Service Manual

Tektronix

TLA Series
Digitizing Oscilloscope Modules
(TLA7D1, TLA7D2, TLA7E1, & TLA7E2)

070-9780-03

This document applies to firmware version 1.00 and above.

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

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WARRANTY

Tektronix warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If a 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; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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Table of Contents

General Safety Summary ..... **v**

Service Safety Summary ..... **vii**

Preface ..... **ix**

Manual Structure ix

Manual Conventions x

Related Manuals x

Introduction ..... **xiii**

Adjustment and Certification Interval xiii

Strategy for Servicing xiii

Service Offerings xiv

Contacting Tektronix xv

Specifications

Product Description 1-1

Characteristics Tables 1-2

Operating Information

Installation 2-1

Software Installation and Removal 2-4

Operating Information 2-6

Theory of Operation

Block Level Description 3-1

Performance Verification

Summary Verification 4-1

Test Equipment 4-3

Functional Verification 4-4

DSO Module Certification 4-7

Performance Verification Instructions 4-7

Performance Verification Tests 4-13

Adjustment Procedures

Prerequisites 5-1

Using the Software 5-2

Test Equipment 5-3

Adjustment Instructions 5-4

Adjustment Procedures 5-5

Completing the Adjustment Steps 5-14

Maintenance

Related Maintenance Procedures 6-1

Preventing ESD 6-1
Battery Disposal 6-2
Inspection and Cleaning 6-2

Removal and Installation Procedures 6-7
Summary of Procedures 6-7
Tools Required 6-8
Injector/Ejector Handles 6-8
Cover 6-10
Processor Board 6-13
Probe Compensation BNC Connector 6-16
Fuses 6-17
Probe Interface 6-19
Acquisition Board 6-22
Rear EMI Gaskets 6-23

Troubleshooting 6-25
Check for Common Problems 6-26
Eliminate Other Problem Sources 6-26
Troubleshoot the DSO Module 6-27
Adjustment After Repair 6-34

Repackaging Instructions 6-35
Packaging 6-35
Storage 6-35

Options

Tektronix Service Options 7-1

Replaceable Electrical Parts

Diagrams

Replaceable Mechanical Parts

Standard Accessories 10-1
Parts Ordering Information 10-1
Using the Replaceable Parts List 10-3

List of Figures

Figure 2–1: Logical address switches 2–2
Figure 2–2: Module retainer screws and ejector mechanism 2–3
Figure 2–3: Digitizing oscilloscope front panel 2–6
Figure 2–4: Typical system window 2–8

Figure 4–1: Calibration/certification procedure flow chart 4–2
Figure 4–2: Calibration and Diagnostics property sheet 4–5
Figure 4–3: Initial setup for the DC gain accuracy test 4–14
Figure 4–4: Initial setup for the analog bandwidth test 4–16
Figure 4–5: Using a power meter to monitor the amplitude of the sine wave generator during the analog bandwidth test 4–17
Figure 4–6: Initial setup for the delay between channels test 4–19
Figure 4–7: Initial setup for the timebase accuracy test 4–20
Figure 4–8: Initial setup for the main trigger accuracy test 4–22
Figure 4–9: Initial setup for the main trigger sensitivity test 4–23
Figure 4–10: Initial setup for the probe compensation test 4–24

Figure 5–1: Initial setup for the base calibration adjustment 5–6
Figure 5–2: Initial setup for the frequency response adjustment . . . 5–8
Figure 5–3: Using a power meter to monitor the amplitude of the sine wave generator during the frequency response adjustment 5–9
Figure 5–4: Initial setup for the channel-to-channel skew adjustment 5–12
Figure 5–5: Initial setup for the probe compensation test 5–13

Figure 6–1: Injector/ejector handle replacement 6–9
Figure 6–2: Cover removal 6–10
Figure 6–3: Seating the cover on the chassis 6–12
Figure 6–4: Processor board removal 6–14
Figure 6–5: Inserting processor board tab into front subpanel 6–15
Figure 6–6: BNC replacement 6–16
Figure 6–7: Fuse replacement 6–18
Figure 6–8: Probe interface replacement 6–20
Figure 6–9: Acquisition board replacement 6–22
Figure 6–10: Rear EMI gasket removal 6–23
Figure 6–11: Rear EMI gasket replacement 6–24

Figure 6-12: Primary troubleshooting procedure 6-30
Figure 6-13: Probe power voltage check 6-31
Figure 6-14: Power supply troubleshooting procedure 6-31
Figure 6-15: Fuse locations for troubleshooting 6-32
Figure 6-16: Probe interface resistance 6-33

Figure 9-1: Interconnections 9-1
Figure 9-2: Block diagram 9-2

Figure 10-1: Digitizing oscilloscope exploded view 10-8

List of Tables

Table i: Tektronix Logic Analyzer Family Documentation xi
Table 1-1: Comparison of product features 1-1
Table 1-2: Signal acquisition system 1-2
Table 1-3: Timebase system 1-5
Table 1-4: Trigger system 1-6
Table 1-5: Front-Panel Connectors 1-7
Table 1-6: Environmental 1-7
Table 1-7: Certifications and compliances 1-8
Table 1-8: Mechanical 1-8
Table 4-1: Test Equipment 4-3
Table 4-2: DSO PV/Adjust software performance verification tests 4-8
Table 4-3: DSO module fault isolation 4-12
Table 5-1: DSO Adjustments and dependencies 5-3
Table 5-2: Fault isolation 5-5
Table 6-1: External inspection check list 6-4
Table 6-2: Internal inspection check list 6-5
Table 6-3: Tools required for parts replacement 6-8
Table 6-4: Failure symptoms and possible causes 6-26
Table 6-5: Power supply fault-location table 6-32
Table 6-6: Diagnostic tests 6-33
Table 10-1: Standard accessories 10-1

General Safety Summary

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

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

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

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

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

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

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

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

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

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

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

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

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

Symbols and Terms

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

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

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

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

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

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

CAUTION indicates a hazard to property including the product.

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

WARNING
High Voltage

Protective Ground
(Earth) Terminal

CAUTION
Refer to Manual

Double
Insulated

Service Safety Summary

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

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

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

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.

Preface

This is the service manual for the Tektronix Logic Analyzer Series Digitizing Oscilloscope Modules (TLA7D1, TLA7D2, TLA7E1, & TLA7E2). Read this preface to learn how this manual is structured, what conventions it uses, and where you can find other information related to servicing this product. Read the *Introduction*, which follows this preface, for safety and other important background information needed before using this manual for servicing this product.

Manual Structure

The *TLA Series Digitizing Oscilloscope Manual* is divided into chapters, which are made up of related subordinate topics. These topics can be cross referenced as sections.

Be sure to read the introductions to all procedures. These introductions provide important information needed to do the service correctly, safely, and efficiently.

A brief description of each chapter follows:

- *Specifications* contains a product description of the DSO Module and tables of the characteristics and descriptions that apply to it.
- *Operating Information* includes basic installation and operating instructions at the level needed to safely operate and service the DSO Module. For complete installation and configuration procedures, refer to the *Tektronix Logic Analyzer Family User Manual*.
- *Theory of Operation* contains circuit descriptions that support general service to the circuit board level.
- *Performance Verification* contains the performance verification procedures for the DSO Module.
- *Adjustment Procedures* contains the adjustment procedures for the DSO Module.
- *Maintenance* contains information and procedures for doing preventive and corrective maintenance on the DSO Module. Included are instructions for cleaning, for removal and installation of replaceable parts, and for trouble-shooting.
- *Options* contains information on the factory-installed options that may be available for the DSO Module.

- *Diagrams* contains a block diagram and an interconnection diagram useful for isolating failed circuit boards or assemblies**.**
- *Mechanical Parts List* includes a table of all replaceable parts, their descriptions, and their Tektronix part numbers.

Manual Conventions

This manual uses certain conventions that you should become familiar with before attempting service.

Modules

Throughout this manual, the term *module* refers to a TLA 700 Series Logic Analyzer or DSO unit that mounts inside a TLA 700 Series Portable or Benchtop Chassis. A module is composed of circuit cards, interconnecting cables, and a user-accessible front panel.

