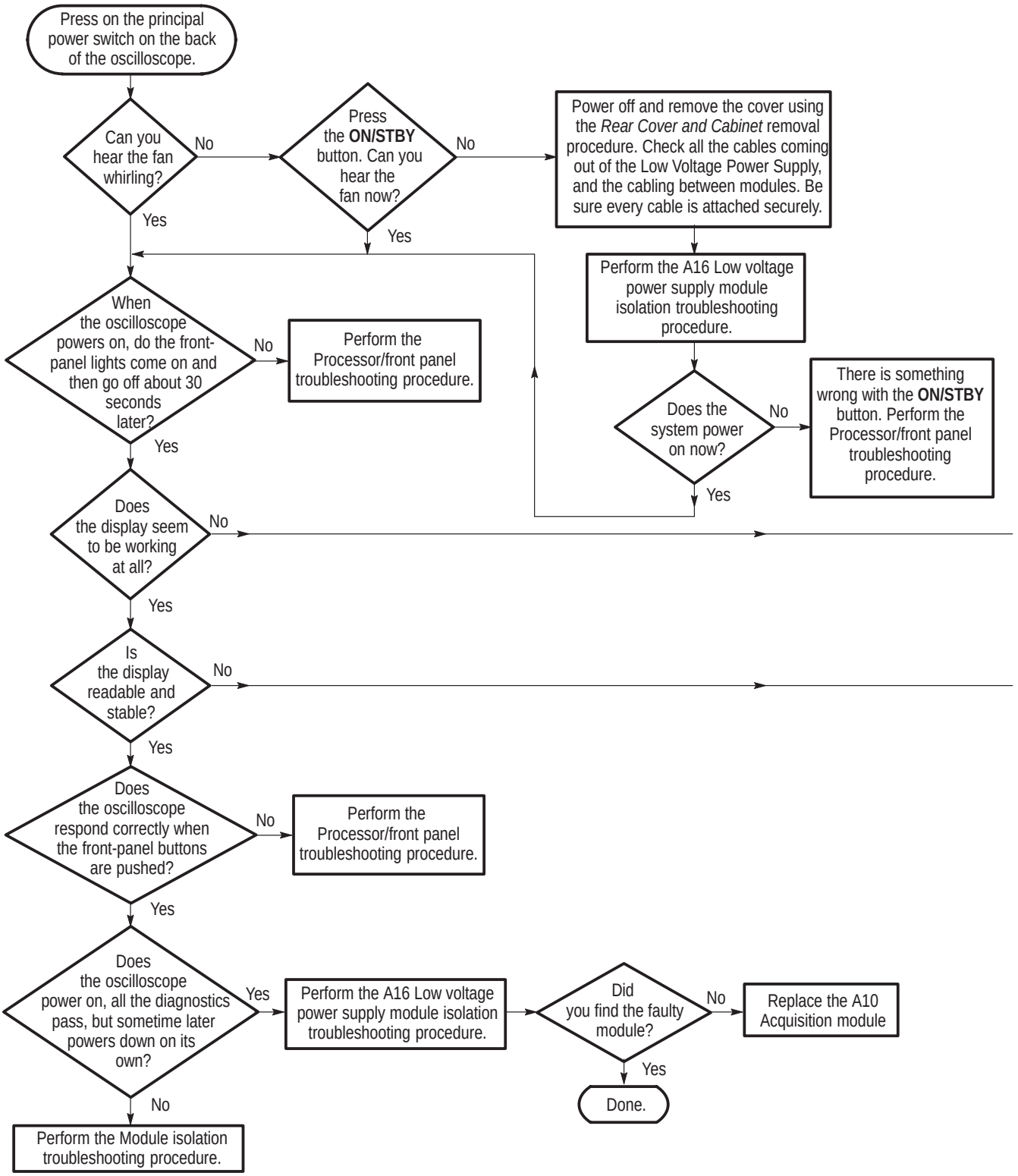



**Figure 6–28: Primary troubleshooting procedure**

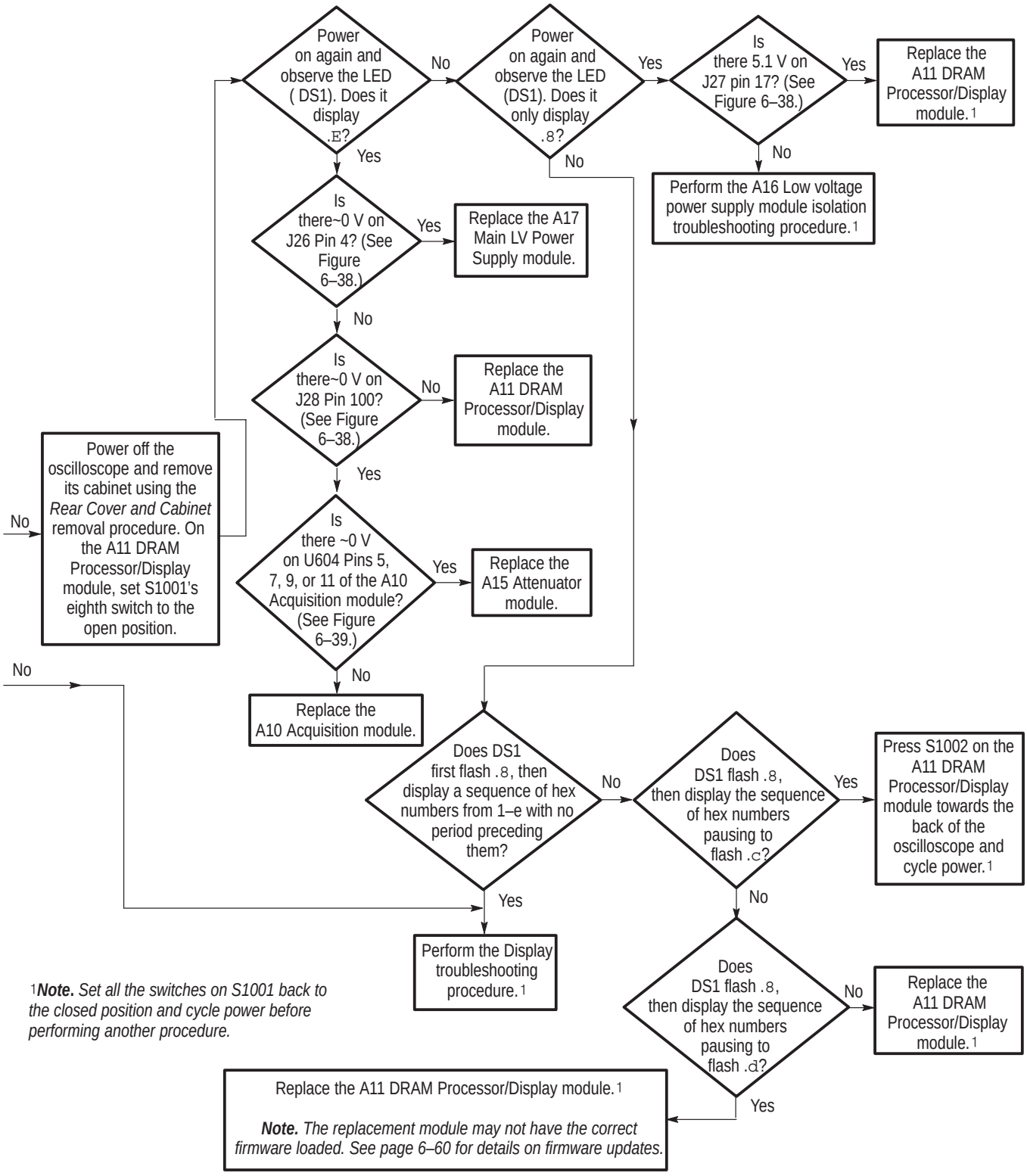



**Figure 6–28: Primary troubleshooting procedure (cont.)**

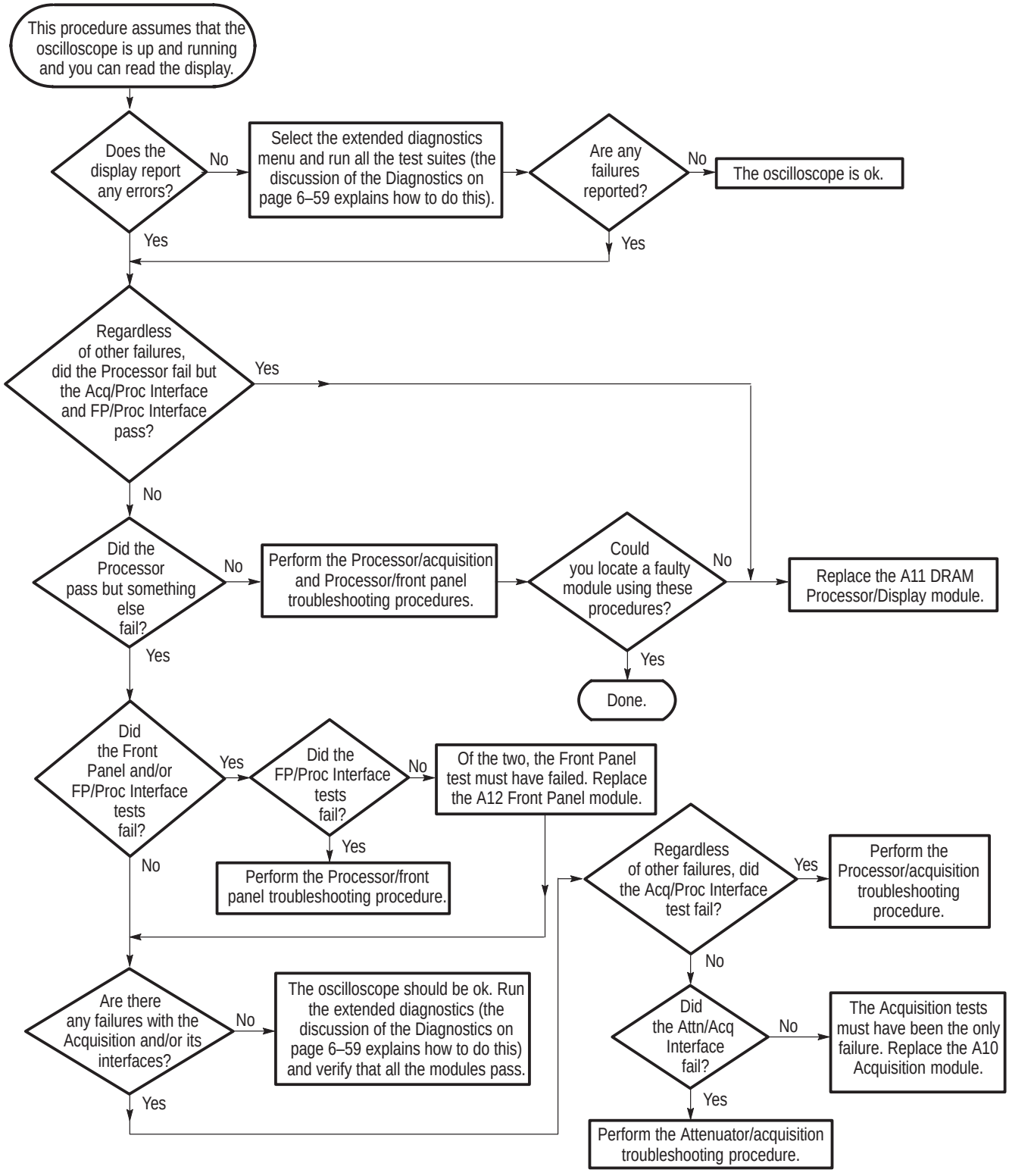



**Figure 6–29: Module isolation troubleshooting procedure**

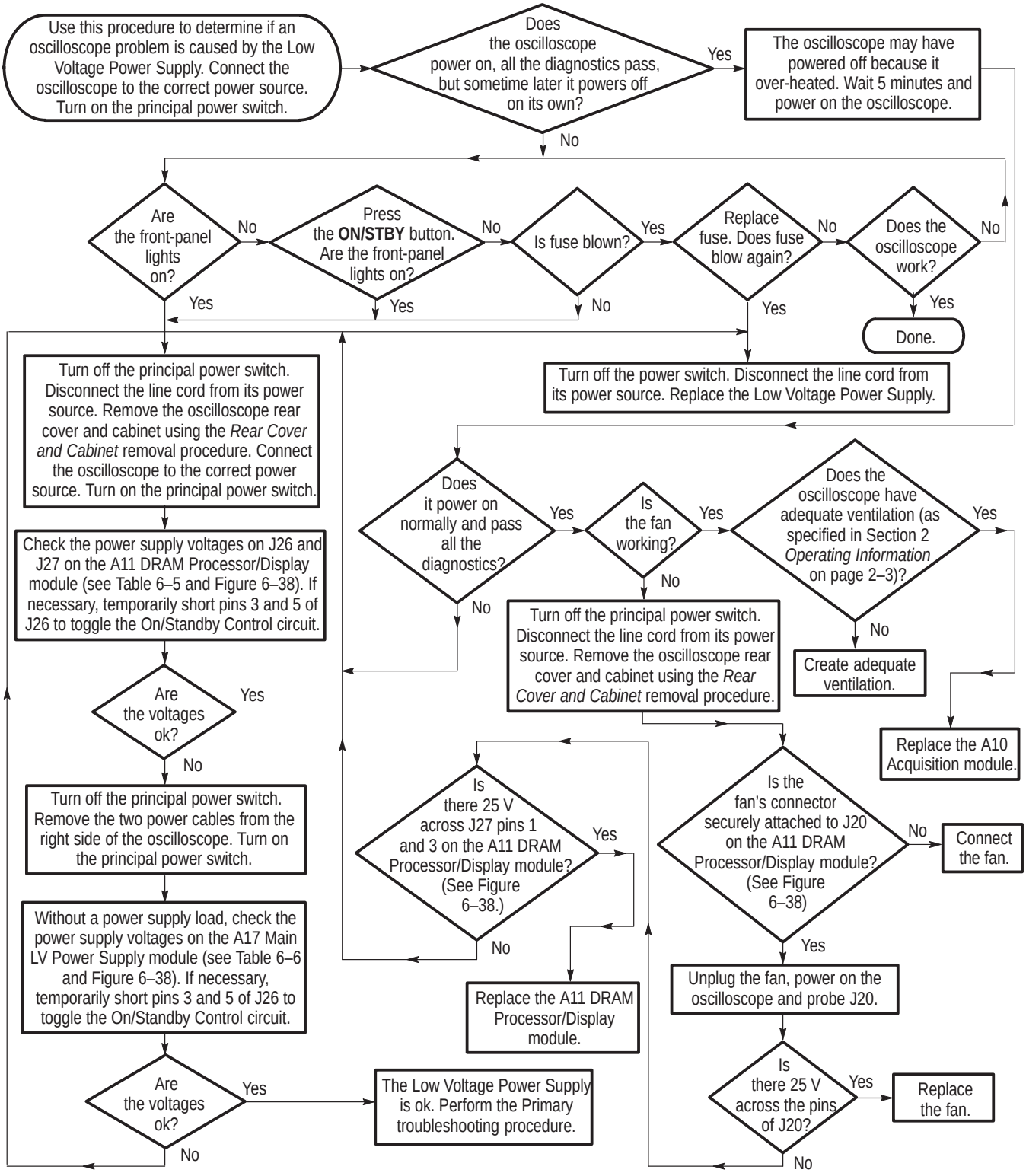



**Figure 6–30: A16 Low voltage power supply module isolation troubleshooting procedure**

**Table 6–5: Normal supply voltages (measured on J26 and J27 on the A11 DRAM Processor/Display module)**

| Supply | Lower Limit | Upper Limit |
|---|---|---|
| Ground (J26 or J27 pin 15) | | |
| +5.1 VA (J27 pin 5) | +5.0 V | +5.2 V |
| +5.1 VB (J27 pin 17) | +5.0 V | +5.2 V |
| +25 V (J27 pin 1) | +23.5 V | +27.5 V |
| +5 V (J26 pin 39) | +4.9 V | +5.1 V |
| –5.1 V (J26 pin 17) | –4.9 V | –5.2 V |
| +15 V (J26 pin 11) | +14.7 V | +15.3 V |
| –15 V (J26 pin 7) | –14.7 V | –15.3 V |

**Table 6–6: No-load supply voltages (measured on J5 and J6 on the A17 Main LV Power Supply module)**

| Supply | Lower Limit | Upper Limit |
|---|---|---|
| Ground (J5 or J6 pin 15) | | |
| +5.1 VA (J6 pin 5) | +4.95 V | +5.25 V |
| +5.1 VB (J6 pin 17) | +4.95 V | +5.25 V |
| +25 V (J6 pin 1) | +23.5 V | +27.5 V |
| +5 V (J5 pin 39) | +0.59 V | +0.81 V |
| –5.1 V (J5 pin 17) | –0.39 V | –0.61 V |
| +15 V (J5 pin 11) | +1.05 V | +1.75 V |
| –15 V (J5 pin 7) | –1.05 V | –1.75 V |

