Service Manual

Tektronix

TDS 684A, TDS 744A, & TDS 784A
Digitizing Oscilloscope

070-8992-03

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 the Safety Summary prior to performing service.

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

Fourth Edition: January 1995
Copyright © Tektronix, Inc. 1994, 1995. All rights reserved.

Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supercedes that in all previously published material. Specifications and price change privileges reserved.

Printed in the U.S.A.

Tektronix, Inc., P.O. Box 1000, Wilsonville, OR 97070–1000

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

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

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

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THIS PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.
## Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Safety Summary</td>
<td>ix</td>
</tr>
<tr>
<td>Service Safety Summary</td>
<td>xiii</td>
</tr>
<tr>
<td>Preface</td>
<td>xv</td>
</tr>
<tr>
<td>Introduction</td>
<td>xix</td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Product Description</td>
<td>1–1</td>
</tr>
<tr>
<td>User Interface</td>
<td>1–2</td>
</tr>
<tr>
<td>Signal Acquisition System</td>
<td>1–2</td>
</tr>
<tr>
<td>Horizontal System</td>
<td>1–3</td>
</tr>
<tr>
<td>Trigger System</td>
<td>1–4</td>
</tr>
<tr>
<td>Acquisition Control</td>
<td>1–4</td>
</tr>
<tr>
<td>On-Board User Assistance</td>
<td>1–5</td>
</tr>
<tr>
<td>Measurement Assistance</td>
<td>1–5</td>
</tr>
<tr>
<td>Storage</td>
<td>1–6</td>
</tr>
<tr>
<td>I/O</td>
<td>1–6</td>
</tr>
<tr>
<td>Display</td>
<td>1–7</td>
</tr>
<tr>
<td>Nominal Traits</td>
<td>1–9</td>
</tr>
<tr>
<td>Warranted Characteristics</td>
<td>1–15</td>
</tr>
<tr>
<td>Typical Characteristics</td>
<td>1–21</td>
</tr>
<tr>
<td><strong>Operational Information</strong></td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td>2–1</td>
</tr>
<tr>
<td>Supplying Operating Power</td>
<td>2–1</td>
</tr>
<tr>
<td>Operating Environment</td>
<td>2–3</td>
</tr>
<tr>
<td>Applying and Interrupting Power</td>
<td>2–3</td>
</tr>
<tr>
<td>Repackaging Instructions</td>
<td>2–4</td>
</tr>
<tr>
<td>Installed Options</td>
<td>2–5</td>
</tr>
<tr>
<td>Operating Instructions</td>
<td>2–7</td>
</tr>
<tr>
<td>Screen Layout</td>
<td>2–7</td>
</tr>
<tr>
<td>Basic Procedures</td>
<td>2–7</td>
</tr>
<tr>
<td><strong>Theory of Operation</strong></td>
<td></td>
</tr>
<tr>
<td>Logic Conventions</td>
<td>3–1</td>
</tr>
<tr>
<td>Module Overview</td>
<td>3–1</td>
</tr>
<tr>
<td><strong>Performance Verification</strong></td>
<td></td>
</tr>
<tr>
<td>Performance Verification Procedures</td>
<td>4–1</td>
</tr>
<tr>
<td>Conventions</td>
<td>4–2</td>
</tr>
<tr>
<td>Brief Procedures</td>
<td>4–5</td>
</tr>
<tr>
<td>Self Tests</td>
<td>4–5</td>
</tr>
<tr>
<td>Functional Tests</td>
<td>4–7</td>
</tr>
</tbody>
</table>
## Table of Contents

### Performance Tests
- Prerequisites .......................................................... 4–15
- Equipment Required ...................................................... 4–16
- TDS 684A Test Record .................................................... 4–19
- TDS 7XXA Test Record ................................................... 4–23
- Signal Acquisition System Checks .................................... 4–27
- Time Base System Checks ............................................. 4–42
- Trigger System Checks .................................................. 4–44
- Output Signal Checks .................................................... 4–57
- Option 05 Video Trigger Checks ...................................... 4–65

### Adjustment Procedures
- Requirements for Performance ........................................ 5–1
- Usage ............................................................................. 5–2
- Equipment Required ...................................................... 5–5
- Adjustment Instructions .................................................. 5–7
- Probe Adjustment for the P6139A Probe ............................ 5–10
- Display Assembly Adjustment ......................................... 5–21

### Maintenance
- Related Maintenance Procedures ..................................... 6–1
- Preparation ..................................................................... 6–2
- Inspection and Cleaning .................................................. 6–4
- Removal and Installation Procedures ............................... 6–9
- Preparation — Please Read ............................................. 6–9
- Access Procedure .......................................................... 6–15
- Procedures for External Modules ..................................... 6–16
- Procedures for Outer-Chassis Modules ............................. 6–29
- Procedures for Inner-Chassis Modules .............................. 6–46
- Disassembly for Cleaning ............................................... 6–53
- Troubleshooting ............................................................. 6–57
- Diagnostics .................................................................... 6–57
- Firmware Updates .......................................................... 6–58

### Options
- Electrical Parts List
- Diagrams
- Mechanical Parts List
List of Figures

Figure 2–1: Map of Display Functions ................................. 2–8
Figure 4–1: Map of Display Functions ................................. 4–3
Figure 4–2: Verifying Adjustments and Signal-Path Compensation . 4–6
Figure 4–3: Universal Test Hookup for Functional Tests .......... 4–8
Figure 4–4: Measurement of DC Offset Accuracy at Zero Setting ... 4–29
Figure 4–5: Initial Test Hookup ........................................... 4–30
Figure 4–6: Measurement of DC Accuracy at Maximum Offset
   and Position .......................................................... 4–32
Figure 4–7: Initial Test Hookup ........................................... 4–34
Figure 4–8: Measurement of Analog Bandwidth .................... 4–36
Figure 4–9: Initial Test Hookup ........................................... 4–38
Figure 4–10: Measurement of Channel Delay – TDS 684A Shown .. 4–40
Figure 4–11: Initial Test Hookup ........................................... 4–42
Figure 4–12: Measurement of Accuracy
   — Long-Term and Delay Time ..................................... 4–44
Figure 4–13: Initial Test Hookup ........................................... 4–45
Figure 4–14: Measurement of Time Accuracy for Pulse and
   Glitch Triggering ..................................................... 4–47
Figure 4–15: Initial Test Hookup ........................................... 4–48
Figure 4–16: Measurement of Trigger-Level Accuracy ............ 4–50
Figure 4–17: Initial Test Hookup ........................................... 4–53
Figure 4–18: Measurement of Trigger Sensitivity
   — 50 MHz Results Shown on a TDS 684A Screen .............. 4–54
Figure 4–19: Initial Test Hookup ........................................... 4–57
Figure 4–20: Measurement of Main Trigger Out Limits .......... 4–59
Figure 4–21: Initial Test Hookup ........................................... 4–61
Figure 4–22: Measurement of Probe Compensator Frequency ... 4–62
Figure 4–23: Subsequent Test Hookup ................................. 4–63
Figure 4–24: Measurement of Probe Compensator Amplitude ... 4–64
Figure 4–25: Jitter Test Hookup ........................................... 4–66
Figure 4–26: Jitter Test Displayed Waveform – TDS 684A Shown .. 4–67
Figure 4–27: Jitter Test When Completed – TDS 684A Shown .... 4–68
Figure 4–28: Triggered Signal Range Test – 300 mV ............... 4–70
Figure 4–29: Triggered Signal Range Test – 75 mV ............... 4–71
Figure 4–30: 60 Hz Rejection Test Hookup .......................... 4–72
| Figure 6–16: A11 Processor/Display Removal                                      | 6–37 |
| Figure 6–17: Board Bracket Removal                                           | 6–38 |
| Figure 6–18: A10 Acquisition Board Removal                                   | 6–41 |
| Figure 6–19: Floppy Disk Removal                                             | 6–43 |
| Figure 6–20: Rear Chassis Removal                                            | 6–45 |
| Figure 6–21: A16 Low Voltage Power Supply Removal                           | 6–47 |
| Figure 6–22: Display Assembly Removal                                        | 6–49 |
| Figure 6–23: Display Driver Board Removal                                    | 6–50 |
| Figure 6–24: Front Subpanel Removal                                          | 6–52 |
| Figure 6–25: Accessing the Protection Switch                                 | 6–58 |
| Figure 6–26: Primary Troubleshooting Procedure                              | 6–59 |
| Figure 6–27: Module Isolation Troubleshooting Procedure                     | 6–61 |
| Figure 6–28: A16 Low Voltage Power Supply Module Isolation                  | 6–62 |
| Troubleshooting Procedure                                                    |       |
| Figure 6–29: Power Supply Voltage Measurement Locations                      | 6–63 |
| Figure 6–30: Color Display Troubleshooting Procedure                         | 6–64 |
| Figure 6–31: Horizontal and Vertical Sync Signals – Color Display            | 6–65 |
| Figure 6–32: A Video Signal with White, Black, and Blanking Levels – Color Display | 6–65 |
| Figure 6–33: Processor/Acquisition Troubleshooting Procedure                 | 6–66 |
| Figure 6–34: Processor/Front Panel Troubleshooting Procedure                | 6–67 |
| Figure 6–35: Attenuator/Acquisition Troubleshooting Procedure                | 6–68 |
| Figure 6–36: A11 DRAM Processor/Display Module (View of Right Side)         | 6–70 |
| Figure 6–37: A11 DRAM Processor/Display Module (View of Upper Left Corner)  | 6–71 |
| Figure 6–38: A11 DRAM Processor/Display Module (View of Lower Left Corner)  | 6–71 |
| Figure 6–39: A10 Acquisition Module (View of Lower Right Corner)            | 6–72 |
| Figure 9–1: Interconnections                                                | 9–2  |
| Figure 9–2: Block Diagram                                                    | 9–4  |
| Figure 10–1: External Modules                                               | 10–7 |
| Figure 10–2: Outer-Chassis Modules                                          | 10–9 |
| Figure 10–3: Inner-Chassis Modules                                          | 10–10|
| Figure 10–4: Cables, Bottom View                                            | 10–11|
| Figure 10–5: Cables, Top View                                               | 10–13|
| Figure 10–6: Floppy Disk                                                    | 10–15|
| Figure 10–7: Accessories                                                    | 10–16|
List of Tables

Table 1–1: Key Features of the TDS 684A and 7XXA Oscilloscopes .......................... 1–1
Table 1–2: Record Length vs. Divisions per Record, Samples per Division and Sec/Div Sequence .............................................................. 1–3
Table 1–3: Nominal Traits — Signal Acquisition System .......................... 1–9
Table 1–4: Nominal Traits — Time Base System .......................... 1–10
Table 1–5: Nominal Traits — Triggering System .......................... 1–10
Table 1–6: Nominal Traits — Display System .......................... 1–11
Table 1–7: Nominal Traits — GPIB Interface, Output Ports, and Power Fuse .......................... 1–12
Table 1–8: Nominal Traits — Data Handling and Reliability .......................... 1–12
Table 1–9: Nominal Traits — Mechanical .......................................................... 1–13
Table 1–10: Warranted Characteristics — Signal Acquisition System .................. 1–16
Table 1–11: Warranted Characteristics — Time Base System .......................... 1–17
Table 1–12: Warranted Characteristics — Triggering System .......................... 1–18
Table 1–13: Warranted Characteristics — Output Ports, Probe Compensator, and Power Requirements .............................................................. 1–18
Table 1–14: Warranted Characteristics — Environmental .................................. 1–19
Table 1–15: Typical Characteristics — Signal Acquisition System .................. 1–21
Table 1–16: Typical Characteristics — Triggering System .......................... 1–23
Table 2–1: Power-Cord Conductor Identification .............................................. 2–2
Table 2–2: Power Cord Identification .............................................................. 2–2
Table 2–3: Effects of Corrupted Data .............................................................. 2–4
Table 4–1: Test Equipment .............................................................. 4–16
Table 4–2: DC Offset Accuracy (Zero Setting) .............................................. 4–28
Table 4–3: DC Accuracy .............................................................. 4–31
Table 4–4: Analog Bandwidth .............................................................. 4–35
Table 5–1: Calibration Tests .............................................................. 5–3
Table 5–2: Adjustments Required for Module Replaced .................................. 5–4
Table 5–3: Adjustments and Dependencies .............................................. 5–4
Table 5–4: Test Equipment, Fixtures, and Supplies ...................................... 5–5
Table 5–5: GPIB Board Configuration .......................................................... 5–7
Table 6–1: Relative Susceptibility to Static-Discharge Damage ........................ 6–3
Table 6–2: External Inspection Check List .......................... 6–5
Table 6–3: Internal Inspection Check List .......................... 6–6
Table 6–4: Tools Required for Module Removal .................. 6–11
Table 6–5: Normal Supply Voltages (Measured on J26 and J27 on the A11 DRAM Processor/Display Module) ................. 6–63
Table 6–6: No-Load Supply Voltages (Measured on J5 and J6 on the A17 Main LV Power Supply Module) .................. 6–63
Table 7–1: Options ..................................................... 7–1
Table 7–2: Standard Accessories ..................................... 7–3
Table 7–3: Optional Accessories ..................................... 7–4
Table 7–4: Accessory Software ...................................... 7–5
General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

*Only qualified personnel should perform service procedures.*

**Injury Precautions**

<table>
<thead>
<tr>
<th>Precaution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Proper Power Cord</td>
<td>To avoid fire hazard, use only the power cord specified for this product.</td>
</tr>
<tr>
<td>Avoid Electric Overload</td>
<td>To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.</td>
</tr>
<tr>
<td>Ground the Product</td>
<td>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.</td>
</tr>
<tr>
<td>Do Not Operate Without Covers</td>
<td>To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.</td>
</tr>
<tr>
<td>Use Proper Fuse</td>
<td>To avoid fire hazard, use only the fuse type and rating specified for this product.</td>
</tr>
<tr>
<td>Do Not Operate in Wet/Damp Conditions</td>
<td>To avoid electric shock, do not operate this product in wet or damp conditions.</td>
</tr>
<tr>
<td>Do Not Operate in Explosive Atmosphere</td>
<td>To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.</td>
</tr>
<tr>
<td>Keep Probe Surface Clean</td>
<td>To avoid electric shock and erroneous readings, keep probe surface clean.</td>
</tr>
</tbody>
</table>

**Product Damage Precautions**

<table>
<thead>
<tr>
<th>Precaution</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Proper Power Source</td>
<td>Do not operate this product from a power source that applies more than the voltage specified.</td>
</tr>
</tbody>
</table>
Use Proper Voltage Setting
Before applying power, ensure that the line selector is in the proper position for the power source being used.

Provide Proper Ventilation
To prevent product overheating, provide proper ventilation.

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

Do Not Immerse in Liquids
Clean the probe using only a damp cloth. Refer to cleaning instructions.

Safety Terms and Symbols

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:

- **DANGER**: High Voltage
- **Protective Ground (Earth) Terminal**
- **ATTENTION**: Refer to Manual
- **Double Insulated**

Certifications and Compliances

**CSA Certified Power Cords**

CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.
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 main 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 684A and 7XXA Digitizing Oscilloscopes, as well as general information critical to safe and effective servicing of this oscilloscope.

Manual Structure

This manual is divided into sections, such as Specification 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.

- **Specification** contains a product description of the TDS 684A and 7XXA Digitizing 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 Digitizing Oscilloscopes are found in this section.

- **Theory of Operation** contains circuit descriptions that support general service and fault isolation down to the module level.

- **Performance Verification** contains a collection of procedures for confirming that these Digitizing Oscilloscopes function properly and meet warranted limits.

- **Adjustment Procedures** contains a collection of procedures for adjusting these Digitizing Oscilloscopes to meet warranted limits.

- **Maintenance** contains information and procedures for doing preventive and corrective maintenance of these Digitizing 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.
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 Digitizing 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.

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 684A and 7XXA Digitizing Oscilloscopes come with the following manuals:

TDS 684A, TDS 744A, & 784A User Manual (Tektronix part number 070-8991-XX) contains a tutorial to quickly show you how to operate the TDS 684A and 7XXA Digitizing Oscilloscopes and an in depth discussion of how to more completely use their features. Applications are also discussed.

TDS 684A, TDS 744A, & TDS 784A Reference (Tektronix part number 070-8999-XX) contains a brief overview of oscilloscope operation.
TDS Family (400, 5XXA, 6XXA, and 7XXA) Programmer Manual (Tektronix part number 070-8709-XX) contains information for programmed operation via the GPIB interface. Included is the complete command set, setup information, and programming examples.

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 684A and 7XXA Digitizing 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 684A and 7XXA Digitizing 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 684A and 7XXA Digitizing Oscilloscopes to fit your requirements.
Option 9C. When you order the TDS 684A and 7XXA Digitizing Oscilloscopes with option 9C, each one is shipped with a Certificate of Calibration and Test Data Report. This certificate provides traceability to the National Institute of Standards and Technology (NIST). It certifies procedures used to calibrate the oscilloscope comply with U. S. Military Standard 45662A.

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 684A and 7XXA Digitizing 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
Tetronix 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 684A and 7XXA Digitizing Oscilloscopes. To prevent injury to yourself or damage to the oscilloscope, do the following tasks before you attempt service:

- Be sure you are a qualified service person.
- 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 heed all warnings, cautions, and notes.
Specifications

This section begins with a general description of the traits of the TDS 684A and 7XXA Digitizing Oscilloscopes. Three sections follow, one for each of three classes of traits: nominal traits, warranted characteristics, and typical characteristics.

Product Description

The TDS 684A and 7XXA Digitizing 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 the TDS 684A and 7XXA Oscilloscopes

<table>
<thead>
<tr>
<th>Feature</th>
<th>TDS 684A</th>
<th>TDS 7XXA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digitizing rate, maximum</td>
<td>5 GS/s on each channel simultaneously</td>
<td>TDS 744A: 2 GS/s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TDS 784A: 4 GS/s</td>
</tr>
<tr>
<td>Analog bandwidth</td>
<td>1 GHz</td>
<td>TDS 744A: 500 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TDS 784A: 1 GHz</td>
</tr>
<tr>
<td>Channels</td>
<td>Four, each with 8-bit resolution</td>
<td></td>
</tr>
<tr>
<td>Record lengths, maximum</td>
<td>15,000 samples</td>
<td>50,000 samples (500,000 with option 1M)</td>
</tr>
<tr>
<td>Acquisition modes</td>
<td>Sample, envelope, and average</td>
<td>Sample, envelope, average, high-resolution, and peak-detect</td>
</tr>
<tr>
<td>Trigger modes</td>
<td>Include: edge, logic, and pulse. Video trigger, with option 05, modes include: NTSC, SECAM, PAL, HDTV, and FlexFormat.</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>Color for distinguishing among waveforms, measurements, and associated text</td>
<td></td>
</tr>
<tr>
<td>Storage</td>
<td>1.44 Mbyte, 3.5 inch, DOS 3.3-or-later floppy disk. NVRAM storage for saving waveforms, hardcopies, and setups</td>
<td></td>
</tr>
<tr>
<td>I/O</td>
<td>Full GPIB programmability. Hardcopy output using GPIB, RS-232, or Centronics ports</td>
<td></td>
</tr>
</tbody>
</table>
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 four, full-featured vertical channels with calibrated vertical scale factors from 1 mV to 10 V per division. All channels can be acquired simultaneously.

Each of the full-featured channels can be displayed, vertically positioned, and offset, can have their bandwidth limited (250 MHz or 20 MHz) and their vertical coupling specified. 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. In other words, waveforms are compressed to fit on the screen. See Table 1–2.

**Table 1–2: Record Length vs. Divisions per Record, Samples per Division and Sec/Div Sequence**

<table>
<thead>
<tr>
<th>Record Length</th>
<th>Divisions per Record</th>
<th>Sample/Division (Sec/Div Sequence)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fit to Screen OFF</td>
<td>Fit to Screen ON</td>
</tr>
<tr>
<td></td>
<td>50 (1–2–5)</td>
<td>(Sample/Div &amp; Sec/Div Sequence varies)</td>
</tr>
<tr>
<td>500</td>
<td>10 divs</td>
<td>10 divs</td>
</tr>
<tr>
<td>1000</td>
<td>20 divs</td>
<td>10 divs</td>
</tr>
<tr>
<td>2500</td>
<td>50 divs</td>
<td>10 divs</td>
</tr>
<tr>
<td>5000</td>
<td>100 divs</td>
<td>10 divs</td>
</tr>
<tr>
<td>15000</td>
<td>300 divs</td>
<td>15 divs</td>
</tr>
<tr>
<td>50000 (TDS 7XXA only)</td>
<td>1,000 divs</td>
<td>10 divs</td>
</tr>
<tr>
<td>75000 (TDS 7XXA opt. 1M only)</td>
<td>1,500 divs</td>
<td>15 divs</td>
</tr>
<tr>
<td>100000 (TDS 7XXA opt. 1M only)</td>
<td>2,000 divs</td>
<td>10 divs</td>
</tr>
<tr>
<td>130000 (TDS 7XXA opt. 1M only)</td>
<td>2,600 divs</td>
<td>13 divs</td>
</tr>
<tr>
<td>250000 (TDS 7XXA opt. 1M only, 1 or 2 channels)</td>
<td>5,000 divs</td>
<td>10 divs</td>
</tr>
<tr>
<td>500000 (TDS 7XXA opt. 1M only, 1 channel)</td>
<td>10,000 divs</td>
<td>10 divs</td>
</tr>
</tbody>
</table>

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).
Specifications

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.

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 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.

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, and average modes to acquire signals. With the TDS 7XXA, also use high-resolution and peak-detect modes.

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 Digitizing 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 Digitizing 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 Digitizing 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 Digitizing 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 Digitizing Oscilloscope continues to acquire waveforms.

**Digital Signal Processing (DSP)**

An important component of the multiprocessor architecture of this Digitizing Oscilloscope is Tektronix’s 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 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 Digitizing 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 above. 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-232C, or Centronics interfaces.

Display

The TDS 684A and 7XXA Digitizing Oscilloscopes offer flexible display options. You can customize the following attributes of your display:

- Color: 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 with color coding
- 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)

Zoom

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.
This section contains a collection of tables that list the various nominal traits that describe the TDS 684A and 7XXA 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

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth Selections</td>
<td>20 MHz, 250 MHz, and FULL</td>
</tr>
<tr>
<td>Samplers, Number of</td>
<td>Four, simultaneous</td>
</tr>
<tr>
<td>Digitized Bits, Number of</td>
<td>8 bits&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Input Channels, Number of</td>
<td>Four</td>
</tr>
<tr>
<td>Input Coupling</td>
<td>DC, AC, or GND</td>
</tr>
<tr>
<td>Input Impedance Selections</td>
<td>1 MΩ or 50 Ω</td>
</tr>
<tr>
<td>Ranges, Offset</td>
<td>Volts/Div Setting</td>
</tr>
<tr>
<td></td>
<td>1 mV/div – 100 mV/div</td>
</tr>
<tr>
<td></td>
<td>101 mV/div – 1 V/div</td>
</tr>
<tr>
<td></td>
<td>1.01 V/div – 10 V/div</td>
</tr>
<tr>
<td>Range, Position</td>
<td>±5 divisions</td>
</tr>
<tr>
<td>Range, 1 MΩ Sensitivity</td>
<td>1 mV/div to 10 V/div</td>
</tr>
<tr>
<td>Range, 50 Ω Sensitivity</td>
<td>1 mV/div to 1 V/div</td>
</tr>
</tbody>
</table>

<sup>1</sup> 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.