Replaceable Parts

This manual refers to any field-replaceable assembly or mechanical part specifically by its name or generically as a replaceable part. In general, a (field) replaceable part is any circuit board or assembly that is listed in the replaceable parts list.

Safety

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

Related Manuals

The following manuals are available as part of the Tektronix Logic Analyzer Family documentation set. The procedures in this manual assume that the service personnel have access to all manuals listed in the following table. Other manuals may exist outside of the table as the product line offerings change. Contact your local Tektronix Service Representative for the latest part numbers of the service documentation. You can also obtain part numbers from the online help for the instrument.

Table i: Tektronix Logic Analyzer Family Documentation

Manual name	Description	Service use
The *Tektronix Logic Analyzer Family User Manual*	Provides basic operation and installation information for the Tektronix Logic Analyzer Family.	Installation and removal of LA, DSO, and pattern generator modules as well as the mainframes. Reinstallation of the system and application software.
The *TLA715 Portable Mainframe Service Manual.*	Provides service information for the TLA715 Portable Mainframe.	Isolating and correcting failures in the portable mainframe and expansion mainframes.
The *TLA721 Benchtop Mainframe & TLA7XM Expansion Mainframe Service Manual.*	Provides service information for the TLA721 Benchtop Mainframe and the TLA7XM Expansion Mainframes.	Isolating and correcting failures in the mainframes.
The *TLA7Dx/TLA7EX Digitizing Oscilloscope Module Service Manual.*	Provides service information for the DSO modules.	Isolating and correcting failures in the DSO module. Performing periodic or after-repair functional or performance verifications, calibrations, and certifications for the DSO modules. Performing periodic or after-repair adjustments for the DSO modules.
The *TLA7PG2 Pattern Generator Module Service Manual.*	Provides service information for the pattern generator modules.	Isolating and correcting failures in the pattern generator module. Performing periodic or after-repair functional or performance verifications, calibrations, and certifications for the pattern generator modules.
The *TLA600 Logic Analyzer Service Manual.*	Provides service information for the TLA600 Series Logic Analyzers.	Isolating and correcting failures in the TLA600 Logic Analyzer. Performing periodic or after-repair functional or performance verifications, calibrations, and certifications for the TLA600 Logic Analyzer. Performing periodic or after-repair adjustments for the TLA600 Logic Analyzer.

Introduction

This manual contains information needed to properly service the DSO Module, as well as general information critical to safe and effective servicing.

To prevent personal injury or damage to the digitizing oscilloscope module, consider the following **requirements** before attempting service:

- The procedures in this manual should be performed only by a qualified service person.
- Read the *General Safety Summary* and *Service Safety Summary* found at the beginning of this manual.

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

Adjustment and Certification Interval

Generally, you should perform the adjustments and certification (calibration) once per year, or following repairs that affect adjustment or calibration.

Strategy for Servicing

This manual supports and contains information needed for periodic maintenance of the DSO Module. (Examples of such information are procedures for fault isolation of a failed circuit board or assembly and for removal and replacement of same.)

This manual also supports and contains information for corrective maintenance of this product:

- Supports isolation of faults to the failed circuit board or assembly level shown in the replaceable parts list
- Supports removal and replacement of those boards or assemblies
- Supports removal and replacement of fuses, chassis, and other mechanical parts listed in the replaceable parts list

This manual does *not* support component-level fault isolation and replacement.

Service Offerings

Tektronix provides service to cover repair under warranty as well as other services that are designed to meet your specific service needs.

Whether providing warranty repair service or any of the other services listed below, Tektronix service technicians are well equipped to service the DSO Module. Tektronix technicians train on Tektronix products; they have access to the latest information on improvements to the DSO Module as well as the latest new product upgrades. *Services are provided at Tektronix Services Centers and on-site at your facility, depending on your location.*

Warranty Repair Service

Tektronix warrants this product for one year from date of purchase. (The warranty appears behind the title page in this manual.) Tektronix technicians provide warranty service at most Tektronix service locations worldwide. The Tektronix product catalog lists all service locations worldwide or you can visit us on our *Customer Services World Center* web site at http://www.tek.com/Measurement/Service. See our latest service offerings and contact us by email.

Calibration and Repair Service

In addition to warranty repair, Tektronix Service offers calibration and other services which provide cost-effective solutions to your service needs and quality-standards compliance requirements. Our instruments are supported worldwide by the leading-edge design, manufacturing, and service resources of Tektronix to provide the best possible service.

The following services can be tailored to fit your requirements for calibration and/or repair of the DSO Module.

Service Agreements. If service options are not added to the instrument purchase, then service agreements are available on an annual basis to provide calibration services or post-warranty repair coverage for the DSO Module. Service agreements may be customized to meet special turn-around time and/or on-site requirements.

Service on Demand. Tektronix also offers calibration and repair services on a "per-incident" basis that is available with standard prices for many products.

Self Service. Tektronix supports repair to the replaceable-part level by providing for circuit board exchange.

Use this service to reduce down-time for repair by exchanging circuit boards for remanufactured ones. Tektronix ships updated and tested exchange boards. Each board 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 Calibration and Repair Services just described.

Contacting Tektronix

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

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

Specifications

This chapter provides a general description of the DSO module and a list of specifications under Characteristics Tables.

Product Description

The digitizing oscilloscope (DSO) modules are designed for use with either the benchtop mainframe or portable mainframe. Key features are listed below:

- Four standard configurations with full-featured, 1 MΩ/50 Ω inputs: TLA7D2 and TLA7E2 have four channels, TLA7D1 and TLA7E1 have two channels.
- A maximum realtime digitizing rate up to 5 GSample/second with an analog bandwidth up to 1 GHz. See Table 1–1 for details.

Table 1-1: Comparison of product features

Product	Input channels	Maximum sample rate	Analog bandwidth
TLA7E2	4	5 GSample/second	1 GHz
TLA7D2	4	2.5 GSample/second	500 MHz
TLA7E1	2	5 GSample/second	1 GHz
TLA7D1	2	2.5 GSample/second	500 MHz

- A maximum record length of 15,000 samples with 8-bit vertical resolution
- A full complement of internal triggering modes such as edge, pulse, logic, and setup hold

Characteristics Tables

This section lists the specifications for the DSO module. All specifications are guaranteed unless noted "typical." Specifications that are marked with the ✓ symbol are checked in the *Performance Verification* chapter of this manual.

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

- The DSO module must have successfully passed self calibration at an ambient temperature between +20° C and +30° C and after a warm-up period of 30 or more minutes at these conditions.
- The DSO module must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications. This includes the warm-up period of 30 or more minutes at these conditions.

Table 1-2: Signal acquisition system

Characteristic	Description	
✓ Accuracy, DC Gain	±1.5% for full scale ranges from 20 mV to 100 V ±2.0% for full scale ranges <19.9 mV	
✓ Accuracy, Internal Offset[1]	*Full Scale Range Setting*	*Offset Accuracy*
	10 mV - 1 V	±[(0.2% × | offset |) + 1.5 mV + (6% × full scale range)]
	1.01 V - 10 V	±[(0.25% × | offset |) + 15 mV + (6% × full scale range)]
	10.1 V - 100 V	±[(0.25% × | offset |) + 150 mV + (6% × full scale range)]
✓ Analog Bandwidth, DC-50 Ω Coupled	*Full Scale Range Setting*	*Bandwidth[2]*
	10.1 V - 100 V	DC - 500 MHz (TLA7E1 and TLA7E2) DC - 500 MHz (TLA7D1 and TLA7D2)
	100 mV - 10 V	DC - 1 GHz (TLA7E1 and TLA7E2) DC - 500 MHz (TLA7D1 and TLA7D2)
	50 mV - 99.5 mV	DC - 750 MHz (TLA7E1 and TLA7E2) DC - 500 MHz (TLA7D1 and TLA7D2)
	20 mV - 49.8 mV	DC - 600 MHz (TLA7E1 and TLA7E2) DC - 500 MHz (TLA7D1 and TLA7D2)
	10 mV - 19.9 mV	DC - 500 MHz (TLA7E1 and TLA7E2) DC - 500 MHz (TLA7D1 and TLA7D2)

1 Net offset is the nominal voltage level at the DSO module input that corresponds to the center of the A/D Converter 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 each °C above +30° C. The bandwidth must be set to FULL.