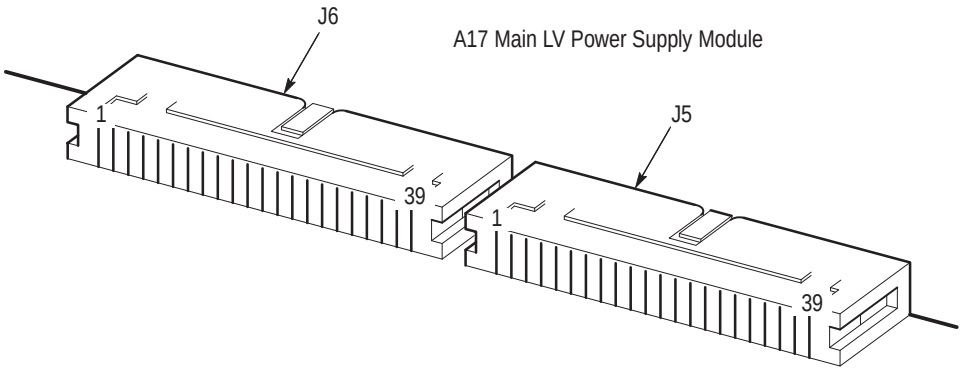



**Figure 6–31: Power supply voltage measurement locations**

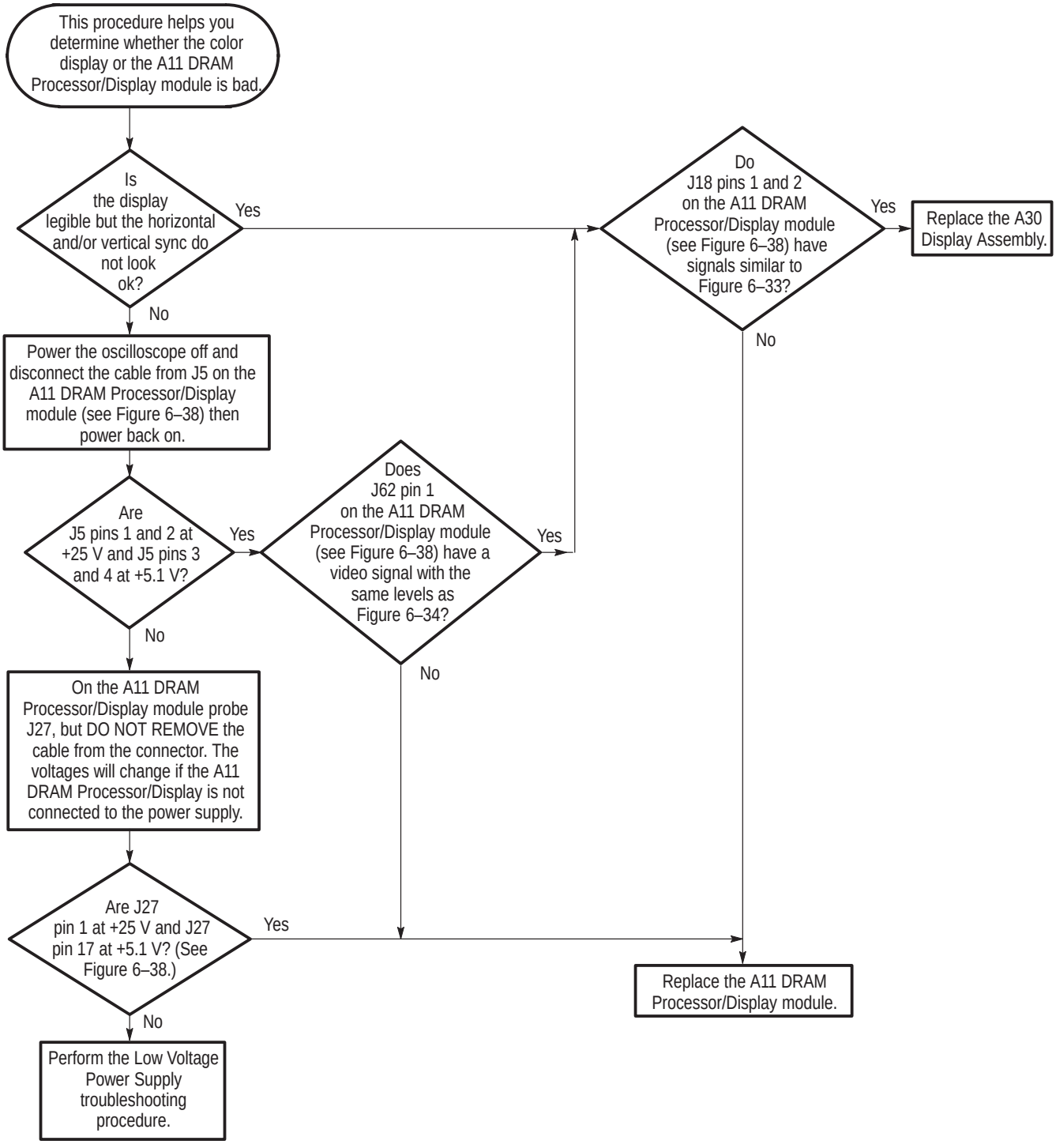



**Figure 6–32: Color display troubleshooting procedure**

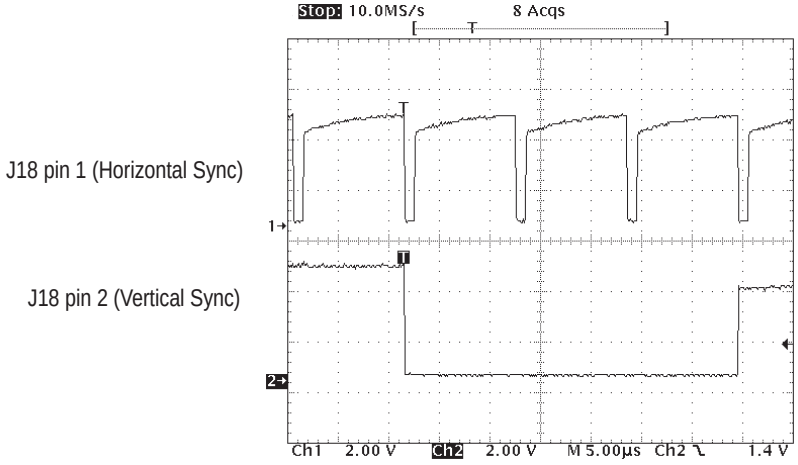



**Figure 6–33: Horizontal and vertical sync signals – color display**

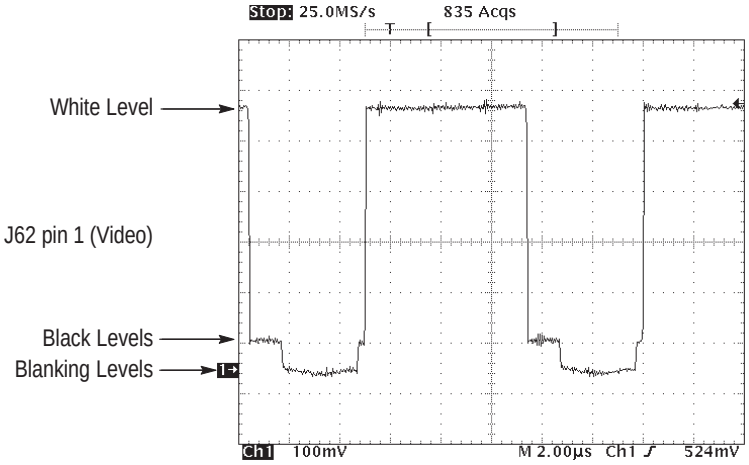



**Figure 6–34: A video signal with white, black, and blanking levels – color display**

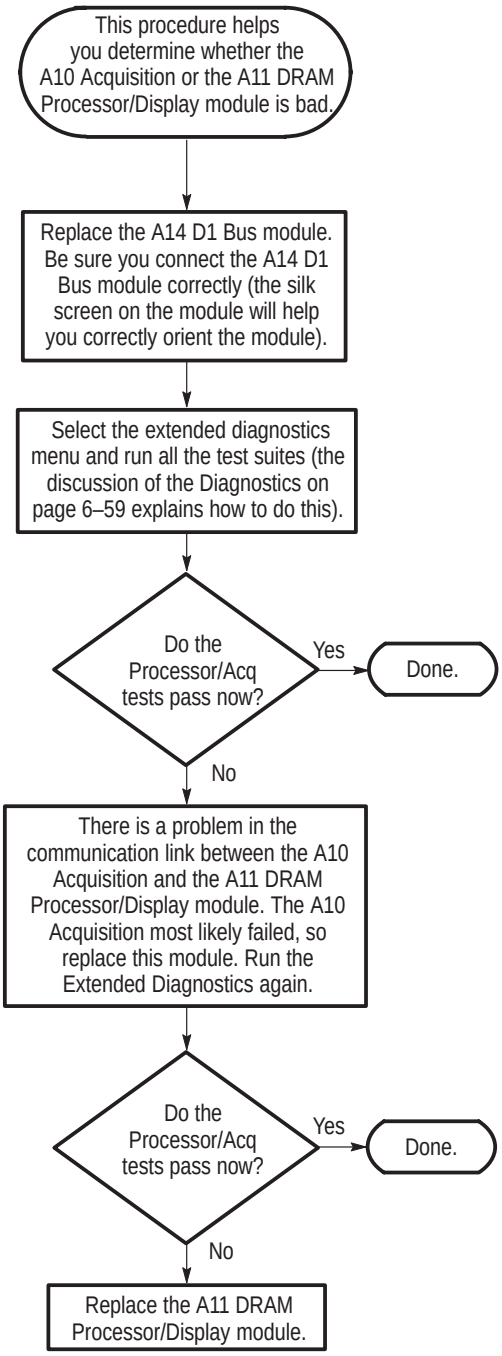



**Figure 6–35: Processor/acquisition troubleshooting procedure**

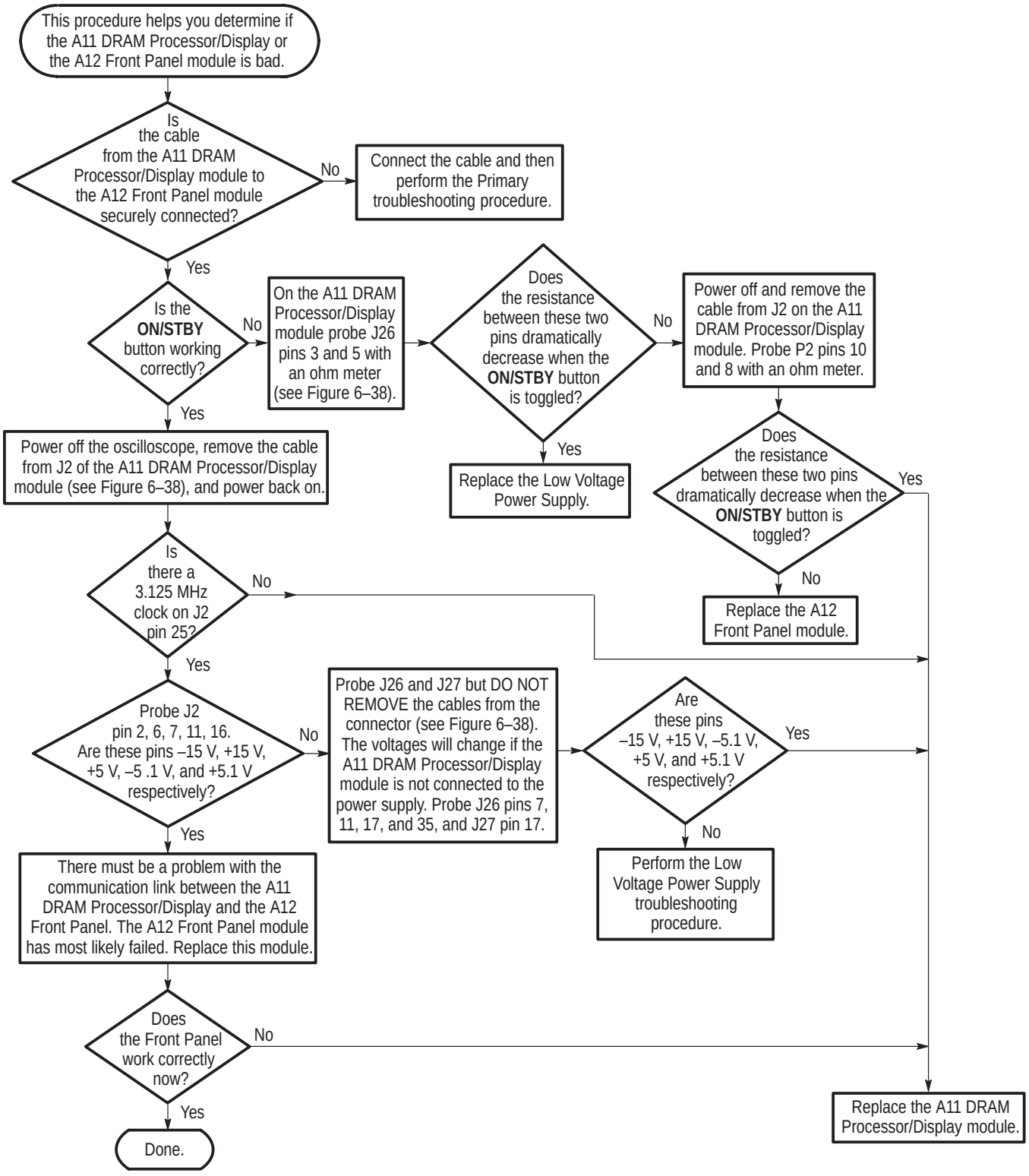



**Figure 6–36: Processor/front panel troubleshooting procedure**

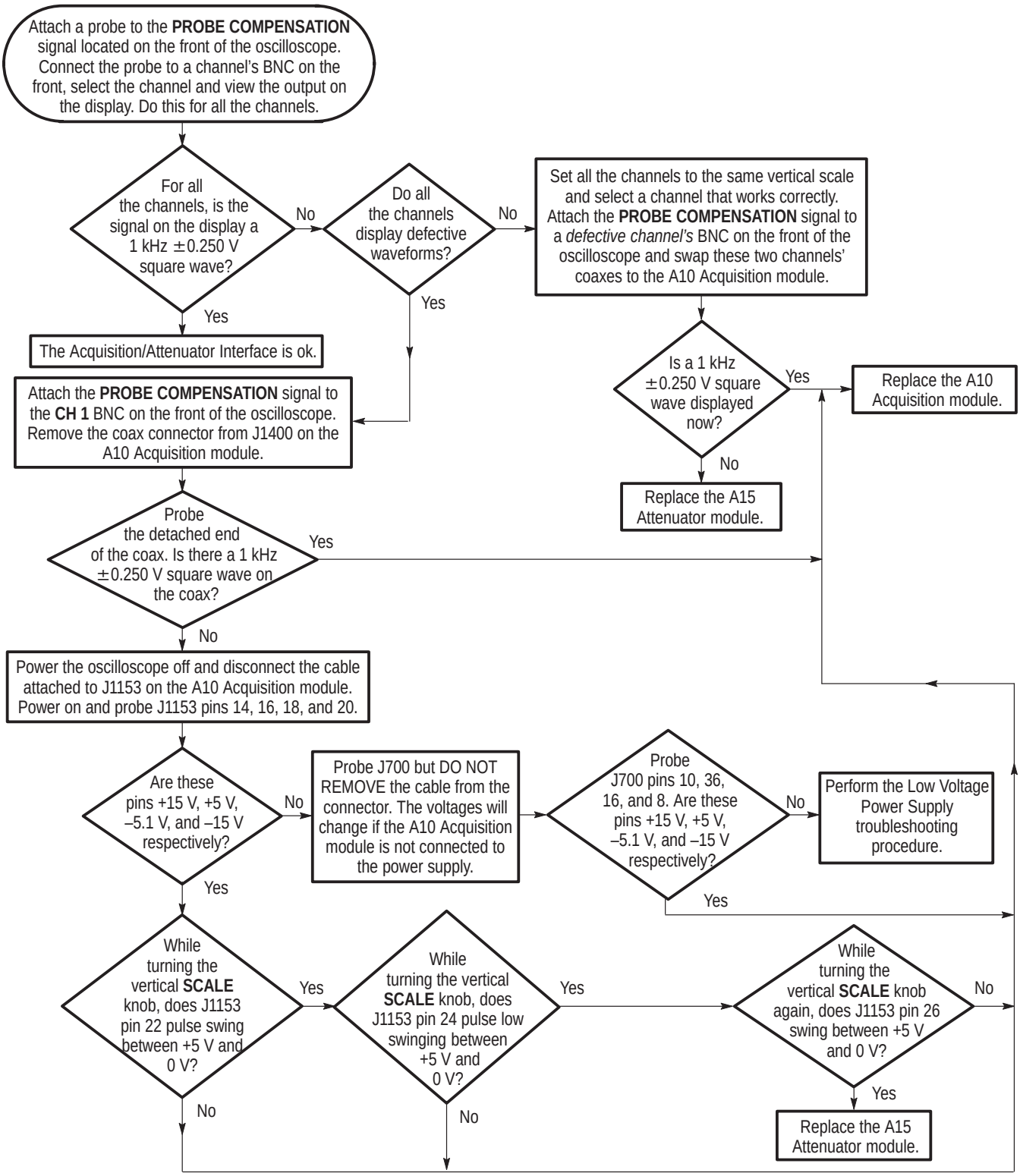



**Figure 6–37: Attenuator/acquisition troubleshooting procedure**

***CAUTION.*** *Only probe points specified in the procedures. You can cause catastrophic damage if you attempt to probe other points.*