<sup>2</sup> 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.
## Table 1–4: Nominal Traits — Time Base System

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
</table>
| Range, Sample-Rate¹,³ | TDS 684A: 5 Samples/sec to 5 GSamples/sec on four channels simultaneously  
TDS 744A: 5 Samples/sec to 2 GSamples/sec when acquiring 1 channel 
TDS 784A: 5 Samples/sec to 4 GSamples/sec when acquiring 1 channel  
TDS 784A: 5 Samples/sec to 1 GSamples/sec when acquiring 3 or 4 channels  
² The range of waveform rates for interpolated (or equivalent-time on the TDS 7XXA) 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. |
| Range, Interpolated Waveform Rate²,³ | TDS 684A: 10 GSamples/sec to 250 GSamples/sec  
TDS 744A: 1 GSamples/sec to 100 GSamples/sec  
TDS 784A: 2 GSamples/sec to 250 GSamples/sec |
| Range, Seconds/Division | TDS 684A: 0.2 ns/div to 10 s/div  
TDS 744A: 0.5 ns/div to 10 s/div  
TDS 784A: 0.2 ns/div to 10 s/div |
| Record Length Selection | 500 samples, 1000 samples, 2500 samples 5000 samples, 15000 samples  
The TDS 7XXA also offers: 50000 samples and, with its option 1M, 75000, 100000, 130000, 250000 (1 or 2 channels), or 500000 (1 channel) samples |

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

## Table 1–5: Nominal Traits — Triggering System

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range, Delayed Trigger Time Delay</td>
<td>16 ns to 250 s</td>
</tr>
</tbody>
</table>
| Range, Events Delay | TDS 684A: 2 to 10,000,000  
TDS 7XXA: 1 to 10,000,000 |
| Range (Time) for Pulse-Glitch, Pulse-Width, Time-Qualified Runt Triggering, or Slew Rate Trigger, Delta Time | 1 ns to 1 s |
Table 1–5: Nominal Traits — Triggering System (Cont.)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ranges, Setup and Hold for Time</strong>&lt;br&gt;<strong>Setup/Hold Violation Trigger</strong></td>
<td><strong>Feature</strong></td>
</tr>
<tr>
<td></td>
<td>Setup Time</td>
</tr>
<tr>
<td></td>
<td>Hold Time</td>
</tr>
<tr>
<td></td>
<td>Setup + Hold Time</td>
</tr>
<tr>
<td></td>
<td>For Setup Time, positive numbers mean a data transition before the clock edge and negative means a transition after the clock edge.</td>
</tr>
<tr>
<td></td>
<td>For Hold Time, positive numbers mean a data transition after the clock edge and negative means a transition before the clock edge.</td>
</tr>
<tr>
<td></td>
<td>Setup + Hold Time is the algebraic sum of the Setup Time and the Hold Time programmed by the user.</td>
</tr>
<tr>
<td><strong>Ranges, Trigger Level or Threshold</strong></td>
<td><strong>Source</strong></td>
</tr>
<tr>
<td></td>
<td>Any Channel</td>
</tr>
<tr>
<td></td>
<td>Auxiliary</td>
</tr>
<tr>
<td></td>
<td>Line</td>
</tr>
<tr>
<td><strong>Video Trigger Modes of Operation</strong>&lt;br&gt;(Option 05 Video Trigger)</td>
<td>Supports the following video standards:</td>
</tr>
<tr>
<td></td>
<td>– NTSC (525/60) – 2 field mono or 4 field</td>
</tr>
<tr>
<td></td>
<td>– PAL (625/50) – 2 field mono or SECAM, 8 field</td>
</tr>
<tr>
<td></td>
<td>– HDTV –</td>
</tr>
<tr>
<td></td>
<td>(787.5/60)</td>
</tr>
<tr>
<td></td>
<td>(1050/60)</td>
</tr>
<tr>
<td></td>
<td>(1125/60)</td>
</tr>
<tr>
<td></td>
<td>(1250/60)</td>
</tr>
<tr>
<td></td>
<td>– FlexFormat™ (user definable standards)</td>
</tr>
<tr>
<td></td>
<td>User can specify: field rate, number of lines, sync pulse width and polarity, line rate, and vertical interval timing.</td>
</tr>
</tbody>
</table>

Table 1–6: Nominal Traits — Display System

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video Display</td>
<td>Color display, 7 inch diagonal, with a display area of 5.04 inches horizontally by 3.78 inches vertically</td>
</tr>
<tr>
<td>Video Display Resolution</td>
<td>640 pixels horizontally by 480 pixels vertically</td>
</tr>
<tr>
<td>Waveform Display Graticule</td>
<td>Single Graticule: 401 × 501 pixels, 8 ×10 divisions, where divisions are 1 cm by 1 cm</td>
</tr>
<tr>
<td>Waveform Display Colors</td>
<td>Sixteen colors in infinite-persistence or variable persistence display with color coding</td>
</tr>
</tbody>
</table>
Table 1–7: Nominal Traits — GPIB Interface, Output Ports, and Power Fuse

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface, GPIB</td>
<td>GPIB interface complies with IEEE Std 488-1987</td>
</tr>
<tr>
<td>Interface, RS-232</td>
<td>RS-232 interface complies with EIA/TIA 574 (talk only)</td>
</tr>
<tr>
<td>Interface, Centronics</td>
<td>Centronics interface complies with Centronics interface standard C332-44 Feb 1977, REV A</td>
</tr>
<tr>
<td>Interface, Video</td>
<td>VGA video output with levels that comply with EIA RS 343A standard. DB-15 connector</td>
</tr>
<tr>
<td>Logic Polarity for Main- and Delayed-Trigger Outputs</td>
<td>Negative TRUE. High to low transition indicates the trigger occurred.</td>
</tr>
<tr>
<td>Fuse Rating</td>
<td>Either of two fuses(^1) may be used: a 0.25” × 1.25” (UL 198.6, 3AG): 6 A FAST, 250 V or a 5 mm × 20 mm (IEC 127): 5 A (T), 250 V.</td>
</tr>
</tbody>
</table>

\(^1\) Each fuse type requires its own fuse cap.

Table 1–8: Nominal Traits — Data Handling and Reliability

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time, Data-Retention, Nonvolatile Memory(^1,2)</td>
<td>Battery life ≥ 5 years</td>
</tr>
<tr>
<td>Floppy disk</td>
<td>3.5 inch, 720 K or 1.44 Mbyte, DOS 3.3-or-later compatible</td>
</tr>
</tbody>
</table>

\(^1\) 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. The amount of lithium is so small in these ICs that they can typically be safely disposed of with ordinary garbage in a sanitary landfill.
### Table 1–9: Nominal Traits — Mechanical

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling Method</td>
<td>Forced-air circulation with no air filter. Clearance is required.</td>
</tr>
<tr>
<td>Construction Material</td>
<td>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.</td>
</tr>
<tr>
<td>Finish Type</td>
<td>Tektronix Blue vinyl-clad aluminum cabinet</td>
</tr>
</tbody>
</table>
| Weight               | **Standard Digitizing Oscilloscope**  
                        14.1 kg (31 lbs), with front cover.  
                        24.0 kg (53 lbs), when packaged for domestic shipment  
                        **Rackmount Digitizing Oscilloscopes**  
                        14.1 kg (31 lbs) plus weight of rackmount parts, for the rackmounted Digitizing Oscilloscopes (Option 1R).  
                        **Rackmount conversion kit**  
                        2.3 kg (5 lbs), parts only; 3.6 kg (8 lbs), parts plus package for domestic shipping |
| Overall Dimensions   | **Standard Digitizing Oscilloscope**  
                        Height: 193 mm (7.6 in), with the feet installed  
                        Width: 445 mm (17.5 in), with the handle  
                        Depth: 434 mm (17.1 in), with the front cover installed  
                        **Rackmount Digitizing Oscilloscope**  
                        Height: 178 mm (7.0 in)  
                        Width: 483 mm (19.0 in)  
                        Depth: 558.8 mm (22.0 in) |
Nominal Traits
Warranted Characteristics

This section lists the various warranted characteristics that describe the TDS 684A and 7XXA Digitizing Oscilloscopes. Electrical and environmental characteristics are included.

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

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

As stated above, this section lists only warranted characteristics. A list of typical characteristics starts on page 1–21.

Performance Conditions

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy, DC Gain</strong></td>
<td>TDS 684A: ±1.5% for all sensitivities from 2 mV/div to 10 V/div</td>
</tr>
<tr>
<td></td>
<td>±2.0% at 1 mV/div sensitivity</td>
</tr>
<tr>
<td></td>
<td>TDS 7XXA: ±1% for all sensitivities from 1 mV/div to 10 V/div with offset from 0 V to ±100V</td>
</tr>
<tr>
<td><strong>Accuracy, Offset</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Volts/Div Setting</strong></td>
<td><strong>TDS 684A Offset Accuracy</strong></td>
</tr>
<tr>
<td>1 mV/div – 100 mV/div</td>
<td>±((0.2% ×</td>
</tr>
<tr>
<td>101 mV/div – 1 V/div</td>
<td>±((0.25% ×</td>
</tr>
<tr>
<td>1.01 V/div – 10 V/div</td>
<td>±((0.25% ×</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analog Bandwidth, DC-50 Ω Coupled and Bandwidth selection is FULL</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Volts/Div</strong></td>
<td><strong>684A Bandwidth</strong>2</td>
</tr>
<tr>
<td>10 mV/div – 1 V/div</td>
<td>DC – 1 GHz</td>
</tr>
<tr>
<td>5 mV/div – 9.95 mV/div</td>
<td>DC – 750 MHz</td>
</tr>
<tr>
<td>2 mV/div – 4.98 mV/div</td>
<td>DC – 600 MHz</td>
</tr>
<tr>
<td>1 mV/div – 1.99 mV/div</td>
<td>DC – 500 MHz</td>
</tr>
<tr>
<td><strong>Analog Bandwidth, DC-50 Ω Coupled with P6245 Probe and Bandwidth selection is FULL</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Volts/Div as Read Out on Screen</strong></td>
<td><strong>684A Bandwidth</strong>2</td>
</tr>
<tr>
<td>10 mV/div – 100 V/div</td>
<td>(Not Applicable)</td>
</tr>
<tr>
<td>100 mV/div – 10 V/div</td>
<td>DC – 1 GHz</td>
</tr>
<tr>
<td>50 mV/div – 99.5 mV/div</td>
<td>DC – 750 MHz</td>
</tr>
<tr>
<td>20 mV/div – 49.8 mV/div</td>
<td>DC – 600 MHz</td>
</tr>
<tr>
<td>10 mV/div – 19.9 mV/div</td>
<td>DC – 500 MHz</td>
</tr>
</tbody>
</table>
### Warranted Characteristics

#### Table 1–10: Warranted Characteristics — Signal Acquisition System (Cont.)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Bandwidth, DC-1M Ω Coupled with P6139A Probe and Bandwidth selection is FULL</td>
<td>Description</td>
</tr>
<tr>
<td></td>
<td>Volts/Div as Read Out on Screen</td>
</tr>
<tr>
<td></td>
<td>10 mV/div – 100 V/div</td>
</tr>
<tr>
<td></td>
<td>100 mV/div – 10 V/div</td>
</tr>
<tr>
<td></td>
<td>50 mV/div – 99.5 mV/div</td>
</tr>
<tr>
<td></td>
<td>20 mV/div – 49.8 mV/div</td>
</tr>
<tr>
<td></td>
<td>10 mV/div – 19.9 mV/div</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crosstalk (Channel Isolation)</th>
<th>≥100:1 at 100 MHz and ≥30:1 at the rated bandwidth for any two channels having equal Volts/Div settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay Between Channels, Full Bandwidth</td>
<td>TDS 684A: ≤100 ps for any two channels with equal Volts/Div and Coupling settings</td>
</tr>
<tr>
<td></td>
<td>TDS 744A/784A: ≤50 ps for any two channels with equal Volts/Div and Coupling settings</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input Impedance, DC–1 MΩ Coupled</th>
<th>1 MΩ ±0.5% in parallel with 10 pF ±3 pF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Impedance, DC–50 Ω Coupled</td>
<td>50 Ω ±1% with VSWR ≤1.3:1 from DC – 500 MHz, ≤1.5:1 from 500 MHz – 1 GHz</td>
</tr>
<tr>
<td>Input Voltage, Maximum, DC–1 MΩ, AC–1 MΩ, or GND Coupled</td>
<td>±400 V (DC + peak AC); derate at 20 dB/decade above 1 MHz</td>
</tr>
<tr>
<td>Input Voltage, Maximum, DC–50 Ω or AC–50 Ω Coupled</td>
<td>5 V RMS, with peaks ≤ ±30 V</td>
</tr>
<tr>
<td>Lower Frequency Limit, AC Coupled</td>
<td>TDS 684A: ≤10 Hz when AC–1 MΩ Coupled; ≤200 kHz when AC–50 Ω Coupled3</td>
</tr>
</tbody>
</table>

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. Reduce the upper bandwidth frequencies by 5 MHz for the TDS 684A or by 2.5 MHz for the TDS 7XXA for each °C above +30°C.
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

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy, Long Term Sample Rate and Delay Time</td>
<td>TDS 684A: ±100 ppm over any ≥1 ms interval</td>
</tr>
<tr>
<td></td>
<td>TDS 7XXA: ±25 ppm over any ≥1 ms interval</td>
</tr>
</tbody>
</table>
### Table 1–12: Warranted Characteristics — Triggering System

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sensitivity, Edge-Type Trigger, Coupling set to “DC”</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trigger Source</td>
</tr>
<tr>
<td></td>
<td>Sensitivity</td>
</tr>
<tr>
<td>Any Channel</td>
<td>TDS 684A: 0.35 division from DC to 50 MHz, increasing to 1 division at 1 GHz</td>
</tr>
<tr>
<td></td>
<td>TDS 7XXXA: 0.35 division from DC to 50 MHz, increasing to 1 division at 500 MHz for the TDS 744A or to 1 division at 1 GHz for the TDS 784A</td>
</tr>
<tr>
<td>Auxiliary</td>
<td>TDS 684A or 784A: 250 mV from DC to 50 MHz, increasing to 500 mV at 100 MHz</td>
</tr>
<tr>
<td></td>
<td>TDS 744A: 400 mV from DC to 50 MHz, increasing to 750 mV at 100 MHz</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy (Time) for Pulse-Glitch or Pulse-Width Triggering</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time Range</td>
</tr>
<tr>
<td></td>
<td>Accuracy</td>
</tr>
<tr>
<td>1 ns to 1 µs</td>
<td>±(20% of setting + 0.5 ns)</td>
</tr>
<tr>
<td>1.02 µs to 1 s</td>
<td>±(100 ns + 0.01% of Setting)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Input Signal Sync Amplitude for Stable Triggering, NTSC and PAL modes</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Field selection “Odd”, “Even”, or “All”: 0.6 division to 4 divisions</td>
</tr>
<tr>
<td></td>
<td>Field selection “Numeric”: 1 division to 4 divisions (NTSC mode)</td>
</tr>
<tr>
<td><strong>Jitter (Option 05 Video Trigger)</strong></td>
<td>60 ns\textsubscript{p-p} on NTSC or PAL signal</td>
</tr>
</tbody>
</table>

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.

### Table 1–13: Warranted Characteristics — Output Ports, Probe Compensator, and Power Requirements

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Logic Levels, Main- and Delayed-Trigger Outputs</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Characteristic</td>
</tr>
<tr>
<td></td>
<td>Limits</td>
</tr>
<tr>
<td>Vout (HI)</td>
<td>≥2.5 V open circuit; ≥1.0 V into a 50 Ω load to ground</td>
</tr>
<tr>
<td>Vout (LO)</td>
<td>≤0.7 V into a load of ≤4 mA; ≤0.25 V into a 50 Ω load to ground</td>
</tr>
<tr>
<td><strong>Output Voltage and Frequency, Probe Compensator</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Characteristic</td>
</tr>
<tr>
<td></td>
<td>Limits</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>0.5 V (base-top) ±1% into a ≥50 Ω load</td>
</tr>
<tr>
<td>Frequency</td>
<td>1 kHz ±5%</td>
</tr>
<tr>
<td><strong>Output Voltage, Signal Out (CH 3\textsuperscript{1})</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>For TDS 684A: 20 mV/division ±20% into a 1 MΩ load; 10 mV/division ±20% into a 50 Ω load</td>
</tr>
<tr>
<td></td>
<td>For TDS 7XXXA: 22 mV/division ±20% into a 1 MΩ load; 11 mV/division ±20% into a 50 Ω load</td>
</tr>
<tr>
<td>Source Voltage</td>
<td>90 to 250 VAC\textsubscript{RMS}, continuous range</td>
</tr>
<tr>
<td>Source Frequency</td>
<td>45 Hz to 440 Hz</td>
</tr>
</tbody>
</table>
Table 1–13: Warranted Characteristics — Output Ports, Probe Compensator, and Power Requirements (Cont.)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Consumption</td>
<td>$\leq 300 \text{ W (450 VA)}$</td>
</tr>
</tbody>
</table>

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

Table 1–14: Warranted Characteristics — Environmental

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospherics</td>
<td>Temperature (no diskette in floppy drive):</td>
</tr>
<tr>
<td></td>
<td>TDS 684A: Operating: +4°C to +45°C</td>
</tr>
<tr>
<td></td>
<td>TDS 7XXA: Operating: +4°C to +50°C</td>
</tr>
<tr>
<td></td>
<td>Nonoperating: –22°C to +60°C</td>
</tr>
<tr>
<td></td>
<td>Relative humidity (no diskette in floppy drive):</td>
</tr>
<tr>
<td></td>
<td>Operating: 20% to 80%, at or below +32°C, upper limit derates to 30% relative humidity at +45°C</td>
</tr>
<tr>
<td></td>
<td>Nonoperating: 5% to 90%, at or below +41°C, upper limit derates to 30% relative humidity at 60°C</td>
</tr>
<tr>
<td></td>
<td>Altitude:</td>
</tr>
<tr>
<td></td>
<td>To 4570 m (15,000 ft.), operating</td>
</tr>
<tr>
<td></td>
<td>To 12190 m (40,000 ft.), nonoperating</td>
</tr>
<tr>
<td>Dynamics</td>
<td>Random vibration (floppy diskette not installed):</td>
</tr>
<tr>
<td></td>
<td>0.31 g rms, from 5 to 500 Hz, 10 minutes each axis, operating</td>
</tr>
<tr>
<td></td>
<td>3.07 g rms, from 5 to 500 Hz, 10 minutes each axis, nonoperating</td>
</tr>
<tr>
<td>Emissions1, 2</td>
<td>Meets or exceeds the requirements of the following standards:</td>
</tr>
<tr>
<td></td>
<td>Vfg. 243/1991 Amended per Vfg. 46/1992</td>
</tr>
<tr>
<td></td>
<td>FCC Code of Federal Regulations, 47 CFR, Part 15, Subpart B, Class A</td>
</tr>
<tr>
<td></td>
<td>European Community Requirements</td>
</tr>
<tr>
<td></td>
<td>EN 55011 Class A Radiated Emissions</td>
</tr>
<tr>
<td></td>
<td>EN 55011 Class A Conducted Emissions</td>
</tr>
<tr>
<td></td>
<td>EN 50081–1</td>
</tr>
<tr>
<td></td>
<td>EN60555–2 Power Line Harmonic Emissions</td>
</tr>
<tr>
<td>Name</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Susceptibility(^1), (^2)</td>
<td>Meets or exceeds the EMC requirements of the following standards:</td>
</tr>
<tr>
<td></td>
<td>EN 50082–1 European Community Requirements</td>
</tr>
<tr>
<td></td>
<td>IEC 801-2 Electrostatic Discharge</td>
</tr>
<tr>
<td></td>
<td>IEC 801-3 Radiated Susceptibility</td>
</tr>
<tr>
<td></td>
<td>IEC 801-4 Fast Transients</td>
</tr>
<tr>
<td></td>
<td>IEC 801-5 AC Surge</td>
</tr>
<tr>
<td>Third Party Certification</td>
<td>Conforms to and is certified where appropriate to:</td>
</tr>
<tr>
<td></td>
<td>UL 1244</td>
</tr>
<tr>
<td></td>
<td>CSA–C22.2 No. 231</td>
</tr>
</tbody>
</table>

\(^1\) VGA output cable needs to be terminated, if connected at all, for the Instrument to meet these standards. The test will pass with LCOM part # CTL3VGAMM–5.

\(^2\) The GPIB cable connected to the instrument for certain of the emissions tests must be “low EMI” having a high-quality outer shield connected through a low impedance to both connector housings. Acceptable cables are Tektronix part numbers 012-0991-00, -01, -02, and -03. In order to maintain the EMI performance conforming to the above regulations, the following cables, or their equivalent, should be used: a shielded Centronics cable, 3 meters in length, part number 012-1214-00, and a shielded RS-232 cable, 2.7 meters in length, CA part number 0294-9.
Typical Characteristics

This subsection contains tables that list the various typical characteristics which describe the TDS 684A and 7XXA Digitizing Oscilloscopes.

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

Table 1–15: Typical Characteristics — Signal Acquisition System

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy, Delta Time Measurement</strong></td>
<td>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 7XXA, pulse duration &lt; 10 div. Channel skew not included. For the Single Shot condition, $1.4 \leq T_r/S_i \leq 4$, where $S_i$ is the sample interval and $T_r$ is the displayed rise time. TDS 684A: 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. TDS 684A: Extra error in the measurement will occur for two-channel measurements due to channel-to-channel skew. This is described elsewhere in these specifications.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Time Measurement Accuracy</th>
</tr>
</thead>
</table>
| Single Shot or Sample mode (or HiRes mode on the TDS 7XXA), Full Bandwidth selected | TDS 684A: $\pm(0.20 \times \text{sample interval}) + (100 \text{ ppm} \times | \text{Reading} |) + (0.05 \times W_i)$  
TDS 684A example: at 5 GS/s, 5 ns/div, measuring a 40 ns wide pulse, accuracy = $\pm(40 \text{ ps} + 4 \text{ ps} + 5 \text{ ps}) = \pm49 \text{ ps}$.  
TDS 7XXA: $\pm\geq 0.15 \text{ sample interval} + 25 \text{ ppm} \times | \text{Reading} | + t/div/1000$  
TDS 7XXA example: at 4 Gs/s, accuracy = 37.5 ps |
| $\geq 100$ Averages, Full Bandwidth selected, TDS 7XXA: repetitive | TDS 684A: $\pm(10 \text{ ps} + (100 \text{ ppm} \times | \text{Reading} |) + (0.25 \times W_i)$  
TDS 7XXA: 20 ps + (25 ppm × | Reading |) + t/div/1000 |

Calculated Rise Time

<table>
<thead>
<tr>
<th>Volts/Div Setting</th>
<th>684A Rise Time</th>
<th>744A Rise Time</th>
<th>784A Rise Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mV/div – 1 V/div</td>
<td>450 ps</td>
<td>800 ps</td>
<td>400 ps</td>
</tr>
<tr>
<td>5 mV/div – 9.95 mV/ div</td>
<td>600 ps</td>
<td>800 ps</td>
<td>530 ps</td>
</tr>
<tr>
<td>2 mV/div – 4.98 mV/ div</td>
<td>750 ps</td>
<td>800 ps</td>
<td>600 ns</td>
</tr>
<tr>
<td>1 mV/div – 1.99 mV/ div</td>
<td>900 ps</td>
<td>890 ns</td>
<td>800 ns</td>
</tr>
</tbody>
</table>
Table 1–15: Typical Characteristics — Signal Acquisition System (Cont.)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Bits — TDS 684A</td>
<td>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:</td>
</tr>
<tr>
<td>Input Frequency</td>
<td>Effective Bits</td>
</tr>
<tr>
<td>98 MHz</td>
<td>6.3 bits</td>
</tr>
<tr>
<td>245 MHz</td>
<td>6.0 bits</td>
</tr>
<tr>
<td>490 MHz</td>
<td>5.5 bits</td>
</tr>
<tr>
<td>990 MHz</td>
<td>5.2 bits</td>
</tr>
<tr>
<td>Effective Bits — TDS 744A</td>
<td>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</td>
</tr>
<tr>
<td>Input Frequency</td>
<td>Sample Rate</td>
</tr>
<tr>
<td>1 MHz – 9.2 divs</td>
<td>6.8 bits</td>
</tr>
<tr>
<td>500 MHz</td>
<td>6.8 bits</td>
</tr>
<tr>
<td>1 MHz – 9.2 divs</td>
<td>9.7 bits</td>
</tr>
<tr>
<td>500 MHz</td>
<td>N/A</td>
</tr>
<tr>
<td>Effective Bits — TDS 784A</td>
<td>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</td>
</tr>
<tr>
<td>Input Frequency</td>
<td>Sample Rate</td>
</tr>
<tr>
<td>1 MHz – 9.2 divs</td>
<td>6.6 bits</td>
</tr>
<tr>
<td>500 MHz – 8.5 divs</td>
<td>6.6 bits</td>
</tr>
<tr>
<td>1 GHz – 6.5 divs</td>
<td>5.5 bits</td>
</tr>
<tr>
<td>500 MHz</td>
<td>N/A</td>
</tr>
<tr>
<td>1 GHz</td>
<td>N/A</td>
</tr>
<tr>
<td>Frequency Limit, Upper, 250 MHz Bandwidth Limited</td>
<td>250 MHz</td>
</tr>
<tr>
<td>Frequency Limit, Upper, 20 MHz Bandwidth Limited</td>
<td>20 MHz</td>
</tr>
<tr>
<td>Step Response Settling Errors</td>
<td>Volts/Div Setting</td>
</tr>
<tr>
<td>1 mV/div – 100 mV/div</td>
<td>≤2 V</td>
</tr>
<tr>
<td>101 mV/div – 1 V/div</td>
<td>≤20 V</td>
</tr>
<tr>
<td>1.01 V/div – 10 V/div</td>
<td>≤200 V</td>
</tr>
</tbody>
</table>