Table 1-2: Signal acquisition system (Cont.)

Characteristic	Description		
Bandwidth, Analog, Selections	20 MHz, 250 MHz, and FULL on each channel		
Calculated Rise Time, typical[3] Typical full-bandwidth rise times are shown in the chart to the right	*Full Scale Range Setting*	*TLA7E1 and TLA7E2*	*TLA7D1 and TLA7D2*
	10.1 V - 100 V	900 ps	900 ps
	100 mV - 10 V	450 ps	900 ps
	50 mV - 99.5 mV	600 ps	900 ps
	20 mV - 49.8 mV	750 ps	900 ps
	10 mV - 19.9 mV	900 ps	900 ps
Crosstalk (Channel Isolation)	≥300:1 at 100 MHz and ≥100:1 at the rated bandwidth for the channel's sensitivity (Full Scale Range) setting, for any two channels having equal sensitivity settings		
✓ Delay Between Channels, Full Bandwidth	≤100 ps with equal full scale Range and Coupling settings		
Digitized Bits, Number of	8 bits		
Effective Bits, Realtime Sampling, typical	*Input Frequency*	*TLA7E1 and TLA7E2 5 GS/s (each Channel)*	*TLA7D1 and TLA7D2 2.5 GS/s (each Channel)*
	10.2 MHz	6.2 bits	6.2 bits
	98 MHz	6.1 bits	6.1 bits
	245 MHz	6.0 bits	6.0 bits
	490 MHz	5.7 bits	5.7 bits
	990 MHz	5.2 bits	N/A
Frequency Limit, Upper, 20 MHz Bandwidth Limited, typical	20 MHz		
Frequency Limit, Upper, 250 MHz Bandwidth Limited, typical	250 MHz		
Input Channels, Number of	*Product*	*Channels*	
	TLA7E2	Four	
	TLA7D2	Four	
	TLA7E1	Two	
	TLA7D1	Two	
Input Coupling	DC, AC, or GND[4]		

[3] Rise time (rounded to the nearest 50 ps) is calculated from the bandwidth when Full Bandwidth is selected. It is defined by the following formula:

$$Rise\ Time\ (ns) = 450 \div BW\ (MHz)$$

[4] GND input coupling disconnects the input connector from the attenuator and connects a ground reference to the input of the attenuator.

Table 1-2: Signal acquisition system (Cont.)

Characteristic	Description				
Input Impedance, DC-1 MΩ Coupled	1 MΩ ±0.5% in parallel with 10 pF ±3 pF				
Input Impedance Selections	1 MΩ or 50 Ω				
Input Resistance, DC-50 Ω Coupled	50 Ω ±1%				
Input VSWR, DC-50 Ω Coupled	≤1.3:1 from DC - 500 MHz, ≤1.5:1 from 500 MHz - 1 GHz				
Input Voltage, Maximum, DC-1 MΩ, AC-1 MΩ, or GND Coupled	300 V_{RMS} but no greater than ±420 V peak, Installation category II, derated at 20 dB/decade above 1 MHz				
Input Voltage, Maximum, DC-50 Ω or AC-50 Ω Coupled	5 V_{RMS}, with peaks ≤ ±25 V				
Lower Frequency Limit, AC Coupled, typical	≤10 Hz when AC-1 MΩ Coupled; ≤200 kHz when AC-50 Ω Coupled[5]				
Random Noise	*Bandwidth Selection*	*RMS Noise*			
	Full	≤(350 μV + 0.5% of the full scale Setting)			
	250 MHz	≤(165 μV + 0.5% of the full scale Setting)			
	20 MHz	≤(75 μV + 0.5% of the full scale Setting)			
Range, Internal Offset	*Full Scale Range Setting*	*Offset Range*			
	10 mV - 1 V	±1 V			
	1.01 V - 10 V	±10 V			
	10.1 V - 100 V	±100 V			
Range, Sensitivity (Full Scale Range), All Channels	10 mV to 100 V[6]				
Step Response Settling Errors, typical[7] The maximum absolute difference between the value at the end of a specified time interval after the mid-level crossing of the step, and the value one second after the mid-level crossing of the step, expressed as a percentage of the step amplitude. See IEEE std. 1057, Section 4.8.1, *Settling Time Parameters*.	*Full Scale Range Setting*	*± Step Response*	*Maximum Settling Error (%) at*		
			20 ns	*100 ns*	*20 ms*
	10 mV - 1 V	≤2 V	0.5%	0.2%	0.1%
	1.01 V - 10 V	≤20 V	1.0%	0.5%	0.2%
	10.1 V - 100 V	≤200 V	1.0%	0.5%	0.2%

5 The AC Coupled Lower Frequency Limits are reduced by a factor of 10 when 10X passive probes are used.

6 The sensitivity ranges from 10 mV to 100 V full scale in a 1-2-5 sequence of coarse settings. Between coarse settings, you can adjust the sensitivity with a resolution equal to 1% of the more sensitive coarse setting. For example, between the 500 mV and 1 V ranges, the sensitivity can be set with 5 mV resolution.

7 The Full Bandwidth settling errors are typically less than the percentages from the table.

Table 1-3: Timebase system

Characteristic	Description	
Range, Extended Realtime Sampling Rate	5 S/s to 10 MS/s in a 1-2.5-5 sequence	
Range, Realtime Sampling Rate	*Products*	*Limits*
	TLA7E1 and TLA7E2	25 MS/s to 5 GS/s on all channels simultaneously in a 1-2.5-5 sequence
	TLA7D1 and TLA7D2	25 MS/s to 2.5 GS/s on all channels simultaneously in a 1-2.5-5 sequence
Record Length	512, 1024, 2048, 4096, 8192, and 15000	
✓ Long Term Sample Rate Accuracy	±100 ppm over any interval ≥ 1 ms	

Table 1-4: Trigger system

Characteristic	Description		
✓ Accuracy (Time) for Pulse Glitch or Pulse Width Triggering	*Time Range*	*Accuracy*	
	2 ns to 500 ns	±(20% of Setting + 0.5 ns)	
	520 ns to 1 s	±(104.5 ns + 0.01% of Setting)	
✓ Accuracy (DC) for Edge Trigger Level, DC Coupled	±((2% × | Setting) |) + 0.03 of Full Scale Range + Offset Accuracy) for signals having rise and fall times ≥20 ns		
Range (Time) for Pulse Glitch and Pulse Width Triggering	2 ns to 1 s		
Range, Trigger Level	*Source*	*Range*	
	Any Channel	±100% of full scale range	
Range, Trigger Point Position	Minimum: 0% Maximum: 100%		
Resolution, Trigger Level	0.2% of full scale for any Channel source		
Resolution, Trigger Position	One Sample Interval at any Sample Rate		
Sensitivities, Pulse-Type Runt Trigger, typical	10% of full scale, from DC to 500 MHz, for vertical settings >100 mV full scale and ≤10 V full scale at the BNC input		
Sensitivities, Pulse-Type Trigger Width and Glitch, typical	10% of full scale for vertical settings >100 mV full scale and ≤10 V full scale at the BNC input		
✓ Sensitivity, Edge-Type Trigger, DC Coupled	The minimum signal levels required for stable edge triggering of an acquisition when the trigger source is DC-coupled.		
	Products	*Trigger Source*	*Sensitivity*
	TLA7E1 and TLA7E2	Any Channel	3.5% of Full Scale Range from DC to 50 MHz, increasing to 10% of Full Scale Range at 1 GHz
	TLA7D1 and TLA7D2	Any Channel	3.5% of Full Scale Range from DC to 50 MHz, increasing to 10% of Full Scale Range at 500 MHz
Sensitivity, Edge-Type Trigger, Not DC Coupled, typical	*Trigger Coupling*	*Typical Signal Level for Stable Triggering*	
	AC	Same as the DC-coupled limits for frequencies above 60 Hz; attenuates signals below 60 Hz	
	High Frequency Reject	One and one-half times the DC-coupled limits from DC to 30 kHz; attenuates signals above 30 kHz	
	Low Frequency Reject	One and one-half times the DC-coupled limits for frequencies above 80 kHz; attenuates signals below 80 kHz	
	Noise Reject	Three times the DC-coupled limits	

Table 1-4: Trigger system (Cont.)