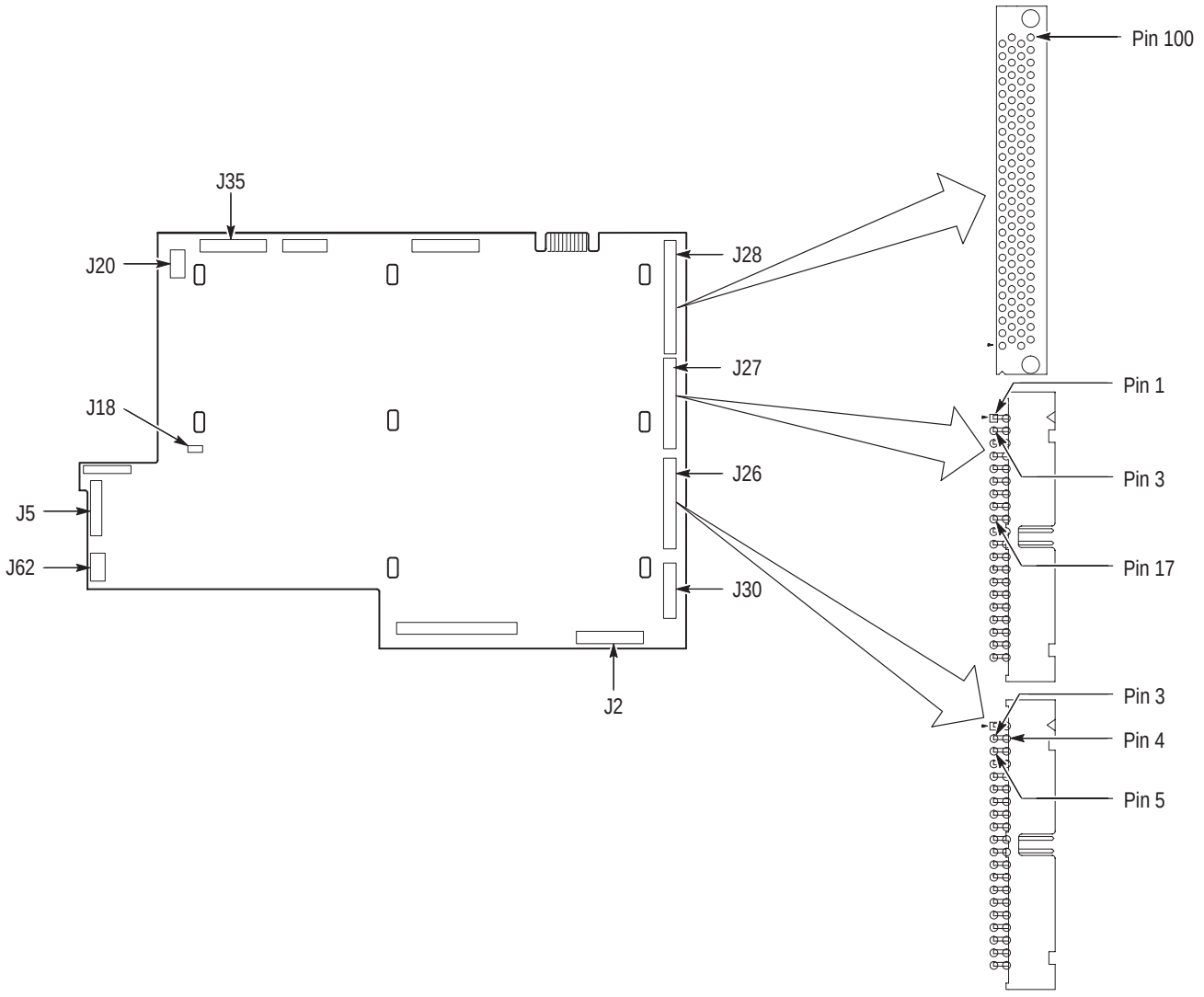



**Figure 6–38: A11 DRAM Processor/Display module**

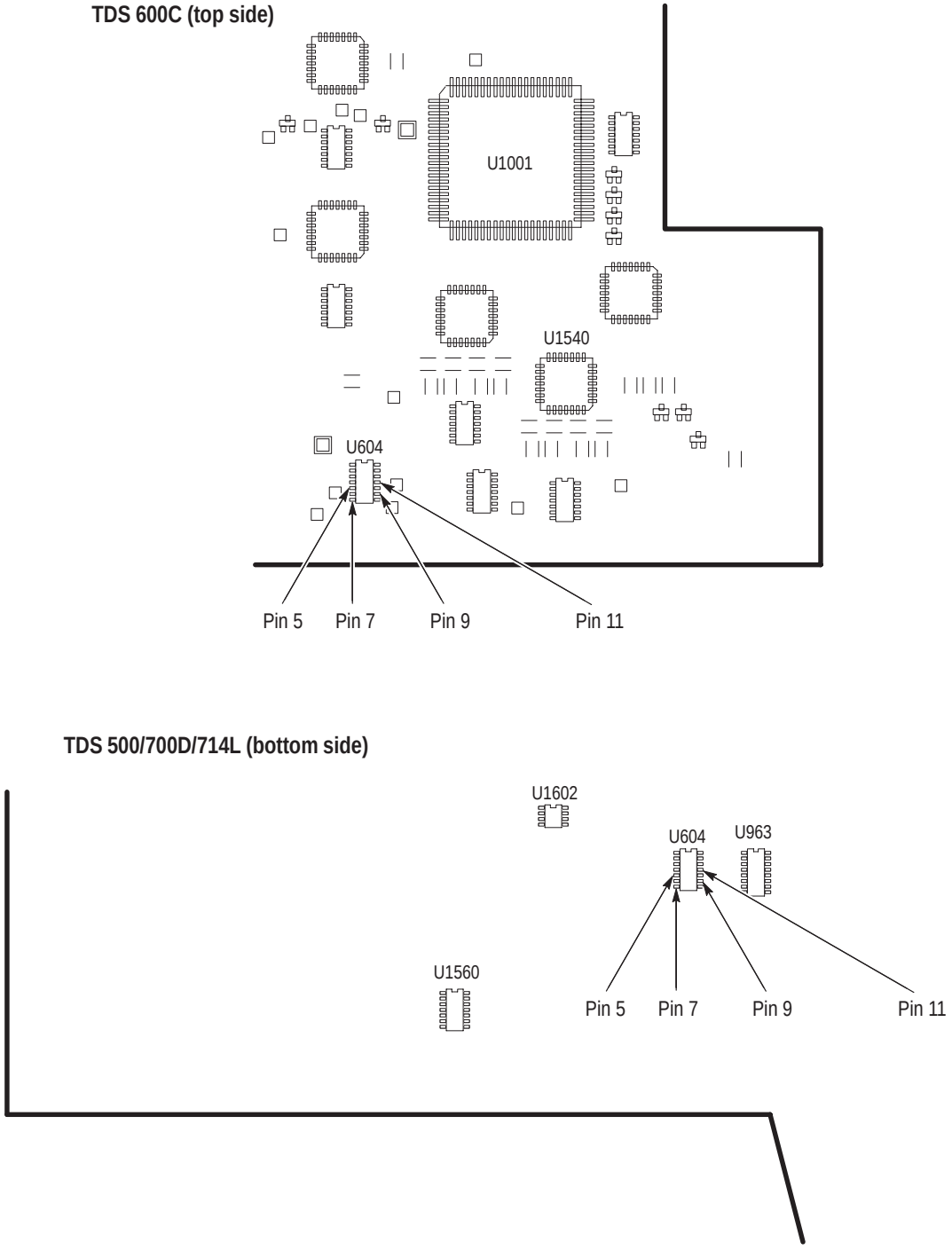



**Figure 6–39: A10 Acquisition module (test points)**

# Options and Accessories

This section describes the various options as well as the standard and optional accessories that are available for the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscope.

## Options

Tektronix will ship the options shown in Table 7–1:

**Table 7–1: Options**

| Option # | Label | Description |
|---|---|---|
| A1 | Universal European power cord | 220 V, 50 Hz power cord |
| A2 | UK power cord | 240 V, 50 Hz power cord |
| A3 | Australian power cord | 240 V, 50 Hz power cord |
| A4 | North American power cord | 240 V, 60 Hz power cord |
| A5 | Switzerland power cord | 220 V, 50 Hz power cord |
| HD | Hard disk drive | Add a hard disk. |
| 05 | Video trigger | Oscilloscope comes with tools for investigating events that occur when a video signal generates a horizontal or vertical sync pulse. These tools allow investigation of a range of NTSC, PAL, SECAM, and high definition TV signals. (Option is not available on the TDS 794D.) |
| 13 | RS-232/Centronics Hard-copy Interface Ports | Add RS-232-C and Centronics interface ports.<br>(Option applies to TDS 500D only.) |
| 1G | 1 GS/s maximum | Limit sample rate to 1 GS/s maximum.<br>(Option applies to TDS 520D, TDS 540D, TDS 724D and TDS 754D only.) |
| 1K | Scope cart | K420 scope cart. This cart can help transport the oscilloscope around many lab environments. |
| 1M | 130,000 record length | Extend record length from 50,000 samples standard as follows:<br>TDS 520D and TDS 724D: To 250,000 samples on one channel and 130,000 on two channels<br>TDS 540D, TDS 580D, TDS 754D, TDS 784D, and TDS 794D: To 500,000 samples on one channel, 250,000 on two channels, and 130,000 samples on three or four channels<br>(Option is only available for the models listed above.) |
| 1M | 120,000 samples record length | Extend record length from 30,000 samples standard<br>(Option applies only to TDS 694C.) |

**Table 7–1: Options (cont.)**

| Option # | Label | Description |
|---|---|---|
| 2M | 8 M acquisition length | Extend standard acquisition length as follows:<br>TDS 520D and TDS 724D: To 2 M samples on two channels and 4 M on one channel<br>TDS 540D, TDS 580D, TDS 714L, TDS 754D, TDS 784D, & TDS 794D: To 2 M samples on three or four channels, 4 M on two channels, and 8 M samples on one channel<br>(Option includes a hard disk and is only available for the models listed above.) |
| 1R | Rackmount | Oscilloscope comes configured for installation in a 19 inch wide instrument rack. For later field conversions, order kit # 016-1236-00. |
| 2C | Communication Signal Analyzer | Oscilloscope comes configured for communications signal triggering and mask testing. (Option applies to TDS 500D & TDS 700D only.) |
| 3C | P6701B with system calibration | Oscilloscope comes with a P6701B and calibrated short-wavelength optical reference receiver on channel 1. (Option applies to TDS 500D & TDS 700D only, except TDS 794D.) |
| 4C | P6703B with system calibration | Oscilloscope comes with a P6703B and calibrated long-wavelength optical reference receiver on channel 1. (Option applies to TDS 500D & TDS 700D only, except TDS 794D.) |
| 31 | Buffered passive probe | Add a 500 MHz P6339A 10x, buffered passive probe (Option applies only to TDS 794D.) |
| 32 | Active probe | Add a 4 GHz P6217 active probe (Option applies only to TDS 794D.) |
| 33 | Low capacitance probe | Add a 3.0 GHz (probe only) P6158 20x, 1 kΩ, low capacitance probe (Option applies only to TDS 580D, TDS 680C, TDS 684C, TDS 784D, and TDS 794D.) |
| 34 | Differential probe | Add a 1 GHz (probe only) P6247 differential probe |
| 35 | Active probe | Add a 1 GHz (probe only) P6243 active probe (Option applies only to TDS 754D, TDS 724D, TDS 714L, TDS 540D, and TDS 520D.) |
| 36 | Passive probe | Add a 500 MHz P6139A 10X passive probe (Option applies only to TDS 784D, TDS 714L, TDS 600C, and TDS 580D.) |
| 37 | Active probe | Add a 1.5 GHz P6245 active probe (Option applies only to TDS 794D, TDS 784D, TDS 680C, TDS 684C, and TDS 580D.) |
| 38 | Active probe | Add a 4 GHz (probe only) P6249 5X, small geometry active probe (Option applies only to TDS 694C and TDS 794D.) |
| 39 | Differential probe | Add a 1.5 GHz (probe only) P6248 small geometry active differential probe (Option applies only to TDS 694C and TDS 794D.) |
| 2F | Advanced DSP math | Add advanced DSP math features such as FFT, integration, and differentiation. (Option applies only to TDS 500D models.) |

**Table 7–1: Options (cont.)**

| Option # | Label | Description |
|---|---|---|
| C3 | Three years calibration | Provides three years of calibration |
| D1 | Calibration data report | Oscilloscope comes with a calibration data report. |
| D3 | Calibration data for C3 | Provides calibration data for option C3 |
| L1 | Manuals in French | Provides Language versions of User Manual, according to option number chosen. |
| L3 | Manuals in German | |
| L5 | Manuals in Japanese | |
| L9 | Manuals in Korean | |

## Standard Accessories

The oscilloscope comes standard with the accessories listed in Table 7–2.

**Table 7–2: Standard accessories**

| Accessory | Part number |
|---|---|
| User Manual with Programmers Manual Help Disk | 071-0130-XX |
| User Manual (with programmer disk 063-3060-XX) TDS 694C | 071-0473-XX |
| TDS 714L Supplement (TDS 714L only) | 071-0628-XX |
| TDS 600C Supplement (TDS 600C only) | 071-0273-XX |
| Reference Manuals | 020-2313-XX |
| Technical Reference: Performance Verification and Specifications | 071-0630-XX |
| Probes:<br>TDS 714L, TDS 754D and TDS 540D:<br>Four P6139A 10X, 500 MHz Passive probes<br>TDS 654C: Four P6243 1 GHz Active probes<br>TDS 724D and TDS 520D:<br>Two P6139A 10X, 500 MHz Passive probes<br>TDS 794D, TDS 784D, TDS 684C, TDS 680C,TDS 580D, TDS 694C:<br>No probes standard | <br><br>P6139A<br>P6243<br><br>P6139A |
| Front Cover | 200-3696-01 |
| Accessory Pouch<br>(TDS 654C, TDS 684C, TDS 700D, TDS 714L without Option 1R) | 016-1268-00 |
| U.S. Power Cord | 161-0230-01 |

## Optional Accessories

You can also order the optional accessories listed in Table 7–3.

**Table 7–3: Optional accessories**

| Accessory | Part number |
|---|---|
| Service Manual | 071-0627-XX |
| Oscilloscope Cart | K420 |
| Rack Mount Kit (for field conversion) | 016-1236-00 |
| Accessory Pouch (TDS 500D and TDS 680C) | 016-1268-00 |
| Soft-Sided Carrying Case | 016-0909-01 |
| Transit Case | 016-1135-00 |
| GPIB Cable (1 meter) | 012-0991-01 |
| GPIB Cable (2 meter) | 012-0991-00 |
| Centronics Cable | 012-1214-00 |
| RS-232 Cable | 012-1298-00 |

## Accessory Probes

Table 7–4 lists the recommended probes for each oscilloscope. Descriptions of each probe follow the table.

**Table 7–4: Recommended probe cross reference**

| Probe | 520D<br>540D | 580D | 654C | 680C<br>684C | 714L<br>724D<br>754D | 784D | 794D |
|---|---|---|---|---|---|---|---|
| Passive<br>1X | P6101B | P6101B | P6101B | P6101B | P6101B | P6101B | |
| 10X | P6139A | P6139A | P6139A | P6139A | P6139A | P6139A | P6339A |
| 100X | P5100 | P5100 | P5100 | P5100 | P5100 | P5100 | |
| 1000X | P6015A | P6015A | P6015A | P6015A | P6015A | P6015A | |
| SMD | P6563A | P6563A | P6563A | P6563A | P6563A | P6563A | |
| Low Capacitance | | P6158 | | P6158 | | P6158 | P6158 |
| Active CMOS/TTL | P6243 | P6245 | P6243 | P6245 | P6243 | P6245 | P6245 |
| Active, High Bandwidth | | P6245<br>P6217 | | P6245<br>P6217 | | P6245<br>P6217 | P6245<br>P6217 |
| Logic | P6408 | P6408 | P6408 | P6408 | P6408 | P6408 | |
| Differential Digital/<br>Telecom | P6246,<br>P6247 | P6247 | P6246,<br>P6247 | P6247 | P6246,<br>P6247 | P6247 | P6247 |
| Micro Volt | ADA400A | ADA400A | ADA400A | ADA400A | ADA400A | ADA400A | |
| High Voltage | P5205<br>P5210 | P5205<br>P5210 | P5205<br>P5210 | P5205<br>P5210 | P5205<br>P5210 | P5205<br>P5210 | |
| Current<br>AC Only | P6021<br>P6022<br>CT-1<br>CT-2 | P6021<br>P6022<br>CT-1<br>CT-2 | P6021<br>P6022<br>CT-1<br>CT-2 | P6021<br>P6022<br>CT-1<br>CT-2 | P6021<br>P6022<br>CT-1<br>CT-2 | P6021<br>P6022<br>CT-1<br>CT-2 | <br><br>CT-1<br>CT-2 |
| Current<br>AC/DC | TCP202<br>AM503S | TCP202<br>AM503S | TCP202<br>AM503S | TCP202<br>AM503S | TCP202<br>AM503S | TCP202<br>AM503S | TCP202<br>AM503S |
| Electro-Optical Converter | P6701B<br>P6703B | P6701B<br>P6703B | P6701B<br>P6703B | P6701B<br>P6703B | P6701B<br>P6703B | P6701B<br>P6703B | P6701B<br>P6703B |

- P6701B Optical-to-Electrical Analog Converter: 500 to 950 nm (DC to 1 GHz, 1 V/mW)
- P6703B Optical-to-Electrical Analog Converter: 1100 to 1700 nm (DC to 1.2 GHz, 1 V/mW)
- P6723 Optical Logic Probe: 1310 to 1550 nm (20 to 650 Mb/s, –8 to –28 dBm
- AFTDS Differential Signal Adapter
- AMT75 75 Ω to 50 Ω Adapter
- P6243 Active, high speed digital voltage probe. FET. DC to 1.0 GHz
- P6245 Active, high speed digital voltage probe. FET. DC to 1.5 GHz
- P6246 Active, high bandwidth differential probe. FET. DC to 400 MHz
- P6247 Active, high bandwidth differential probe. FET. DC to 1 GHz
- P6248 Active, high bandwidth differential probe. FET. DC to 1.5 GHz
- P6249 Active, small geometry active probe, 5X, 4 GHz
- P6101B 1X, 15 MHz, Passive probe
- P6158 3.0 GHz, 20x, 1 KΩ, low capacitance probe
- P6139A 10X, 500 MHz Passive probe
- P6339A 500 MHz buffered passive, AC/DC coupling, 20/150 MHz bandwidth limit probe (for TDS 794D)
- P6217 Active, high speed digital voltage probe. FET. DC to 4 GHz. DC offset
- P6204 Active, high speed digital voltage probe. FET. DC to 1 GHz. DC offset
- P6563A Passive, SMD probe, 20X, 500 MHz

- P5100 High Voltage Passive probe, 2.5 kV, DC to 250 MHz
- P6015A High Voltage probe, 40 kV peak, 75 MHz
- P5205 High Voltage differential probe, 1.3 kV (differential), DC to 100 MHz
- P5210 Differential, high voltage probe, 5.6 kV (DC + peak AC) 50 MHz
- ADA 400A differential preamp, switchable gain
- AM 503S — DC/AC 50 MHz Current measurement system, AC/DC. Supplied with A6302 Current Probe
- AM 503S Option 03: DC/AC 100 A Current measurement system, AC/DC. Supplied with A6303 Current Probe
- AM 503S Option 05: DC/AC 100 MHz Current measurement system. Supplied with A6312 Current Probe
- TCP 202 Current Probe, DC to 50 Mhz, 15 A DC
- P6021 AC Current probe. 120 Hz to 60 MHz
- P6022 AC Current probe. 935 kHz to 120 MHz
- CT-1 Current probe — designed for permanent or semi-permanent in-circuit installation. 25 kHz to 1 GHz, 50 Ω input
- CT-2 Current probe — designed for permanent or semi-permanent in-circuit installation. 1.2 kHz to 200 MHz, 50 Ω input
- CT-4 Current Transformer — for use with the AM 503S (A6302, A6312) and P6021. Peak pulse 20 kA. 0.5 Hz to 20 MHz with AM 503S (A6302)
- P6408 Logic probe, 17-bit, TTL

## Accessory Software

The optional accessories listed in Table 7–5 are Tektronix software products recommended for use with your oscilloscope.