1 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:

\[
TDS \, 684A \, \text{Rise Time (ns)} = \frac{450}{BW (MHz)} \quad TDS \, 7XXA \, \text{Rise Time (ns)} = \frac{400}{BW (MHz)}
\]

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 \(RT_{gen}\) according to the following formula:

\[
RT_m^2 = RT_i^2 + RT_{gen}^2
\]

2 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 1–16: Typical Characteristics — Triggering System

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accuracy, Trigger Level or Threshold, DC Coupled</strong> (for signals having rise and fall times ≥ 20 ns)</td>
<td><strong>Trigger Source</strong></td>
</tr>
<tr>
<td></td>
<td>Any Channel</td>
</tr>
<tr>
<td></td>
<td>Auxiliary</td>
</tr>
<tr>
<td><strong>Input, Auxiliary Trigger</strong></td>
<td>The input resistance is ≥1.5 kΩ; the maximum safe input voltage is ±20 V (DC + peak AC).</td>
</tr>
<tr>
<td><strong>Trigger Position Error, Edge Triggering</strong></td>
<td><strong>Acquisition Mode</strong></td>
</tr>
<tr>
<td></td>
<td>Sample, Average</td>
</tr>
<tr>
<td></td>
<td>Envelope</td>
</tr>
<tr>
<td><strong>Holdoff, Variable, Main Trigger</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Lowest Frequency for Successful Operation of “Set Level to 50%” Function</strong></td>
<td>30 Hz</td>
</tr>
<tr>
<td><strong>Sensitivity, Edge Trigger, Not DC Coupled³</strong></td>
<td><strong>Trigger Source</strong></td>
</tr>
<tr>
<td></td>
<td>AC</td>
</tr>
<tr>
<td></td>
<td>Noise Reject</td>
</tr>
<tr>
<td></td>
<td>High Frequency Reject</td>
</tr>
<tr>
<td></td>
<td>Low Frequency Reject</td>
</tr>
<tr>
<td><strong>Sensitivities, Logic Trigger and Events Delay, DC Coupled⁴</strong></td>
<td>1.0 division, from DC to 500 MHz, at vertical settings &gt; 10 mV/div and ≤ 1 V/div at the BNC input</td>
</tr>
<tr>
<td><strong>Sensitivities, Pulse-Type Runt Trigger⁵</strong></td>
<td>1.0 division, from DC to 500 MHz, at vertical settings &gt; 10 mV/div and ≤ 1 V/div at the BNC input</td>
</tr>
<tr>
<td><strong>Sensitivities, Pulse-Type Trigger Width and Glitch⁶</strong></td>
<td>1.0 division, at vertical settings &gt; 10 mV/div and ≤ 1 V/div at the BNC input</td>
</tr>
</tbody>
</table>
### Table 1–16: Typical Characteristics — Triggering System (Cont.)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width, Minimum Pulse and Rearm, for Logic Triggering or Events Delay</td>
<td>For vertical settings &gt; 10 mV/div and ≤ 1 V/div at the BNC input</td>
</tr>
<tr>
<td><strong>Triggering Type</strong></td>
<td><strong>Minimum Pulse Width</strong></td>
</tr>
<tr>
<td>Logic</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Events Delay</td>
<td>1 ns (for either + or – pulse widths)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Width, Minimum Pulse and Rearm, for Pulse Triggering</th>
<th>The minimum pulse widths and rearm widths and transition times required for Pulse-Type triggering.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulse Class</strong></td>
<td><strong>Minimum Pulse Width</strong></td>
</tr>
<tr>
<td>Glitch</td>
<td>1 ns</td>
</tr>
<tr>
<td>Runt</td>
<td>2 ns</td>
</tr>
<tr>
<td>Time-Qualified Runt</td>
<td>2 ns</td>
</tr>
<tr>
<td>Width</td>
<td>1 ns</td>
</tr>
<tr>
<td>Slew Rate</td>
<td>600 ps</td>
</tr>
</tbody>
</table>

| 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<sub>p-p</sub> |
| 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. |

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 1–10.
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.)
### Table 1–16: Typical Characteristics — Triggering System (Cont.)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>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.)</td>
</tr>
<tr>
<td>7</td>
<td>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.</td>
</tr>
<tr>
<td>8</td>
<td>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.</td>
</tr>
</tbody>
</table>
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 I 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 appropriate plug configuration is supplied with each Digitizing 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

<table>
<thead>
<tr>
<th>Conductor</th>
<th>Color</th>
<th>Alternate Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ungrounded (Line)</td>
<td>Brown</td>
<td>Black</td>
</tr>
<tr>
<td>Grounded (Neutral)</td>
<td>Light Blue</td>
<td>White</td>
</tr>
<tr>
<td>Grounded (Earthing)</td>
<td>Green/Yellow</td>
<td>Green</td>
</tr>
</tbody>
</table>

### Table 2–2: Power Cord Identification

<table>
<thead>
<tr>
<th>Plug Configuration</th>
<th>Normal Usage</th>
<th>Option Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>North America</td>
<td>Standard</td>
</tr>
<tr>
<td></td>
<td>125 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Europe</td>
<td>A1</td>
</tr>
<tr>
<td></td>
<td>230 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>United Kingdom</td>
<td>A2</td>
</tr>
<tr>
<td></td>
<td>230 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Australia</td>
<td>A3</td>
</tr>
<tr>
<td></td>
<td>230 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>North America</td>
<td>A4</td>
</tr>
<tr>
<td></td>
<td>230 V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Switzerland</td>
<td>A5</td>
</tr>
<tr>
<td></td>
<td>230 V</td>
<td></td>
</tr>
</tbody>
</table>

**Operating Voltage**

This oscilloscope operates with any line voltage from 90–250 VAC\(_{\text{RMS}}\) 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 684A and 7XXA Digitizing 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 Digitizing Oscilloscopes where the ambient air temperature is from 4°C to +45°C (+50°C for the TDS 7XXA) 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 Digitizing 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 Oscilloscopes'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>
<thead>
<tr>
<th>Table 2–3: Effects of Corrupted Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Corrupted Data Type</strong></td>
</tr>
<tr>
<td>Adjustment Constants:</td>
</tr>
<tr>
<td>Signal Path Compensation</td>
</tr>
<tr>
<td>Voltage Reference</td>
</tr>
<tr>
<td>Frequency Response</td>
</tr>
<tr>
<td>Error Log</td>
</tr>
<tr>
<td>Reference Waveforms</td>
</tr>
<tr>
<td>Saved Setups</td>
</tr>
</tbody>
</table>

**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 Digitizing 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 Digitizing 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 Digitizing 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.
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 toggle through the pop-up menu. Notice the other main-menu button labels change accordingly. Toggle 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’ve pushed TRIGGER MENU.)

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.
The Digitizing 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.

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

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 \( \Omega \) input termination is
selected and the input is overloaded, the processor system switches the input to the 1 MΩ position.

**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 phased 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 68020 microprocessor that controls the entire instrument. It includes the firmware. It also includes 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 684A and 7XXA.

**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.
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.

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.

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.

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 4–15, 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 4–16.)

If you are not familiar with operating this oscilloscope, read the TDS 684A, TDS 744A, & TDS 784A Reference (070-8999-XX) or the TDS 684A, TDS 744A, & TDS 784A User Manual (070-8991-XX). These contain instructions that will acquaint you with the use of the front-panel controls and the menu system.
Conventions

Throughout these procedures the following conventions apply:

- Each test procedure uses the following general format:
  
  **Title of Test**
  
  **Equipment Required**
  
  **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 symbol 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](image)

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, such as the P6245, 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

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites</td>
<td>Power on the Digitizing Oscilloscope and allow a 20 minute warm-up before doing this procedure.</td>
</tr>
</tbody>
</table>

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. At some time during the wait, a “clock” icon (shown at left) will appear on-screen. When the verification is finished, the resulting status will appear on the screen.
   d. **Confirm no failures are found:** Verify that no failures are found and reported on-screen.
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 minutes on the TDS 7XXA or fifteen minutes on the 684A 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](image-url)
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 optional P6245 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), 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 4–15.

---

**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

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>One probe such as the P6245 or P6139A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites</td>
<td>None</td>
</tr>
</tbody>
</table>

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 P6245 probe, you may want to attach a Y-lead connector and two SMD KlipChips as shown in Figure 4–3.

   ![Signal Gnd](image)