Characteristic	Description		
Time, Minimum Pulse or Rearm, and Minimum Transition Time, for Pulse-Type Triggering, typical	For vertical settings >100 mV and ≤10 V at the BNC input		
	Pulse Class	*Minimum Pulse Width*	*Minimum Rearm Width*
	Glitch	1 ns	2 ns + 5% of Glitch Width Setting
	Width	1 ns	2 ns + 5% of Width Upper Limit Setting
Trigger Position Error, Edge Triggering, typical	*Acquisition Mode*	*Trigger Position Error*[8]	
	Sample	±(1 Sample Interval + 1 ns)	

Table 1-5: Front-Panel Connectors

Characteristic	Description
Probe Compensator, Output Voltage The Probe Compensator output voltage in peak-to-peak Volts	0.5 V (base-top) ± 1% into a ≥ 50 Ω load

Table 1-6: Environmental

Characteristic	Description
Altitude, Operating and Nonoperating	Operating: to 15,000 feet (4570 m) provided maximum ambient temperature is derated by 1° C/1000 ft. above 1000 ft. Nonoperating: to 40,000 feet (12,190 m)
Humidity, Operating and Nonoperating	To 95% relative humidity at or below +30° C; to 45% relative humidity up to +50° C
Temperature, Operating and Nonoperating	Operating: 0° C to +50° C ambient air, when operated in a mainframe that provides at least 14 CFM of air flow resulting in no more than 12° C temperature rise of the air passing through this instrument. Nonoperating: -40° C to +71° C

[8] **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 ≥5% of full scale/ns.**

Table 1-7: Certifications and compliances

Characteristic	Description
Certifications	CAN/CSA-C22.2 No.1010.1 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use. UL3111-1 Standard for Electrical Measuring and Test Equipment.
EC Declaration of Conformity	EC Council Directive 89/336/EEC: Emissions shall be within the limits specified by the following requirements: Enclosure: EN55011 Class A limits for radiated emissions. AC Mains: EN 60555 - 2 for power line harmonics. EN 55011 Class A limits for conducted emissions.
FCC Compliance	Complies with the requirements of FCC CFR 47, Part 15, Subpart B, Class A for radiated and conducted emissions.
Pollution Degree	Pollutions Degree 2 (as defined in IEC 1010-1) - indoor use only

Table 1-8: Mechanical

Characteristic	Description	
Construction Material	Chassis parts constructed of aluminum alloy; front panel constructed of plastic laminate; circuit boards constructed of glass laminate. Cabinet is aluminum.	
Weight	*Products*	*Weight*
	TLA7D1 and TLA7E1	2.44 kg (5.38 lbs)
	TLA7D2 and TLA7E2	2.55 kg (5.63 lbs)
Weight, shipping	*Products*	*Weight*
	TLA7D1 and TLA7E1	6.35 kg (14 lbs)
	TLA7D2 and TLA7E2	7.71 kg (17 lbs)
Overall Dimensions	Height: 262.05 mm (10.32 in) Width: 60.66 mm (2.39 in) Depth: 373.38 mm (14.70 in)	

Operating Information

This chapter describes how to operate the DSO module when performing maintenance. The operating information is limited to the functions you need to perform the procedures found in this manual. You can find more detailed operating instructions in the *Tektronix Logic Analyzer Family User Manual* and in the online help.

The following sections are included in this chapter:

- The *Installation* section describes how to install the DSO module in the mainframe.
- The *Software Installation and Removal* section describe how to install and remove the performance verification and adjustment software. You need this software to complete the performance verification procedures and adjustment procedures as described in the *Performance Verification* and *Adjustment Procedures* chapters of this manual.
- Operating Information describes front-panel connectors and indicators, the power-on procedure, self cal, self tests, and instrument commands used for maintenance.

Installation

Basic installation instructions are contained in the *Tektronix Logic Analyzer Family User Manual*; refer to that manual for detailed information not covered in this manual. This section describes how the following tasks:

- Set the logical address
- Install the DSO module in a mainframe
- Remove the DSO module from a mainframe

Setting the Logical Address

Every module installed within a mainframe must have a unique logical address; no two modules can have the same address. Two rotary switches on the rear panel of the DSO module select the logical address. Refer to Figure 2–1 for the switch location.

The factory default recommended switch setting (FF) allows the controller to assign a logical address to the digitizing oscilloscope module. This is called Dynamic Auto Configuration. You can also select static addresses between 01 and FE hexadecimal (1 to 254 decimal). Read the following descriptions before setting the logical address.

***NOTE**. Do not set the digitizing oscilloscope logical address to 00. Logical address 00 is reserved for the controller.*

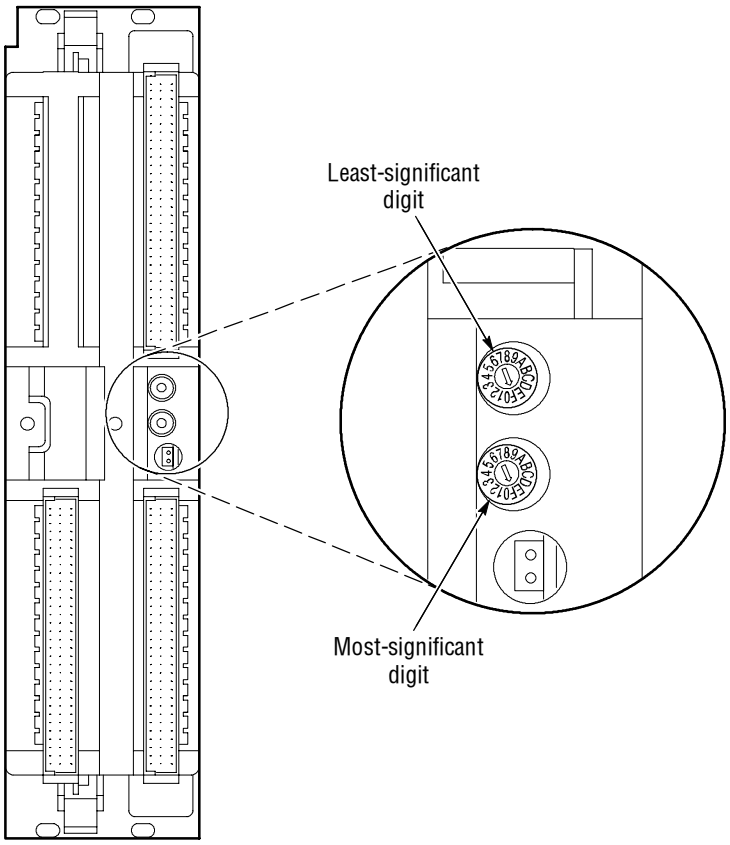


Figure 2- 1: Logical address switches

Dynamic Auto Configuration. With Dynamic Auto Configuration selected (hexadecimal FF or decimal 255), the system automatically sets the address to an unused value. For example, if there are devices set to addresses 01 and 02 already in your system, the resource manager will automatically assign the DSO module an address other than 01 or 02.

Static Logical Address. Static logical address selections set the address to a fixed value. If you use static logical addressing, each device within your system must have a unique address to avoid communication problems.

Installing the DSO Module

The DSO module can be inserted into any two adjacent slots in the mainframe except Slot 0. Be sure the logical address is set before installation (see *Setting the Logical Address* on page 2–1).