**Table 7–5: Accessory software**

| Software | Part number |
|---|---|
| Wavewriter: AWG and waveform creation | S3FT400 |
| WaveStar™: Waveform capture and documentation | WSTR31 |
| WaveStar™: Waveform capture and documentation, Windows 95/NT version | WSTRO |
| Telecommunication Package and i–Pattern Software | TTiP |

## Warranty Information

Check for the full warranty statements for this product and the products listed above on the first page after the title page of each product manual.

# Electrical Parts List

The modules that make up this instrument are often a combination of mechanical and electrical subparts. Therefore, all replaceable modules are listed in Section 10, *Mechanical Parts List.* Refer to that section for part numbers when using this manual.

# Diagrams

This contains the interconnection diagram, see Figure 9–1 on page 9–2 and block diagram, see Figure 9–2 on page 9–4 for the TDS 500D, TDS 600C, TDS 700D and TDS 714L Oscilloscopes.

## Symbols

Graphic symbols and class designation letters are based on ANSI Standard Y32.2–1975. Abbreviations are based on ANSI Y1.1–1972.

Logic symbology is based on ANSI/IEEE Std 91-1984 in terms of positive logic. Logic symbols depict the logic function performed and can differ from the manufacturer's data.

The tilde (~) preceding a signal name indicates that the signal performs its intended function when in the low state.

Other standards used in the preparation of diagrams by Tektronix, Inc. are:

- Tektronix Standard 062–2476 Symbols and Practices for Schematic Drafting
- ANSI Y14.159–1971 Interconnection Diagrams
- ANSI Y32.16–1975 Reference Designations for Electronic Equipment
- MIL–HDBK–63038–1A Military Standard Technical Manual Writing Handbook

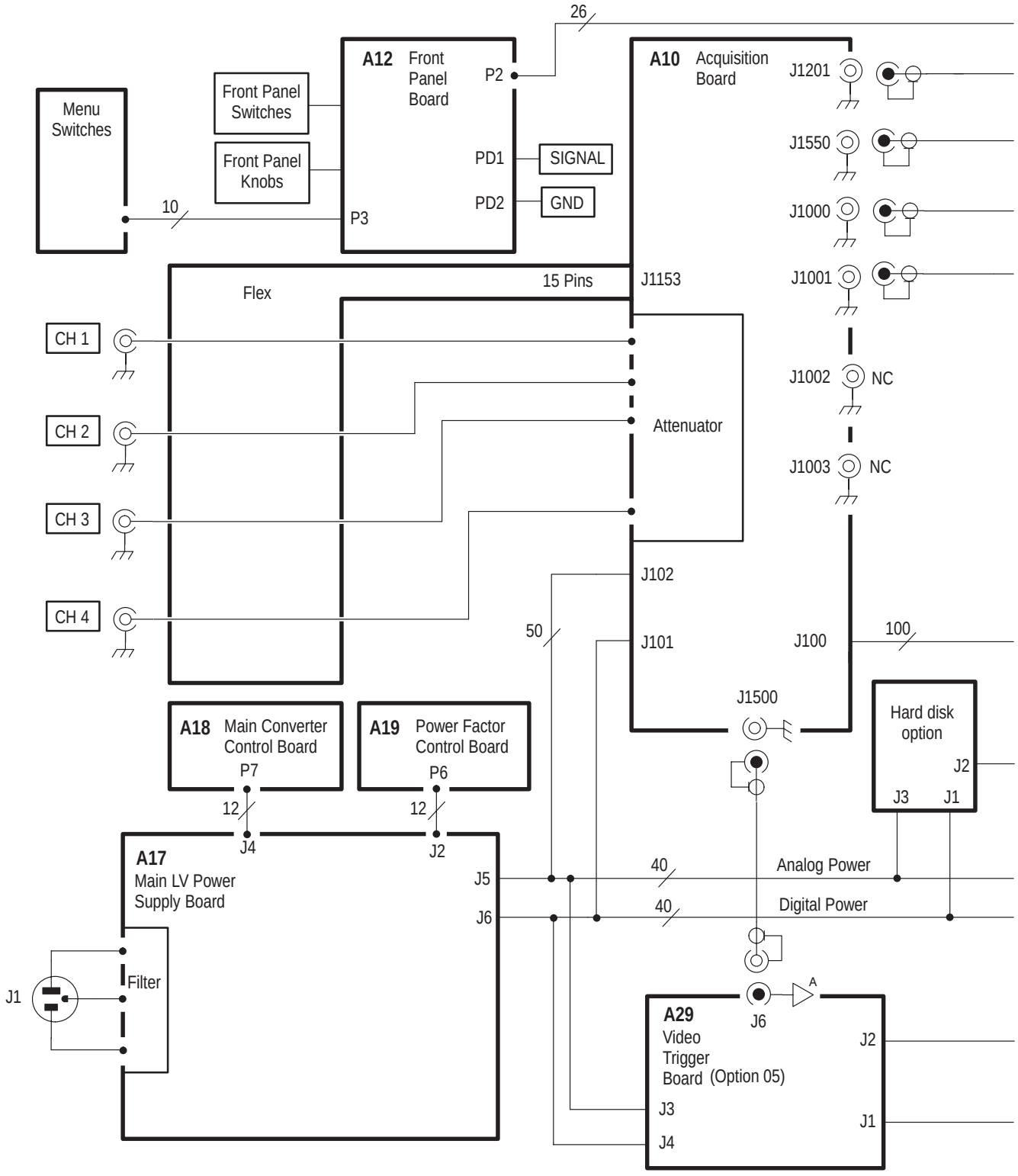



**Figure 9–1: Interconnections**

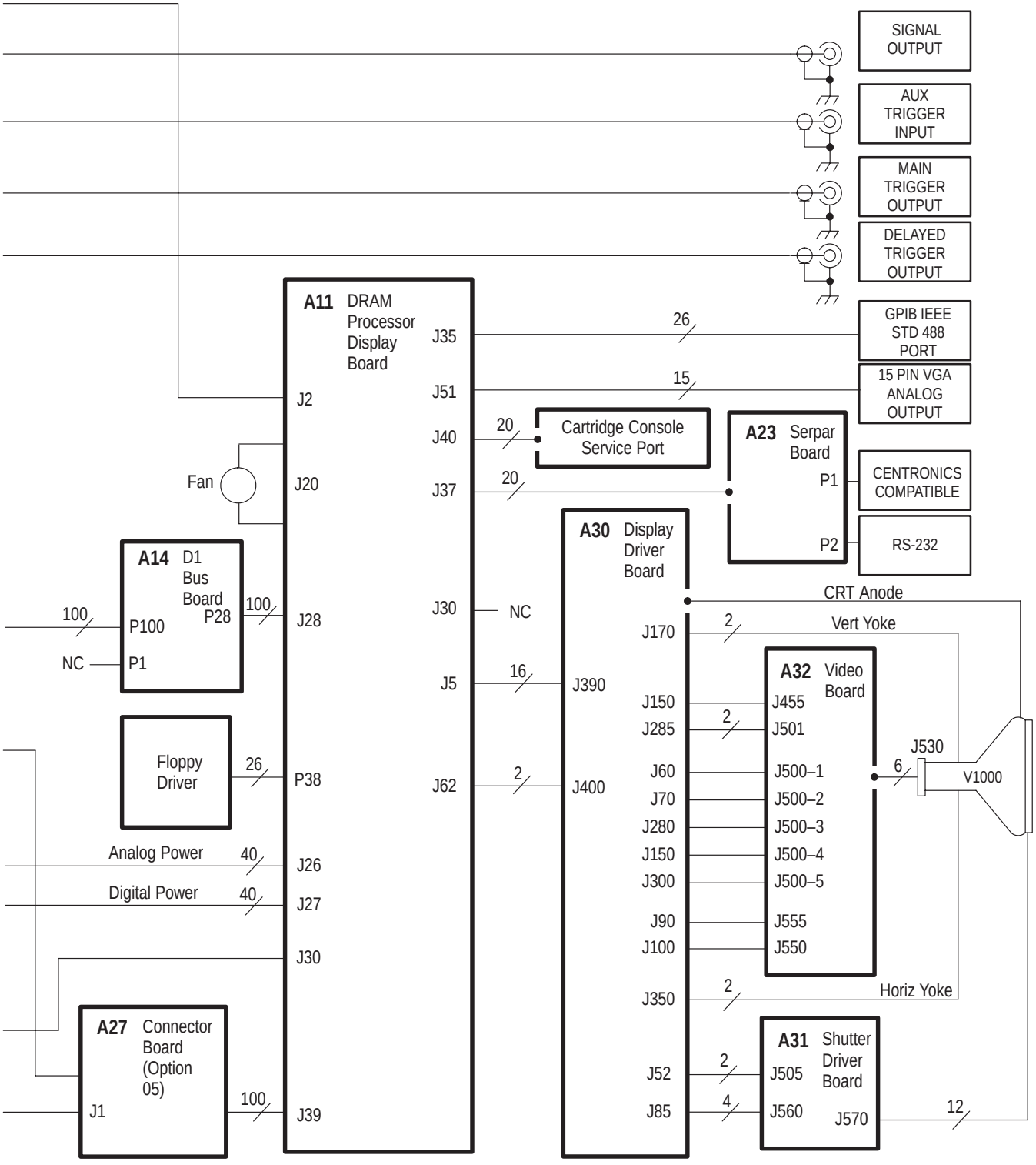



**Figure 9–1: Interconnections (Cont.)**

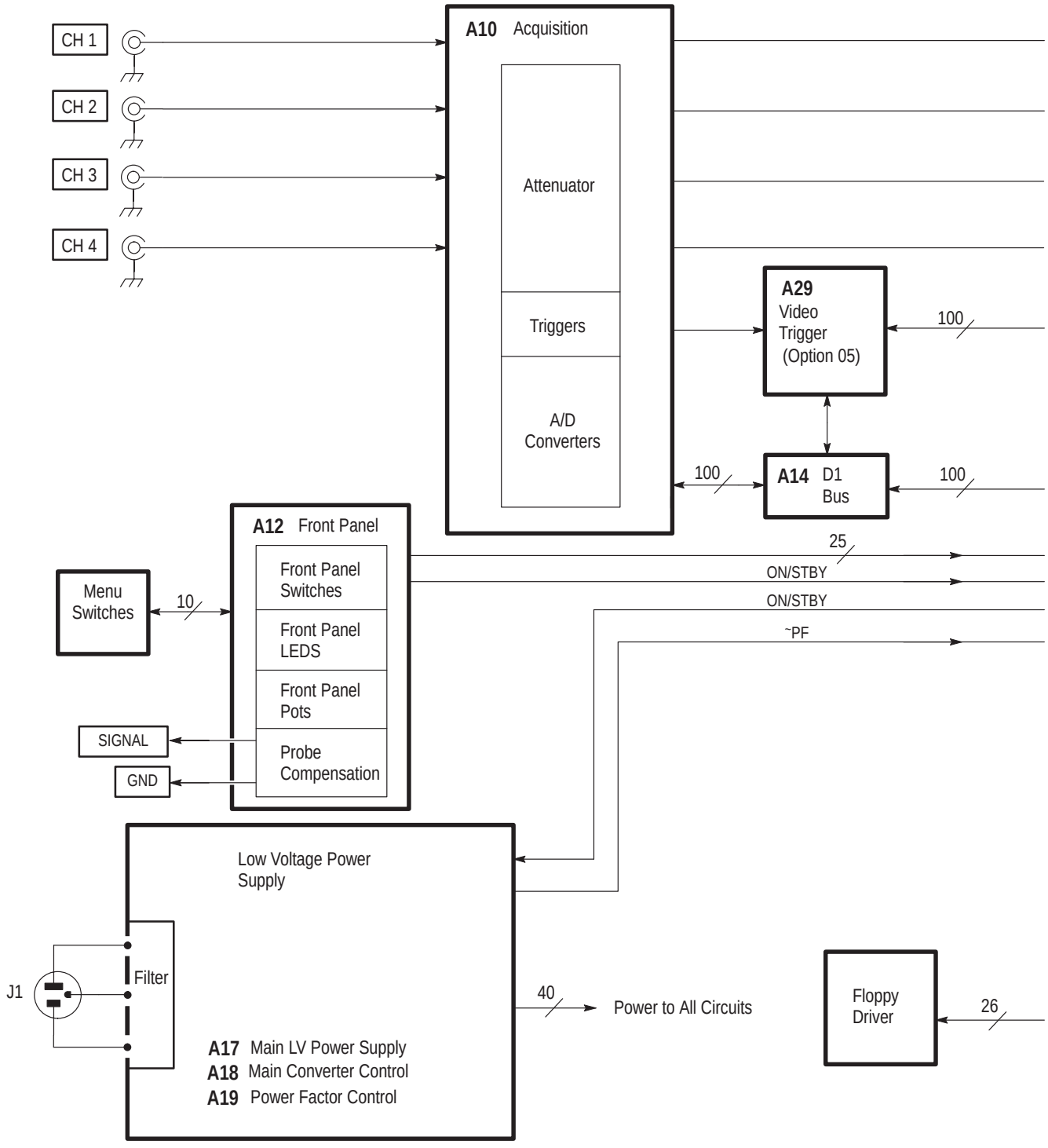



**Figure 9–2: Block diagram**

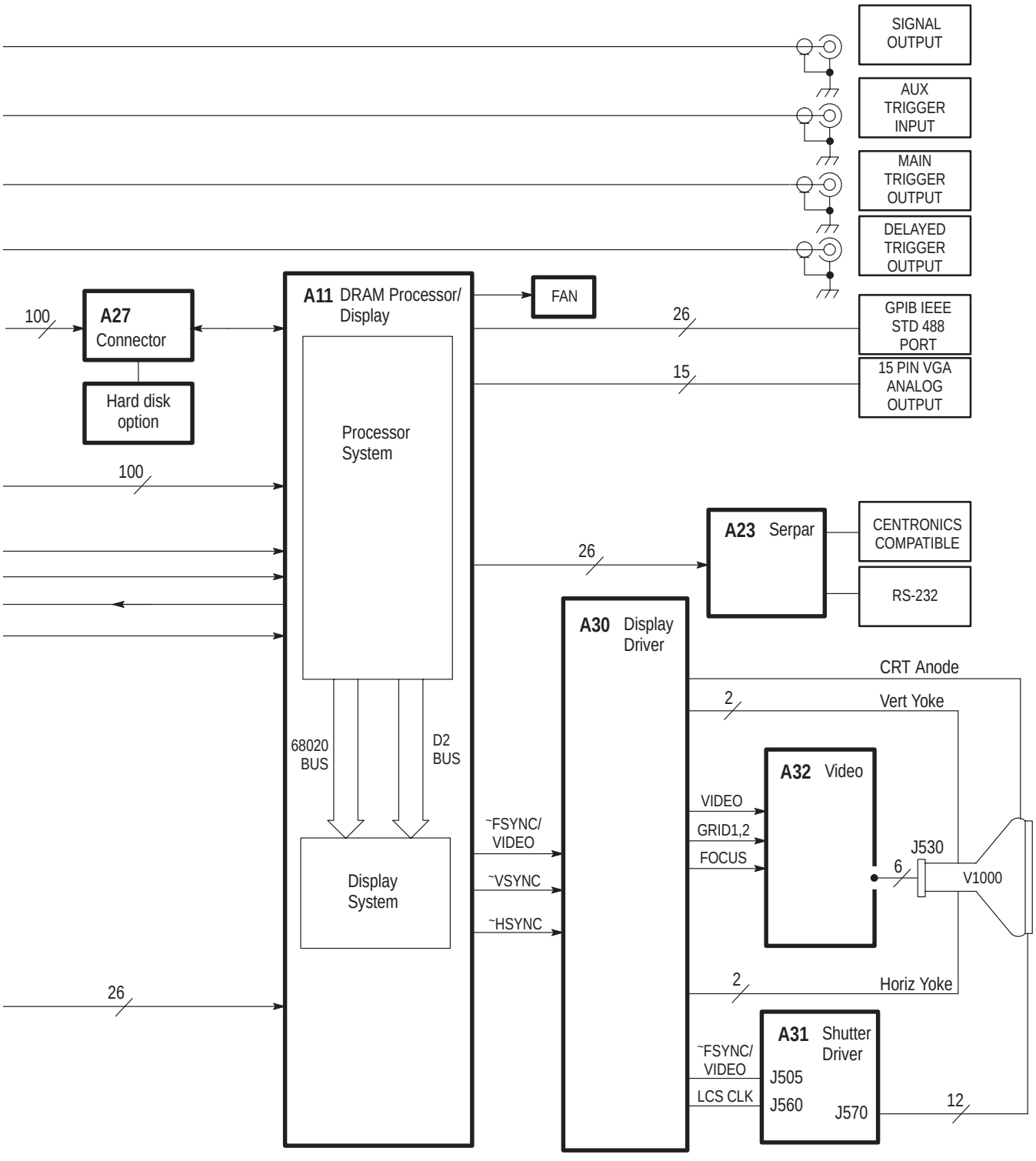



**Figure 9–2: Block diagram (Cont.)**

# Mechanical Parts List

This section contains a list of the replaceable modules for the oscilloscope. Use this list to identify and order replacement parts.

## Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest circuit improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If you order a part that has been replaced with a different or improved part, your local Tektronix field office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

### Module Servicing

Modules can be serviced by selecting one of the following three options. Contact your local Tektronix service center or representative for repair assistance.

**Module Exchange.** In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-TEK-WIDE, extension 6630.

**Module Repair and Return.** You may ship your module to us for repair, after which we will return it to you.

**New Modules.** You may purchase replacement modules in the same way as other replacement parts.

## Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the oscilloscope. Use this list to identify and order replacement parts. The following table describes each column in the parts list.

**Parts list column descriptions**

| Column | Column name | Description |
|---|---|---|
| 1 | Figure & Index Number | Items in this section are referenced by component number. |
| 2 | Tektronix Part Number | Use this part number when ordering replacement parts from Tektronix. |
| 3 and 4 | Serial Number | Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers. |
| 5 | Qty | This indicates the quantity of parts used. |
| 6 | Name & Description | An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification. |
| 7 | Mfr. Code | This indicates the code of the actual manufacturer of the part. (Code to name and address cross reference is located after this page.) |
| 8 | Mfr. Part Number | This indicates the actual manufacturer's or vendor's part number. |

### Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1–1972.

### Mfr. Code to Manufacturer Cross Index

The following table cross indexes codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

## Manufacturers Cross Index

| Mfr. code | Manufacturer | Address | City, state, zip code |
|---|---|---|---|
| S3109 | FELLER | 72 VERONICA AVE<br>UNIT 4 | SUMMERSET NJ 08873 |
| TK0IK | MODERN METALS | UNIT A/K, 5/F GOLD KING IND.<br>BLDG NO. 35–41 TAI LIN ROAD | KWAI–CHUNG N.T. HONG KONG |
| TK0488 | CURRAN COIL SPRING INC | 9265 SW 5TH | WILSONVILLE, OR 97070 |
| TK0588 | UNIVERSAL PRECISION PRODUCTS | 1775 NW 216TH | HILLSBORO OR 97123 |
| TK1163 | POLYCAST INC | 9898 SW TIGARD ST | TIGARD OR 97223 |
| TK1465 | BEAVERTON PARTS MFG CO | 1800 NW 216TH AVE | HILLSBORO OR 97124–6629 |
| TK2162 | DERBY MFG | 24350 STATE ROAD 23 SOUTH | SOUTH BEND IN 46614–9696 |
| TK2248 | WESTERN MICRO TECHNOLOGY | 1800 NW 169TH PL<br>SUITE B–300 | BEAVERTON OR 97006 |
| TK2338 | ACC MATERIALS | ED SNYDER<br>BLDG 38–302 | BEAVERTON OR 97077 |
| TK2376 | CONDUCTIVE RUBBER TECH | 22125 17TH AVE SE, SUITE 117 | BOTHELL, WA 98021 |
| TK2432 | UNION ELECTRIC | 15/F #1, FU–SHING N. ROAD | TAIPEI, TAIWAN ROC |
| TK2500 | SOLECTEK ACCESSORIES CORP | 6370 NANCY RIDGE DR<br>SUITE 109 | SAN DIEGO CA 92121 |
| TK2539 | ROYAL CASE CO INC | 315 SOUTH MONTGOMERY<br>PO BOX 2231 | SHERMAN TX 75091–2231 |
| TK2548 | XEROX BUSINESS SERVICES<br>DIV OF XEROX CORPORATION | 14181 SW MILLIKAN WAY | BEAVERTON OR 97077 |
| TK2597 | MERIX CORPORATION | 1521 POPLAR LANE | FOREST GROVE, OR 97116 |
| 03LB0 | SANDISK CORP | 140 CASPIAN COURT | SUNNYVALE, CA 94089 |
| 0JR05 | TRIQUEST CORP | 3000 LEWIS AND CLARK HWY | VANCOUVER WA 98661–2999 |
| 0J9P9 | GEROME MFG CO INC | PO BOX 737<br>403 NORTH MAIN | NEWBERG OR 97132 |
| 0KB01 | STAUFFER SUPPLY | 810 SE SHERMAN | PORTLAND OR 97214–4657 |
| 0KB05 | NORTH STAR NAMEPLATE | 5750 NE MOORE COURT | HILLSBORO OR 97124–6474 |
| 00779 | AMP INC | 2800 FULLING MILL<br>PO BOX 3608 | HARRISBURG PA 17105 |
| 060D9 | UNITREK CORPORATION | 3000 COLUMBIA HOUSE BLVD, SUITE 1<br>20 | VANCOUVER, WA 98661 |
| 07416 | NELSON NAME PLATE CO | 3191 CASITAS | LOS ANGELES CA 90039–2410 |
| 1DM20 | PARLEX CORPORATION<br>LAMINATED CABLE DIV | 7 INDUSTRIAL WAY | SALEM, NH 03079 |
| 1GM54 | ARTESYN TECHNOLOGIES | 7575 MARKET PLACE DR | EDEN PRAIRIE, MN 55344 |
| 1JJ96 | KAM ELECTRIC CO | 11866 SLATER AVE NE | KIRKLAND WA 98034 |
| 11536 | OPTICAL COATING LABORATORY INC | 2789 NORTHPOINT PARKWAY | SANTA ROSA, CA 95407 |
| 2W733 | COOPER INDUSTRIES INC<br>BELDEN DIVISION | 2200 US HIGHWAY 27 SOUTH<br>PO BOX 1980 | RICHMOND IN 47375–0010 |
| 22526 | BERG ELECTRONICS INC (DUPONT) | 857 OLD TRAIL RD | ETTERS PA 17319 |

## Manufacturers Cross Index (Cont.)

| Mfr. code | Manufacturer | Address | City, state, zip code |
|---|---|---|---|
| 24931 | BERG ELECTRONICS INC | RF/COAXIAL DIV<br>2100 EARLYWOOD DR<br>PO BOX 547 | FRANKLIN, IN 46131 |
| 30817 | INSTRUMENT SPECIALTIES CO INC | EXIT 53 RT 80<br>BOX A | DELAWARE WATER GAP PA 18327 |
| 34416 | PARSONS MFG CORP | 1055 OBRIAN DR | MENLO PARK CA 94025–1408 |
| 5Y400 | TRIAX METAL PRODUCTS INC<br>DIV OF BEAVERTON PARTS MFG CO | 1800 NW 216TH AVE | HILLSBORO OR 97124–6629 |
| 50356 | TEAC AMERICA INC | 7733 TELEGRAPH RD, PO BOX 750 | MONTEBELLO, CA 90640–6537 |
| 52152 | 3M COMPANY | INDUSTRIAL TAPE DIVISION<br>3M CENTER | ST PAUL, MN 55144–1000 |
| 53387 | 3M COMPANY<br>ELECTRONIC PRODUCTS DIV | 3M AUSTIN CENTER | AUSTIN TX 78769–2963 |
| 6D224 | HARBOR ELECTRONICS COMPANY | 14500 S BROADWAY | GARDENA, CA 90248 |
| 61857 | SAN–0 INDUSTRIAL CORP | 91–3 COLIN DRIVE | HOLBROOK NY 11741 |
| 61935 | SCHURTER INC | 1016 CLEGG COURT | PETALUMA CA 94952–1152 |
| 75915 | LITTELFUSE TRACOR INC<br>SUB OF TRACOR INC | 800 E NORTHWEST HWY | DES PLAINES IL 60016–3049 |
| 80009 | TEKTRONIX INC | 14150 SW KARL BRAUN DR<br>PO BOX 500 | BEAVERTON OR 97077–0001 |
| 97918 | LINEMASTER SWITCH CORP. | 29 PLAINE HILL ROAD<br>PO BOX 238 | WOODSTOCK, CT 06281–0238 |

## Replaceable Parts List

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| 10–1 | | | | | | | |
| –1 | 212–0189–00 | | | 4 | SCR,ASSEM WSHR:8–32 X 0.500,PNH,STL,CDPL,T–20 | 0KB01 | ORDER BY DESC |
| –2 | 200–3695–02 | | | 1 | COVER,REAR:REAR COSMETIC COVER | TK1163 | 200–3695–02 |
| | 334–9709–00 | B010100 | B039999 | 1 | MARKER,IDENT:REAR LABEL, SAFETY UL CSA CE | 0KB05 | 334–9709–00 |
| | 334–9918–00 | B040100 | | 1 | MARKER,IDENT:REAR LABEL, SAFETY UL CSA CE | 0KB05 | 334–9918–00 |
| | 334–9918–00 | | | 1 | MARKER,IDENT:REAR LABEL, SAFETY UL CSA CE,TDS694C | 0KB05 | 334–9918–00 |
| –3 | 161–0230–01 | | | 1 | CABLE ASSY,PWR,:3,18 AWG,92 L,SVT,TAN (STANDARD ACCESSORY) | TK2432 | ORDER BY DESC |
| –4 | 343–1213–00 | | | 1 | CLAMP,PWR CORD:POLYMIDE (STANDARD ACCESSORY) | TK1163 | ORDER BY DESC |
| –5 | 200–2264–00 | | | 1 | CAP,FUSEHOLDER:3AG FUSES (AMERICAN) | 61935 | FEK 031 1666 |
| | 200–2265–00 | | | 1 | CAP,FUSEHOLDER:5 X 20MM FUSES (EUROPEAN) | 61935 | FEK 031.1663 |
| –6 | 159–0013–00 | | | 1 | FUSE,CARTRIDGE:3AG,6A,250V,FAST BLOW (AMERICAN) | 75915 | 312006 |
| | 159–0210–00 | | | 1 | FUSE,CART:DIN 5 X 20MM,5AMP,250VSLOW (EUROPEAN) | 61857 | ET 5 AMP |
| –7 | 650–3595–01 | B010100 | B039999 | 1 | CABINET ASSY:TDS500D,TDS724D, 754D, 784D | 0J9P9 | 650–3595–01 |
| | | B010100 | B019999 | 1 | CABINET ASSY:TDS714L | 0J9P9 | 650–3595–01 |
| | | | | 1 | CABINET ASSY:TDS600C (EXCEPT 694C), TDS794D, TLS216, TDS820 | 0J9P9 | 650–3595–01 |
| | 437–0485–00 | B040100 | | 1 | CABINET ASSY:TDS500D,TDS724D, 754D, 784D | 0J9P9 | 437–0485–00 |
| | | B020100 | | 1 | CABINET ASSY:TDS714L | 0J9P9 | 437–0485–00 |
| | | | | 1 | CABINET ASSY:TDS694C | 0J9P9 | 437–0485–00 |
| –8 | 367–0247–01 | | | 1 | HANDLE,CARRYING:11.54 L,W/CLIP | 80009 | 367–0247–01 |
| –9 | 200–2191–00 | | | 2 | CAP,RETAINER:PLASTIC | 0JR05 | ORDER BY DESC |
| –10 | 437–0465–00 | B010100 | B039999 | 1 | CABINET,SCOPE:TDS500D,TDS724D, 754D, 784D (Opt. 1R) | 80009 | 437–0465–00 |
| | | B010100 | B019999 | 1 | CABINET,SCOPE:TDS714L (Opt. 1R) | 80009 | 437–0465–00 |
| | | | | 1 | CABINET,SCOPE:TDS600C (EXCEPT 694C), TDS794D, TLS216, TDS820 (Opt. 1R) | 80009 | 437–0465–00 |
| | 390–1197–00 | B040100 | | 1 | CABINET,SCOPE:TDS500D,TDS724D, 754D, 784D (Opt. 1R) | 80009 | 390–1197–00 |
| | | B020100 | | 1 | CABINET,SCOPE:TDS714L (Opt. 1R) | 80009 | 390–1197–00 |
| | | | | 1 | CABINET,SCOPE:TDS694C (Opt. 1R) | 80009 | 390–1197–00 |
| –11 | 348–1110–04 | | | 4 | FOOT,CABINET: | 80009 | 348–1110–04 |
| –12 | 348–1254–01 | | | 4 | PAD,FOOT:TEK BLACK,SANTOPRENE | 80009 | 348–1254–01 |
| –13 | 348–0875–00 | | | 1 | FLIPSTAND,CAB.: | TK0488 | ORDER BY DESC |
| –14 | 348–1109–01 | | | 2 | GASKET,SHIELD:348–1109–00 CUT 45.0 L | 80009 | 348–1109–01 |
| –15 | 200–3696–01 | | | 1 | COVER,FRONT:PLASTIC (STANDARD ACCESSORY) | 80009 | 200–3696–01 |
| –16 | 101–0142–00 | | | 1 | TRIM,DECORATIVE:FRONT | TK1163 | ORDER BY DESC |
| | 101–0142–01 | | | 1 | TRIM,DECORATIVE:FRONT (for use in Opt. 1R, rackmount instruments) | TK1163 | ORDER BY DESC |
| –17 | 334–9659–00 | | | 1 | MARKER,IDENT:FRONT PANEL,500MHZ,2GS/S,TDS520D | 0KB05 | 334–9659–00 |

## Replaceable Parts List (Cont.)

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| | 334–9660–00 | | | 1 | MARKER,IDENT:FRONT PANEL,500MHZ,2GS/S,TDS540D | 0KB05 | 334–9660–00 |
| | 334–9661–00 | | | 1 | MARKER,IDENT:FRONT PANEL,500MHZ,1GS/S,TDS540D OPT.1G | 0KB05 | 334–9661–00 |
| | 334–9832–00 | | | 1 | MARKER, IDENT:FRONT LABEL, TDS654C | 80009 | 334–9832–00 |
| | 334–9833–00 | | | 1 | MARKER, IDENT:FRONT LABEL, TDS680C | 80009 | 334–9833–00 |
| | 334–9834–00 | | | 1 | MARKER, IDENT:FRONT LABEL, TDS684C | 80009 | 334–9834–00 |
| | 334–9916–00 | | | 1 | MARKER, IDENT:FRONT LABEL, TDS694C | 0KB05 | 334–9916–00 |
| | 335–0099–00 | | | 1 | MARKER,IDENT:FRONT PANEL,500MHZ,500MS/S,TDS714L | 0KB05 | 335–0099–00 |
| | 334–9708–00 | | | 1 | MARKER,IDENT:FRONT PANEL,500MHZ,2GS/S,TDS724D | 0KB05 | 334–9708–00 |
| 2118 | 334–9663–00 | | | 1 | MARKER,IDENT:FRONT PANEL,500MHZ,2GS/S,TDS754D | 0KB05 | 334–9663–00 |
| | 334–9664–00 | | | 1 | MARKER,IDENT:FRONT PANEL,500MHZ,1GS/S,TDS754D OPT.1G | 0KB05 | 334–9664–00 |
| | 334–9665–00 | | | 1 | MARKER,IDENT:FRONT PANEL,1GHZ,4GS/S,TDS784D | 0KB05 | 334–9665–00 |
| | 334–9666–00 | | | 1 | MARKER,IDENT:MKD,FRONT PANEL,2GHZ,4GS/S,TDS794D | 0KB05 | 334–9666–00 |
| –18 | 214–4287–01 | B010100 | B032299 | 1 | ACTUATOR:ELASTOMER MAT,FRONT PANEL,RBR (TDS 500D) | TK0IK | ORDER BY DESC |
| | | | B020399 | | (TDS 654C, 680C, 684C) | | |
| | | | B031509 | | (TDS 694C) | | |
| | | | B010409 | | (TDS 714L, 724D) | | |
| | | | B033620 | | (TDS 754D, 784D) | | |
| | | | B031620 | | (TDS 794D) | | |
| | 260–2715–00 | B032300 | | | ACTUATOR:ELASTOMER MAT,FRONT PANEL,RBR (TDS 500D) | TK2376 | 260–2715–00 |
| | | B020400 | | | (TDS 654C, 680C, 684C) | | |
| | | B031510 | | | (TDS 694C) | | |
| | | B010410 | | | (TDS 714L, 724D) | | |
| | | B033621 | | | (TDS 754D, 784D) | | |
| | | B031621 | | | (TDS 794D) | | |
| –19 | 366–2114–00 | | | 2 | KNOB:LARGE,DETENTED | TK1163 | ORDER BY DESC |
| –20 | 366–2111–00 | | | 3 | KNOB:SMALL,FLUTED | TK1163 | ORDER BY DESC |
| –21 | 650–2927–00 | | | 1 | REPLACEABLE AS:DISPLAY FRAME WITH FLEX | 80009 | 650–2927–00 |
| –22 | 386–5954–00 | | | 1 | PANEL,INPUT:PLASTIC,ATTENUATOR | 80009 | 386–5954–00 |
| | 386–7099–00 | | | 1 | PANEL,INPUT:PLASTIC,ATTENUATOR, TDS794D ONLY | 80009 | 386–7099–00 |
| | 386–5954–00 | | | 1 | PANEL,INPUT:PLASTIC,ATTENUATOR, TDS694C ONLY | 80009 | 386–5954–00 |
| –23 | 174–2288–00 | | | 1 | CA ASSY,PWR:18 AWG,3.5 L,RTANG,0.25 XRING TONGUE | 060D9 | 174–2288–00 |
| | 131–1688–00 | | | 1 | TERM,QIK DISC.:0.250 SPADE,STUD MT | 00779 | 42822–4 |
| –24 | 614–0935–02 | B010100 | B020376 | 1 | FNT PANEL ASSY:TDS654C, TDS684C, | 80009 | 614–0935–02 |
| | | B010100 | B010144 | | TDS714L | | |
| | 614–0971–00 | B020376 | | 1 | FNT PANEL ASSY:TDS654C, TDS684C, | 80009 | 614–0971–00 |
| | | B010144 | | | TDS714L | | |
| | 614–0936–02 | B010100 | B020203 | 1 | FNT PANEL ASSY:TDS680C | 80009 | 614–0936–00 |
| | 614–0972–00 | B020204 | | | | 80009 | 614–0972–00 |
| | 614–0967–01 | B010100 | B031503 | 1 | FNT PANEL ASSY:TDS694C | 80009 | 614–0967–00 |
| | 614–0995–00 | B031504 | | | | | |