   ```plaintext
   Figure 4–3: Universal Test Hookup for Functional Tests – TDS 684A 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).

   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.

   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 (TDS 7XXA only) displays an actively acquiring waveform on-screen with the noise present in Sample mode “peak detected.”

Hi Res mode (TDS 7XXA 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.

<table>
<thead>
<tr>
<th>Verify the Time Base</th>
<th>Equipment Required</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One probe such as the P6245 or P6139A</td>
<td>None</td>
</tr>
</tbody>
</table>

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 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), counterclockwise 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

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>One probe such as the P6245 or P6139A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites</td>
<td>None</td>
</tr>
</tbody>
</table>

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 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 untriggered, 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 true:**
      - 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 untriggered, 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 P6245 or P6139A  
|                   | One 720 K or 1.44 Mbyte, 3.5 inch DOS-compatible disk.  
|                   | You can use a disk of your own or you can use the Programming Examples Software 3.5 inch disk (Tektronix part number 063-1134-XX) contained in the TDS Family Programmer Manual (Tektronix part number 070-8709-XX). |

| Prerequisites | None |

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 disk in the 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 **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 fdo:). 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.
- 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 above and used a blank disk, you had the oscilloscope assign the name TEK00000.SET to your file.
- Press the side-menu button **Recall From Selected File**.
- Verify that Digitizing 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 disk from the disk drive. Do this by pushing in the tab at the bottom of the disk drive.
Performance Tests

This section contains a collection of procedures for checking that the TDS 684A and 7XXA Digitizing Oscilloscopes perform as warranted.

The procedures are arranged in four logical groupings: Signal Acquisition System Checks, 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 Digitizing 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 Digitizing 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 temperature between +4°C and either +45°C for the TDS 684A or +50°C for the TDS 7XXA. (The warm-up requirement is usually met in the course of meeting the first prerequisite listed above.)
These procedures use external, traceable signal sources to directly check warranted characteristics. The required equipment list follows this introduction.

Table 4–1: Test Equipment

<table>
<thead>
<tr>
<th>Item Number and Description</th>
<th>Minimum Requirements</th>
<th>Example</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Attenuator, 10X (two required)</td>
<td>Ratio: 10X; impedance 50 Ω; connectors: female BNC input, male BNC output</td>
<td>Tektronix part number 011-0059-02</td>
<td>Signal Attenuation</td>
</tr>
<tr>
<td>2. Attenuator, 5X</td>
<td>Ratio: 5X; impedance 50 Ω; connectors: female BNC input, male BNC output</td>
<td>Tektronix part number 011-0060-02</td>
<td>Signal Attenuation</td>
</tr>
<tr>
<td>3. Adapter, BNC female to Clip Leads</td>
<td>BNC female to Clip Leads</td>
<td>Tektronix part number 013-0076-00</td>
<td>Signal Coupling for Probe Compensator Output Check</td>
</tr>
<tr>
<td>4. Terminator, 50 Ω</td>
<td>Impedance 50 Ω; connectors: female BNC input, male BNC output</td>
<td>Tektronix part number 011-0049-01</td>
<td>Signal Termination for Channel Delay Test</td>
</tr>
<tr>
<td>5. Cable, Precision 50 Ω Coaxial (two required)</td>
<td>50 Ω, 36 in, male to male BNC connectors</td>
<td>Tektronix part number 012-0482-00</td>
<td>Signal Interconnection</td>
</tr>
<tr>
<td>6. Connector, Dual-Banana (two required)</td>
<td>Female BNC to dual banana</td>
<td>Tektronix part number 103-0090-00</td>
<td>Various Accuracy Tests</td>
</tr>
<tr>
<td>7. Connector, BNC “T”</td>
<td>Male BNC to dual female BNC</td>
<td>Tektronix part number 103-0030-00</td>
<td>Checking Trigger Sensitivity</td>
</tr>
<tr>
<td>8. Coupler, Dual-Input</td>
<td>Female BNC to dual male BNC</td>
<td>Tektronix part number 067-0525-02</td>
<td>Checking Delay Between Channels</td>
</tr>
<tr>
<td>9. Generator, DC Calibration</td>
<td>Variable amplitude to ±104 V; accuracy to 0.1%</td>
<td>Data Precision 8200</td>
<td>Checking DC Offset, Gain, and Measurement Accuracy</td>
</tr>
<tr>
<td>10. Generator, Calibration</td>
<td>500 mV square wave calibrator amplitude; accuracy to 0.25%</td>
<td>Tektronix PG 506A1</td>
<td>To check accuracy of CH 3 Signal Out</td>
</tr>
<tr>
<td>11. Generator, Leveled Sine Wave, Medium-Frequency</td>
<td>200 kHz to 250 MHz; Variable amplitude from 5 mV to 4 Vp-p into 50 Ω</td>
<td>Tektronix SG 503 Leveled Sine Wave Generator1</td>
<td>Checking Trigger Sensitivity at low frequencies</td>
</tr>
<tr>
<td>12. Generator, Leveled Sine Wave, High-Frequency</td>
<td>250 MHz to 1 GHz; Variable amplitude from 500 mV to 4 Vp-p into 50 Ω; 6 MHz reference</td>
<td>Tektronix SG 504 Leveled Sine Wave Generator1 with SG 504 Output Head</td>
<td>Checking Analog Bandwidth and Trigger Sensitivity at high frequencies</td>
</tr>
<tr>
<td>13. Generator, Time Mark</td>
<td>Variable marker frequency from 10 ms to 10 ns; accuracy within 2 ppm</td>
<td>Tektronix TG 501A Time Mark Generator4</td>
<td>Checking Sample-Rate and Delay-time Accuracy</td>
</tr>
<tr>
<td>14. Probe, 10X</td>
<td>A P6139A or P6245 probe2</td>
<td>Tektronix part number P6139A or P6245</td>
<td>Signal Interconnection</td>
</tr>
</tbody>
</table>
Table 4–1: Test Equipment (Cont.)

<table>
<thead>
<tr>
<th>Item Number and Description</th>
<th>Minimum Requirements</th>
<th>Example</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. 3.5 inch, 720 K or 1.44 Mbyte, DOS-compatible floppy disk</td>
<td>Programming Examples Software Disk (Tektronix part number 063-1134-XX) that comes with the TDS Family Programmer Manual (Tektronix part number 070-8709-XX)</td>
<td>Checking File System Basic Functionality</td>
<td></td>
</tr>
<tr>
<td>16. Generator, Video Signal</td>
<td>Provides PAL compatible outputs</td>
<td>Tektronix TSG 121</td>
<td>Used to Test Video Option 05 Equipped Instruments Only</td>
</tr>
<tr>
<td>17. Oscillator, Leveled Sine wave Generator</td>
<td>60 Hz. Sine wave</td>
<td>Tektronix part number SG 502</td>
<td>Used to Test Video Option 05 Equipped Instruments Only</td>
</tr>
<tr>
<td>18. Pulse Generator</td>
<td></td>
<td>Tektronix part number PG 502</td>
<td>Used to Test Video Option 05 Equipped Instruments Only</td>
</tr>
<tr>
<td>19. Cable, Coaxial (two required)</td>
<td>75 Ω, 36 in, male to male BNC connectors</td>
<td>Tektronix part number 012-1338-00</td>
<td>Used to Test Video Option 05 Equipped Instruments Only</td>
</tr>
<tr>
<td>20. Terminator, 75 Ω (two required)</td>
<td>Impedance 75 Ω; connectors: female BNC input, male BNC output</td>
<td>Tektronix part number 011-0102-01</td>
<td>Used to Test Video Option 05 Equipped Instruments Only</td>
</tr>
</tbody>
</table>

1 Requires a TM 500 or TM 5000 Series Power Module Mainframe.

2 Warning: The optional 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.
TDS 684A Test Record

Photocopy this and the next three pages and use them to record the performance test results for your TDS 684A.

TDS 684A Test Record

<table>
<thead>
<tr>
<th>Instrument Serial Number:</th>
<th>Certificate Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature:</td>
<td>RH %:</td>
</tr>
<tr>
<td>Date of Calibration:</td>
<td>Technician:</td>
</tr>
</tbody>
</table>

TDS 684A Performance Test

<table>
<thead>
<tr>
<th>Offset Accuracy</th>
<th>Minimum</th>
<th>Incoming</th>
<th>Outgoing</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1 Offset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+1 mV</td>
<td>−1.45 mV</td>
<td></td>
<td></td>
<td>+1.45 mV</td>
</tr>
<tr>
<td>+101 mV</td>
<td>−69.1 mV</td>
<td></td>
<td></td>
<td>+69.1 mV</td>
</tr>
<tr>
<td>+1.01 V</td>
<td>−691 mV</td>
<td></td>
<td></td>
<td>+691 mV</td>
</tr>
<tr>
<td>CH2 Offset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+1 mV</td>
<td>−1.45 mV</td>
<td></td>
<td></td>
<td>+1.45 mV</td>
</tr>
<tr>
<td>+101 mV</td>
<td>−69.1 mV</td>
<td></td>
<td></td>
<td>+69.1 mV</td>
</tr>
<tr>
<td>+1.01 V</td>
<td>−691 mV</td>
<td></td>
<td></td>
<td>+691 mV</td>
</tr>
<tr>
<td>CH3 Offset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+1 mV</td>
<td>−1.45 mV</td>
<td></td>
<td></td>
<td>+1.45 mV</td>
</tr>
<tr>
<td>+101 mV</td>
<td>−69.1 mV</td>
<td></td>
<td></td>
<td>+69.1 mV</td>
</tr>
<tr>
<td>+1.01 V</td>
<td>−691 mV</td>
<td></td>
<td></td>
<td>+691 mV</td>
</tr>
<tr>
<td>CH4 Offset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+1 mV</td>
<td>−1.45 mV</td>
<td></td>
<td></td>
<td>+1.45 mV</td>
</tr>
<tr>
<td>+101 mV</td>
<td>−69.1 mV</td>
<td></td>
<td></td>
<td>+69.1 mV</td>
</tr>
<tr>
<td>+1.01 V</td>
<td>−691 mV</td>
<td></td>
<td></td>
<td>+691 mV</td>
</tr>
</tbody>
</table>

DC Voltage Measurement Accuracy (Averaged)

| CH1  | 5 mV Vert scale setting, −5 Div position setting, +1 V offset | + 1.029 V |          |          | + 1.0513 V |
| CH1  | 5 mV Vert scale setting, +5 Div position setting, −1 V offset | −1.0513 V |          |          | −1.029 V  |
| CH1  | 200 mV Vert scale setting, −5 Div position setting, +10 V offset | + 11.420 V|          |          | + 11.786 V|
| CH1  | 200 mV Vert scale setting, +5 Div position setting, −10 V offset | −11.786 V |          |          | −11.420 V |
| CH1  | 1 V Vert scale setting, −5 Div position setting, +10 V offset  | + 17.26 V |          |          | + 18.76 V |
| CH1  | 1 V Vert scale setting, +5 Div position setting, −10 V offset  | −18.76 V |          |          | −17.26 V  |
| CH2  | 5 mV Vert scale setting, −5 Div position setting, +1 V offset  | + 1.029 V |          |          | + 1.0513 V|
| CH2  | 5 mV Vert scale setting, +5 Div position setting, −1 V offset  | −1.0513 V |          |          | −1.029 V  |
| CH2  | 200 mV Vert scale setting, −5 Div position setting, +10 V offset | + 11.420 V|          |          | + 11.786 V|
## TDS 684A Test Record (Cont.)

<table>
<thead>
<tr>
<th>Instrument Serial Number:</th>
<th>Certificate Number:</th>
<th>Temperature:</th>
<th>RH %:</th>
<th>Date of Calibration:</th>
<th>Technician:</th>
</tr>
</thead>
</table>

### TDS 684A Performance Test

<table>
<thead>
<tr>
<th>Channel</th>
<th>Vert Scale Setting</th>
<th>Div Position Setting</th>
<th>Offset</th>
<th>Minimum</th>
<th>Incoming</th>
<th>Outgoing</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH2</td>
<td>200 mV</td>
<td>+5 Div</td>
<td>–10 V</td>
<td>–11.786 V</td>
<td>__________</td>
<td>__________</td>
<td>–11.420 V</td>
</tr>
<tr>
<td>CH2</td>
<td>1 V</td>
<td>–5 Div</td>
<td>+10 V</td>
<td>+17.26 V</td>
<td>__________</td>
<td>__________</td>
<td>+18.76 V</td>
</tr>
<tr>
<td>CH2</td>
<td>1 V</td>
<td>+5 Div</td>
<td>–10 V</td>
<td>–18.76 V</td>
<td>__________</td>
<td>__________</td>
<td>–17.26 V</td>
</tr>
<tr>
<td>CH3</td>
<td>5 mV</td>
<td>–5 Div</td>
<td>+1 V</td>
<td>+1.029 V</td>
<td>__________</td>
<td>__________</td>
<td>+1.0513 V</td>
</tr>
<tr>
<td>CH3</td>
<td>5 mV</td>
<td>+5 Div</td>
<td>–1 V</td>
<td>–1.0513 V</td>
<td>__________</td>
<td>__________</td>
<td>–1.029 V</td>
</tr>
<tr>
<td>CH3</td>
<td>200 mV</td>
<td>–5 Div</td>
<td>+10 V</td>
<td>+11.420 V</td>
<td>__________</td>
<td>__________</td>
<td>+11.786 V</td>
</tr>
<tr>
<td>CH3</td>
<td>200 mV</td>
<td>+5 Div</td>
<td>–10 V</td>
<td>–11.786 V</td>
<td>__________</td>
<td>__________</td>
<td>–11.420 V</td>
</tr>
<tr>
<td>CH3</td>
<td>1 V</td>
<td>–5 Div</td>
<td>+10 V</td>
<td>+17.26 V</td>
<td>__________</td>
<td>__________</td>
<td>+18.76 V</td>
</tr>
<tr>
<td>CH3</td>
<td>1 V</td>
<td>+5 Div</td>
<td>–10 V</td>
<td>–18.76 V</td>
<td>__________</td>
<td>__________</td>
<td>–17.26 V</td>
</tr>
<tr>
<td>CH4</td>
<td>5 mV</td>
<td>–5 Div</td>
<td>+1 V</td>
<td>+1.029 V</td>
<td>__________</td>
<td>__________</td>
<td>+1.0513 V</td>
</tr>
<tr>
<td>CH4</td>
<td>5 mV</td>
<td>+5 Div</td>
<td>–1 V</td>
<td>–1.0513 V</td>
<td>__________</td>
<td>__________</td>
<td>–1.029 V</td>
</tr>
<tr>
<td>CH4</td>
<td>200 mV</td>
<td>–5 Div</td>
<td>+10 V</td>
<td>+11.420 V</td>
<td>__________</td>
<td>__________</td>
<td>+11.786 V</td>
</tr>
<tr>
<td>CH4</td>
<td>200 mV</td>
<td>+5 Div</td>
<td>–10 V</td>
<td>–11.786 V</td>
<td>__________</td>
<td>__________</td>
<td>–11.420 V</td>
</tr>
<tr>
<td>CH4</td>
<td>1 V</td>
<td>–5 Div</td>
<td>+10 V</td>
<td>+17.26 V</td>
<td>__________</td>
<td>__________</td>
<td>+18.76 V</td>
</tr>
<tr>
<td>CH4</td>
<td>1 V</td>
<td>+5 Div</td>
<td>–10 V</td>
<td>–18.76 V</td>
<td>__________</td>
<td>__________</td>
<td>–17.26 V</td>
</tr>
</tbody>
</table>

### Analog Bandwidth

<table>
<thead>
<tr>
<th>Channel</th>
<th>Scale Setting</th>
<th>Minimum</th>
<th>Incoming</th>
<th>Outgoing</th>
<th>Maximum</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1</td>
<td>100 mV</td>
<td>424 mV</td>
<td>__________</td>
<td>__________</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>CH2</td>
<td>100 mV</td>
<td>424 mV</td>
<td>__________</td>
<td>__________</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>CH3</td>
<td>100 mV</td>
<td>424 mV</td>
<td>__________</td>
<td>__________</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>CH4</td>
<td>100 mV</td>
<td>424 mV</td>
<td>__________</td>
<td>__________</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>
## TDS 684A Test Record (Cont.)

<table>
<thead>
<tr>
<th>Instrument Serial Number:</th>
<th>Certificate Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature:</td>
<td>RH %:</td>
</tr>
<tr>
<td>Date of Calibration:</td>
<td>Technician:</td>
</tr>
</tbody>
</table>

### TDS 684A Performance Test

<table>
<thead>
<tr>
<th></th>
<th>Minimum</th>
<th>Incoming</th>
<th>Outgoing</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay Between Channels</td>
<td>N/A</td>
<td>______</td>
<td>______</td>
<td>100 ps</td>
</tr>
</tbody>
</table>

### Time Base System

| Long Term Sample Rate/ Delay Time @ 500 ns/10 ms | -2.0 Div | ______ | ______ | +2.0 Div |

### Trigger System Accuracy

<table>
<thead>
<tr>
<th>Pulse-Glitch or Pulse-Width, Hor. scale ≤ 1 μs</th>
<th>2.5 ns</th>
<th>______</th>
<th>______</th>
<th>7.5 ns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Limit</td>
<td>2.5 ns</td>
<td>______</td>
<td>______</td>
<td>7.5 ns</td>
</tr>
<tr>
<td>Upper Limit</td>
<td>2.5 ns</td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulse-Glitch or Pulse-Width, Hor. scale &gt; 1 μs</th>
<th>1 μs</th>
<th>______</th>
<th>______</th>
<th>3 μs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Limit</td>
<td>1 μs</td>
<td>______</td>
<td>______</td>
<td>3 μs</td>
</tr>
<tr>
<td>Upper Limit</td>
<td>1 μs</td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
</tbody>
</table>

### Output Signal Checks

<table>
<thead>
<tr>
<th></th>
<th>High</th>
<th>______</th>
<th>______</th>
<th>Low ≤ 0.7 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1 Sensitivity, 1 GHz, Main</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
<tr>
<td>CH1 AUX Trigger Input</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
<tr>
<td>CH1 Sensitivity, 1 GHz, Delayed</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
</tbody>
</table>

### MAIN TRIGGER OUTPUT, 1 MΩ

<table>
<thead>
<tr>
<th></th>
<th>High ≥ 2.5 V</th>
<th>______</th>
<th>______</th>
<th>Low ≤ 0.7 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
</tbody>
</table>

### MAIN TRIGGER OUTPUT, 50 Ω

<table>
<thead>
<tr>
<th></th>
<th>High ≥ 1.0 V</th>
<th>______</th>
<th>______</th>
<th>Low ≤ 0.25 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
</tbody>
</table>

### DELAYED TRIGGER OUTPUT, 50 Ω

<table>
<thead>
<tr>
<th></th>
<th>High ≥ 1.0 V</th>
<th>______</th>
<th>______</th>
<th>Low ≤ 0.25 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
</tbody>
</table>

### DELAYED TRIGGER OUTPUT, 1 MΩ

<table>
<thead>
<tr>
<th></th>
<th>High ≥ 2.5 V</th>
<th>______</th>
<th>______</th>
<th>Low ≤ 0.7 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td>______</td>
<td>______</td>
<td></td>
</tr>
</tbody>
</table>
TDS 684A Test Record (Cont.)

<table>
<thead>
<tr>
<th>Instrument Serial Number:</th>
<th>Certificate Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature:</td>
<td>RH %:</td>
</tr>
<tr>
<td>Date of Calibration:</td>
<td>Technician:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TDS 684A Performance Test</th>
<th>Minimum</th>
<th>Incoming</th>
<th>Outgoing</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 3 SIGNAL OUTPUT, 1 MΩ</td>
<td>Pk-Pk ≥ 80 mV</td>
<td>_________</td>
<td>_________</td>
<td>Pk-Pk ≤ 120 mV</td>
</tr>
<tr>
<td>CH 3 SIGNAL OUTPUT, 50 Ω</td>
<td>Pk-Pk ≥ 40 mV</td>
<td>_________</td>
<td>_________</td>
<td>Pk-Pk ≤ 60 mV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Probe Compensator Output Signal</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (CH1 Freq.)</td>
<td>950 Hz</td>
</tr>
<tr>
<td>Voltage (difference)</td>
<td>495 mV</td>
</tr>
</tbody>
</table>
### TDS 7XXA Test Record

Photocopy this and the next three pages and use them to record the performance test results for your TDS 7XXA.

#### TDS 7XXA Test Record

<table>
<thead>
<tr>
<th>Instrument Serial Number:</th>
<th>Certificate Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature:</td>
<td>RH %:</td>
</tr>
<tr>
<td>Date of Calibration:</td>
<td>Technician:</td>
</tr>
</tbody>
</table>

#### TDS 7XXA Performance Test

<table>
<thead>
<tr>
<th>Offset Accuracy</th>
<th>Minimum</th>
<th>Incoming</th>
<th>Outgoing</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1 Offset</td>
<td>1 mV</td>
<td>- 1.6 mV</td>
<td></td>
<td>+ 1.6 mV</td>
</tr>
<tr>
<td></td>
<td>101 mV</td>
<td>- 25.1 mV</td>
<td></td>
<td>+ 25.1 mV</td>
</tr>
<tr>
<td></td>
<td>1.01 V</td>
<td>- 251 mV</td>
<td></td>
<td>+ 251 mV</td>
</tr>
<tr>
<td>CH2 Offset</td>
<td>1 mV</td>
<td>- 1.6 mV</td>
<td></td>
<td>+ 1.6 mV</td>
</tr>
<tr>
<td></td>
<td>101 mV</td>
<td>- 25.1 mV</td>
<td></td>
<td>+ 25.1 mV</td>
</tr>
<tr>
<td></td>
<td>1.01 V</td>
<td>- 251 mV</td>
<td></td>
<td>+ 251 mV</td>
</tr>
<tr>
<td>CH3 Offset</td>
<td>1 mV</td>
<td>- 1.6 mV</td>
<td></td>
<td>+ 1.6 mV</td>
</tr>
<tr>
<td></td>
<td>101 mV</td>
<td>- 25.1 mV</td>
<td></td>
<td>+ 25.1 mV</td>
</tr>
<tr>
<td></td>
<td>1.01 V</td>
<td>- 251 mV</td>
<td></td>
<td>+ 251 mV</td>
</tr>
<tr>
<td>CH4 Offset</td>
<td>1 mV</td>
<td>- 1.6 mV</td>
<td></td>
<td>+ 1.6 mV</td>
</tr>
<tr>
<td></td>
<td>101 mV</td>
<td>- 25.1 mV</td>
<td></td>
<td>+ 25.1 mV</td>
</tr>
<tr>
<td></td>
<td>1.01 V</td>
<td>- 251 mV</td>
<td></td>
<td>+ 251 mV</td>
</tr>
</tbody>
</table>

#### 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 | + 11.5385 V |          | + 11.6615 V |
| CH1 | 200 mV Vert scale setting, +5 Div position setting, -10 V offset | - 11.6615 V |          | - 11.5385 V |
| CH1 | 1 V Vert scale setting, -5 Div position setting, +10 V offset | + 17.7785 V |          | + 18.2215 V |
| CH1 | 1 V Vert scale setting, +5 Div position setting, -10 V offset | - 18.2215 V |          | - 17.7785 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 | + 11.5385 V |          | + 11.6615 V |
### TDS 7XXA Test Record (Cont.)

<table>
<thead>
<tr>
<th>Instrument Serial Number:</th>
<th>Certificate Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature:</td>
<td>RH %:</td>
</tr>
<tr>
<td>Date of Calibration:</td>
<td>Technician:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TDS 7XXA Performance Test</th>
<th>Minimum</th>
<th>Incoming</th>
<th>Outgoing</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH2 200 mV Vert scale setting, +5 Div position setting, −10 V offset</td>
<td>−11.6615 V</td>
<td>________</td>
<td>________</td>
<td>−11.5385 V</td>
</tr>
<tr>
<td>CH2 1 V Vert scale setting, −5 Div position setting, +10 V offset</td>
<td>+17.7785 V</td>
<td>________</td>
<td>________</td>
<td>+18.2215 V</td>
</tr>
<tr>
<td>CH2 1 V Vert scale setting, +5 Div position setting, −10 V offset</td>
<td>−18.2215 V</td>
<td>________</td>
<td>________</td>
<td>−17.7785 V</td>
</tr>
<tr>
<td>CH3 5 mV Vert scale setting, −5 Div position setting, +1 V offset</td>
<td>+1.0355 V</td>
<td>________</td>
<td>________</td>
<td>+1.0445 V</td>
</tr>
<tr>
<td>CH3 5 mV Vert scale setting, +5 Div position setting, −1 V offset</td>
<td>−1.0445 V</td>
<td>________</td>
<td>________</td>
<td>−1.0355 V</td>
</tr>
<tr>
<td>CH3 200 mV Vert scale setting, −5 Div position setting, +10 V offset</td>
<td>+11.5385 V</td>
<td>________</td>
<td>________</td>
<td>+11.6615 V</td>
</tr>
<tr>
<td>CH3 200 mV Vert scale setting, +5 Div position setting, −10 V offset</td>
<td>−11.6615 V</td>
<td>________</td>
<td>________</td>
<td>−11.5385 V</td>
</tr>
<tr>
<td>CH3 1 V Vert scale setting, −5 Div position setting, +10 V offset</td>
<td>+17.7785 V</td>
<td>________</td>
<td>________</td>
<td>+18.2215 V</td>
</tr>
<tr>
<td>CH3 1 V Vert scale setting, +5 Div position setting, −10 V offset</td>
<td>−18.2215 V</td>
<td>________</td>
<td>________</td>
<td>−17.7785 V</td>
</tr>
<tr>
<td>CH4 5 mV Vert scale setting, −5 Div position setting, +1 V offset</td>
<td>+1.0355 V</td>
<td>________</td>
<td>________</td>
<td>+1.0445 V</td>
</tr>
<tr>
<td>CH4 5 mV Vert scale setting, +5 Div position setting, −1 V offset</td>
<td>−1.0445 V</td>
<td>________</td>
<td>________</td>
<td>−1.0355 V</td>
</tr>
<tr>
<td>CH4 200 mV Vert scale setting, −5 Div position setting, +10 V offset</td>
<td>+11.5385 V</td>
<td>________</td>
<td>________</td>
<td>+11.6615 V</td>
</tr>
<tr>
<td>CH4 200 mV Vert scale setting, +5 Div position setting, −10 V offset</td>
<td>−11.6615 V</td>
<td>________</td>
<td>________</td>
<td>−11.5385 V</td>
</tr>
<tr>
<td>CH4 1 V Vert scale setting, −5 Div position setting, +10 V offset</td>
<td>+17.7785 V</td>
<td>________</td>
<td>________</td>
<td>+18.2215 V</td>
</tr>
<tr>
<td>CH4 1 V Vert scale setting, +5 Div position setting, −10 V offset</td>
<td>−18.2215 V</td>
<td>________</td>
<td>________</td>
<td>−17.7785 V</td>
</tr>
</tbody>
</table>

### Analog Bandwidth

<table>
<thead>
<tr>
<th>Channel</th>
<th>Scale Setting</th>
<th>Minimum</th>
<th>Incoming</th>
<th>Outgoing</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1</td>
<td>100 mV</td>
<td>424 mV</td>
<td>________</td>
<td>________</td>
<td>N/A</td>
</tr>
<tr>
<td>CH2</td>
<td>100 mV</td>
<td>424 mV</td>
<td>________</td>
<td>________</td>
<td>N/A</td>
</tr>
<tr>
<td>CH3</td>
<td>100 mV</td>
<td>424 mV</td>
<td>________</td>
<td>________</td>
<td>N/A</td>
</tr>
<tr>
<td>CH4</td>
<td>100 mV</td>
<td>424 mV</td>
<td>________</td>
<td>________</td>
<td>N/A</td>
</tr>
</tbody>
</table>
### TDS 7XXA Test Record (Cont.)

<table>
<thead>
<tr>
<th>Instrument Serial Number:</th>
<th>Certificate Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature:</td>
<td>RH %:</td>
</tr>
<tr>
<td>Date of Calibration:</td>
<td>Technician:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TDS 7XXA Performance Test</th>
<th>Minimum</th>
<th>Incoming</th>
<th>Outgoing</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay Between Channels</td>
<td>N/A</td>
<td>________</td>
<td>________</td>
<td>50 ps</td>
</tr>
<tr>
<td>Time Base System</td>
<td>-2.5 Div</td>
<td>________</td>
<td>________</td>
<td>+2.5 Div</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trigger System Accuracy</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse-Glitch or Pulse-Width, Hor. scale ≤ 1 μs</td>
<td>3.5 ns</td>
<td>2.5 ns</td>
<td>3.5 ns</td>
<td>2.5 ns</td>
<td>6.5 ns</td>
<td>6.5 ns</td>
</tr>
<tr>
<td>Pulse-Glitch or Pulse-Width, Hor. scale &gt; 1 μs</td>
<td>1.9 μs</td>
<td>1.9 μs</td>
<td>1.9 μs</td>
<td>1.9 μs</td>
<td>2.1 μs</td>
<td>2.1 μs</td>
</tr>
</tbody>
</table>

| Main Trigger, DC Coupled, Positive Slope | 9.9393 V | ________ | 10.1147 V |
| Main Trigger, DC Coupled, Negative Slope | 9.9393 V | ________ | 10.1147 V |
| Delayed Trigger, DC Coupled, Positive Slope | 9.9393 V | ________ | 10.1147 V |
| Delayed Trigger, DC Coupled, Negative Slope | 9.9393 V | ________ | 10.1147 V |
| 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

<table>
<thead>
<tr>
<th>MAIN TRIGGER OUTPUT, 1 MΩ</th>
<th>High</th>
<th>Low</th>
<th>High ≥ 2.5 V</th>
<th>________</th>
<th>Low ≤ 0.7 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAIN TRIGGER OUTPUT, 50 Ω</td>
<td>High</td>
<td>Low</td>
<td>High ≥ 1.0 V</td>
<td>________</td>
<td>Low ≤ 0.25 V</td>
</tr>
<tr>
<td>DELAYED TRIGGER OUTPUT, 50 Ω</td>
<td>High</td>
<td>Low</td>
<td>High ≥ 1.0 V</td>
<td>________</td>
<td>Low ≤ 0.25 V</td>
</tr>
<tr>
<td>DELAYED TRIGGER OUTPUT, 1 MΩ</td>
<td>High</td>
<td>Low</td>
<td>High ≥ 2.5 V</td>
<td>________</td>
<td>Low ≤ 0.7 V</td>
</tr>
</tbody>
</table>
## TDS 7XXA Test Record (Cont.)

<table>
<thead>
<tr>
<th>Instrument Serial Number:</th>
<th>Certificate Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature:</td>
<td>RH %:</td>
</tr>
<tr>
<td>Date of Calibration:</td>
<td>Technician:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TDS 7XXA Performance Test</th>
<th>Minimum</th>
<th>Incoming</th>
<th>Outgoing</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH 3 SIGNAL OUTPUT, 1 MΩ</td>
<td>Pk-Pk ≥ 88 mV</td>
<td>_______</td>