Use the following procedure and Figure 2–2 to install the digitizing oscilloscope into the mainframe:

1. If you have not already done so, power the mainframe off.
2. Insert the DSO module into the mainframe top and bottom module guides and push it partially into the mainframe (Figure 2–2). Then slide the module into the mainframe as far as it will go without forcing it.
3. Use the ejector handles to secure the module in the mainframe.
4. Use a screwdriver to install the top and bottom retainer screws. Alternate between the screws, applying only a few turns at a time to fully seat the module.

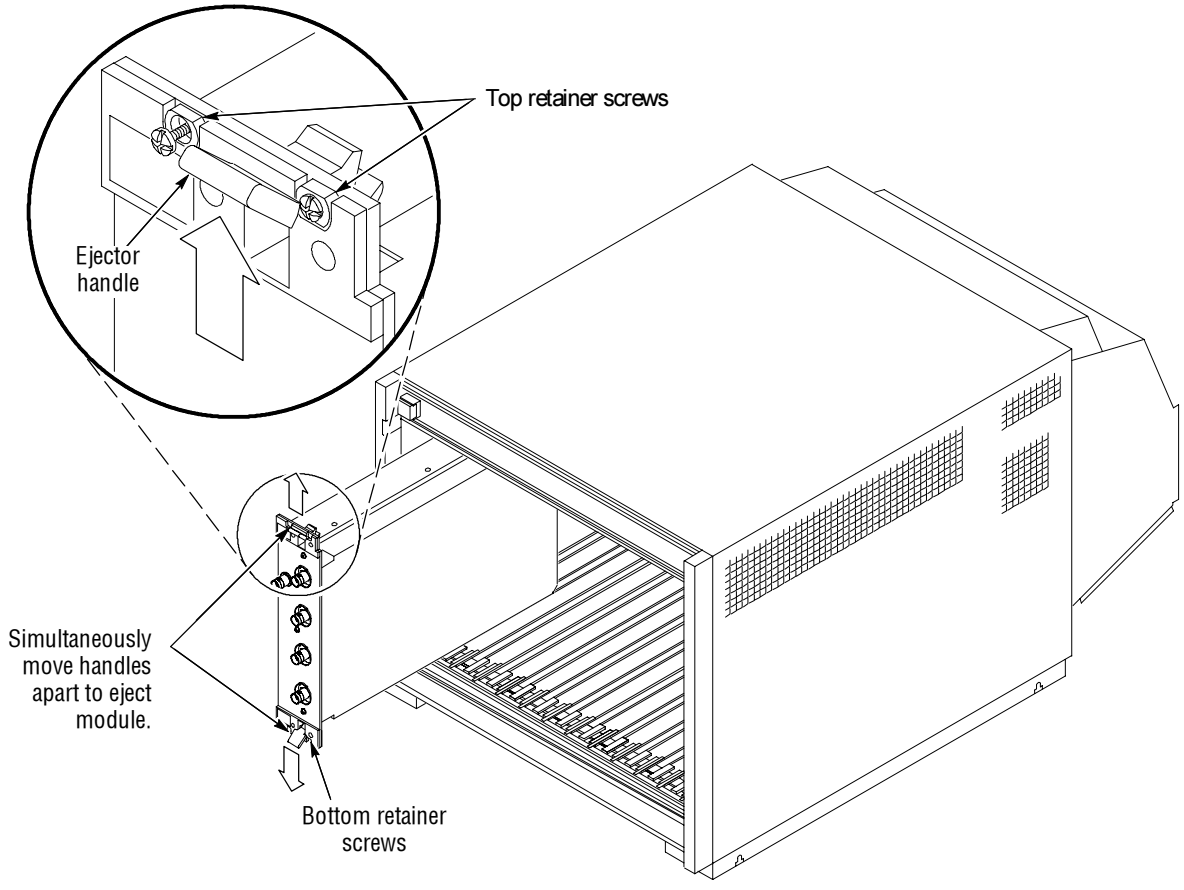


Figure 2–2: Module retainer screws and ejector mechanism

Removing the DSO module from the Mainframe

Use the following procedure to remove the DSO module from a mainframe.

1. Power off the mainframe.
2. Using a screwdriver, loosen the top and bottom retainer screws (Figure 2–2).
3. Grasp the ejector handles on the DSO module. At the same time, move the top handle upward and the bottom handle downward to eject the DSO module.
4. Pull the DSO module out of the mainframe.

Software Installation and Removal

These procedures describe loading and unloading the performance verification and adjustment software. Refer to the *Tektronix Logic Analyzer Family User Manual* for information on installing or removing any other software. It is recommended you have ≥10 MB of free space on the hard drive before installing the software. The Performance Verification software is located on Disk 1 of the Tektronix Logic Analyzer Family Application Software CD.

NOTE. *This installation program uses parameters you supply to create a custom start-up file in your hard disk directory.*

The batch file enables the software to configure your instrument properly before it runs the program.

---

1. Power on the instrument.
2. Exit the Application.

Verify PV/Adjust Software Version

If your logic analyzer already has PV/Adjust software loaded on it, you must verify that the version is the same as the version printed on Disc 1 of the Tektronix Logic Analyzer Family Application Software CD.

If the version of the PV/Adjust software loaded on your logic analyzer is an earlier version, you must delete the earlier version before you can load the newer version.

Verify Directories

If your logic analyzer already has a directory named Tekcats or Temptek on the hard drive, the software installation cannot be completed. Follow these instructions to verify the directory is not present:

1. Select Start → Search → For Files or Folders.

2. In the "Search for files or folders:" box, type "Tekcats" or "TempTek" and then click the Search Now button for search for either directory.
3. If either directory is found follow the instructions under *Removing the Software* to remove the software and the directories.

Install the PV/Adjust Software

Follow these instructions to install the PV/Adjust software.

1. Close all open windows on the desktop.
2. Insert Disk 1 of the Tektronix Logic Analyzer Family Application Software CD in the CD-ROM drive.
3. Click the My Computer Icon and double-click the CD-ROM drive.
4. Double-click the TLA Performance Verification folder.
5. Double-click on the Logic Analyzer PV folder and then double-click the Disk1 folder.
6. Double-click the Setup.exe icon to begin the installation program.
7. Follow the on-screen instructions to install the software on the hard disk.
8. After the installation is complete, go back to the TLA Performance Verification folder on the CD.

This completes the software installation procedure.

Removing the Software

Use the following procedure to remove the performance verification and adjustment software from the instrument. These steps are necessary when you want to upgrade the PV software.

1. Open Windows Explorer and then locate and select the C:\Tekcats folder.
2. Go to the File menu and select Delete to delete the folder.
3. Repeat steps 1 and 2 to delete the Temptek folder if it exists.
4. Select Start → Settings → Taskbar & Start Menu.
5. Click the Advanced tab followed by the Advanced button.
6. Open the following directory path under Documents and Settings:

   All Users → Start Menu → Programs
7. Locate and delete the TLA Performance Verification item.

Operating Information

This section provides the information you will need to operate the DSO module when performing the procedures in this manual.

Connectors and Indicators

Figure 2–3 shows the connectors and indicators on the front panel of a four-channel digitizing oscilloscope. The two-channel model looks and operates the same, but without the CH 3 and CH 4 inputs. Descriptions of each connector and indicator follow the illustration.

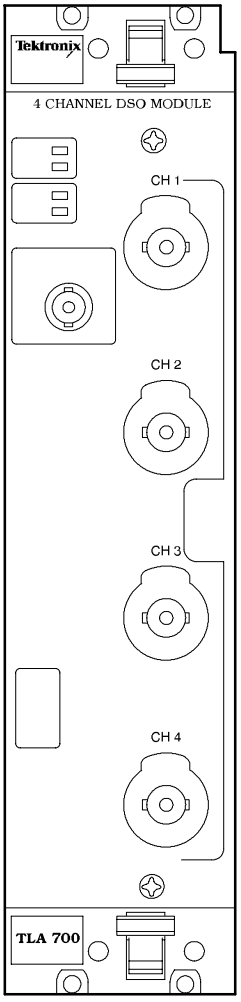


Figure 2- 3: Digitizing oscilloscope front panel

CH 1, CH 2, CH 3, and CH 4 Channel Inputs. These BNC input connectors drive the vertical channel amplifiers and their dedicated digitizers. The TLA7D2 and TLA7E2 have four input channels as shown in Figure 2–3. The TLA7D1 and TLA7E1 have the top two channels.