## Replaceable Parts List (Cont.)

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| | 614–0952–02 | B010100<br>B010100 | B032117<br>B010409 | 1 | FNT PANEL ASSY:TDS520D,<br>TDS724D | 80009 | 614–0952–00 |
| | 614–0974–00 | B032118<br>B010410 | | | FNT PANEL ASSY:TDS520D,<br>TDS724D | 80009 | 614–0974–00 |
| | 614–0953–02 | B010100<br>B010100 | B032276<br>B033620 | 1 | FNT PANEL ASSY:TDS540D, TDS580D,<br>TDS754D, TDS784D | 80009 | 614–0953–00 |
| | 614–0975–00 | B032277<br>B033621 | | | FNT PANEL ASSY:TDS540D, TDS580D,<br>TDS754D, TDS784D | 80009 | 614–0975–00 |
| | 614–0954–02<br>614–0976–00 | B010100<br>B031621 | B031620 | 1 | FNT PANEL ASSY:TDS794D | 80009<br>80009 | 614–0954–00<br>614–0976–00 |
| –25 | 366–2170–00 | | | 1 | KNOB:DIMPLED GPK,1.7 DIA | TK1163 | ORDER BY DESC |

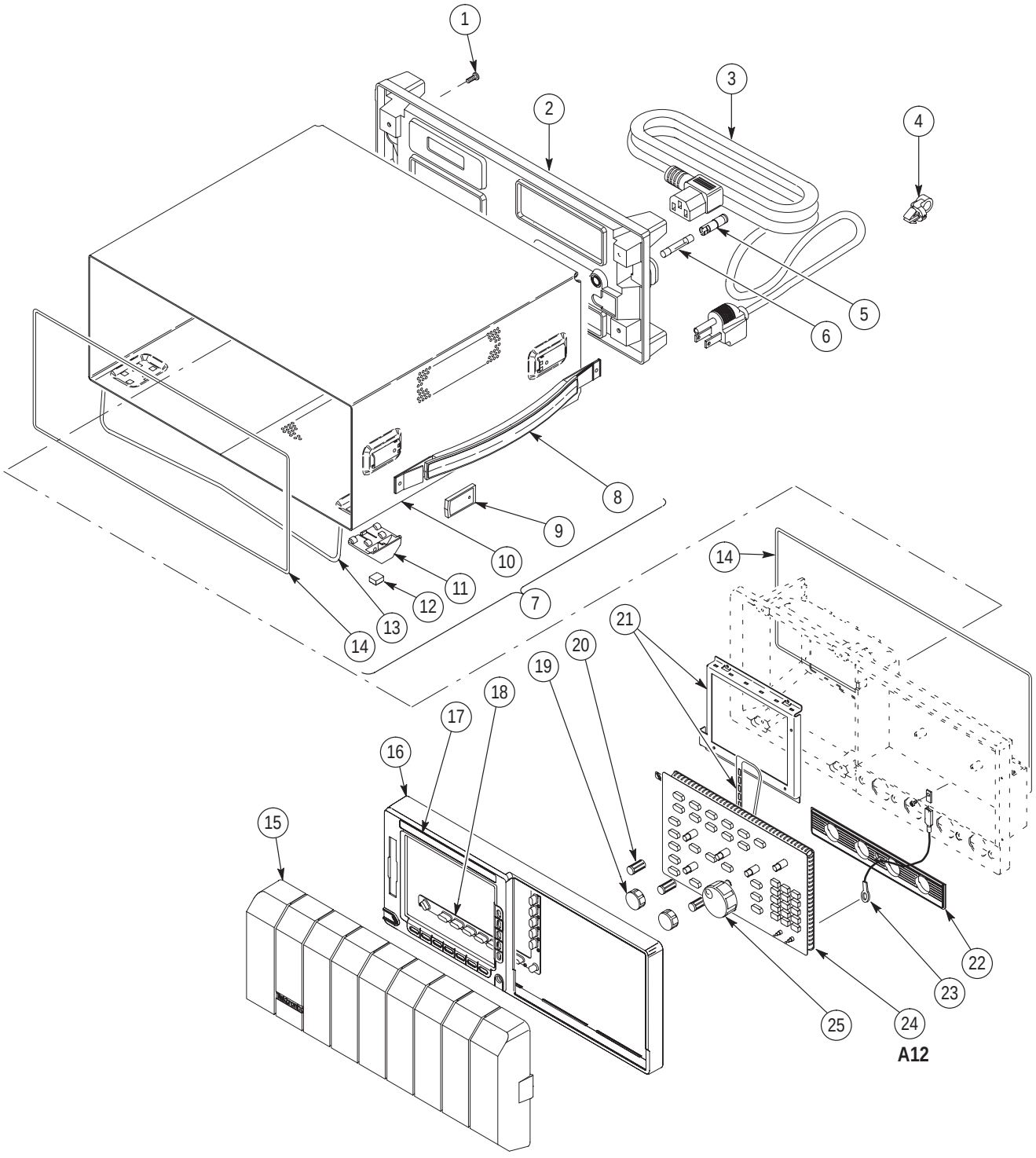



**Figure 10–1: External modules**

## Replaceable Parts List

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| 10–2 | | | | | | | |
| –1 | 212–0189–00 | | | 6 | SCR,ASSEM WSHR:8–32 X 0.500,PNH,STL,T–20 | 0KB01 | ORDER BY DESC |
| –2 | 119–5044–00 | | | 1 | FAN,DC:TUBEAXIAL;ASSY,24V,5W,1600 RPM | 5Y921 | JQ24F4V/031349 |
| | 174–2349–00 | | | 1 | CA ASSY:DISCRETE,LDI,2,22AWG,7.0L,1X2, | 060D9 | 174–2349–00 |
| –3 | 671–4172–00 | | | 1 | CIRCUIT BD ASSY:COLOR PROCESSOR DISPLAY A11 (TDS 654C, 684C, 714L, 724D, 754D, 784D, 794D) | 80009 | 671–4172–00 |
| | 671–4171–00 | | | 1 | CIRCUIT BD ASSY:MONO PROCESSOR DISPLAY A11 (TDS 520D, 540D, 580D, 680C) | 80009 | 671–4171–00 |
| –4 | 441–1902–01 | | | 1 | CHASSIS,SCOPE:REAR | 0J9P9 | ORDER BY DESC |
| | 650–4021–00 | | | 1 | CHASSIS,SCOPE:REAR:TDS694C | 0J9P9 | 650–4021–00 |
| –5 | 334–7966–02 | | | 1 | MARKER,IDENT:MKD W/CONN IDENT,REARBNC | 07416 | 334–7966–02 |
| | 334–9919–00 | | | 1 | MARKER,IDENT:MKD W/CONN IDENT,REARBNC, TDS694C | 0KB05 | 334–9919–00 |
| –6 | 131–1315–01 | | | 4 | CONN,RF JACK:BNC/PNL, 50 OHM, FEMALE | 24931 | 28JR306–1 |
| –7 | 679–2437–00 | | | 1 | CIRCUIT BD ASSY:RS232/CENTRONIC; (OPTION 13 ON TDS 520D, 540D, & 680C) | 80009 | 679–2437–00 |
| –8 | 407–3825–00 | | | 2 | BRACKET,CKT BD:PLASTIC,REAR | TK1163 | ORDER BY DESC |
| –9 | 386–6182–00 | | | 1 | PLATE,REAR:ALUMINUM,RS232/CENTRONIC (OPTION 13) | 0J9P9 | 386–6182–00 |
| | 386–5872–00 | | | | PLATE,REAR:STANDARD (WITHOUT OPTION 13) | | |
| –10 | 131–0890–01 | | | 2 | CONN,HARDWARE:DSUB,JACK SCREW (OPTION 13 ON TDS 520D, 540D, & 680C) | 00779 | 205818–2 |
| –11 | 348–1300–00 | | | 2 | SHLD,GSKT,ELEK:3.165 L,CLIP ON | 30817 | 0098–0564–09–03 |
| –12 | 211–0730–00 | | | 6 | SCR,ASSEM WSHR:6–32 X 0.375,PNH,STL,T–15 | 0KB01 | ORDER BY DESC |
| –13 | 344–0575–00 | B032300 | | 1 | PULL TAB:POLYESTER,DOUBLE SIDED ADHESIVE TAPE WITH LINER,34 POS (TDS 500D) | 53387 | 3490–3 |
| | | B020400 | | | (TDS 654C, 680C, 684C) | | |
| | | B031510 | | | (TDS 694C) | | |
| | | B010410 | | | (TDS 714L, 724D) | | |
| | | B033621 | | | (TDS 754D, 784D) | | |
| | | B031621 | | | (TDS 794D) | | |
| –14 | 650–3972–03 | B020100 | | 1 | HARD DRIVE,119–5949–00 FORMATTED (OPTIONAL) | 80009 | 650–3972–00 |
| –15 | 407–4697–00 | B032300 | | 1 | BRACKET,SUPPORT:HARD DRIVE BASE FIXTURE,3.725L X 2.815W X 0.375H.0.025 AL (TDS 500D) | 0J9P9 | 407–4697–00 |
| | | B020400 | | | (TDS 654C, 680C, 684C) | | |
| | | B031510 | | | (TDS 694C) | | |
| | | B010410 | | | (TDS 714L, 724D) | | |
| | | B033621 | | | (TDS 754D, 784D) | | |
| | | B031621 | | | (TDS 794D) | | |
| –16 | 119–5901–00 | B010100 | B020099 | 1 | DISK DRIVE:PCMCIA (OPTIONAL) | 03LB0 | SDP–3B175–101 |
| –17 | 407–4486–00 | B010100 | B020099 | 1 | RETAINER BRACKET,PCMCIA BD (OPTIONAL) | 80009 | 407–4486–00 |
| | 407–4486–01 | B020100 | | | | | |
| –18 | 210–0457–00 | B020100 | | 4 | NUT,PL,ASSEM WA6 32X0.312,STL CD PL,W/LOCKWASHER (OPTIONAL) | 0KB01 | ORDER BY DESC |

## Replaceable Parts List (Cont.)

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| –19 | 610–0825–00 | B020100 | B032299 | 1 | CHASSIS ASSY:HD DRIVE:2BKTS,SPR,COVER (OPTIONAL) (TDS 500D) | 80009 | 610–0825–00 |
| | | | B020399 | | (TDS 654C, 680C, 684C) | | |
| | | | B031509 | | (TDS 694C) | | |
| | | | B010409 | | (TDS 714L, 724D) | | |
| | | | B033620 | | (TDS 754D, 784D) | | |
| | | | B031620 | | (TDS 794D) | | |
| –20 | 211–0461–00 | B020100 | B032299 | 4 | SCR,MACHINE M3X0.5X6MM,PNH,STL CD PL,T10 (OPTIONAL) (TDS 500D) | 0KB01 | 211–0461–00 |
| | | | B020399 | | (TDS 654C, 680C, 684C) | | |
| | | | B031509 | | (TDS 694C) | | |
| | | | B010409 | | (TDS 714L, 724D) | | |
| | | | B033620 | | (TDS 754D, 784D) | | |
| | | | B031620 | | (TDS 794D) | | |
| –21 | 671–2848–00 | | | 1 | CIRCUIT BD ASSY:D1 BUS A14 | 80009 | 671–2848–00 |
| –22 | 211–0730–00 | | | 7 | SCR,ASSEM WSHR:6–32 X 0.375,PNH,STL,T–15 | 0KB01 | ORDER BY DESC |
| –23 | 671–4165–01 | B010100 | B029999 | 1 | CIRCUIT BD ASSY:ACQUISITION SHORT (TDS 540D & 754D) | 80009 | 671–4165–00 |
| | 671–4166–02 | B010100 | B039999 | 1 | CIRCUIT BD ASSY:ACQUISITION LONG (TDS 540D & 754D) | 80009 | 671–4166–02 |
| | 671–4771–01 | B040100 | | 1 | CIRCUIT BD ASSY:ACQUISITION LONG (TDS 540D & 754D) | 80009 | 671–4771–01 |
| | 671–4493–01 | B010100 | B029999 | 1 | CIRCUIT BD ASSY:ACQ. SHORT (TDS 540D & 754D) OPT.1G | 80009 | 671–4493–01 |
| | 671–4492–02 | B010100 | B039999 | 1 | CIRCUIT BD ASSY:ACQ. LONG (TDS 540D & 754D) OPT.1G | 80009 | 671–4492–02 |
| | 671–4786–00 | B040100 | | 1 | CIRCUIT BD ASSY:ACQ. LONG (TDS 540D & 754D) OPT.1G | 80009 | 671–4786–00 |
| | 671–4167–00 | B010100 | B029999 | 1 | CIRCUIT BD ASSY:ACQUISITION SHORT (TDS 520D & 724D) | 80009 | 671–4167–00 |
| | 671–4168–02 | B010100 | B039999 | 1 | CIRCUIT BD ASSY:ACQUISITION LONG (TDS 520D & 724D) | 80009 | 671–4168–02 |
| | 671–4774–01 | B040100 | | 1 | CIRCUIT BD ASSY:ACQUISITION LONG (TDS 520D & 724D) | 80009 | 671–4774–01 |
| | 671–4709–01 | B010100 | B029999 | 1 | CIRCUIT BD:ACQUISITION (TDS 520D & 724D OPT.1G) | 80009 | 671–4709–01 |
| | 671–4779–02 | B010100 | B039999 | 1 | CIRCUIT BD:ACQUISITION (TDS 520D & 724D OPT.1G) | 80009 | 671–4779–02 |
| | 671–4788–00 | B040100 | | 1 | CIRCUIT BD:ACQUISITION (TDS 520D & 724D OPT.1G) | 80009 | 671–4788–00 |
| | 671–4515–00 | B010100 | B010108 | 1 | CIRCUIT BD:ACQUISITION (TDS 654C) | 80009 | 671–4515–00 |
| | 671–3314–04 | B010109 | B020295 | 1 | CIRCUIT BD:ACQUISITION (TDS 654C) | 80009 | 671–3314–04 |
| | 671–4515–01 | B020296 | B020328 | 1 | CIRCUIT BD:ACQUISITION (TDS 654C) | 80009 | 671–4515–01 |
| | 671–3314–04 | B020329 | | 1 | CIRCUIT BD:ACQUISITION (TDS 654C) | 80009 | 671–3314–04 |
| | 671–4534–00 | B010100 | B010108 | 1 | CIRCUIT BD:ACQUISITION (TDS 680C, 684C) A10 | 80009 | 671–4534–00 |
| | 671–3462–06 | B010109 | B020219 | 1 | CIRCUIT BD:ACQUISITION (TDS 680C) A10 | 80009 | 671–3462–06 |
| | 671–3462–06 | B010109 | B020405 | 1 | CIRCUIT BD:ACQUISITION (TDS 684C) A10 | 80009 | 671–3462–06 |
| | 671–4534–01 | B020220 | B020264 | 1 | CIRCUIT BD:ACQUISITION (TDS 680C) A10 | 80009 | 671–4534–01 |
| | 671–4534–01 | B020406 | B020443 | 1 | CIRCUIT BD:ACQUISITION (TDS 684C) A10 | 80009 | 671–4534–01 |
| | 671–3462–06 | B020265 | | 1 | CIRCUIT BD:ACQUISITION (TDS 680C) A10 | 80009 | 671–3462–06 |
| | 671–3462–06 | B020444 | | 1 | CIRCUIT BD:ACQUISITION (TDS 684C) A10 | 80009 | 671–3462–06 |
| | 671–4724–01 | | | 1 | CIRCUIT BD:ACQUISITION (TDS 694C) A10 | 80009 | 671–4724–01 |
| | 671–4163–02 | B010100 | B029999 | 1 | CIRCUIT BD ASSY:ACQUISITION SHORT (TDS 580D & 784D) | 80009 | 671–4163–02 |
| | 671–4164–02 | B010100 | B039999 | 1 | CIRCUIT BD ASSY:ACQUISITION LONG (TDS 580D & 784D) | 80009 | 671–4164–02 |
| | 671–4770–01 | B040100 | | 1 | CIRCUIT BD ASSY:ACQUISITION LONG (TDS 580D & 784D) | 80009 | 671–4770–01 |
| | 671–5087–00 | B010100 | B019999 | 1 | CIRCUIT BD ASSY:ACQUISITION (TDS 714L) | 80009 | 671–5087–00 |
| | 671–4772–01 | B020100 | | 1 | CIRCUIT BD ASSY:ACQUISITION (TDS 714L) | 80009 | 671–4772–01 |
| | 671–4161–00 | B010100 | B029999 | 1 | CIRCUIT BD ASSY:ACQUISITION SHORT (TDS 794D) | 80009 | 671–4161–00 |
| | 671–4162–01 | B010100 | | 1 | CIRCUIT BD ASSY:ACQUISITION LONG (TDS 794D) | 80009 | 671–4162–01 |
| –24 | 407–4666–00 | | | 1 | BRACKET,CRT:BNC MOUNTING,0.040 BRASS | 5Y400 | 407–4666–00 |
| –25 | 259–0101–02 | | | 1 | FLEX CIRCUIT:TEK PROBE INTERFACE | TK2597 | 259–0101–02 |
| –26 | 348–1422–00 | | | 1 | GASKET, RF, SHIELDING | 0J9P9 | 348–1422–00 |
| –27 | 131–1315–00 | | | 4 | CONN,RCPT,ELEC:BNC,FEMALE | 24931 | 28JR235–1 |
| –28 | 407–3878–00 | | | 6 | BRACKET,CKT BD:PLASTIC | TK1163 | ORDER BY DESC |