<td>_______</td>
<td>Pk-Pk ≤ 132 mV</td>
</tr>
<tr>
<td>CH 3 SIGNAL OUTPUT, 50 Ω</td>
<td>Pk-Pk ≥ 44 mV</td>
<td>_______</td>
<td>_______</td>
<td>Pk-Pk ≤ 66 mV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Probe Compensator Output Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency (CH1 Freq.)</td>
</tr>
<tr>
<td>Voltage (difference)</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Check Offset Accuracy (Zero Setting)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment Required</strong></td>
</tr>
<tr>
<td><strong>Prerequisites</strong></td>
</tr>
</tbody>
</table>

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 684A, press the main-menu button **Mode**; then press the side-menu button **Average 16**.
      - On the TDS 7XXA, 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)

<table>
<thead>
<tr>
<th>Vertical Scale Setting</th>
<th>Vertical Position and Offset Setting</th>
<th>TDS 684A Offset Accuracy Limits</th>
<th>TDS 7XXA Offset Accuracy Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mV</td>
<td>0</td>
<td>±1.45 mV</td>
<td>±1.6 mV</td>
</tr>
<tr>
<td>101 mV</td>
<td>0</td>
<td>±69.1 mV</td>
<td>±25.1 mV</td>
</tr>
<tr>
<td>1.01 V</td>
<td>0</td>
<td>±691 mV</td>
<td>±251 mV</td>
</tr>
</tbody>
</table>

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.
Align the active cursor over the waveform.

Read the measurement results.

**Figure 4–4: Measurement of DC Offset Accuracy at Zero Setting**

1. **Check DC Voltage Measurement Accuracy**

   **WARNING:** The generator is capable of outputting dangerous voltages. Be sure to set the DC calibration generator to 0 volts before connecting, disconnecting, and/or moving the test hookup during the performance of this procedure.

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>Two dual-banana connectors (Item 6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One BNC T connector (Item 7)</td>
</tr>
<tr>
<td></td>
<td>One DC calibration generator (Item 9)</td>
</tr>
<tr>
<td></td>
<td>Two precision coaxial cables (Item 5)</td>
</tr>
</tbody>
</table>

   | Prerequisites | The oscilloscope must meet the prerequisites listed on page 4–15 |

3. **Disconnect the hookup:** No hookup was required.

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

   ![Diagram of Initial Test Hookup](https://example.com/diagram.png)

   **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**.
Performance Tests

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 Accuracy

<table>
<thead>
<tr>
<th>Scale Setting</th>
<th>Position Setting (Divs)</th>
<th>Offset Setting</th>
<th>Generator Setting</th>
<th>TDS 684A Accuracy Limits</th>
<th>TDS 7XXA Accuracy Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mV</td>
<td>–5</td>
<td>+1 V</td>
<td>+1.040 V</td>
<td>+1.029 V to +1.0513 V</td>
<td>+1.0355 V to +1.0445 V</td>
</tr>
<tr>
<td></td>
<td>+5 V</td>
<td>–1 V</td>
<td>–1.040 V</td>
<td>–1.0513 V to –1.029 V</td>
<td>–1.0445 V to –1.0355 V</td>
</tr>
<tr>
<td>200 mV</td>
<td>–5</td>
<td>+10 V</td>
<td>+11.6 V</td>
<td>+11.420 V to +11.786 V</td>
<td>+11.5385 V to +11.6615 V</td>
</tr>
<tr>
<td>1 V</td>
<td>–5</td>
<td>+10 V</td>
<td>+18 V</td>
<td>+17.26 V to +18.76 V</td>
<td>+17.7785 V to +18.2215 V</td>
</tr>
<tr>
<td></td>
<td>+5</td>
<td>–10 V</td>
<td>–18 V</td>
<td>–18.76 V to –17.26 V</td>
<td>–18.2215 V to –17.7785 V</td>
</tr>
</tbody>
</table>

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 is 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](image)

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

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>One high-frequency leveled sine wave generator and its leveling head (Item 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Two 10X attenuators (Item 1)</td>
</tr>
</tbody>
</table>

| Prerequisites       | See page 4–15                                                                   |

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:**

      - Press TRIGGER MENU. Press the main-menu button **Coupling**.

      - Press the side-menu button **Noise Rej**.

      - Turn the horizontal SCALE knob to 50 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 **High–Low Setup**; then press the side-menu button **Min–Max**.

   c. **Hook up the test-signal source:** Connect, through its leveling head, the sine wave output of a high-frequency leveled sine wave generator to CH 1. Set the output of the generator to a reference frequency of 6 MHz. See Figure 4–7.
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 head 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:
   - Press VERTICAL MENU; then press the main-menu button Coupling.
   - 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. 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 Measrnnt for CHx.

- 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.

- 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.

- 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, which for the TDS 684A/784A = 1 GHz and for the 744A = 500 MHz frequency, you may also want to make small, manual adjustments to the trigger level. You can use the TRIGGER LEVEL knob to do this.
f. 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 4–8.
- 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 4–8.

![Figure 4–8: Measurement of Analog Bandwidth](image)

g. 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 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, h) if this digitizing 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.

h. 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 g for each of the remaining scale settings listed in Table 4–4 for the channel under test.
- When doing substep e, skip the subparts that turn on the CHx Pk-Pk measurement until you check a new channel.
- Install/remove 10X attenuators between the generator leveling head and the channel input as needed to obtain the six division reference signals listed in the table.

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

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

<table>
<thead>
<tr>
<th>Check Delay Between Channels</th>
<th>Equipment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Required</td>
<td>One medium-frequency leveled sine wave generator (Item 11)</td>
</tr>
<tr>
<td></td>
<td>One precision coaxial cable (Item 5)</td>
</tr>
<tr>
<td></td>
<td>One 50 Ω terminator (Item 4)</td>
</tr>
<tr>
<td></td>
<td>One dual-input coupler (Item 8)</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>See page 4–15</td>
</tr>
</tbody>
</table>
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, through a 50 Ω precision coaxial cable followed by a 50 Ω termination, the sine wave output of a medium-frequency sine wave generator to a dual-input coupler. See Figure 4–9.
      - Connect the coupler to both **CH 1** and **CH 2**. See Figure 4–9.

![Figure 4–9: Initial Test Hookup](image-url)
2. Confirm all four channels (CH 1 through CH 4) are within limits for channel delay:

   a. Set up the generator: Set the generator frequency to 250 MHz and the amplitude for about six 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 784A, now set it to 200 ps. On the TDS 744A, 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.

   c. Save a CH 2 waveform: Press CH 2. Be sure the vertical scale factor is kept at 1.0X. Then 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 waveform:

      Move the coupler from CH 2 to CH 3, so that CH 1 and CH 3 are driven. Press WAVEFORM OFF. Press CH 3. Be sure the vertical scale factor is kept at 1.0X. Then press the side-menu button To Ref 3.

   e. Display all test signals:

      Press WAVEFORM OFF to remove CH 3 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. Press CH 4 to display. Be sure the vertical scale factor is kept at 1.0X. See Figure 4–10 on page 4–40.

      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 4–10 on page 4–40.

   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 4–10 on page 4–40.

      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 4–10 on page 4–40.
- Read the measurement results at the Δ: cursor readout, not the @: readout on screen.

**Figure 4–10: Measurement of Channel Delay – TDS 684A Shown**

- **g. Check against limits:** CHECK that the cursor readout on screen is ≤100 ps for the TDS 684A or ≤50 ps for the TDS 744A/784A.
- **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. Write down these three numbers in the first measure-
ment 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., 4th bullet item.

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 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 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 TDS 684A or between –50 ps and + 50 ps for the TDS 744A/784A.

p. Enter time on the test record.

Table 4–5: Delay Between Channels Worksheet

<table>
<thead>
<tr>
<th>Coupling</th>
<th>First Measurement</th>
<th>Second Measurement</th>
<th>Add First and Second Measurements</th>
<th>Divide Sum by 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH1 to CH2 skew</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH1 to CH3 skew</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH1 to CH4 skew</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>One time-mark generator (Item 13)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One 50 Ω, precision coaxial cable (Item 5)</td>
</tr>
</tbody>
</table>

| Prerequisites       | See page 4–15 |

Figure 4–11: 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 time-mark output of a time-mark generator to CH 1. Set the output of the generator for 10 ms markers.

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 500 mV.
   - Press VERTICAL MENU; then press the main-menu button Coupling. Press the side-menu button Ω to toggle it to the 50 Ω setting.
   - Press SET LEVEL TO 50%.
   - Use the vertical POSITION knob to center the test signal on screen.
2. Confirm Main and Delayed time bases are within limits for accuracies:
   
a. Display the test signal:
   
   - Align the trigger T to the center vertical graticule line by adjusting the horizontal POSITION. See Figure 4–12 on page 4–44.
   
   - 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 4–12.

b. Measure the test signal:
   
   - Set the horizontal SCALE of the D (delayed) time base to 500 ns for the TDS 684A or to 100 ns for the TDS 7XXA.
   
   - Set delayed time to 10 ms. Do this on the keypad by pressing 10, 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 crosses the center horizontal graticule line at a point within either ±2.0, for the TDS 684A, or ±2.5, for the TDS 7XXA, divisions of center graticule. See Figure 4–12.
   
   - Enter number of divisions on test record.
Performance Tests

Figure 4–12: 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.

**Trigger System Checks**

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

<table>
<thead>
<tr>
<th>Check Accuracy (Time) for Pulse-Glitch or Pulse-Width Triggering</th>
<th>Equipment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One medium-frequency leveled sine wave generator (Item 11)</td>
</tr>
<tr>
<td></td>
<td>One 10X attenuator (Item 1)</td>
</tr>
<tr>
<td></td>
<td>One 50 Ω precision coaxial cable (Item 5)</td>
</tr>
</tbody>
</table>

| Prerequisites | See page 4–15 |
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:**
      - Press **VERTICAL MENU**.
      - Press the main-menu button **Coupling**; then press the side-menu **Ω** button to select **50 Ω** coupling.
      - Set the horizontal **SCALE** to 10 ns on the TDS 684A and 12.5 ns on the TDS 7XXA.

   c. **Hook up the test-signal source:** Connect the output of a medium-frequency leveled sine wave generator (Item 11) to CH 1. Do this through a **50 Ω** precision coaxial cable, followed by a 10X attenuator. See Figure 4–13.

![Figure 4–13: Initial Test Hookup](image)

2. **Confirm the trigger system is within time-accuracy limits for pulse-glitch or pulse-width triggering (Horizontal Scale ≤1 μs):**

   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 4–14.

- 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.

- 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 2.5 ns to 7.5 ns, inclusive, for the TDS 684A or is within 3.5 ns to 6.5 ns, inclusive, for the TDS 7XXA.

- 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 2.5 ns to 7.5 ns, inclusive, for the TDS 684A or is within 2.5 ns to 6.5 ns, inclusive, for the TDS 7XXA.

- Enter time on test record.
3. **Confirm the trigger system is within time-accuracy limits for pulse-glitch or pulse-width triggering (horizontal scale > 1 µs):**

   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.
      
      - 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 μs to 3 μs, inclusive, for the TDS 684A or is within 1.9 μs to 2.1 μs, inclusive, for the TDS 7XXA.

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 μs to 3 μs, inclusive, for the TDS 684A or is within 1.9 μs to 2.1 μs, inclusive, for the TDS 7XXA.

Enter time on test record.

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

---

**Check Accuracy, Trigger-Level or Threshold, DC Coupled**

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>One DC calibration generator (Item 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One BNC T connector (Item 7)</td>
</tr>
<tr>
<td></td>
<td>Two 50 Ω, precision coaxial cables (Item 5)</td>
</tr>
</tbody>
</table>

**Prerequisites**

See page 4–15.

---

**Figure 4–15: Initial Test Hookup**

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

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

      - Set the output of the DC calibration generator to 0 volts.
Connect the output of the DC calibration generator, through a dual-banana connector followed by a 50 Ω precision coaxial cable, to one side of a BNC T connector.

Connect the Sense output of the generator, through a second dual-banana connector followed by a 50 Ω precision coaxial cable, to other side of the BNC T connector. Now connect the BNC T connector to CH 1.

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. Confirm Main trigger system is within limits for Trigger-level/Threshold accuracy:

a. Display the test signal:
- Set the vertical SCALE to 200 mV.
- Press VERTICAL MENU, then press the main-menu button Position.
- Set vertical position to –3 divisions (press –3, then ENTER, on the keypad.) The baseline level will move down three divisions. See Figure 4–16 on page 4–50.
- Press the main-menu button Offset.
- Set vertical offset to +10 volts with the keypad. The baseline level will move off screen.
- Set the standard output of the DC calibration generator equal to the offset (+10 volts). The DC test level will appear on screen. See Figure 4–16.

b. Measure the test signal:
- Press SET LEVEL TO 50%.
- Press TRIGGER MENU.
- Read the measurement results from the readout below the label Level in the main menu, not the trigger readout in the graticule area.
c. **Read results (Check against limits):** See Figure 4–16.

- CHECK that the **Level** readout in the main menu is within 9.863 V to 10.137 V, inclusive, for the TDS 684A or is within 9.9393 V to 10.1147 V, inclusive, for the TDS 7XXA.

- Enter voltage on test record.

- Press the main-menu button **Slope**; then press the side-menu button for negative slope. See icon at left. Repeat substep b.

- CHECK that the **Level** readout in the main menu is within 9.863 V to 10.137 V, inclusive, for the TDS 684A or is within 9.9393 V to 10.1147 V, inclusive, for the TDS 7XXA.

- Enter voltage on test record.

---

**Figure 4–16: Measurement of Trigger-Level Accuracy**

3. **Confirm Delayed trigger system is within limits for Trigger-level/Threshold accuracy:**

a. **Select the Delayed time base:**
Press HORIZONTAL MENU.

Press the main-menu button Time Base.

Press the side-menu buttons Delayed Only and Delayed Triggerable.

Set D (delayed) horizontal SCALE to 500 μs.

b. Select the Delayed trigger system:

- Press SHIFT; then press the front-panel DELAYED TRIG button.
- Press the main-menu button Level.

c. Measure the test signal: Press the side-menu button SET TO 50%.
Read the measurement results in the side (or main) menu below the label Level.

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

- CHECK that the Level readout in the side menu is within 9.863 V to 10.137 V, inclusive, for the TDS 684A or is within 9.9393 V to 10.1147 V, inclusive, for the TDS 7XXA.
- Enter voltage on test record.
- Press the main-menu button Slope; then press the side-menu button for negative slope. See icon at left. Press the main-menu button Level. Repeat substep c.
- CHECK that the Level readout in the side menu is within 9.863 V to 10.137 V, inclusive, for the TDS 684A or is within 9.9393 V to 10.1147 V, inclusive, for the TDS 7XXA.
- Enter voltage on test record.

4. Disconnect the hookup:

a. First set the output of the DC calibration generator to 0 volts.

b. Disconnect the cable from the generator output at the input connector of CH 1.
Performance Tests

Sensitivity, Edge Trigger, DC Coupled

<table>
<thead>
<tr>
<th>Equipment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>One medium-frequency leveled sine wave generator (Item 11)</td>
</tr>
<tr>
<td>One high-frequency leveled sine wave generator (Item 12)</td>
</tr>
<tr>
<td>Two precision 50 Ω coaxial cables (Item 5)</td>
</tr>
<tr>
<td>One 10X attenuator (Item 1)</td>
</tr>
<tr>
<td>One BNC T connector (Item 7)</td>
</tr>
<tr>
<td>One 5X attenuator (Item 2)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>See page 4–15.</td>
</tr>
</tbody>
</table>

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 684A or 25 ns on the TDS 7XXA.
   
   - 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 684A or 25 ns on the TDS 7XXA; 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.
   
   - 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 a medium-frequency sine wave 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](image)

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 **High-Low 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 \( \Omega \) 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.
- Press SET LEVEL TO 50%. Adjust the TRIGGER LEVEL knob so that the TRIG’D light is on. Set the level to near the middle of the range where the TRIG’D light is on. CHECK that the trigger is stable for the test waveform on both the positive and negative slopes. Use the side menu to switch between trigger slopes.
- 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 684A Screen](image)
3. **Performance Tests**

   **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.
   - 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, for TDS 684A & TDS 784A = 1 GHz, for TDS 744A = 500 MHz):

   a. Hook up the test-signal source: Disconnect the hookup installed in step 1. Connect, through its leveling head, the signal output of a high-frequency leveled sine wave generator to CH 1.

   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 (for TDS 684A & TDS 784A = 1 GHz, for 744A = 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.)

      - Disconnect the leveling head at CH 1 and reconnect it to CH 1 through a 5X attenuator.

   d. Repeat step 2, substeps b and c only, since only the full bandwidth (for TDS 684A & TDS 784A = 1 GHz, for 744A = 500 MHz) is to be checked here.
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
**Main and Delayed Trigger**

| Equipment Required | Two 50 Ω precision cables (Item 5)  
<table>
<thead>
<tr>
<th></th>
<th>One calibration generator (Item 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites</strong></td>
<td>See page 4–15. Also, the Digitizing Oscilloscope must have passed Check DC Voltage Measurement Accuracy on page 4–29.</td>
</tr>
</tbody>
</table>

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

   ![Figure 4–19: Initial Test Hookup](image)

   a. *Hook up test-signal source 1:*

      - Connect the standard amplitude output of a calibration generator through a 50 Ω precision coaxial cable to CH 3.
      - 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:*
Performance Tests

- 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 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.

**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 1.
- Press CH 2 to display that channel.
- Set the vertical SCALE to 1 V.
- 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:**
- 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 test record.
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.
- 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 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 SIGNAL OUT BNC.
- Push TRIGGER MENU.
Press the main-menu button **Source**.

Press the side-menu button **Ch3**.

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:**

- CHECK that the readout **Ch2 Pk-Pk** is between 80 mV and 120 mV, inclusive, for the TDS 684A or is between 88 mV and 132 mV, inclusive, for the TDS 7XXA.

- 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 684A or is between 44 mV and 66 mV, inclusive, for the TDS 7XXA.

- 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**

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>See page 4–15. Also, the Digitizing Oscilloscope must have passed Check Accuracy For Long-Term Sample Rate, Delay Time, and Delta Time Measurements on page 4–42.</th>
</tr>
</thead>
<tbody>
<tr>
<td>One female BNC to clip adapter (Item 3)</td>
<td></td>
</tr>
<tr>
<td>Two dual-banana connectors (Item 6)</td>
<td></td>
</tr>
<tr>
<td>One BNC T connector (Item 7)</td>
<td></td>
</tr>
<tr>
<td>Two 50 Ω precision cables (Item 5)</td>
<td></td>
</tr>
<tr>
<td>One DC calibration generator (Item 9)</td>
<td></td>
</tr>
</tbody>
</table>
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](img)

   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**.
Performance Tests

- Select 128 averages.

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 for Ch1**. Press the side-menu **Measurement 1**.

![Figure 4–22: Measurement of Probe Compensator Frequency](image)

   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 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](image)

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

<table>
<thead>
<tr>
<th>Check Video Trigger</th>
<th>Equipment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PAL signal source (Item 16)</td>
</tr>
<tr>
<td></td>
<td>60 Hz. sine wave generator (Item 17)</td>
</tr>
<tr>
<td></td>
<td>Pulse generator (Item 18)</td>
</tr>
<tr>
<td></td>
<td>Two 75 Ω cables (Item 19)</td>
</tr>
<tr>
<td></td>
<td>Two 75 Ω terminators (Item 20)</td>
</tr>
<tr>
<td></td>
<td>One BNC T connector (Item 7)</td>
</tr>
<tr>
<td></td>
<td>50 Ω cable (Item 5)</td>
</tr>
<tr>
<td></td>
<td>50 Ω terminator (Item 4)</td>
</tr>
</tbody>
</table>

| Prerequisites | See page 4–15. These prerequisites include running the signal path compensation routine. |

1. Set up digitizing 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 digitizing oscilloscope is setup as shown below.
      Channel: CH1
      Volt/div: 100 mV
      Horizontal scale: 500 μs/div

2. Set up digitizing 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. Use the keypad to set the fine scale to 282mV (press 282, **SHIFT**, m, then **ENTER**).

k. Press **HORIZONTAL MENU**.

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

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

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 TDS.

      - 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](image)

   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 684A Shown

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

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

e. Select the side-menu **Average**. It should be already set to 16.

f. Press the main-menu **Create Limit Test Template**.

g. Press the side-menu **V Limit**.

h. Use the keypad to set V Limit to 180 mdiv (press 180, **SHIFT**, m, then **ENTER**)

i. Press the side-menu **OK Store Template**.

j. Press **MORE**.

k. Press the main-menu **Ref1**.

l. Press **CH1**.

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

n. Press the main-menu **Limit Test Setup**.

o. Toggle the side-menu **Limit Test** to **ON**.

p. Toggle the side-menu **Ring Bell if Condition Met** to **ON**.
q. Press the main-menu Mode.

r. Press the side-menu Envelope.

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

t. Press the main-menu Stop After button.

u. Press the side-menu Single Acquisition Sequence.

v. Confirm that the oscilloscope successfully makes 100 acquisitions. If not successful, the oscilloscope bell will ring. When the word Run in the top left corner of the display changes to STOP, the test is complete. See Figure 4–27.

Figure 4–27: Jitter Test When Completed – TDS 684A Shown

w. Press the main-menu Limit Test Setup.

x. Toggle the side-menu Ring Bell if Condition Met to OFF.

y. Toggle the side-menu Limit Test to OFF.

4. 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. 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 4–28.
Performance Tests

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.
5. **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 (SG 502).
   
   - Connect the output of the SG 502 to the CH2 input through a 50 Ω cable. See Figure 4–30.
Figure 4–30: 60 Hz Rejection Test Hookup

- Adjust the SG 502 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 (SG 502). 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 digitizing oscilloscope.
Performance Tests

Figure 4–33: 60 Hz Rejection Test Result – TDS 684A Shown

6. 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.
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 digitizing oscilloscope.