The channel inputs may be set for 1 MΩ or 50 Ω input impedance. Coupling selections are DC, AC, and Ground. The Ground setting grounds the internal amplifier, but presents a high impedance to the signal.

READY Indicator. The green LED lights continuously after the digitizing oscilloscope completes power-on. During normal operation, READY blinks when an error occurs that generates a message.

ACCESSED Indicator. The yellow LED blinks on and then off under the following conditions:

- Each time communication with the digitizing oscilloscope occurs
- When the Slot 0 controller asserts the Module Identification (MODID) line

ARM'D Indicator. The green LED lights when the digitizing oscilloscope is ready to accept a trigger signal to complete an acquisition.

TRIG'D Indicator. The green LED lights when a trigger is received for the most recent acquisition.

PROBE COMPENSATION. The BNC output provides a signal for adjusting probe compensation. The square wave frequency is approximately 1 kHz. Amplitude is 500 mV_{p-p} into a ≥ 50 Ω load.

Menu Overview

The digitizing oscilloscope is controlled by interactive windows through the Windows application. The TLA Series application consists of the following windows:

- System window. This window provides an overview of the entire logic analyzer. Use this window to navigate through the logic analyzer. Figure 2–4 shows an example of the system window.

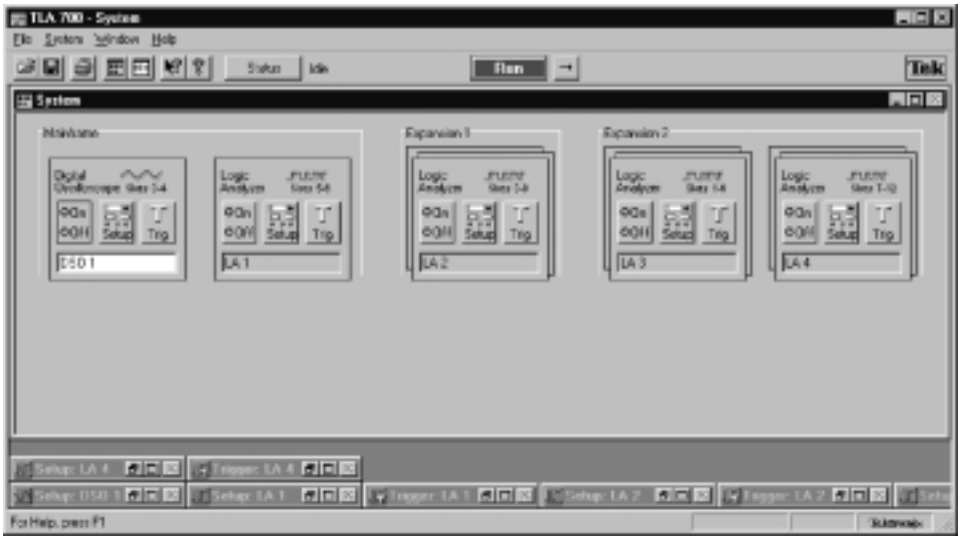


Figure 2- 4: Typical system window

The center of the System window displays icons which represent hardware modules installed in the logic analyzer. The icons are links to the other windows in the logic analyzer.

- Setup Window. A setup window exists for each module in the logic analyzer. It contains all of the setup information for the digitizing oscilloscope module. Menus and dialogs contain information to set up the window as needed.
- Listing Data Window. The Listing Data Window displays acquired data as tabular text. Each column of data represents one group of data or other logical data information, such as time stamps. Each row of data represents a different time that the data was acquired; newer samples of data display below older samples.
- Waveform Data Window. The Waveform Data Window displays acquired data as graphical waveforms. All defined channel groups display as busforms for the logic analyzer and as individual channels for the digitizing oscilloscope.

Refer to the online help for more information on the individual menus, icons, and fields within each window.

Theory of Operation

This chapter describes the electrical operation of the DSO module. The information supports fault isolation to the module or circuit board level. It supplements the diagnostic information found in the *Troubleshooting* section that begins on page 6–25.

The following *Block Level Description* describes circuit operation to the functional block level. When reading this description, refer to Figure 9–1 and Figure 9–2 for interconnection and block diagram illustrations, respectively.

Block Level Description

The block level description provides an overview of each functional circuit within the DSO module. Except for the number of channels, the basic operation is the same for each model. The TLA7D2 and TLA7E2 models have four input channels. The TLA7D1 and TLA7E1 have two input channels.

Input/Output Connectors

Input signals to be measured enter the DSO module through probes or cables connected to BNC connectors on the front panel. A probe interface detects the attenuation factor of each probe. The probe data is routed to the Acquisition Board (A2) where it is used to set the vertical scale.

The front-panel BNC provides a probe compensation signal. A coaxial cable assembly routes the signals between the front panel and the circuit boards.

Acquisition Board (A2)

The Acquisition Board (A2) accepts analog input signals and converts them to digital information. Two 100-pin ribbon cables provide interconnections with the Processor Board (A1) for power supplies, waveform data, and control signals.

The Acquisition Board (A2) consists of the following circuits:

- Attenuators
- Acquisition System
- VCO
- Trigger
- Intermodule Triggers

Attenuators. Signals applied to each channel input (CH 1, CH 2, CH 3, and CH 4) connect to an attenuator. The Main Processor System controls the attenuators. The attenuators select input coupling, termination, bandwidth, offset, and full scale range. Outputs from each attenuator drive the Acquisition System and Trigger circuits.

Acquisition System. The Acquisition System amplifies the input signals, samples them, and converts them to digital signals with 8-bit resolution. The system controls the acquisition process under direction of the Main Processor System.

Voltage Controlled Oscillator (VCO). Master clocks for the Acquisition System are generated by the Voltage Controlled Oscillator (VCO). The VCO circuit is a phase locked loop that is referenced to a 10 MHz clock provided by the mainframe.

Trigger. The Trigger circuit produces trigger signals to control the Acquisition System timebase. Trigger signals are selected from the following sources:

- Attenuator — internal triggering
- Intermodule Triggers — triggering from the communications bus

Intermodule Triggers. The Intermodule Triggers circuit routes system-generated TTLTRG and ECLTRG trigger signals to the Trigger circuit. Under control of the Main Processor System, the Intermodule Triggers circuit selects which TTLTRG and ECLTRG trigger signals are active, and defines the arming and triggering parameters.

Processor Board (A1)

The Processor Board (A1) controls instrument hardware, signal acquisition, and communications functions. Two 100-pin ribbon cables provide interconnections with the Acquisition Board (A2) for power supplies, waveform data, and control signals.

The Processor Board (A1) consists of the following circuits:

- Main Processor System
- DSP Processor System
- Backplane Interface
- Power Supplies

Main Processor System. The Main Processor System contains a 68330 microprocessor that controls the entire instrument. Commands and data sent to the instrument over the communications bus pass through the backplane interface, which resides on the 68330 bus. The 68330 bus also routes data between the Main Processor System and the DSP Processor System.

The Main Processor System includes the instrument firmware. To facilitate upgrades the firmware resides in FlashROM that can be reprogrammed using a Slot 0 controller.

DSP Processor System. The DSP Processor System contains a 320C31 microprocessor that controls signal acquisition, waveform processing, and measurements. Acquisition Memory addressing signals are transferred over the DSP Bus. The DSP Processor System is under control of the Main Processor System.

Backplane Interface. The backplane interface transfers commands and data between the communications bus and the Main Processor System. Signals pass between the instrument and the communications bus through the P1 communications bus connector.