## Replaceable Parts List (Cont.)

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| –29 | 407–3877–00 | | | 2 | BRACKET,CKT BD:PLASTIC | TK1163 | ORDER BY DESC |
| –30 | 441–1901–03 | | | 1 | CHASSIS,SCOPE:TOP | 0J9P9 | ORDER BY DESC |
| | | | | | *ATTACHED PARTS* | | |
| | 407–3877–00 | | | 1 | BRACKET,CKT BD:PLASTIC | TK1163 | ORDER BY DESC |
| | 407–3878–00 | | | 1 | BRACKET,CKT BD:PLASTIC | TK1163 | ORDER BY DESC |
| –31 | 671–4050–00 | B010100 | B020099 | 1 | CIRCUIT BD ASSY:PCMCIA (OPTION HD) | 80009 | 671–4050–00 |
| | 671–4050–01 | B020100 | B032299 | 1 | CIRCUIT BD ASSY:(OPTION HD) (TDS 500D) | 80009 | 671–4050–01 |
| | | | B020399 | | (TDS 654C, 680C, 684C) | | |
| | | | B031509 | | (TDS 694C) | | |
| | | | B010409 | | (TDS 714L, 724D) | | |
| | | | B033620 | | (TDS 754D, 784D) | | |
| | | | B031620 | | (TDS 794D) | | |
| | | | | | *ATTACHED PART* | | |
| | 174–4179–00 | B020100 | B032299 | 1 | CA ASSY:44,28 AWG,7.0 L,Flat (TDS 500D) | 52152 | 174–4179–00 |
| | | | B020399 | | (TDS 654C, 680C, 684C) | | |
| | | | B031509 | | (TDS 694C) | | |
| | | | B010409 | | (TDS 714L, 724D) | | |
| | | | B033620 | | (TDS 754D, 784D) | | |
| | | | B031620 | | (TDS 794D) | | |
| | 671–4850–00 | B032300 | | 1 | CIRCUIT BD ASSY:HARD DRIVE OPTION, TESTED,389–2347–02 WIRED,TDS SERIES (TDS 500D) | 80009 | 671–4850–00 |
| | | B020400 | | | (TDS 654C, 680C, 684C) | | |
| | | B031510 | | | (TDS 694C) | | |
| | | B010410 | | | (TDS 714L, 724D) | | |
| | | B033621 | | | (TDS 754D, 784D) | | |
| | | B031621 | | | (TDS 794D) | | |
| –32 | 671–4095–00 | | | 1 | CIRCUIT BD ASSY:OPTION CONNECTOR BD | 80009 | 671–4095–00 |

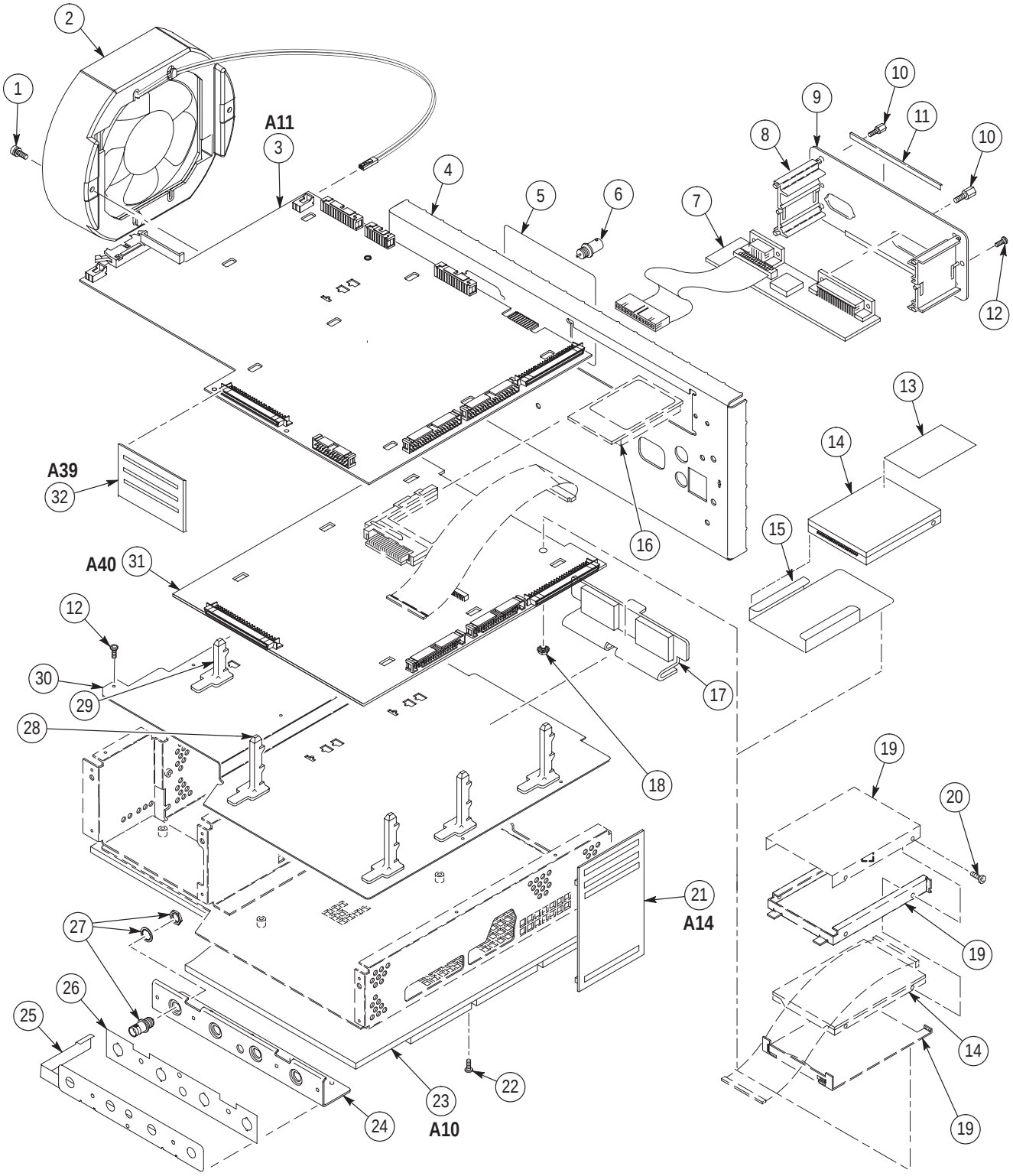



**Figure 10–2: Outer-chassis modules**

## Replaceable Parts List

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| 10–3 | | | | | | | |
| –1 | 640–0077–11 | | | 1 | DISPLAY MODULE:TDS FAMILY FULL COLOR<br>A30 (TDS 654C, 684C, 700D, & 714L ONLY) | 80009 | 640–0077–11 |
| | 640–0071–06 | | | 1 | DISPLAY,MONO:7 INCH<br>A20 (TDS 520B, 540B, & 680C ONLY) | 80009 | 640–0071–06 |
| | 378–0366–01 | | | 1 | FILTER,LT,CRT:6.525 X 5.225, ESP, EMC<br>(TDS 520B, 540B, & 680C ONLY) | 11536 | 378–0366–01 |
| | 386–6211–02 | | | 1 | RETAINER,FILTER:DUST SEAL ASSY,LEXAN<br>(TDS 520B, 540B, & 680C ONLY) | TK1163 | 386–6211–02 |
| –2 | 348–1300–00 | | | 2 | SHLD,GSKT,ELEK:3.165 L,CLIP ON | 30817 | 0098–0564–09–03 |
| –3 | 620–0063–05 | B010100 | B039999 | 1 | POWER SUPPLY:400W;5V 12A,5.1V 22A,15V 1,5A A16 | 1GM54 | 620–0063–05 |
| | 119–6040–00 | B040100 | | 1 | POWER SUPPLY: TDS500, 600, 724/754/784 | 1GM54 | 119–6040–00 |
| | 119–6040–00 | B020100 | | 1 | POWER SUPPLY: TDS714L | 1GM54 | 119–6040–00 |
| | 119–6040–00 | | | 1 | POWER SUPPLY: TDS694C | 1GM54 | 119–6040–00 |
| –4 | 441–2043–01 | B010100 | B039999 | 1 | CHASSIS,SCOPE:MAIN,0.05 ALUMINUM | 0J9P9 | 441–2043–01 |
| | 441–2169–00 | B040100 | | 1 | CHASSIS,SCOPE:MAIN,AL,TDS500, 724/754/784 | 0J9P9 | 441–2169–00 |
| | 441–2169–00 | B020100 | | 1 | CHASSIS,SCOPE:MAIN,AL, TDS714L | 0J9P9 | 441–2169–00 |
| | 441–2169–00 | | | 1 | CHASSIS,SCOPE:MAIN,AL, TDS694C | 0J9P9 | 441–2169–00 |
| –5 | 386–5871–01 | | | 1 | SUBPANEL,FRONT:FINISHED,ALUMINUM | 5Y400 | 386–5871–01 |

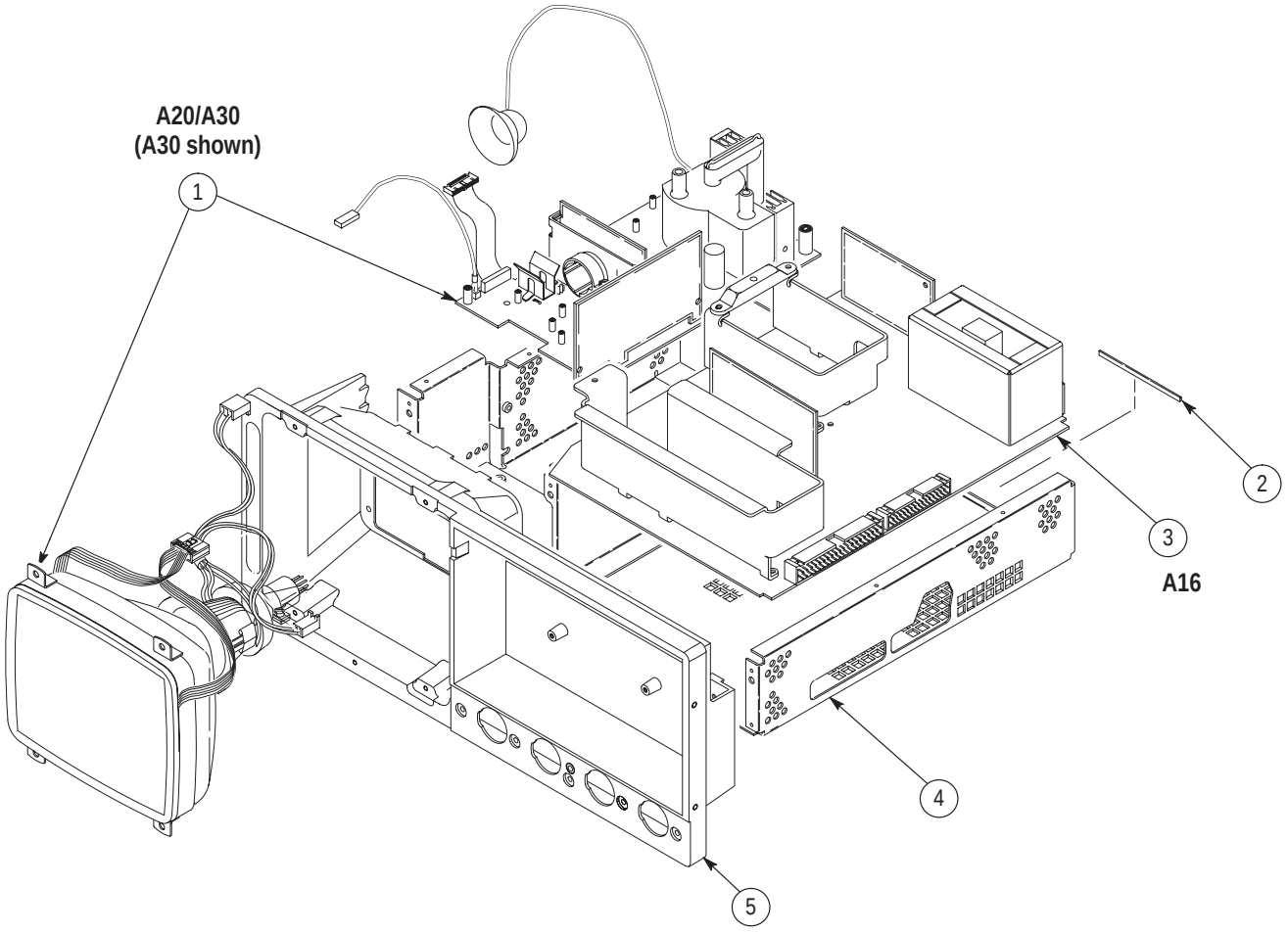



**Figure 10–3: Inner-chassis modules**

## Replaceable Parts List

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| 10–4 | | | | | | | |
| –1 | 174–2031–00 | | | 4 | CABLE ASSY,RF:50 OHM COAX,6.5 L,W/BLUE JKT<br>(A10J1000 MAIN TO TRIGGER OUTPUT)<br>(A10J1001 TO DELAYED TRIGGER OUTPUT) | TK2338 | 174–2031–00 |
| –2 | 174–4175–00 | | | 1 | CA ASSY, PWR:TW PAIR,20 AWG,26 L, (1 X 2,STR,) TDS 694C | 060D9 | 174–4175–00 |

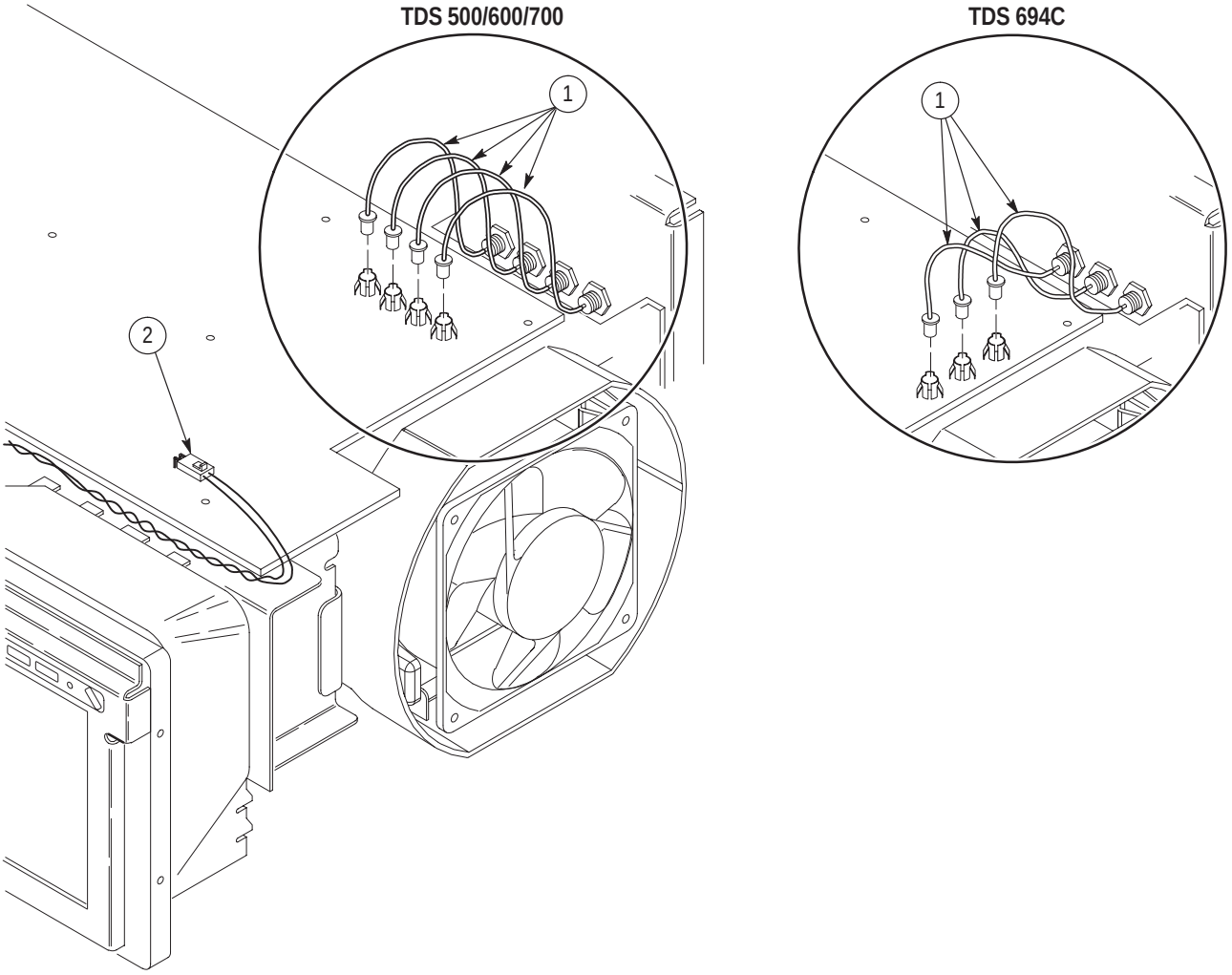



**Figure 10–4: Cables, bottom view**

## Replaceable Parts List

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| 10–5 | | | | | | | |
| –1 | 174–1525–00 | | | 1 | CA ASSY,SP,ELEC:2 X 8–13,28 AWG | 060D9 | ORDER BY DESC |
| –2 | 174–1524–01 | | | 1 | CA ASSY SP:RIBBON,GPIB;IDC,24,28 AWG,4.0L | 060D9 | ORDER BY DESC |
| | 129–1439–00 | | | 2 | SPACER,POST:0.17 L,4–40 BRS,0.25 RND (USE WITH 174–1524–XX ONLY) | TK0588 | ORDER BY DESC |
| –3 | 174–2975–00 | | | 1 | CA ASSY,SP:RIBBON,;CPR,16,28 AWG,4.0 L | 060D9 | ORDER BY DESC |
| | 131–0890–01 | | | 2 | CONN,HARDWARE:DSUB,JACK SCREW | 00779 | 205818–2 |
| –4 | 346–0266–00 | | | 1 | STRAP,CABLE:PLASTIC | 0KB05 | 346–0266–00 |
| –5 | 174–3736–00 | | | 1 | CA ASSY,SP,ELEC:50,28 AWG,5.85 L,FLAT | 53387 | 174–3736–00 |
| –6 | 174–3735–00 | | | 2 | CA ASSY,SP,ELEC:50,28 AWG,5.85 L,FLAT | 53387 | 174–3735–00 |
| –7 | 174–1728–00 | | | 1 | CA ASSY,SP:RIBBON, IDC,26,28 AWG,6.0 L | 53387 | ORDER BY DESC |
| | | | | | **OPTION 05 CABLES** | | |
| | 174–0655–00 | | | 1 | CABLE ASSY:COAX,RFP,50 OHM,9–2,22.4 L | 80009 | 174–0655–00 |
| | 174–3728–00 | | | 1 | CA ASSY,SP:RIBBON,OPTION 05 AND PCMCIA,IDC, 28 AWG,2X25,5.15L | 060D9 | 174–3728–00 |
| | 174–3729–00 | | | 1 | CA ASSY,SP:RIBBON, OPTION 05 AND PCMCIA, IDC,28AWG,2X20,5.15L | 060D9 | 174–3729–00 |