- Turn off cursors by pressing CURSOR, then the main-menu Function button, and, finally, Off from the side menu.

7. **Check the Sync Duty Cycle.**

a. Set up digitizing 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 (PG502) 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 (PG502) through a 50 Ω cable and a 50 Ω terminator to the oscilloscope CH1 input. See Figure 4–37.

![Figure 4–37: PG502 Setup for Sync Duty Cycle Test](image)

- 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 (TSG 121) from the digitizing oscilloscope.

- Press save/recall SETUP, the main-menu button Recall Factory Setup, and the side-menu OK Confirm Factory Init.
Adjustment Procedures

This section contains information needed to adjust the TDS 684A and 7XXA Digitizing Oscilloscopes.

**Description**

The Adjustment Procedures are divided into six subsections:

- General information about adjusting the TDS 684A and 7XXA Digitizing Oscilloscopes.
- A list of equipment required to perform the adjustments.
- The written procedures for installing and using both the TDS 684A Adjustment Software and the TDS 700A Adjustment Software.
- The TDS 684A and the TDS 700A Adjustment Software (two disks) 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 digitizing oscilloscope to conformance with its Warranted Characteristics as listed in Section 1, Specification. 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**

The following computer and peripherals are required to adjust this oscilloscope.

An IBM® PC™ compatible computer equipped as follows:

- Eight MHz clock speed or faster.
- DOS 3.2 or higher.
- 640K Resident RAM with 580 K Available RAM.
- A hard drive.
- A high-density floppy drive: 3.5 inch (1.44 M) or 5.25 inch (1.2 M).
- 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).
- Suitable keyboard and monitor.

**Optional Peripherals**

Installation of a math coprocessor in your system is strongly recommended to decrease the time required to adjust the oscilloscope.

**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 5–7.

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 684A Adjustment Software and the TDS 700A 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 (CATS) and an internal compensation routine (SPC). The Adjustment Software provides 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

<table>
<thead>
<tr>
<th>Class of Adjustment</th>
<th>CATS Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Reference</td>
<td>CVR_CAL</td>
</tr>
<tr>
<td></td>
<td>TEMPERATURE_SET</td>
</tr>
<tr>
<td></td>
<td>SPC</td>
</tr>
<tr>
<td>Frequency Response</td>
<td>SPC</td>
</tr>
<tr>
<td></td>
<td>HF_CAL</td>
</tr>
<tr>
<td>Pulse Trigger</td>
<td>SPC</td>
</tr>
<tr>
<td></td>
<td>TRIG_POS_CAL</td>
</tr>
<tr>
<td></td>
<td>PNP_LATENCY</td>
</tr>
<tr>
<td></td>
<td>GLITCH_TRIG_CAL</td>
</tr>
</tbody>
</table>

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 5–2.

Table 5–2: Adjustments Required for Module Replaced

<table>
<thead>
<tr>
<th>Module Replaced</th>
<th>Adjustment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition Board</td>
<td>Complete Adjustment</td>
</tr>
<tr>
<td>Front Panel Assembly</td>
<td>None Required</td>
</tr>
<tr>
<td>Low Voltage Power Supply</td>
<td>None Required</td>
</tr>
<tr>
<td>Processor Board</td>
<td>None Required</td>
</tr>
<tr>
<td>Display Assembly</td>
<td>Display Adjustment Only</td>
</tr>
</tbody>
</table>

Adjustment Dependencies

Some adjustments depend on successful prior completion of other adjustments. For example, all the CATS tests associated with the Voltage Reference Adjustment class must be passed before any other adjustments can be successfully completed. Table 5–3 lists the adjustments and their dependencies.

Table 5–3: Adjustments and Dependencies

<table>
<thead>
<tr>
<th>Class of Adjustment</th>
<th>Prior Completion Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Reference Adjustment</td>
<td>None</td>
</tr>
<tr>
<td>Frequency Response Adjustment</td>
<td>Voltage Reference (SPC and all tests)</td>
</tr>
<tr>
<td>Pulse Trigger Adjustment</td>
<td>Voltage Reference (SPC and all tests)</td>
</tr>
<tr>
<td>P6139A Probe Adjustment</td>
<td>Voltage Reference and Frequency Response (SPC and all tests)</td>
</tr>
<tr>
<td>Display Adjustment</td>
<td>None</td>
</tr>
</tbody>
</table>
Equipment Required

Table 5–4 lists the test equipment required to adjust the TDS 684A and 7XXA Digitizing Oscilloscopes.

<table>
<thead>
<tr>
<th>Item Number and Description</th>
<th>Minimum Requirements</th>
<th>Example</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Adapter, BNC-Female-to-BNC-Female</td>
<td>Tektronix part number 013-0028-00</td>
<td>Tektronix part number 013-0028-00</td>
<td>Probe Adjustment</td>
</tr>
<tr>
<td>2. Adapter, Probe Tip to BNC, 50 Ω termination</td>
<td>Tektronix part number 013-0227-00</td>
<td>Tektronix part number 013-0227-00</td>
<td>Probe Adjustment</td>
</tr>
<tr>
<td>3. Adjustment Tool</td>
<td>Less than 1/8 inch diameter and over 2 inches long</td>
<td>Tektronix part number 003-0675-00</td>
<td>Software-based Adjustments (used as a probe) and Manual Adjustments</td>
</tr>
<tr>
<td>4. Adjustment Tool</td>
<td>7/32 inch hex wrench on both ends</td>
<td>GC Electronics #8606</td>
<td>A30 CRT Driver adjustment</td>
</tr>
<tr>
<td>5. Attenuator, 10X (Two required)</td>
<td>Ratio: 10X; impedance 50 Ω; connectors: female BNC input, male BNC output</td>
<td>Tektronix part number 011-0059-02</td>
<td>Software-based Adjustments</td>
</tr>
<tr>
<td>6. Attenuator, 2X</td>
<td>Ratio: 2X; impedance 50 Ω; connectors: female BNC input, male BNC output</td>
<td>Tektronix part number 011-0069-02</td>
<td>Software-based Adjustments</td>
</tr>
<tr>
<td>8. Coupler, Dual-Input</td>
<td></td>
<td>Tektronix part number 067-0525-02</td>
<td>Software-based Adjustments</td>
</tr>
<tr>
<td>9. Cable, Precision Coaxial</td>
<td>50 Ω, 36 in, male to male BNC connectors</td>
<td>Tektronix part number 012-0482-00</td>
<td>Software-based Adjustments</td>
</tr>
<tr>
<td>10. Connector, Dual-Banana</td>
<td>Female BNC to dual banana</td>
<td>Tektronix part number 103-0090-00</td>
<td>Software-based Adjustments</td>
</tr>
<tr>
<td>11. Generator, Calibration</td>
<td>High Amplitude pulse with variable amplitude of at least 60 V.</td>
<td>Tektronix PG 506A(^1) Calibration Generator</td>
<td>Probe Adjustment</td>
</tr>
<tr>
<td>12. Generator, DC Calibration</td>
<td>Variable amplitude to ±104 V; accuracy to 0.1%</td>
<td>Data Precision 8200</td>
<td>Software-based Adjustments</td>
</tr>
<tr>
<td>13. Generator, Leveled Sine Wave, Medium-Frequency</td>
<td>200 kHz to 250 MHz; Variable amplitude from 5 mV to 4 V(^{pp}) into 50 Ω; flatness ≤ 3%; harmonic content: 2(^{nd}) harmonic down –30 dB from fundamental; all others down –40 dB</td>
<td>Tektronix SG 503(^1) or SG5030(^1) Leveled Sine Wave Generator</td>
<td>Software-based Adjustments</td>
</tr>
</tbody>
</table>
### Table 5-4: Test Equipment, Fixtures, and Supplies (Cont.)

<table>
<thead>
<tr>
<th>Item Number and Description</th>
<th>Minimum Requirements</th>
<th>Example</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. Generator, Leveled Sine Wave, High-Frequency</td>
<td>250 MHz to 1 GHz; Variable amplitude from 0.5 V to 4 V${}_{pp}$ into 50 Ω; 6 MHz reference; harmonic content: 2nd harmonic down –25 dB from fundamental; all others down –40 dB</td>
<td>Tektronix SG 504$^1$ Leveled Sine Wave Generator with its leveling head or a Tektronix SG 5030$^1$ Programmable Leveled Sine Wave Generator with its leveling head</td>
<td>Software-based Adjustments</td>
</tr>
<tr>
<td>15. Magnifier, 6X</td>
<td>Standard Tool</td>
<td></td>
<td>Brightness and Focus Adjustment</td>
</tr>
<tr>
<td>16. Photometer</td>
<td>0.1 to 200 Footlamberts</td>
<td>Tektronix J16 Photometer with J6503 Luminance Probe</td>
<td>Contrast Adjustment</td>
</tr>
<tr>
<td>17. Probe, 10X, optional accessory</td>
<td>A P6139A Probe</td>
<td>Tektronix P6139A</td>
<td>Probe Adjustment</td>
</tr>
<tr>
<td>18. Multimeter, Digital</td>
<td>200 V, ±0.05% Accuracy</td>
<td>Tektronix DM504A Digital Multimeter$^1$</td>
<td>A30 CRT Driver Adjustment</td>
</tr>
<tr>
<td>19. Fixture, Display Holding</td>
<td></td>
<td>Tektronix part number 067-0211-00</td>
<td>Display Adjustment</td>
</tr>
<tr>
<td>20. Fixture, Raster-Center Locating</td>
<td></td>
<td>Tektronix part number 067-0208-00</td>
<td>Locating Center of Display</td>
</tr>
<tr>
<td>21. Adhesive</td>
<td>Non-corrosive RTV silicon rubber paste</td>
<td>RTV #3145, Tektronix part number 006-1171-00</td>
<td>Fixing Adjustments and Components</td>
</tr>
<tr>
<td>22. Adhesive</td>
<td>Non-corrosive</td>
<td>Loctite Assure #42540</td>
<td>Fixing Adjustments</td>
</tr>
<tr>
<td>23. Adhesive</td>
<td>Non-corrosive</td>
<td>TRA-CON Tra-Bond #BA-2114</td>
<td>Fixing BNC</td>
</tr>
<tr>
<td>24. Graticule, External</td>
<td></td>
<td>Tektronix part number 067-0206-00</td>
<td>A30 CRT Driver Linearity Check</td>
</tr>
<tr>
<td>25. Extension Cable</td>
<td>18 inch, 16 pin</td>
<td>Tektronix part number 174-2655-00</td>
<td>A30 CRT Driver Adjustment</td>
</tr>
<tr>
<td>26. Screwdriver, Torque</td>
<td>Standard Tool</td>
<td></td>
<td>CRT Yoke Adjustment</td>
</tr>
<tr>
<td>27. Magnets, Horizontal Linearity</td>
<td>0.59 × 0.59 × 0.09, 4–20 Gauss</td>
<td>Tektronix part number 119-1616-00</td>
<td>Horizontal Linearity Adjustment</td>
</tr>
<tr>
<td>28. Strap, Nylon</td>
<td>8.0 × 0.1 Nylon</td>
<td>Tektronix part number 346-0128-00</td>
<td>Horizontal Linearity Adjustment</td>
</tr>
<tr>
<td>29. Pulser, Tunnel Diode</td>
<td></td>
<td>Tektronix part number 067-0681-01</td>
<td>Probe Adjustment</td>
</tr>
</tbody>
</table>

$^1$ Requires a TM 500 or TM5000 Series Power Module Mainframe.
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. This software is compatible with cards configured for PCII and PCIIA operation. 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**

<table>
<thead>
<tr>
<th>Board Settings</th>
<th>GPIB-PCII</th>
<th>GPIB-PCIIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base I/O Address</td>
<td>2B8</td>
<td>2E1</td>
</tr>
<tr>
<td>Interrupt Line</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>DMA Channel</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

   *Systems using the combination card (GPIB-PCII/IIA) can be configured as either a GPIB-PCII or a GPIB-PCIIA.*

**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 a) 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:* Using the proper DOS commands, copy the Adjustment Software disk to a working disk.
2. **Install the software to hard disk:**
   
a. Install your working disk in a floppy drive and type `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.

b. The adjustment software will be installed in a directory called `TDS684.ADJ` or `TDS700.ADJ` on your hard drive.

3. **Store your installation disk:** Remove your installation disk and store in a secure place.

### Software-Based Adjustments

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>All items that are listed for “Software-based Adjustments” under “Purpose” in Table 5–4 starting on page 5–5.</th>
</tr>
</thead>
</table>

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 any address between 0 and 29.

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.

b. Change directories to TDS684A.ADJ for the TDS 684A or TDS700.ADJ for the TDS 744A or TDS 784A.

c. Type `ADJ684A` for the TDS 684A or type `ADJ700` for the TDS 744A and TDS 784A.
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 3) 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](image)

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 3) 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.

<table>
<thead>
<tr>
<th>Equipment Required</th>
<th>One P6139A probe (Item 17).</th>
</tr>
</thead>
</table>

1. Install the test hookup and preset the oscilloscope controls:
Figure 5–2: Hookup for Probe Compensation

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.

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 $\mu$s.
   - 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).

![Figure 5–3: Performing Probe Compensation](image)

![Figure 5–4: Proper and Improper Probe Compensation](image)
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

<table>
<thead>
<tr>
<th>Equipment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>One high-frequency sine wave generator with its leveling head (Item 14)</td>
</tr>
<tr>
<td>One BNC-female-to-female BNC adapter (Item 1)</td>
</tr>
<tr>
<td>One BNC-to-probe tip adapter (Item 2)</td>
</tr>
<tr>
<td>One P6139A 10X probe (Item 17)</td>
</tr>
</tbody>
</table>

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](image)

   - Pull forward to remove the retractable hook tip.
   - Unscrew the ribbed ferrule tip cover and pull forward to remove.
   - Pull forward to remove the ground-lead assembly.

   **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.
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:
Adjustment Procedures

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.

<table>
<thead>
<tr>
<th>Equipment Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>One calibration generator (Item 11)</td>
</tr>
<tr>
<td>One 50 Ω precision cable (Item 9)</td>
</tr>
<tr>
<td>One tunnel diode pulser (Item 29)</td>
</tr>
<tr>
<td>One BNC female-to-female adapter (Item 1)</td>
</tr>
<tr>
<td>One BNC to probe adapter (Item 2)</td>
</tr>
<tr>
<td>One 10X attenuator (Item 5)</td>
</tr>
<tr>
<td>One P6139A 10X probe (Item 17)</td>
</tr>
</tbody>
</table>

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](image)

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.
2. **Adjust the Probe:**

   a. **Display and store the reference signal:**

      - Set the high-amplitude output of the generator to \( \geq 60 \text{ V at the input to the tunnel diode pulser} \).

      - 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.
Adjustment Procedures

- 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 **VERTI+CAL 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.
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.
1. Adjust R1 for best overall match.
2. Adjust R2 and C1 for best match between front corners.
3. Repeat the first two steps as needed due to interaction between adjustments.

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.

### Equipment Required

<table>
<thead>
<tr>
<th>Required</th>
<th>One 6X magnifier (Item 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One J16 Photometer with a J6503 Luminance Probe (Item 16)</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Switch No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

   - 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.

![Figure 5–11: Five and Ten Percent Luminance Patches](image)

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 J16 photometer and a luminance probe.
- Adjust R404 (CONTRAST) for a reading of 40 foot lamberts.

**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:

<table>
<thead>
<tr>
<th>Switch No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**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.
This section contains the information needed to do periodic and corrective maintenance on the TDS 684A and 7XXA Digitizing 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/Replacement Instructions** — 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 and troubleshooting 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/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 8, *Replaceable Electrical Parts*, lists all replaceable electrical parts by part number.

- 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

### Preventing ESD

**CAUTION.** Static discharge can damage any semiconductor component in this oscilloscope.

**Precautions.** 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

<table>
<thead>
<tr>
<th>Semiconductor Classes</th>
<th>Relative Susceptibility Levels¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOS or CMOS microcircuits or discrete circuits, or linear microcircuits with MOS inputs (most sensitive)</td>
<td>1</td>
</tr>
<tr>
<td>ECL</td>
<td>2</td>
</tr>
<tr>
<td>Schottky signal diodes</td>
<td>3</td>
</tr>
<tr>
<td>Schottky TTL</td>
<td>4</td>
</tr>
<tr>
<td>High-frequency bipolar transistors</td>
<td>5</td>
</tr>
<tr>
<td>JFET</td>
<td>6</td>
</tr>
<tr>
<td>Linear microcircuits</td>
<td>7</td>
</tr>
<tr>
<td>Low-power Schottky TTL</td>
<td>8</td>
</tr>
<tr>
<td>TTL (least sensitive)</td>
<td>9</td>
</tr>
</tbody>
</table>

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 on, and how to clean the exterior and interior of the TDS 684A and 7XXA Digitizing 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 breakdown. (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

<table>
<thead>
<tr>
<th>Item</th>
<th>Inspect For</th>
<th>Repair Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabinet, front panel, and cover</td>
<td>Cracks, scratches, deformations, damaged hardware or gaskets.</td>
<td>Repair or replace defective module.</td>
</tr>
<tr>
<td>Front-panel knobs</td>
<td>Missing, damaged, or loose knobs.</td>
<td>Repair or replace missing or defective knobs.</td>
</tr>
<tr>
<td>Connectors</td>
<td>Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.</td>
<td>Repair or replace defective modules. Clear or wash out dirt.</td>
</tr>
<tr>
<td>Carrying handle, bail, cabinet feet.</td>
<td>Correct operation.</td>
<td>Repair or replace defective module.</td>
</tr>
<tr>
<td>Accessories</td>
<td>Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors.</td>
<td>Repair or replace damaged or missing items, frayed cables, and defective modules.</td>
</tr>
</tbody>
</table>

Cleaning Procedure — Exterior.

To clean the oscilloscope exterior, do the following:

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 repaired or replaced, check Table 5–2 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

<table>
<thead>
<tr>
<th>Item</th>
<th>Inspect For</th>
<th>Repair Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circuit boards</td>
<td>Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.</td>
<td>Remove failed module and replace with a fresh module.</td>
</tr>
<tr>
<td>Resisters</td>
<td>Burned, cracked, broken, blistered condition.</td>
<td>Remove failed module and replace with a fresh module.</td>
</tr>
<tr>
<td>Solder connections</td>
<td>Cold solder or rosin joints.</td>
<td>Resolder joint and clean with isopropyl alcohol.</td>
</tr>
<tr>
<td>Capacitors</td>
<td>Damaged or leaking cases. Corroded solder on leads or terminals.</td>
<td>Remove damaged module and replace with a fresh module from the factory.</td>
</tr>
<tr>
<td>Semiconductors</td>
<td>Loosely inserted in sockets. Distorted pins.</td>
<td>Firmly seat loose semiconductors. Remove devices that have distorted pins. Carefully straighten pins (as required to fit the socket), using long-nose pliers, and reinset firmly. Ensure that straightening action does not crack pins, causing them to break off.</td>
</tr>
<tr>
<td>Wiring and cables</td>
<td>Loose plugs or connectors. Burned, broken, or frayed wiring.</td>
<td>Firmly seat connectors. Repair or replace modules with defective wires or cables.</td>
</tr>
<tr>
<td>Chassis</td>
<td>Dents, deformations, and damaged hardware.</td>
<td>Straighten, repair, or replace defective hardware.</td>
</tr>
</tbody>
</table>

Cleaning Procedure — Interior.

To clean the oscilloscope interior, do the following:

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 and disassemble 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.)
- Module disassembly procedures.

**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.
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 6–53.

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 6–29 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 6–46 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 6–53 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. 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

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Name</th>
<th>Description</th>
<th>Tektronix Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Screwdriver handle</td>
<td>Accepts Torx®-driver bits</td>
<td>003-0301-00</td>
</tr>
<tr>
<td>2</td>
<td>T-15 Torx tip</td>
<td>Torx®-driver bit for T-15 size screw heads</td>
<td>003-0966-00</td>
</tr>
<tr>
<td>3</td>
<td>T-20 Torx tip</td>
<td>Torx®-driver bit for T-20 size screw heads</td>
<td>003-0866-00</td>
</tr>
<tr>
<td>4</td>
<td>T-20 Torx tip</td>
<td>Special Tool: Narrow Torx®-driver bit for T-20 size screw heads (fan removal only)</td>
<td>003-1457-01</td>
</tr>
<tr>
<td>5</td>
<td>Flat-bladed screwdriver</td>
<td>Screwdriver for removing standard-headed screws</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Needle-Nose Pliers</td>
<td>Standard tool</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Nutdriver, ¾ inch</td>
<td>Standard tool</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Retaining Ring Pliers</td>
<td>Standard tool; 1⅛ inch minimum throw</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Angle-Tip Tweezers</td>
<td>Standard tool</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Soldering Iron</td>
<td>Standard tool</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Pliers</td>
<td>Standard tool</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Solder Wick</td>
<td>Standard tool</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>⅜ hex tip</td>
<td>Bit for ⅜ hex set screw</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Adhesive</td>
<td>TRA-CON: Tra-Bond #BA-2114</td>
<td></td>
</tr>
</tbody>
</table>
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 6–29.

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.
Removal and Installation Procedures

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 6–29.

d. Find and do the procedure whose title matches the name of the module to be removed under Procedures for Inner-Chassis Modules, page 6–46.

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 wish 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.
Removal and Installation Procedures

When reinstalling the knobs, note there are three sizes. Be sure to reinstall the proper size knob in the proper location.

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.

![Diagram of Line Fuse and Line Cord Removal](image)

**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.

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.

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 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:**
   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 as 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 6–6: 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.

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. See Figure 6–7.

---

**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.
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.)

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.

---

**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.”

---

**A12 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.

   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 6–8.

   c. Finally, lift the front-panel assembly out of the front subpanel to complete the removal.
4. *Further disassembly of front-panel assembly*: If the front panel or the front-panel buttons are to be serviced, do the following substeps:

   a. Remove the front-panel control knobs from the front-panel assembly using the method described in *Front-Panel Knobs* on page 6–16.

   b. Remove the eight screws mounting the front-panel board to the front panel.
c. Now hand disassemble the front-panel assembly components using Figure 6–9 as a guide. Reverse procedure to reassemble, using the same Figure 6–9 as a guide.

Figure 6–9: Disassembly of Front-Panel Assembly

5. Reinstallation: If the front-panel assembly was further disassembled in step 4, then reverse substeps 4a–4c to reassemble, using Figure 6–9 as a guide. Then do step 3, reversing the procedure outlined in each substep. Last, reinstall the trim ring and, if desired, the front cover, referring to the procedure Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel (page 6–22).

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* (page 6–42) 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).

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:*
   
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.
Handle Removal

Flip Stand Removal

Push down to flex handle and flatten against cabinet; then pull it out.

Handle Cap Removal

Foot Removal

Figure 6–10: Cabinet Modules Removal
Procedures for Outer-Chassis Modules

You should have completed the Access Procedure 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**
- **Top Cover and Board Brackets**
- **Rear-Panel Cables**
- **A10 Acquisition Board**
- **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.

![A14 D1 Bus and Analog-Power and Digital-Power Cables Removal](image_url)

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.
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).

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.

**Figure 6–12: Remove Circuit Board Assembly From Oscilloscope**
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](image)

3. Replace circuit board:

**Equipment Required:** One ⅛ inches 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 6–57.

**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 6–35.

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
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 684A, 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 6–29), A23 SerPar Board (page 6–31) 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 6–57.