Power Supplies. The Power Supplies receive +5 V, –5 V, and ± 12 V from the communications bus mainframe to power the DSO module. Fuses protect the mainframe from over-current conditions. Voltage regulators produce additional ± 15 V and ± 5 V supplies for use on the Acquisition Board (A2). All power connections to the Acquisition Board (A2) are made through the 100-pin ribbon cables.

Performance Verification

This chapter contains procedures for functional verification, certification, and performance verification procedures for the DSO modules. Generally, you should perform these procedures once per year or following repairs that affect certification.

Summary Verification

Functional verification procedures verify the basic functionality of the instrument inputs, outputs, and basic instrument actions. These procedures include power-on diagnostics, extended diagnostics, and manual check procedures. These procedures can be used for incoming inspection purposes.

Certification procedures certify the accuracy of an instrument and provide a traceability path to national standards. Calibration data reports are produced for the DSO modules as output from the performance verification and adjustment software.

Performance verification procedures confirm that a product meets or exceeds the performance requirements for the published specifications documented in the *Specifications* chapter of this manual. Refer to Figure 4–1 on page 4–2 for a graphic overview of the procedures.

Adjustment procedures check for, and if necessary, correct any adjustment errors discovered when performing functional or performance verification procedures. The adjustment procedures are controlled by software. Some of the adjustment procedures require user intervention to move probes or change test equipment settings.

The performance verification and adjustment software is provided on the product CD-ROM. If you have not already done so, refer to *Software Installation and Removal* beginning on page 2–4 for instructions on installing the performance verification and adjustment software.

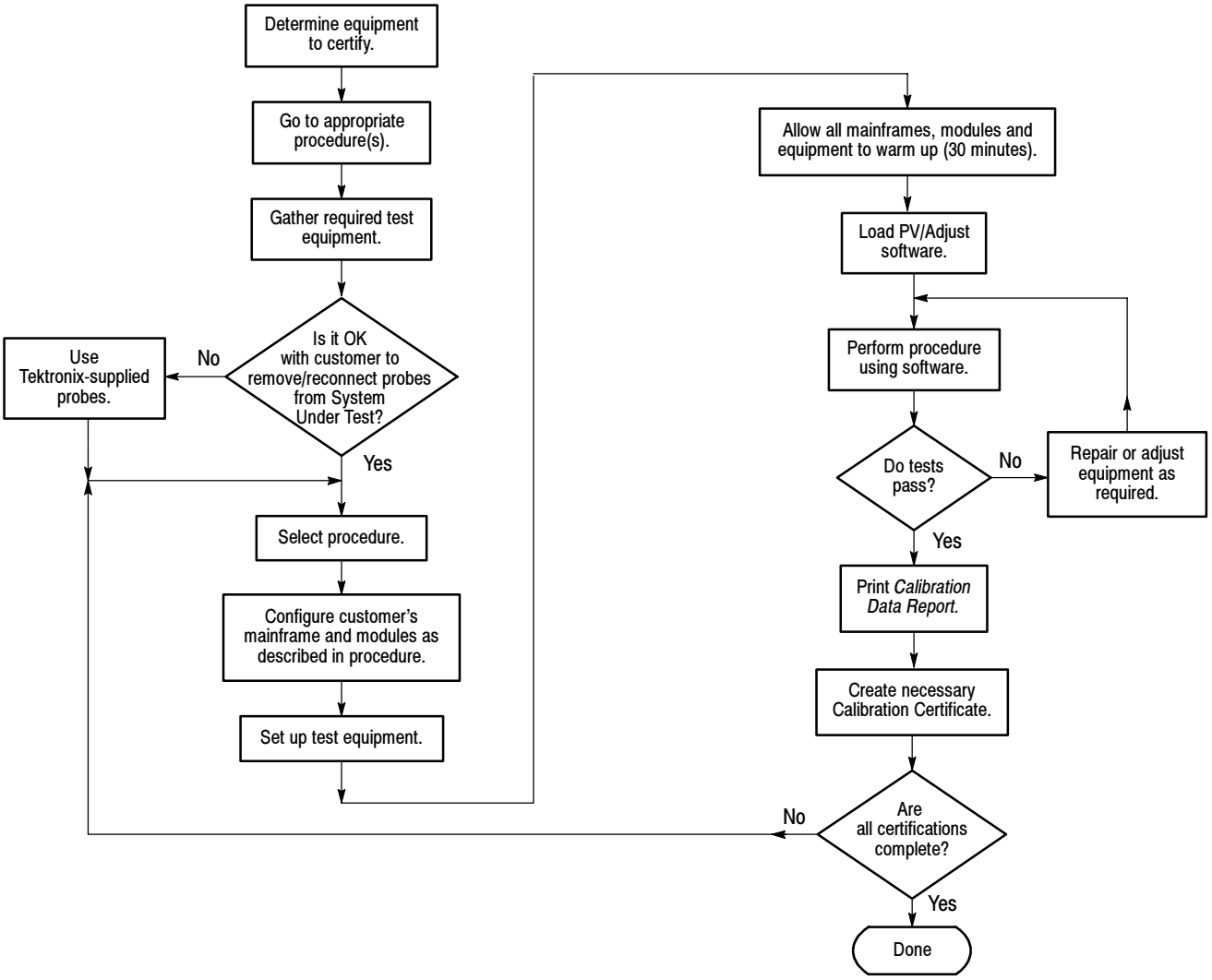


Figure 4- 1: Calibration/certification procedure flow chart

Test Equipment

These procedures use external, traceable signal sources to directly test characteristics that are designated as checked (✓) in the *Specifications* chapter of this manual. Table 4–1 shows the required equipment list. Always warm up the equipment for 30 minutes before beginning the procedures.

Table 4-1: Test Equipment

Item number and description	Minimum requirements	Example
1. Mainframe	TLA700 Series Mainframe with a DSO module installed	TLA721 Benchtop mainframe or TLA715 Portable Mainframe
2. DSO probe calibration fixture	One required	Tektronix part number 671-3930-XX
3. DSO probes	Two required, with < one-inch ground leads	Tektronix P6243 or P6245 probe, with std. accessories
4. Adapter, male BNC-to-male BNC	One required	Tektronix part number 103-0029-XX
5. Digital multimeter with test leads	DCV accuracy: 0.1% from –10 V to +100 V	Tektronix DMM 900 Series
6. Connector, dual-banana	Female BNC-to-dual banana	Tektronix part number 103-0090-XX
7. Voltage reference	Accuracy: ≤0.01%	Data Precision 8200
8. Capacitor[1]	0.1 μF, 200 V	Tektronix part number 283-0189-XX
9. Cable, dual-input	Female BNC-to-dual male BNC	Tektronix part number 067-0525-XX
10. Adapter, N-to-BNC	Male type N-to-female BNC	Tektronix part number 103-0045-XX
11. Adapter, SMA-to-BNC	Female type SMA-to-female BNC	Tektronix part number 015-1018-XX
12. Cable, precision 50 Ω coaxial	50 Ω, 36 in, male-to-male BNC connectors	Tektronix part number 012-0482-XX
13. Generator, function	Frequency range: 1 Hz to 20 MHz Frequency accuracy: 0.1% Amplitude range: 10 mV to 20 V_{p-p}	Hewlett Packard 3325B
14. Generator, sine wave	Frequency range: 100 kHz to 1005 MHz Frequency accuracy: <6 ppm Amplitude: 2 mV to 1.5 V_{RMS} Accuracy: <0.35 dB	Gigatronics 6061
15. Power meter with sensor	Bandwidth: >1.2 GHz Accuracy: 0.2 dB Sensitivity: 500 pW to 20 mW	Rohde & Schwarz NRVS with model NRV-Z4 Sensor
16. Adapter, N-to-BNC (used only with power meter)	Female type N-to-male BNC	Tektronix part number 103-0058-XX
17. 50 Ω power divider (used only with power meter)	Provide load isolation between equipment Maximum VSWR: 1.50	Tektronix part number 015-0565-XX
18. SMA-to-BNC adapters (used only with power meter)	For use with the 50 Ω power divider (three required)	Tektronix part number 015-1018-XX
19. Printer with cable (optional, to print Calibration Data Reports)	PC-compatible, continuous feed, prints ASCII text, connects to EPP connector	Any general purpose printer

[1] **The capacitor is installed across the Data Precision 8200 output terminals to reduce noise. If your voltage reference produces <4 mVp-p of noise, external noise reduction is not necessary.**

Functional Verification

The functional verification procedure consists of the following parts:

- Self tests and power-on diagnostics
- Extended diagnostics
- Self calibration (Self cal)
- Probe calibration

This procedure provides a functional check only. Perform the functional verification procedure whenever you need to gain confidence that the DSO module is operating properly. If more detailed testing is required, perform the performance verification procedure, which begin on page 4–7, after completing the functional check procedures.