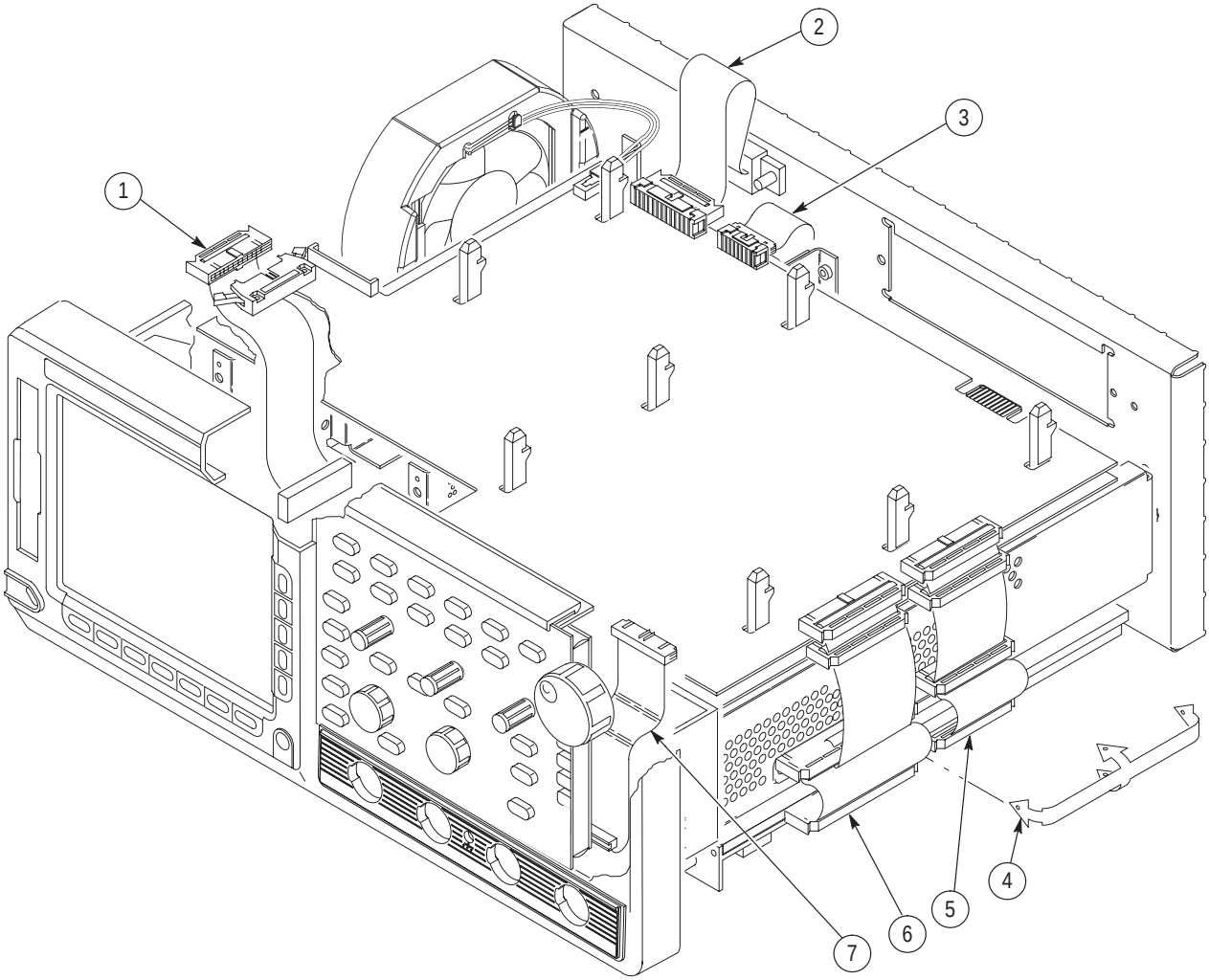



**Figure 10–5: Cables, top view**

## Replaceable Parts List

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| 10–6 | | | | | | | |
| –1 | 407–4460–01 | | | 1 | FDD NOISE SHIELD,DISK DRIVE TOP,0.014,80%NICKEL | OJ9P9 | ORDER BY DESC |
| –2 | 211–0840–00 | not present in all models | | 2 | SCREW,MACHINE:M2.6 X 0.45MM PITCH X 4.0 L | 0KB01 | .26C4MXPHY |
| | 211–0840–00 | not present in all models | | 1 | SCREW,MACHINE:M2.6 X 0.45MM PITCH X 4.0 L | 0KB01 | .26C4MXPHY |
| –3 | 211–0730–00 | | | 2 | SCR,ASSEM WSHR:6–32 X 0.375,PNH,STL | 0KB01 | ORDER BY DESC |
| –4 | 174–2964–00 | | | 1 | WIRE,ELECTRICAL:FLAT FLEX,JUMPER | 1DM20 | 1.00MM–26–7–B |
| –5 | 276–0849–00 | | | 1 | CORE,EM:EMI SUPPRESS,RBN CA | 1JJ96 | BFS 33.5 X 8 X |
| –6 | 407–4230–01 | | | 1 | BRKT,DISK DRIVE:ALUMINUM | 0J9P9 | 407–4230–01 |
| –7 | 337–3935–01 | | | 1 | SHLD,DISK DRIVE | 0JR05 | 337–3935–01 |
| –8 | 119–5677–01 | not present in all models | | 1 | DISK DRIVE:FLOPPY,3.5 INCH;2MB,0.5 INH DSDD | 50356 | FD–04HF–2300 |
| | 119–6106–01 | not present in all models | | 1 | DISK DRIVE:FLOPPY,3.5INCH,1.44 MB, 0.5 IN HIGH,GRAY BEZEL,DDDS,96 X 126 X 12.7MM,FD–05HF563 | TK2250 | FD–05HF–5630 |
| | 950–4827–00 | | | 1 | SCREW PHIL M 2.5 X 8 CSK | OKB01 | 950–4827–00 |
| –9 | 105–1081–00 | not present in all models | | 1 | ADAPTER:FLOPPY DISK DRIVE BRACKET ADAPTER | TK1163 | 105–1081–00 |
| –10 | 211–0866–00 | not present in all models | | 1 | 92451–25010,SCREW PHIL M2.5X10 PHIL PNH BRZN | 0KB01 | 211–0866–00 |

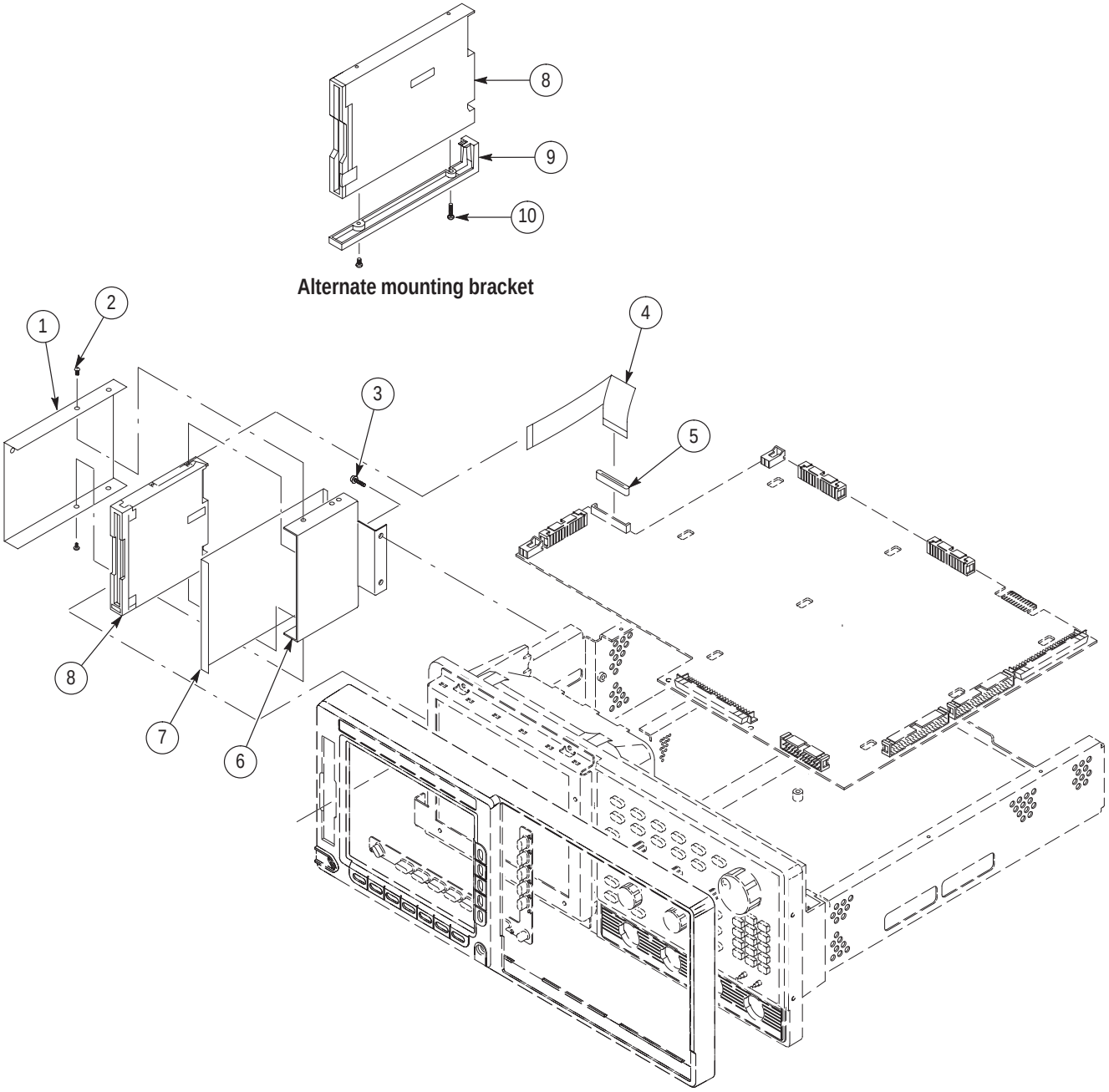



**Figure 10–6: Floppy disk drive**

## Replaceable Parts List

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| 10–7 | | | | | **STANDARD ACCESSORIES** | | |
| –1 | 161–0104–05 | | | 1 | CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 M (OPTION A3 – AUSTRALIAN) | S3109 | 198–010 |
| –2 | 161–0104–06 | | | 1 | CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 M (OPTION A1 – EUROPEAN) | S3109 | 198–010 |
| –3 | 161–0104–07 | | | 1 | CA ASSY,PWR:3,1.0MM SQ,240V/10A,2.5 M (OPTION A2 – UNITED KINGDOM) | S3109 | 209010 |
| –4 | 161–0104–08 | | | 1 | CA ASSY,PWR:3,18 AWG,250/10A,98 INCH L (OPTION A4 – NORTH AMERICAN) | 2W733 | ORDER BY DESC |
| –5 | 161–0167–00 | | | 1 | CA ASSY,PWR:3,0.75MM SQ,250V/10A,2.5 M (OPTION A5 – SWITZERLAND) | S3109 | ORDER BY DESC |
| | ———— | | | 1 | CABLE ASSY,PWER,:3,18 AWG,92 L (STANDARD CABLE – SEE FIG 10–1–3) | | |
| | 343–0170–00 | | | 1 | RTNR,CA TO CA:U/W 0.25 OD CABLES (OPTIONS A1,A2,A3,A4,A5) | 0JR05 | ORDER BY DESC |
| | ———— | | | 1 | CLAMP,PWER CORD:POLYMIDE (SEE FIGURE 10–1–4) | | |
| | 006–3415–04 | | | 1 | STRAP,WRIST:3M TYPE 2214,ADJ.,6 FT COILED CORD (TDS794D ONLY) | TK0623 | 400 1829 |
| | 200–0678–00 | | | 1 | COVER,ELEC CONN:BNC,COVER,MALE,STR,W/O INSERT,NON–SHORTING (TDS794D ONLY) | 91836 | KC89–58,TR–5 |
| | 063–3060–xx | | | 1 | MANUAL,TECH:PROGRAMMER HELP DISK TDS694C | 80009 | 063–3060–xx |
| | 063–3120–xx | | | 1 | MANUAL,TECH:PROGRAMMER HELP DISK | 80009 | 063–3120–xx |
| | 071–0473–xx | | | 1 | MANUAL,TECH:USERS TDS694C | 80009 | 071–0473–xx |
| | 071–0130–xx | | | 1 | MANUAL,TECH:USERS | 80009 | 071–0130–xx |
| | 071–0134–xx | | | 1 | MANUAL,TECH:USERS, (OPT. L5,JAPANESE) | 80009 | 071–0134–xx |
| | 071–0131–xx | | | 1 | MANUAL,TECH:USERS, (OPT. L1,FRENCH) | 80009 | 071–0131–xx |
| | 071–0132–xx | | | 1 | MANUAL,TECH:USERS, (OPT. L3,GERMAN) | 80009 | 071–0132–xx |
| | 071–0133–xx | | | 1 | MANUAL,TECH:USERS(OPT. L9,KOREAN) | 80009 | 071–0133–xx |
| | 071–0630–xx | | | 1 | MANUAL,TECH:PERF VERIF | 80009 | 071–0630–xx |
| | 020–2235–xx | | | 1 | MANUAL,TECH:REFERENCE SET | 80009 | 020–2235–xx |
| | 071–0273–xx | | | 1 | MANUAL,TECH:SUPPLEMENT (TDS 600C) | TK2548 | 020–0273–xx |
| | 071–0628–xx | | | 1 | MANUAL,TECH:SUPPLEMENT (TDS 714L) | TK2548 | 020–0628–xx |
| | ———— | | | 1 | COVER,FRONT:PLASTIC (SEE FIG 10–1–14) | | |
| | 016–1268–00 | | | 1 | POUCH, ACCESSORY | TK2539 | 2122 |
| | 063–2028–00 | | | 1 | DATA SHEET:INSTALLING THE ACCESSORY POUCH INSTRUCTION,TDS/TLS FAMILIES,DP | TK2548 | PER TEK P/N |

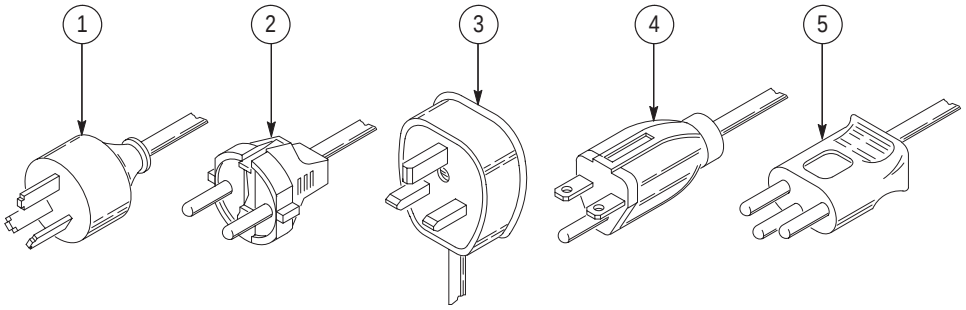



**Figure 10–7: Accessories**

## Replaceable Parts List

| Fig. & index number | Tektronix part number | Serial no. effective | Serial no. discont'd | Qty | Name & description | Mfr. code | Mfr. part number |
|---|---|---|---|---|---|---|---|
| | | | | | **OPTIONAL ACCESSORIES** | | |
| | 003–1457–01 | | | 1 | BIT,TORX DRIVER:MODIFY THE T–20 | TK1465 | 003–1457–01 |
| | 012–0991–00 | | | 1 | CABLE,INTCON:SHLD CMPST,GPIB | 22526 | 81190–020 |
| | 012–0991–01 | | | 1 | CABLE,GPIB:LOW EMI,1 METER | 00779 | 553577–2 |
| | 012–1214–00 | | | 1 | CABLE,INTCON:SHLD CMPST,IBM TO PRINTER | 6D224 | 2206 |
| | 012–1298–00 | | | 1 | CABLE,INTCON:RS232C DB25M–DB9F SERIAL | TK2500 | C294–9 |
| | 012–1388–00 | | | 1 | CABLE ASSEMBLY:OSCILLOSCOPE SECURITY | 80009 | 012–1388–00 |
| | 016–0909–01 | | | 1 | CASE,CARRYING:SOFTSIDED FOR 3002C | TK2162 | 0587 |
| | 016–1135–00 | | | 1 | CASE,CARRYING:26 X 22 X 15,HARD TRANSFER | 34416 | 2622RW–7T–7B |
| | 016–1145–00 | | | 1 | HOOD ASSEMBLY:TDS SERIES | 80009 | 016–1145–00 |
| | 016–0099–00 | | | 1 | HDW KIT,ELEK EQ:RACKMOUNTING HDW | 80009 | 016–0099–00 |
| | 071–0627–xx | | | 1 | MANUAL,TECH:SERVICE | 80009 | 071–0627–xx |
| | 070–8432–xx | | | 1 | MANUAL,TECH:INSTR,TDS FAMILY RACKMOUNT | TK2548 | 070–8432–xx |

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