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 6–29), A23 SerPar Board (page 6–31), if option 05 is
installed, A29 Video Trigger Board, and Rear Cover and Cabinet (page 6–18) to complete reassembly of the oscilloscope.

1. Unplug the cables.

2. Slide the A11 DRAM Processor/Display board to the rear to release it from the board mounts; then lift up to complete removal.

Figure 6–16: A11 Processor/Display 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 6–29), *A23 SerPar Board* (page 6–31), if option 05 is installed *A29 Video Trigger Board* (page 6–32) and *A11 Processor/Display Board* (page 6–36) 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.)

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.
1. Assemble equipment and locate modules to be removed: Have handy a pair of needle-nose pliers (Item 6). Have handy 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 6–39.
   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 6–29) 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 6–18 as a guide.

   a. Disconnect the cables from (CH 3) SIGNAL OUT (at J1201), AUX TRIG INPUT (at J1550), MAIN TRIG OUTPUT (at J1000), DELAYED TRIG OUTPUT (at J1001).

   b. If the option 05 video board is installed, disconnect the coax cable attached to J1500.

   c. Remove the six screws that mount the acquisition board to the main chassis.

   d. Remove the 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 6–29).

   ■ Front Cover, Trim Ring, Menu Buttons, and Attenuator Panel (page 6–22).

   ■ Rear Cover and Cabinet (page 6–18).
Figure 6–18: A10 Acquisition Board Removal
Floppy Disk

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:** Use Figure 6–19 as a guide.
   a. Unplug the J38 floppy driver 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. Then pull out the disk.
5. **Reinstallation:** Do, in reverse order, substeps 4b then 4a to reinstall the floppy disk. 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’s 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 6–20 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 6–29)
   - Rear Cover and Cabinet (page 6–18)
Figure 6–20: 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:

   CAUTION. If any RTV Silicon is removed from the oscilloscope, it must be replaced in order to maintain the warranted characteristics for random vibration.

   a. Working from the rear of the oscilloscope, remove the two screws securing the low-voltage power supply to the rear chassis. See Figure 6–21.

   b. Now, working from the top of the oscilloscope, remove the seven screws, indicated in Figure 6–21, that mount the supply to the main chassis.

   c. Grasp the supply at the points indicated in Figure 6–21 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 6–37)
   - A11 Processor/Display Board (page 6–36)
   - If option 05 is installed, A29 Video Trigger Board (page 6–32)
- A14 D1 Bus and Analog-Power and Digital-Power Cables (page 6–29)
- Rear Cover and Cabinet (page 6–18)

**Figure 6–21: A16 Low Voltage Power Supply Removal**

**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 6–22 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 6–22: Display Assembly Removal*

5. *Remove the display supply board:* Use Figure 6–23 as a guide.

**CAUTION.** If any RTV Silicon is removed from the oscilloscope, it must be replaced in order to maintain the warranted characteristics for random vibration.

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 6–23: 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:
Removal and Installation Procedures

- Top Cover and Board Brackets (top cover only) on page 6–37
- All Processor/Display Board (page 6–36)
- If option 05 is installed, A29 Video Trigger Board (page 6–32)
- A14 D1 Bus and Analog-Power and Digital-Power Cables (page 6–29)
- 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 6–47). 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 6–24 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 6–24.) Then reinstall the six screws removed in step 3.
   b. See the procedure A30 Display Assembly and Supply Fuse (page 6–47) 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 6–37)
      - All Processor/Display Board (page 6–36)
      - If option 05 is installed, A29 Video Trigger Board (page 6–32)
Figure 6–24: 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 Oscilloscopes 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, 6–2, and 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. **Front Subpanel** (page 6–51) 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 6–29.
   a. **Fan** (page 6–29)
   b. **A14 D1 Bus and Analog-Power and Digital-Power Cables** (page 6–29)
   c. **A23 SerPar Board** (page 6–31)
   d. **A29 Video Trigger Board – with option 05** (page 6–32)
   e. **A11 Processor/Display Board** (page 6–36)
   f. **Top Cover and Board Brackets** (page 6–37)
   g. **A10 Acquisition Board** (page 6–39)

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 6–46.
   a. **A16 Low Voltage Power Supply** (page 6–46)
   b. **A30 Display Assembly and Supply Fuse** (page 6–47)
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 6–24 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 6–20 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.

   **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 the following procedures. When doing these procedures, do their steps in reverse order. These procedures are found under Procedures for Inner-Chassis Modules which start on page 6–46.
   
   - A30 Display Assembly and Supply Fuse (page 6–47)
   - A16 Low Voltage Power Supply (page 6–46)

c. **Reinstall the outer-chassis modules:** Do in the order listed 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 6–29.
   
   - Top Cover and Board Brackets (page 6–37)
   - A11 Processor/Display Board (page 6–36)
   - A23 SerPar Board (page 6–31)
   - A29 Video Trigger Board – with option 05 (page 6–32)
   - A14 D1 Bus and Analog-Power and Digital-Power Cables (page 6–29)
   - Fan (page 6–29)
d. Reinstall external modules: Do in the order listed 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.

- A10 Acquisition Board (page 6–39)
- Front Subpanel (page 6–51)
- Display-Frame Assembly (page 6–47)
- 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

Digitizing Oscilloscopes 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 6–25 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, see *Optional Accessories, Mechanical Parts List* in Section 10 for the part number.
Press on the principal power switch on the back of the oscilloscope.

- Can you hear the fan whirling?
  - Yes
  - No

- When the oscilloscope powers on, do the front-panel lights come on and then go off about 30 seconds later?
  - Yes
  - No

- Does the display seem to be working at all?
  - Yes
  - No

- Is the display readable and stable?
  - Yes
  - No

- Does the oscilloscope respond correctly when the front-panel buttons are pushed?
  - Yes
  - No

- Does the oscilloscope power on, all the diagnostics pass, but sometime later powers down on its own?
  - Yes
  - No

- Perform the Module Isolation troubleshooting procedure.

Power off and remove the cover using the Rear Cover and Cabinet removal procedure. Check all the cables coming out of the Low Voltage Power Supply, and the cabling between modules. Be sure every cable is attached securely.

- Perform the A16 Low Voltage Power Supply Module Isolation troubleshooting procedure.

- Does the system power on now?
  - Yes
  - No

- There is something wrong with the ON/STBY button. Perform the Processor/Front Panel troubleshooting procedure.

- Perform the Processor/Front Panel troubleshooting procedure.

- Did you find the faulty module?
  - Yes
  - No

- Replace the A10 Acquisition module

- Done.

Figure 6–26: Primary Troubleshooting Procedure
Troubleshooting

Replace the A11 DRAM Processor/Display module.

Note. The replacement module may not have the correct firmware loaded. See page 6–58 for details on firmware updates.

Figure 6–26: Primary Troubleshooting Procedure (Cont.)
This procedure assumes that the oscilloscope is up and running and you can read the display.

Does the display report any errors?

Yes

If yes, select the extended diagnostics menu and run all the test suites (the discussion of the Diagnostics on page 6–57 explains how to do this).

No

Are any failures reported?

Yes

The oscilloscope is ok.

No

Regardless of other failures, did the Processor fail but the Acq/Proc Interface and FP/Proc Interface pass?

Yes

Did the Processor pass but something else fail?

Yes

Could you locate a faulty module using these procedures?

Yes

Replace the A11 DRAM Processor/Display module.

No

Perform the Processor/Front Panel troubleshooting procedures.

Done.

No

Did the Processor pass but something else fail?

Yes

Perform the Processor/Front Panel troubleshooting procedure.

No

Did the Processor/Front Panel and/or FP/Proc Interface tests fail?

Yes

Did the FP/Proc Interface tests fail?

Yes

Of the two, the Front Panel test must have failed. Replace the A12 Front Panel module.

No

Perform the Processor/Front Panel troubleshooting procedure.

No

Are there any failures with the Acquisition and/or its interfaces?

Yes

The oscilloscope should be ok. Run the extended diagnostics (the discussion of the Diagnostics on page 6–57 explains how to do this) and verify that all the modules pass.

No

Regardless of other failures, did the Acq/Proc Interface test fail?

Yes

Perform the Processor/Acquisition troubleshooting procedure.

No

Did the Attn/Acq Interface fail?

Yes

The Acquisition tests must have been the only failure. Replace the A10 Acquisition module.

No

Perform the Attenuator/Acquisition troubleshooting procedure.

Figure 6–27: Module Isolation Troubleshooting Procedure
Troubleshooting

The oscilloscope may have powered off because it over-heated. Wait 5 minutes and power on the oscilloscope.

Is the fan's connector securely attached to J20 on the A11 DRAM Processor/Display module? (See Figure 6–33.)

Is there 25 V across J20 pins 1 and 3 on the A11 DRAM Processor/Display module? (See Figure 6–32.)

Does the oscilloscope work?

Replace the A10 Acquisition module.

Does the oscilloscope have adequate ventilation (as specified in Section 2 Operating Information on page 2–3)?

Connect the fan.

Is the oscilloscope have adequate ventilation (as specified in Section 2 Operating Information on page 2–3)?

Create adequate ventilation.

Turn off the principal power switch. Disconnect the line cord from its power source. Remove the oscilloscope rear cover and cabinet using the Rear Cover and Cabinet removal procedure. Connect the oscilloscope to the correct power source. Turn on the principal power switch.

Are the voltages ok?

Yes

No

Without a power supply load, check the power supply voltages on the A17 Main LV Power Supply module (see Table 6–6 and Figure 6–32). If necessary, temporarily short pins 3 and 5 of J5 to toggle the On/Standby Control circuit.

The Low Voltage Power Supply is ok. Perform the Primary troubleshooting procedure.

Unplug the fan, power on the oscilloscope and probe J20.

Is there 25 V across the pins of J20?

Yes

No

Replace the fan.

Does the oscilloscope work?

Yes

No

Is the fan working?

No

Yes

Turn off the principal power switch. Disconnect the line cord from its power source. Remove the oscilloscope rear cover and cabinet using the Rear Cover and Cabinet removal procedure.

Are the voltages ok?

Yes

No

Turn off the power switch. Disconnect the line cord from its power source. Replace the Low Voltage Power Supply.

Does the oscilloscope work?

Yes

No

Are the front-panel lights on?

Yes

No

Press the ON/STBY button. Are the front-panel lights on?

Yes

No

Is fuse blown?

Yes

No

Replace fuse. Does fuse blow again?

Yes

No

Is the oscilloscope power on, all the diagnostics pass, but sometime later it powers off on its own?

Yes

No

The oscilloscope may have powered off because it over-heated. Wait 5 minutes and power on the oscilloscope.

Does the oscilloscope have adequate ventilation (as specified in Section 2 Operating Information on page 2–3)?

Create adequate ventilation.

Figure 6–28: 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)

<table>
<thead>
<tr>
<th>Supply</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground (J26 or J27 pin 15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+5.1 VA (J27 pin 5)</td>
<td>+5.0 V</td>
<td>+5.2 V</td>
</tr>
<tr>
<td>+5.1 VB (J27 pin 17)</td>
<td>+5.0 V</td>
<td>+5.2 V</td>
</tr>
<tr>
<td>+25 V (J27 pin 1)</td>
<td>+23.5 V</td>
<td>+27.5 V</td>
</tr>
<tr>
<td>+5 V (J26 pin 39)</td>
<td>+4.9 V</td>
<td>+5.1 V</td>
</tr>
<tr>
<td>–5.1 V (J26 pin 17)</td>
<td>–4.9 V</td>
<td>–5.2 V</td>
</tr>
<tr>
<td>+15 V (J26 pin 11)</td>
<td>+14.7 V</td>
<td>+15.3 V</td>
</tr>
<tr>
<td>–15 V (J26 pin 7)</td>
<td>–14.7 V</td>
<td>–15.3 V</td>
</tr>
</tbody>
</table>

### Table 6–6: No-Load Supply Voltages (Measured on J5 and J6 on the A17 Main LV Power Supply Module)

<table>
<thead>
<tr>
<th>Supply</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground (J5 or J6 pin 15)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+5.1 VA (J6 pin 5)</td>
<td>+4.95 V</td>
<td>+5.25 V</td>
</tr>
<tr>
<td>+5.1 VB (J6 pin 17)</td>
<td>+4.95 V</td>
<td>+5.25 V</td>
</tr>
<tr>
<td>+25 V (J6 pin 1)</td>
<td>+23.5 V</td>
<td>+27.5 V</td>
</tr>
<tr>
<td>+5 V (J5 pin 39)</td>
<td>+0.59 V</td>
<td>+0.81 V</td>
</tr>
<tr>
<td>–5.1 V (J5 pin 17)</td>
<td>–0.39 V</td>
<td>–0.61 V</td>
</tr>
<tr>
<td>+15 V (J5 pin 11)</td>
<td>+1.05 V</td>
<td>+1.75 V</td>
</tr>
<tr>
<td>–15 V (J5 pin 7)</td>
<td>–1.05 V</td>
<td>–1.75 V</td>
</tr>
</tbody>
</table>

---

Figure 6–29: Power Supply Voltage Measurement Locations
This procedure helps you determine whether the color display or the A11 DRAM Processor/Display module is bad.

Is the display legible but the horizontal and/or vertical sync do not look ok?

No

Power the oscilloscope off and disconnect the cable from J5 on the A11 DRAM Processor/Display module (see Figure 6–38) then power back on.

Are J5 pins 1 and 2 at +25 V and J5 pins 3 and 4 at +5.1 V?

No

On the A11 DRAM Processor/Display module probe J27, but DO NOT REMOVE the cable from the connector. The voltages will change if the A11 DRAM Processor/Display is not connected to the power supply.

Are J27 pin 1 at +25 V and J27 pin 17 at +5.1 V? (See Figure 6–36.)

No

Perform the Low Voltage Power Supply troubleshooting procedure.

Yes

Do J18 pins 1 and 2 on the A11 DRAM Processor/Display module (see Figure 6–38) have signals similar to Figure 6–31?

No

Yes Replace the A30 Display Assembly.

Yes

Does J62 pin 1 on the A11 DRAM Processor/Display module (see Figure 6–38) have a video signal with the same levels as Figure 6–32?

No

Replace the A11 DRAM Processor/Display module.

Yes

Perform the Low Voltage Power Supply troubleshooting procedure.

Figure 6–30: Color Display Troubleshooting Procedure
J18 pin 1 (Horizontal Sync)

J18 pin 2 (Vertical Sync)

Figure 6–31: Horizontal and Vertical Sync Signals – Color Display

White Level

J62 pin 1 (Video)

Black Levels
Blanking Levels

Figure 6–32: A Video Signal with White, Black, and Blanking Levels – Color Display
Troubleshooting

This procedure helps you determine whether the A10 Acquisition or the A11 DRAM Processor/Display module is bad.

Replace the A14 D1 Bus module. Be sure you connect the A14 D1 Bus module correctly (the silkscreen on the module will help you correctly orient the module).

Select the extended diagnostics menu and run all the test suites (the discussion of the Diagnostics on page 6–57 explains how to do this).

Do the Processor/Acq tests pass now?

Yes

Done.

No

There is a problem in the communication link between the A10 Acquisition and the A11 DRAM Processor/Display module. The A10 Acquisition most likely failed, so replace this module. Run the Extended Diagnostics again.

Do the Processor/Acq tests pass now?

Yes

Done.

No

Replace the A11 DRAM Processor/Display module.

Figure 6–33: Processor/Acquisition Troubleshooting Procedure
This procedure helps you determine if the A11 DRAM Processor/Display or the A12 Front Panel module is bad.

1. **Is the cable from the A11 DRAM Processor/Display module to the A12 Front Panel module securely connected?**
   - Yes: Connect the cable and then perform the Primary troubleshooting procedure.
   - No: Perform the Low Voltage Power Supply troubleshooting procedure.

2. **Is the ON/STBY button working correctly?**
   - Yes: Power off and remove the cable from J2 on the A11 DRAM Processor/Display module. Probe P2 pins 10 and 8 with an ohm meter.
   - No: Replace the Low Voltage Power Supply.

3. **Is there a 3.125 MHz clock on J2 pin 25?**
   - Yes: Replace the A12 Front Panel module.
   - No: Probe J2 pin 2, 6, 7, 11, 16. Are these pins –15 V, +15 V, +5 V, –5.1 V, and +5.1 V respectively?
     - Yes: There must be a problem with the communication link between the A11 DRAM Processor/Display and the A12 Front Panel. The A12 Front Panel module has most likely failed. Replace this module.
     - No: Does the Front Panel work correctly now?
       - Yes: Done.
       - No: Replace the A11 DRAM Processor/Display module.

4. **Does the resistance between these two pins dramatically decrease when the ON/STBY button is toggled?**
   - Yes: Replace the A12 Front Panel module.
   - No: Perform the Low Voltage Power Supply troubleshooting procedure.

Figure 6–34: Processor/Front Panel Troubleshooting Procedure
Troubleshooting

Attach a probe to the PROBE COMPENSATION signal located on the front of the oscilloscope. Connect the probe to a channel's BNC on the front, select the channel and view the output on the display. Do this for all the channels.

For all the channels, is the signal on the display a 1 kHz ±0.250 V square wave?

Yes

The Acquisition/Attenuator Interface is ok.

No

Do all the channels display defective waveforms?

Yes

Set all the channels to the same vertical scale and select a channel that works correctly. Attach the PROBE COMPENSATION signal to a defective channel's BNC on the front of the oscilloscope and swap these two channels' coaxes to the A10 Acquisition module.

No

Attach the PROBE COMPENSATION signal to the CH 1 BNC on the front of the oscilloscope. Remove the coax connector from J1400 on the A10 Acquisition module.

Probe the detached end of the coax. Is there a 1 kHz ±0.250 V square wave on the coax?

Yes

Power the oscilloscope off and disconnect the cable attached to J1153 on the A10 Acquisition module. Power on and probe J1153 pins 14, 16, 18, and 20.

No

Are these pins +15 V, +5 V, –5.1 V, and –15 V respectively?

Yes

Probe J700 but DO NOT REMOVE the cable from the connector. The voltages will change if the A10 Acquisition module is not connected to the power supply.

No

Perform the Low Voltage Power Supply troubleshooting procedure.

Yes

While turning the vertical SCALE knob, does J1153 pin 22 pulse swing between +5 V and 0 V?

Yes

While turning the vertical SCALE knob, does J1153 pin 24 pulse low swinging between ±5 V and 0 V?

Yes

While turning the vertical SCALE knob again, does J1153 pin 26 swing between +5 V and 0 V?

Yes

Replace the A15 Attenuator module.

No

While turning the vertical SCALE knob, does J1153 pin 22 pulse swing between +5 V and 0 V?

No

While turning the vertical SCALE knob, does J1153 pin 24 pulse low swinging between ±5 V and 0 V?

No

While turning the vertical SCALE knob again, does J1153 pin 26 swing between +5 V and 0 V?

No

Replace the A10 Acquisition module.

Figure 6–35: 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 6–36: A11 DRAM Processor/Display Module (View of Right Side)
Figure 6–37: A11 DRAM Processor/Display Module (View of Upper Left Corner)

Figure 6–38: A11 DRAM Processor/Display Module (View of Lower Left Corner)
Figure 6–39: A10 Acquisition Module (View of Lower Right Corner)
Options and Accessories

This section describes the various options as well as the standard and optional accessories that are available for the TDS 684A and 7XXA Oscilloscope.

Options

Tektronix will ship the options shown in Table 7–1:

Table 7–1: Options

<table>
<thead>
<tr>
<th>Option #</th>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Universal European power cord</td>
<td>220 V, 50 Hz power cord</td>
</tr>
<tr>
<td>A2</td>
<td>UK power cord</td>
<td>240 V, 50 Hz power cord</td>
</tr>
<tr>
<td>A3</td>
<td>Australian power cord</td>
<td>240 V, 50 Hz power cord</td>
</tr>
<tr>
<td>A4</td>
<td>North American power cord</td>
<td>240 V, 60 Hz power cord</td>
</tr>
<tr>
<td>A5</td>
<td>Switzerland power cord</td>
<td>220 V, 50 Hz power cord</td>
</tr>
<tr>
<td>05</td>
<td>Video trigger</td>
<td>Oscilloscope comes with tools for investigating events that occur when a video signal generates a horizontal or vertical sync pulse. It allows investigation of a range of NTSC, PAL, SECAM, and high definition TV signals.</td>
</tr>
<tr>
<td>1K</td>
<td>Scope cart</td>
<td>K420 scope cart. This cart can help transport the oscilloscope around many lab environments.</td>
</tr>
</tbody>
</table>
## Options and Accessories

### Table 7–1: Options (Cont.)

<table>
<thead>
<tr>
<th>Option #</th>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1M</td>
<td>130,000 record length (TDS 7XXA)</td>
<td>Extend TDS 7XXA record length from 50,000 standard to 500,000 samples on one channel, 250,000 on two channels, and 130,000 samples on three or four channels.</td>
</tr>
<tr>
<td>1R</td>
<td>Rackmount</td>
<td>Oscilloscope comes configured for installation in a 19 inch wide instrument rack. For later field conversions, order kit # 016-1236-00.</td>
</tr>
<tr>
<td>23</td>
<td>Two active probes (TDS 744A)</td>
<td>Add two 750 MHz P6205 active probes</td>
</tr>
<tr>
<td>24</td>
<td>Four passive probes</td>
<td>Add four 500 MHz P6139 passive probes</td>
</tr>
<tr>
<td>26</td>
<td>Four active probes</td>
<td>Add four 1 GHz P6245 active probes</td>
</tr>
<tr>
<td>2P</td>
<td>Color printer</td>
<td>Tektronix Phaser 200e, 300 dpi, thermal transfer, color printer. It handles letter or A4 size Tektronix thermal paper and transparencies. It can handle laser copy (plain) paper with the ColorCoat Transfer roll.</td>
</tr>
</tbody>
</table>
Table 7–1: Options (Cont.)

<table>
<thead>
<tr>
<th>Option #</th>
<th>Label</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
<td>Calibration Data Report</td>
<td></td>
</tr>
</tbody>
</table>

96 Calibration Certificate Certificate of Calibration which states this instrument meets or exceeds all warranted specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant, or a ratio calibration technique. The calibration is in compliance with US MIL-STD-45662A. This option includes a test data report for the oscilloscope.

Standard Accessories

The oscilloscope comes standard with the accessories listed in Table 7–2.

Table 7–2: Standard Accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Manual</td>
<td>070-8991-xx</td>
</tr>
<tr>
<td>Programmer Manual</td>
<td>070-8709-xx</td>
</tr>
<tr>
<td>Reference</td>
<td>070-8999-xx</td>
</tr>
<tr>
<td>Performance Verification</td>
<td>070-8990-xx</td>
</tr>
<tr>
<td>TDS 744A: Four P6139A 10X, 500 MHz Passive probes</td>
<td>P6139A</td>
</tr>
<tr>
<td>Front Cover</td>
<td>200-3696-00</td>
</tr>
<tr>
<td>U.S. Power Cord</td>
<td>161-0230-01</td>
</tr>
</tbody>
</table>
Optional Accessories

You can also order the optional accessories listed in Table 7–3.

### Table 7–3: Optional Accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Manual</td>
<td>070-8992-xx</td>
</tr>
<tr>
<td>Plotter (GPIB and Centronics Standard)</td>
<td>HC100</td>
</tr>
<tr>
<td>Oscilloscope Cart</td>
<td>K420</td>
</tr>
<tr>
<td>Rack Mount Kit (for field conversion)</td>
<td>016-1236-00</td>
</tr>
<tr>
<td>Soft-Sided Carrying Case</td>
<td>016-0909-01</td>
</tr>
<tr>
<td>Transit Case</td>
<td>016-1135-00</td>
</tr>
<tr>
<td>GPIB Cable (1 meter)</td>
<td>012-0991-01</td>
</tr>
<tr>
<td>GPIB Cable (2 meter)</td>
<td>012-0991-00</td>
</tr>
<tr>
<td>Centronics Cable</td>
<td>012-1250-00</td>
</tr>
</tbody>
</table>

### Accessory Probes

The following optional accessory probes are recommended for use with your oscilloscope:

- **P6245** Active, high speed digital voltage probe. FET. DC to 1 GHz. 50 Ω input.
- **P6101B** 1X, 15 MHz, Passive probe.
- **P6156** 10X, 3.5 GHz, Passive, low capacitance, (low impedance Z₀) probe. Provides 100X, when ordered with Option 25.
- **P6139A** 10X, 500 MHz Passive probe.
- **P6009** Passive, high voltage probe, 100X, 1500 VDC + Peak AC.
- **P6015A** Passive high voltage probe, 1000X, 20 kVDC + Peak AC (40 kV peak for less than 100 ms).
- **P6217** Active, high speed digital voltage probe. FET. DC to 4 GHz. DC offset. 50 Ω input. Use with 1103 TekProbe Power Supply for offset control.
- **P6204** Active, high speed digital voltage probe. FET. DC to 1 GHz. DC offset. 50 Ω input. Use with 1103 TekProbe Power Supply for offset control.
- **P6563AS** Passive, SMD probe, 20X, 500 MHz.
- **P6046** Active, differential probe, 1X/10X, DC to 100 MHz, 50 Ω input.
- AM 503S — DC/AC Current probe system, AC/DC. Uses A6302 Current Probe.
- AM 503S Option 03: DC/AC Current probe system, AC/DC. Uses A6303 Current Probe.
- 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 semipermanent in-circuit installation. 25 kHz to 1 GHz, 50 Ω input.
- CT-2 Current probe — designed for permanent or semipermanent in-circuit installation. 1.2 kHz to 200 MHz, 50 Ω input.
- CT-4 Current Transformer — for use with the AM 503S (A6302) and P6021. Peak pulse 1 kA. 0.5 Hz to 20 MHz with AM 503S (A6302).
- P6701A Opto-Electronic Converter, 500 to 950 nm, DC to 850 MHz, 1 V/mW.
- P6703A Opto-Electronic Converter, 1100 to 1700 nm, DC to 1 GHz, 1 V/mW.
- P6711 Opto-Electronic Converter, 500 to 950 nm, DC to 250 MHz, 5 V/mW.
- P6713 Opto-Electronic Converter, 1100 to 1700 nm, DC to 300 MHz, 5 V/mW.

Accessory Software

The optional accessories listed in Table 7–4 are Tektronix software products recommended for use with your oscilloscope:

<table>
<thead>
<tr>
<th>Software</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavewriter: AWG and waveform creation</td>
<td>S3FT400</td>
</tr>
<tr>
<td>LabWindows</td>
<td>S3FG910</td>
</tr>
</tbody>
</table>

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.

Service Assurance

Tektronix offers the following services that you can purchase any time during the warranty period of this product:

- *REPXXXX* provides one year of post-warranty repair support. It is available in one year increments up to three years.
Options and Accessories

- CALXXX provides one year of calibration support. It is available in one year increments up to five years.
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 block diagram and the interconnection diagram for the TDS 684A and 7XXA Digitizing 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
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

<table>
<thead>
<tr>
<th>Column</th>
<th>Column Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Figure &amp; Index Number</td>
<td>Items in this section are referenced by component number.</td>
</tr>
<tr>
<td>2</td>
<td>Tektronix Part Number</td>
<td>Use this part number when ordering replacement parts from Tektronix.</td>
</tr>
<tr>
<td>3 and 4</td>
<td>Serial Number</td>
<td>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.</td>
</tr>
<tr>
<td>5</td>
<td>Qty</td>
<td>This indicates the quantity of parts used.</td>
</tr>
<tr>
<td>6</td>
<td>Name &amp; Description</td>
<td>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.</td>
</tr>
<tr>
<td>7</td>
<td>Mfr. Code</td>
<td>This indicates the code of the actual manufacturer of the part. (Code to name and address cross reference is located after this page.)</td>
</tr>
<tr>
<td>8</td>
<td>Mfr. Part Number</td>
<td>This indicates the actual manufacturer’s or vendor’s part number.</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>Mfr. Code</th>
<th>Manufacturer</th>
<th>Address</th>
<th>City, State, Zip Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3109</td>
<td>FELLER</td>
<td>72 VERONICA AVE UNIT 4</td>
<td>SUMMERSET NJ 08873</td>
</tr>
<tr>
<td>TK01K</td>
<td>MODERN METALS</td>
<td>UNIT A/K, 5/F GOLD KING IND. BLDG NO. 35-41 TAI LIN ROAD</td>
<td>KWAI–CHUN N.T. HONG KONG</td>
</tr>
<tr>
<td>TK0488</td>
<td>CURRAN COIL SPRING INC</td>
<td>9265 SW 5TH</td>
<td>WILSONVILLE, OR 97070</td>
</tr>
<tr>
<td>TK0588</td>
<td>UNIVERSAL PRECISION PRODUCTS</td>
<td>1775 NW 216TH</td>
<td>HILLSBORO OR 97123</td>
</tr>
<tr>
<td>TK1163</td>
<td>POLYCAST INC</td>
<td>9888 SW TIGARD ST</td>
<td>TIGARD OR 97223</td>
</tr>
<tr>
<td>TK1465</td>
<td>BEAVERTON PARTS MFG CO</td>
<td>1800 NW 216TH AVE</td>
<td>HILLSBORO OR 97124–6629</td>
</tr>
<tr>
<td>TK2162</td>
<td>DERBY MFG</td>
<td>24350 STATE ROAD 23 SOUTH</td>
<td>SOUTH BEND IN 46614–6696</td>
</tr>
<tr>
<td>TK2193</td>
<td>PHOTO AND SOUND</td>
<td>820 NW 18TH AVENUE</td>
<td>PORTLAND OR 97209</td>
</tr>
<tr>
<td>TK2248</td>
<td>WESTERN MICRO TECHNOLOGY</td>
<td>1800 NW 169TH PL SUITE B–300</td>
<td>BEAVERTON OR 97006</td>
</tr>
<tr>
<td>TK2338</td>
<td>ACC MATERIALS</td>
<td>ED SNYDER BLDG 38–302</td>
<td>BEAVERTON OR 97077</td>
</tr>
<tr>
<td>TK2432</td>
<td>UNION ELECTRIC</td>
<td>15/F #1, FU–SHING N. ROAD</td>
<td>TAIPEI, TAIWAN ROC</td>
</tr>
<tr>
<td>TK2469</td>
<td>UNITREK CORPORATION</td>
<td>3000 LEWIS &amp; CLARK WAY SUITE #2</td>
<td>VANCOUVER WA 98601</td>
</tr>
<tr>
<td>TK2500</td>
<td>SOLECTEK ACCESSORIES CORP</td>
<td>6370 NANCY RIDGE DR SUITE 109</td>
<td>SAN DIEGO CA 92121</td>
</tr>
<tr>
<td>TK2539</td>
<td>ROYAL CASE CO INC</td>
<td>315 SOUTH MONTGOMERY PO BOX 2231</td>
<td>SHERMAN TX 75091–2231</td>
</tr>
<tr>
<td>TK2548</td>
<td>XEROX BUSINESS SERVICES DIV OF XEROX CORPORATION</td>
<td>14181 SW MILLIKAN WAY</td>
<td>BEAVERTON OR 97077</td>
</tr>
<tr>
<td>TK2597</td>
<td>MERIX CORPORATION</td>
<td>1521 POPULAR LANE</td>
<td>FOREST GROVE, OR 97116</td>
</tr>
<tr>
<td>0JR05</td>
<td>TRIQUEST CORP</td>
<td>3000 LEWIS AND CLARK HWY</td>
<td>VANCOUVER WA 98661–2999</td>
</tr>
<tr>
<td>0J9P9</td>
<td>GEROME MFG CO INC</td>
<td>PO BOX 737</td>
<td>NEWBERG OR 97132</td>
</tr>
<tr>
<td>0KB01</td>
<td>STAUFFER SUPPLY</td>
<td>810 SE SHERMAN</td>
<td>PORTLAND OR 97214</td>
</tr>
<tr>
<td>0KB05</td>
<td>NORTH STAR NAMEPLATE</td>
<td>5750 NE MOORE COURT</td>
<td>HILLSBORO OR 97124–6474</td>
</tr>
<tr>
<td>00779</td>
<td>AMP INC</td>
<td>2800 FULLING MILL PO BOX 3608</td>
<td>HARRISBURG PA 17105</td>
</tr>
<tr>
<td>07416</td>
<td>NELSON NAME PLATE CO</td>
<td>3191 CASITAS</td>
<td>LOS ANGELES CA 90039–2410</td>
</tr>
<tr>
<td>1DM20</td>
<td>PARLEX CORPORATION LAMINATED CABLE DIV</td>
<td>7 INDUSTRIAL WAY</td>
<td>SALEM, NH 03079</td>
</tr>
<tr>
<td>1GM54</td>
<td>ZYTEC CORPORATION</td>
<td>7575 MARKET PLACE DR</td>
<td>EDEN PRAIRIE MN 55344–3637</td>
</tr>
<tr>
<td>1J9J6</td>
<td>KAM ELECTRIC CO</td>
<td>11866 SLATER AVE NE</td>
<td>KIRKLAND WA 98034</td>
</tr>
<tr>
<td>2W733</td>
<td>COOPER INDUSTRIES INC BELDEN DIVISION</td>
<td>2200 US HIGHWAY 27 SOUTH PO BOX 1980</td>
<td>RICHMOND IN 47375–0010</td>
</tr>
<tr>
<td>22526</td>
<td>BERG ELECTRONICS INC (DUPONT)</td>
<td>857 OLD TRAIL RD</td>
<td>ETTERS PA 17319</td>
</tr>
<tr>
<td>24931</td>
<td>SPECIALTY CONNECTOR CO INC</td>
<td>2100 EARLYWOOD DR PO BOX 547</td>
<td>FRANKLIN IN 46131</td>
</tr>
<tr>
<td>30817</td>
<td>INSTRUMENT SPECIALTIES CO INC</td>
<td>EXIT 53 RT 80 BOX A</td>
<td>DELAWARE WATER GAP PA 18327</td>
</tr>
<tr>
<td>Mfr. Code</td>
<td>Manufacturer</td>
<td>Address</td>
<td>City, State, Zip Code</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>---------</td>
<td>----------------------</td>
</tr>
<tr>
<td>34416</td>
<td>PARSONS MFG CORP</td>
<td>1055 O'BRIAN DR</td>
<td>MENLO PARK CA 94025–1408</td>
</tr>
<tr>
<td>5Y400</td>
<td>TRIAX METAL PRODUCTS INC DIV OF BEAVERTON PARTS MFG CO</td>
<td>1800 NW 216TH AVE</td>
<td>HILLSBORO OR 97124–6629</td>
</tr>
<tr>
<td>53387</td>
<td>3M COMPANY ELECTRONIC PRODUCTS DIV</td>
<td>3M AUSTIN CENTER</td>
<td>AUSTIN TX 78769–2963</td>
</tr>
<tr>
<td>61857</td>
<td>SAN-0 INDUSTRIAL CORP</td>
<td>91–3 COLIN DRIVE</td>
<td>HOLBROOK NY 11741</td>
</tr>
<tr>
<td>61935</td>
<td>SCHURTER INC</td>
<td>1016 CLEGG COURT</td>
<td>PETALUMA CA 94952–1152</td>
</tr>
<tr>
<td>75915</td>
<td>LITTelfUSE TRACOR INC SUB OF TRACOR INC</td>
<td>800 E NORTHWEST HWY</td>
<td>DES PLAINES IL 60016–3049</td>
</tr>
<tr>
<td>80009</td>
<td>TEKTRONIX INC</td>
<td>14150 SW KARL BRAUN DR PO BOX 500</td>
<td>BEAVERTON OR 97077–0001</td>
</tr>
</tbody>
</table>
### Replaceable Parts List

<table>
<thead>
<tr>
<th>Fig. &amp; Index Number</th>
<th>Tektronix Part Number</th>
<th>Serial No. Effective</th>
<th>Serial No. Discont’d</th>
<th>Qty</th>
<th>Name &amp; Description</th>
<th>Mfr. Code</th>
<th>Mfr. Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–1</td>
<td>200–3695–02</td>
<td>1</td>
<td></td>
<td></td>
<td>COVER, REAR: REAR COSMETIC COVER</td>
<td>TK1163</td>
<td>200–3695–02</td>
</tr>
<tr>
<td>~2</td>
<td>161–0230–01</td>
<td>1</td>
<td></td>
<td></td>
<td>CABLE ASSY, PWR: 3.18 AWG, .92 L, SVT, TAN (STANDARD ACCESSORY)</td>
<td>TK2432</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~3</td>
<td>343–1213–00</td>
<td>1</td>
<td></td>
<td></td>
<td>CLAMP, PWR CORD: POLYIMIDE (STANDARD ACCESSORY)</td>
<td>TK1163</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~4</td>
<td>200–2264–00</td>
<td>1</td>
<td></td>
<td></td>
<td>CAP, FUSEHOLDER: 3AG FUSES (AMERICAN)</td>
<td>61935</td>
<td>FEK 031 1666</td>
</tr>
<tr>
<td></td>
<td>200–2265–00</td>
<td>1</td>
<td></td>
<td>2</td>
<td>CAP, FUSEHOLDER: 5 X 20MM FUSES (EUROPEAN)</td>
<td>61935</td>
<td>FEK 031.1663</td>
</tr>
<tr>
<td>~5</td>
<td>159–0013–00</td>
<td>1</td>
<td></td>
<td></td>
<td>FUSE, CARTRIDGE: 3AG, 6A, 250V, FAST BLOW (AMERICAN)</td>
<td>75915</td>
<td>312006</td>
</tr>
<tr>
<td></td>
<td>159–0210–00</td>
<td>1</td>
<td></td>
<td></td>
<td>FUSE, CART: DIN 5 X 20MM, 5AMP, 250V, SLOW (EUROPEAN)</td>
<td>61857</td>
<td>ET 5 AMP</td>
</tr>
<tr>
<td>~6</td>
<td>650–3039–00</td>
<td>1</td>
<td></td>
<td></td>
<td>CABINET ASSY:</td>
<td>OJBP9</td>
<td>650–3039–00</td>
</tr>
<tr>
<td>~7</td>
<td>367–0247–01</td>
<td>1</td>
<td></td>
<td></td>
<td>HANDLE, CARRYING: 11.54 L, W/ CLIP</td>
<td>80009</td>
<td>367024701</td>
</tr>
<tr>
<td>~8</td>
<td>200–2191–00</td>
<td>2</td>
<td></td>
<td></td>
<td>CAP, RETAINER: PLASTIC</td>
<td>0JR05</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~9</td>
<td>437–0399–01</td>
<td>1</td>
<td></td>
<td></td>
<td>CABINET, SCOPE:</td>
<td>80009</td>
<td>437039901</td>
</tr>
<tr>
<td>~10</td>
<td>348–1110–02</td>
<td>4</td>
<td></td>
<td></td>
<td>FOOT, CABINET:</td>
<td>80009</td>
<td>348111002</td>
</tr>
<tr>
<td>~11</td>
<td>348–1254–01</td>
<td>4</td>
<td></td>
<td></td>
<td>PAD, FOOT, TEK BLACK, SANTOPRENE</td>
<td>80009</td>
<td>348125401</td>
</tr>
<tr>
<td>~12</td>
<td>348–0875–00</td>
<td>1</td>
<td></td>
<td></td>
<td>FLIPSTAND, CAB:</td>
<td>TK0488</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~13</td>
<td>348–1109–01</td>
<td>2</td>
<td></td>
<td></td>
<td>GASKET, SHIELD: 348–1109–00 CUT 45.0 L</td>
<td>80009</td>
<td>348110901</td>
</tr>
<tr>
<td>~14</td>
<td>200–3696–01</td>
<td>1</td>
<td></td>
<td></td>
<td>COVER, FRONT: PLASTIC (STANDARD ACCESSORY)</td>
<td>80009</td>
<td>200369601</td>
</tr>
<tr>
<td>~15</td>
<td>101–0142–00</td>
<td>1</td>
<td></td>
<td></td>
<td>TRIM, DECORATIVE: FRONT</td>
<td>TK1163</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~16</td>
<td>334–8581–00</td>
<td>1</td>
<td></td>
<td></td>
<td>MARKER, IDENTITY: FRONT NOMINCLATURE (TDS684A ONLY)</td>
<td>0KB05</td>
<td>334–8581–00</td>
</tr>
<tr>
<td></td>
<td>334–8856–00</td>
<td>1</td>
<td></td>
<td></td>
<td>MARKER, IDENTITY: FRONT, TDS744A (TDS744A ONLY)</td>
<td>80009</td>
<td>334885600</td>
</tr>
<tr>
<td></td>
<td>334–8551–00</td>
<td>1</td>
<td></td>
<td></td>
<td>MARKER, IDENTITY: MKD TDSXXX, FRONT (TDS784A ONLY)</td>
<td>0KB05</td>
<td>334–8551–00</td>
</tr>
<tr>
<td>~17</td>
<td>214–4287–00</td>
<td>1</td>
<td></td>
<td></td>
<td>ACTUATOR: ELASTOMER MAT, FRONT PANEL, RBR</td>
<td>TK0IK</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~18</td>
<td>366–2114–00</td>
<td>2</td>
<td></td>
<td></td>
<td>KNOB, LARGE, DETENTED</td>
<td>TK1163</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~19</td>
<td>366–2111–00</td>
<td>3</td>
<td></td>
<td></td>
<td>KNOB, SMALL, FLUTED</td>
<td>TK1163</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~20</td>
<td>650–2827–00</td>
<td>1</td>
<td></td>
<td></td>
<td>REPLACEABLE AS: DISPLAY FRAME WITH FLEX</td>
<td>80009</td>
<td>650292700</td>
</tr>
<tr>
<td>~21</td>
<td>386–5954–00</td>
<td>1</td>
<td></td>
<td></td>
<td>PANEL, INPUT: PLASTIC, ATTENUATOR</td>
<td>80009</td>
<td>386595400</td>
</tr>
<tr>
<td>~22</td>
<td>614–0914–03</td>
<td>1</td>
<td></td>
<td></td>
<td>FNT PANEL ASSY: (TDS684A ONLY)</td>
<td>80009</td>
<td>614091403</td>
</tr>
<tr>
<td></td>
<td>614–0929–00</td>
<td>1</td>
<td></td>
<td></td>
<td>FNT PANEL ASSY: (TDS744A/784A ONLY) (A12, EXCHANGE ITEM)</td>
<td>80009</td>
<td>614092900</td>
</tr>
<tr>
<td>~23</td>
<td>366–2170–00</td>
<td>1</td>
<td></td>
<td></td>
<td>KNOB, DIMPLED GPK, 1.7 DIA</td>
<td>TK1163</td>
<td>ORDER BY DESC</td>
</tr>
</tbody>
</table>
Figure 10–1: External Modules
## Replaceable Parts List

<table>
<thead>
<tr>
<th>Fig. &amp; Index Number</th>
<th>Tektronix Part Number</th>
<th>Serial No. Effective</th>
<th>Serial No. Discont’d</th>
<th>Qty</th>
<th>Name &amp; Description</th>
<th>Mfr. Code</th>
<th>Mfr. Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2–1</td>
<td>212–0189–00</td>
<td>6</td>
<td>SCR, ASSEM WSR: 8–32 X 0.500, PNH, STL, T–20</td>
<td>6</td>
<td>SCR, ASSEM WSR: 8–32 X 0.500, PNH, STL, T–20</td>
<td>0KB01</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~2</td>
<td>119–4615–00</td>
<td>1</td>
<td>FAN, DC; TUBEAXIAL; ASSY, 24V, 6W, 2800/1600 RPM</td>
<td>1</td>
<td>FAN, DC; TUBEAXIAL; ASSY, 24V, 6W, 2800/1600 RPM</td>
<td>TK2469</td>
<td>119–4615–00</td>
</tr>
<tr>
<td>~3</td>
<td>671–3182–00</td>
<td>1</td>
<td>CIRCUIT BD ASSY; COLOR PROCESSOR DISPLAY (A11, EXCHANGE ITEM)</td>
<td>1</td>
<td>CIRCUIT BD ASSY; COLOR PROCESSOR DISPLAY (A11, EXCHANGE ITEM)</td>
<td>80009</td>
<td>671318200</td>
</tr>
<tr>
<td>~4</td>
<td>441–1902–01</td>
<td>1</td>
<td>CHASSIS, SCOPE, REAR</td>
<td>1</td>
<td>CHASSIS, SCOPE, REAR</td>
<td>0J9P9</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~5</td>
<td>334–7966–02</td>
<td>1</td>
<td>MARKER, IDENT: MKD W/CONN IDENT, REAR BNC</td>
<td>1</td>
<td>MARKER, IDENT: MKD W/CONN IDENT, REAR BNC</td>
<td>07416</td>
<td>334–7966–02</td>
</tr>
<tr>
<td>~6</td>
<td>131–1315–01</td>
<td>4</td>
<td>CONN, RF JACK: BNC/PNL, 50 OHM, FEMALE</td>
<td>4</td>
<td>CONN, RF JACK: BNC/PNL, 50 OHM, FEMALE</td>
<td>24931</td>
<td>28JR306–1</td>
</tr>
<tr>
<td>~7</td>
<td>671–2437–00</td>
<td>1</td>
<td>CIRCUIT BD ASSY: RS232/CENTRONIC;</td>
<td>1</td>
<td>CIRCUIT BD ASSY: RS232/CENTRONIC;</td>
<td>80009</td>
<td>671243700</td>
</tr>
<tr>
<td>~8</td>
<td>407–3825–00</td>
<td>2</td>
<td>BRACKET, Ckt BD: PLASTIC, REAR</td>
<td>2</td>
<td>BRACKET, Ckt BD: PLASTIC, REAR</td>
<td>TK1163</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~9</td>
<td>386–6182–00</td>
<td>1</td>
<td>PLATE, REAR: ALUMINUM, RS232/CENTRONIC</td>
<td>1</td>
<td>PLATE, REAR: ALUMINUM, RS232/CENTRONIC</td>
<td>0J9P9</td>
<td>386–6182–00</td>
</tr>
<tr>
<td>~10</td>
<td>131–0890–01</td>
<td>10</td>
<td>CONN, HARDWARE: DSUB, JACK SCREW</td>
<td>10</td>
<td>CONN, HARDWARE: DSUB, JACK SCREW</td>
<td>00779</td>
<td>205818–2</td>
</tr>
<tr>
<td>~11</td>
<td>348–1300–00</td>
<td>2</td>
<td>SHLD, GSKT, ELEK: 3.165 L, CLIP ON</td>
<td>2</td>
<td>SHLD, GSKT, ELEK: 3.165 L, CLIP ON</td>
<td>30817</td>
<td>0098–0564–09–03</td>
</tr>
<tr>
<td>~12</td>
<td>211–0730–00</td>
<td>6</td>
<td>SCR, ASSEM WSR: 8–32 X 0.375, PNH, STL, T–15</td>
<td>6</td>
<td>SCR, ASSEM WSR: 8–32 X 0.375, PNH, STL, T–15</td>
<td>0KB01</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~13</td>
<td>671–2847–00</td>
<td>1</td>
<td>CIRCUIT BD ASSY: D1 BUS (A14, EXCHANGE ITEM)</td>
<td>1</td>
<td>CIRCUIT BD ASSY: D1 BUS (A14, EXCHANGE ITEM)</td>
<td>80009</td>
<td>671284700</td>
</tr>
<tr>
<td>~14</td>
<td>671–2848–00</td>
<td>1</td>
<td>CIRCUIT BD ASSY: D1 BUS (A14, OPT 05, EXCHANGE ITEM)</td>
<td>1</td>
<td>CIRCUIT BD ASSY: D1 BUS (A14, OPT 05, EXCHANGE ITEM)</td>
<td>80009</td>
<td>671284800</td>
</tr>
<tr>
<td>~15</td>
<td>671–2694–00</td>
<td>1</td>
<td>CIRCUIT BOARD: ACQUISITION (TDS684A ONLY)</td>
<td>1</td>
<td>CIRCUIT BOARD: ACQUISITION (TDS684A ONLY)</td>
<td>80009</td>
<td>671269400</td>
</tr>
<tr>
<td>~16</td>
<td>343–0088–00</td>
<td>2</td>
<td>CLAMP, CABLE: 0.062 DIA, PLASTIC</td>
<td>2</td>
<td>CLAMP, CABLE: 0.062 DIA, PLASTIC</td>
<td>80009</td>
<td>343008800</td>
</tr>
<tr>
<td>~17</td>
<td>407–3878–00</td>
<td>6</td>
<td>BRACKET, Ckt BD: PLASTIC</td>
<td>6</td>
<td>BRACKET, Ckt BD: PLASTIC</td>
<td>TK1163</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~18</td>
<td>407–3877–00</td>
<td>2</td>
<td>BRACKET, Ckt BD: PLASTIC</td>
<td>2</td>
<td>BRACKET, Ckt BD: PLASTIC</td>
<td>TK1163</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~19</td>
<td>441–1901–00</td>
<td>1</td>
<td>CHASSIS, SCOPE, TOP</td>
<td>1</td>
<td>CHASSIS, SCOPE, TOP</td>
<td>0J9P9</td>
<td>ORDER BY DESC</td>
</tr>
</tbody>
</table>
Figure 10–2: Outer-Chassis Modules
## Replaceable Parts List

<table>
<thead>
<tr>
<th>Fig. &amp; Index Number</th>
<th>Tektronix Part Number</th>
<th>Serial No. Effective</th>
<th>Serial No. Discont’d</th>
<th>Qty</th>
<th>Name &amp; Description</th>
<th>Mfr. Code</th>
<th>Mfr. Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>3–1</td>
<td>640–0077–04</td>
<td></td>
<td></td>
<td>1</td>
<td>DISPLAY MODULE: TDS FAMILY FULL COLOR</td>
<td>80009</td>
<td>640–0077–03</td>
</tr>
<tr>
<td>~2</td>
<td>348–1300–00</td>
<td></td>
<td></td>
<td>2</td>
<td>SHLD,GSKT,ELEK: 3.165 L, CLIP ON</td>
<td>30817</td>
<td>0098–0564–09–03</td>
</tr>
<tr>
<td>~3</td>
<td>620–0063–02</td>
<td></td>
<td></td>
<td>1</td>
<td>POWER SUPPLY: 400W; 5V 12A, 5.1V 22A, 15V 1.5A (A16, EXCHANGE ITEM)</td>
<td>1GM54</td>
<td>620–0063–02</td>
</tr>
<tr>
<td>~4</td>
<td>441–2043–00</td>
<td></td>
<td></td>
<td>1</td>
<td>CHASSIS, SCOPE, MAIN, 0.05 ALUMINUM</td>
<td>0J9P9</td>
<td>441–2043–00</td>
</tr>
<tr>
<td>~5</td>
<td>386–5871–01</td>
<td></td>
<td></td>
<td>1</td>
<td>SUBPANEL, FRONT, FINISHED, ALUMINUM</td>
<td>5Y400</td>
<td>386–5871–01</td>
</tr>
</tbody>
</table>

Figure 10–3: Inner-Chassis Modules
Replaceable Parts List

<table>
<thead>
<tr>
<th>Fig. &amp; Index Number</th>
<th>Tektronix Part Number</th>
<th>Serial No. Effective</th>
<th>Serial No. Discont’d</th>
<th>Qty</th>
<th>Name &amp; Description</th>
<th>Mfr. Code</th>
<th>Mfr. Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>4–1</td>
<td>174–2031–00</td>
<td></td>
<td></td>
<td>4</td>
<td>CABLE ASSY, RF: 50 OHM COAX, 6.5 L, W/BLUE JKT (A10J1000 MAIN TO TRIGGER OUTPUT) (A10J1001 TO DELAYED TRIGGER OUTPUT)</td>
<td>TK2338</td>
<td>174–2031–00</td>
</tr>
</tbody>
</table>

Figure 10–4: Cables, Bottom View
# Replaceable Parts List

<table>
<thead>
<tr>
<th>Fig. &amp; Index Number</th>
<th>Tektronix Part Number</th>
<th>Serial No. Effective</th>
<th>Serial No. Discont’d</th>
<th>Qty</th>
<th>Name &amp; Description</th>
<th>Mfr. Code</th>
<th>Mfr. Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>5–1</td>
<td>174–1525–00</td>
<td></td>
<td></td>
<td>1</td>
<td>CA ASSY,SP,ELEC:2 X 8–13,28 AWG</td>
<td>TK2469</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~2</td>
<td>174–1524–00</td>
<td>129–1439–00</td>
<td></td>
<td>1</td>
<td>CA ASSY SP;RIBBON,GPIB,IDC,24,28 AWG,4.0L</td>
<td>TK2469</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>SPACER,POST:0.17 L,4–40 BRS,0.25 RND</td>
<td>TK0588</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>-3</td>
<td>174–2975–00</td>
<td></td>
<td></td>
<td>1</td>
<td>CA ASSY,SP;RIBBON,CPR,16,28 AWG,4.0 L</td>
<td>TK2469</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>131–0890–01</td>
<td></td>
<td>2</td>
<td>CONN,HARDWARE;DSUB,JACK SCREW</td>
<td>00779</td>
<td>205818–2</td>
</tr>
<tr>
<td>-4</td>
<td>346–0266–00</td>
<td></td>
<td></td>
<td>1</td>
<td>STRAP,CABLE:PLASTIC</td>
<td>0KB05</td>
<td>346–0266–00</td>
</tr>
<tr>
<td>-5</td>
<td>174–3053–00</td>
<td></td>
<td></td>
<td>1</td>
<td>CA ASSY,SP,ELEC:50,28 AWG,5.85 L,FLAT</td>
<td>53387</td>
<td>174–3053–00</td>
</tr>
<tr>
<td>-6</td>
<td>174–3052–00</td>
<td></td>
<td></td>
<td>2</td>
<td>CA ASSY,SP,ELEC:50,28 AWG,5.85 L,FLAT</td>
<td>53387</td>
<td>174–3052–00</td>
</tr>
<tr>
<td>-7</td>
<td>174–1728–00</td>
<td></td>
<td></td>
<td>1</td>
<td>CA ASSY,SP;RIBBON,IDC,26,28 AWG,6.0 L</td>
<td>53387</td>
<td>ORDER BY DESC</td>
</tr>
</tbody>
</table>

**OPTION 05 CABLES**

<p>| | | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>174–0655–00</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>CABLE ASSY:COAX,RFP,50 OHM,9–2,22.4 L</td>
<td>80009</td>
<td>174–0655–00</td>
</tr>
<tr>
<td>174–3089–00</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>CA ASSY OPTICAL:RIBBON IDC 40,28 AWG,4,875 L</td>
<td>80009</td>
<td>174–3089–00</td>
</tr>
<tr>
<td>174–3090–00</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>CA ASSY OPTICAL:RIBBON IDC 50,28 AWG,4,85 L</td>
<td>80009</td>
<td>174–3090–00</td>
</tr>
</tbody>
</table>
Figure 10–5: Cables, Top View
## Replaceable Parts List

<table>
<thead>
<tr>
<th>Fig. &amp; Index Number</th>
<th>Tektronix Part Number</th>
<th>Serial No. Effective</th>
<th>Serial No. Discont’d</th>
<th>Qty</th>
<th>Name &amp; Description</th>
<th>Mfr. Code</th>
<th>Mfr. Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>6–1</td>
<td>119–4547–00</td>
<td></td>
<td></td>
<td>1</td>
<td>DISK DRIVE:FLOPPY, 3.5 INCH; 2 MB, 0.5 INH DSDD</td>
<td>TK2248</td>
<td>119–4547–00</td>
</tr>
<tr>
<td>~2</td>
<td>211–0840–00</td>
<td></td>
<td></td>
<td>2</td>
<td>SCREW, MACHINE: M2.6 X 0.45 MM PITCH X 4.0 L</td>
<td>0KB01</td>
<td>.26C4MPHY</td>
</tr>
<tr>
<td>~3</td>
<td>211–0730–00</td>
<td></td>
<td></td>
<td>2</td>
<td>SCR, ASSEM WSHR: 6–32 X 0.375, PNH, STL</td>
<td>0KB01</td>
<td>ORDER BY DESC</td>
</tr>
<tr>
<td>~4</td>
<td>174–2964–00</td>
<td></td>
<td></td>
<td>1</td>
<td>WIRE, ELECTRICAL: FLAT FLEX, JUMPER</td>
<td>1DM20</td>
<td>1.00MM–26–7–B</td>
</tr>
<tr>
<td></td>
<td>276–0849–00</td>
<td></td>
<td></td>
<td>1</td>
<td>CORE, EM: EMI SUPPRESS, RBN CA</td>
<td>1JJ96</td>
<td>BFS 33.5 X 8 X</td>
</tr>
<tr>
<td>~5</td>
<td>407–4230–00</td>
<td></td>
<td></td>
<td>1</td>
<td>BRKT, DISK DRIVE: ALUMINUM</td>
<td>0J9P9</td>
<td>407–4230–00</td>
</tr>
<tr>
<td>~6</td>
<td>337–3935–00</td>
<td></td>
<td></td>
<td>1</td>
<td>SHLD, DISK DRIVE:</td>
<td>0JR05</td>
<td>337–3935–00</td>
</tr>
</tbody>
</table>
Figure 10–6: Floppy Disk
## Replaceable Parts List

<table>
<thead>
<tr>
<th>Fig. &amp; Index Number</th>
<th>Tektronix Part Number</th>
<th>Serial No. Effective</th>
<th>Serial No. Discont’d</th>
<th>Qty</th>
<th>Name &amp; Description</th>
<th>Mfr. Code</th>
<th>Mfr. Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>7–1</td>
<td>161–0104–05</td>
<td>1</td>
<td></td>
<td>1</td>
<td>CA ASSY, PWR: 3, 1.0 MM SQ, 250 V/10 A, 2.5 M (OPTION A3 – AUSTRALIAN)</td>
<td>S3109</td>
<td>198–010</td>
</tr>
<tr>
<td>–2</td>
<td>161–0104–06</td>
<td>1</td>
<td></td>
<td>1</td>
<td>CA ASSY, PWR: 3, 1.0 MM SQ, 250 V/10 A, 2.5 M (OPTION A1 – EUROPEAN)</td>
<td>S3109</td>
<td>198–010</td>
</tr>
<tr>
<td>–3</td>
<td>161–0104–07</td>
<td>1</td>
<td></td>
<td>1</td>
<td>CA ASSY, PWR: 3, 1.0 MM SQ, 240 V/10 A, 2.5 M (OPTION A2 – UNITED KINGDOM)</td>
<td>S3109</td>
<td>209010</td>
</tr>
<tr>
<td>–4</td>
<td>161–0104–08</td>
<td>1</td>
<td></td>
<td>1</td>
<td>CA ASSY, PWR: 3, 18 AWG, 250 V/10 A, 98 INCH L (OPTION A4 – NORTH AMERICAN)</td>
<td>2W733 ORDER BY DESC</td>
<td></td>
</tr>
<tr>
<td>–5</td>
<td>161–0167–00</td>
<td>1</td>
<td></td>
<td>1</td>
<td>CA ASSY, PWR: 3, 0.75 MM SQ, 250 V/10 A, 2.5 M (OPTION A5 – SWITZERLAND)</td>
<td>S3109 ORDER BY DESC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>CABLE ASSY, PWR, 3, 18 AWG, 92 L (STANDARD CABLE – SEE FIG 10–1–2)</td>
<td>0JR05 ORDER BY DESC</td>
<td></td>
</tr>
<tr>
<td>343–0170–00</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>RTNR, CA TO CA: U/W 0.25 OD CABLES (OPTIONS A1, A2, A3, A4, A5)</td>
<td>0JR05 ORDER BY DESC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>CLAMP, POWER CORD: POLYMIDE (SEE FIGURE 10–1–3)</td>
<td>0JR05 ORDER BY DESC</td>
<td></td>
</tr>
<tr>
<td>070–8709–06</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>MANUAL, TECH: PROGRAMMER, TDS4/5/6/7XXA</td>
<td>80009</td>
<td>070870906</td>
</tr>
<tr>
<td>070–8991–02</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>MANUAL, TECH: USERS, TDS744A/784A/684A</td>
<td>80009</td>
<td>070899102</td>
</tr>
<tr>
<td>070–8990–02</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>MANUAL, TECH: PERF VERIF, TDS684A/744A/784A</td>
<td>80009</td>
<td>070899003</td>
</tr>
<tr>
<td>070–8999–02</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>MANUAL, TECH: REFERENCE, TDS684A/744A/784A</td>
<td>80009</td>
<td>070899902</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>COVER, FRONT: PLASTIC (SEE FIG 10–1–14)</td>
<td>0JR05 ORDER BY DESC</td>
<td></td>
</tr>
<tr>
<td>016–1268–00</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>POUCH, ACCESS:</td>
<td>TK2539</td>
<td>2122</td>
</tr>
</tbody>
</table>

### Figure 10–7: Accessories
## Replaceable Parts List

<table>
<thead>
<tr>
<th>Fig. &amp; Index Number</th>
<th>Tektronix Part Number</th>
<th>Serial No. Effective</th>
<th>Serial No. Discont'd</th>
<th>Qty</th>
<th>Name &amp; Description</th>
<th>Mfr. Code</th>
<th>Mfr. Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>003–1457–01</td>
<td>1 BIT, TORX DRIVER: MODIFY THE T-20</td>
<td>TK1465</td>
<td>003–1457–01</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>012–0991–00</td>
<td>1 CABLE, INTCON: SHLD CMPST, GPIB</td>
<td>22526</td>
<td>81190–020</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>012–0991–01</td>
<td>1 CABLE, GPIB: LOW EMI, 1 METER</td>
<td>00779</td>
<td>55357–2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>012–1250–00</td>
<td>1 CABLE, INTCON: SHLD CMPST, PARALLEL</td>
<td>TK2193</td>
<td>CACC 3049</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>012–1298–00</td>
<td>1 CABLE, INTCON: RS232C DB25M–DB9F SERIAL</td>
<td>00779</td>
<td>55357–2</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>012–1388–00</td>
<td>1 CABLE ASSEMBLY: OSCilloscope SECURITY</td>
<td>80009</td>
<td>012138800</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>016–0909–01</td>
<td>1 CASE, CARRYING: SOFTSIDED FOR 3002C</td>
<td>TK2162</td>
<td>0587</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>016–1135–00</td>
<td>1 CASE, CARRYING: 26 X 22 X 15, HARD TRANSFER</td>
<td>34416</td>
<td>2622RW–7T–7B</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>016–1145–00</td>
<td>1 HOOD ASSEMBLY: TDS SERIES</td>
<td>80009</td>
<td>016114500</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>016–0099–00</td>
<td>1 HDW KIT, ELEK EQ: RACKMOUNTING HDW</td>
<td>80009</td>
<td>016009900</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>070–8992–03</td>
<td>1 MANUAL, TECH: SERVICE, TDS684A/744A/784A</td>
<td>80009</td>
<td>070899203</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>070–8432–02</td>
<td>1 MANUAL, TECH: INSTR, TDS FAMILY RACKMOUNT</td>
<td>TK2548</td>
<td>PER TEK P/N</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>