Test Equipment

You will need the following test equipment identified by the item numbers listed in Table 4–1 on page 4–3.

- TLA700 Series Logic Analyzer mainframe with one DSO module
- One P6243 or P6245 oscilloscope probe, with standard accessories (item 3)
- One DSO probe calibration fixture (item 2)
- One male-male BNC adapter (item 4)

Setup

It is assumed that the DSO module is properly installed and that all accessories are connected. Refer to the *Tektronix Logic Analyzer Family User Manual* for detailed installation instructions.

Power on the instrument and allow a 30-minute warmup before continuing with any procedures in this section.

Self Tests and Power-On Diagnostics

During power-on, the installed modules perform an internal self test to verify basic functionality. No external test equipment is required. The self tests require only a few seconds per module to complete. The front-panel ARM'D and TRIG'D indicators blink during the self test. After testing completes, the front panel indicators have the following states:

- READY — Green (on)
- ACCESSED — off
- ARM'D — off
- TRIG'D — off

Next, the power-on diagnostics are run. If any self tests or power-on diagnostics fail, the instrument will display the Calibration and Diagnostics property sheet.

Extended Diagnostics

Complete the following steps to run the Extended Diagnostics on the DSO module:

1. Go to the System menu and select Calibration and Diagnostics.
2. Click on the Extended Diagnostics tab.

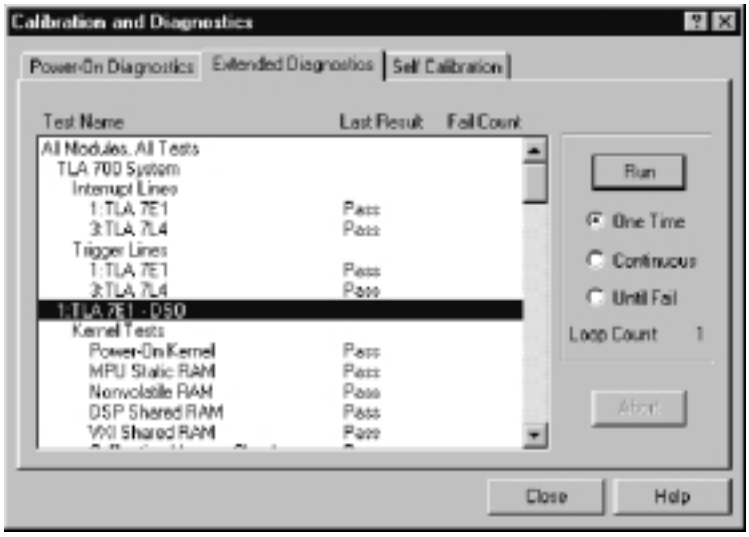


Figure 4-2: Calibration and Diagnostics property sheet

3. Select the top-level test for the module; refer to Figure 4–2.
4. Under the Run button, select One Time.
5. Click the Run button, then click OK to run the extended diagnostics.

   When the instrument runs the extended diagnostics all tests with an Unknown test status will change to either a pass or fail result.
6. When the extended diagnostics are complete, check that all tests for the module have passed.

Self Cal

Self calibration is an internal routine that optimizes performance at the current ambient temperature to maximize measurement accuracy. No external equipment or user actions are needed to complete the procedure. The DSO module saves data generated by the self calibration in nonvolatile memory.

***NOTE**. Performing the self calibration does not guarantee that all parameters operate within limits. Operation within limits is checked by performing the performance verification procedures.*

When to Perform Self Calibration. You can run the self calibration at any time during normal operation. To maintain measurement accuracy, perform the self calibration if any of the following conditions occur:

- Operating temperature is not within ± 5° C of the temperature when the self calibration was last performed.
- Once a week when the vertical input voltage range of 50 mV/div or less is used.

Running the Self Calibration. Complete the following steps to run the self calibration:

1. Ensure that the instrument has had a 30-minute warmup before attempting the self calibration.
2. Disconnect any probes connected to the DSO module.
3. Go to the System menu and select Calibration and Diagnostics.
4. Select the Self Calibration tab page.
5. Select the DSO module.
6. Click the Run button to start the self calibration.

   The self calibration takes several minutes to complete. Upon successfully completing the self calibration, the module status changes from Running to Calibrated and the Date and Time field is set to the present.

Probe Calibration

You should perform a probe calibration on any active probes that you intend to use with the DSO module. To perform the probe calibration, complete the following steps:

1. Connect an oscilloscope probe to the probe input channel on the DSO module.
2. Connect the DSO probe calibration fixture to the DSO module probe compensation output.
3. Click the Setup button in the DSO module icon.
4. Select the tab page for the input channel.

5. Click the Probe Cal button.
6. Follow the on-screen instructions for completing the probe calibration.

For more information on the probe calibration, refer to the online help.

DSO Module Certification

The certification procedures for the DSO module consist of performing the *Performance Verification Tests* and printing the software-generated Calibration Data Report.

Performance Verification Instructions

This section contains information to verify the performance of the DSO module. Testing is performed using the performance verification and adjustment software.

The performance verification and adjustment software contains instructions and control programs for testing each characteristic that is designated as checked (✓) in the *Specifications* chapter of this manual.

As a general rule, these tests should be done once a year.

Prerequisites

These procedures ask for the serial number of the DSO module under test. Before installing the DSO module in the benchtop chassis or portable mainframe, record the serial number of the DSO module.

Alternatively, you can access the module serial number through the logic analyzer application. Go to the System menu, select System Properties, and then click the DSO module tab.

You must quit the logic analyzer application before continuing with the performance verification and adjustment software procedures.

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

- When multiple DSO modules of the same model number are installed in the mainframe, the performance verification and adjustment software will address only the module in the highest slot number.

  If you are testing a TLA7E1 module, for example, move it to a higher slot number than all other TLA7E1 modules in the mainframe. This method avoids unnecessary module warm-up time.

- The logic analyzer application must not be running, and the performance verification and adjustment software must be loaded. Refer to *Software Installation and Removal* on page 2–4.
- The DSO module must be installed in a TLA700 Logic Analyzer, must have been operating for a warm-up period of at least 30 minutes, and must be operating at an ambient temperature between +20° C and +30° C.
- The DSO module must have been last adjusted at an ambient temperature between +20° C and +30° C.
- The logic analyzer must be in an environment within the limits described in the *Specifications* section of the *Tektronix Logic Analyzer Family User Manual*.

Procedure Overview

When using the performance verification and adjustment software, you will connect external test equipment to the DSO module in response to prompts on the screen. You will connect the test signals and then instruct the program to continue.

The performance verification and adjustment software automatically selects the DSO module settings and determines the results of each test. The results of the tests are recorded in a temporary file and are available for printing for certification.

To obtain partial test information you can also run individual tests or selected groups.

***NOTE**. The INTERNAL_CAL (self calibration) test must run successfully before the other tests are performed. The remaining tests can be performed in any order.*

The performance verification and adjustment software contains the tests shown in Table 4–2. Each test verifies one or more parameters. All of the tests except INTERNAL_CAL check characteristics that are designated as checked (✓) in the *Specifications* section of the *Tektronix Logic Analyzer Family User Manual*. By running a full sequence, you will verify the performance of the DSO module.

Table 4-2: DSO PV/Adjust software performance verification tests

Test name	Specification tested
1. INTERNAL_CAL	Runs the internal self cal
2. DC_GAIN_ACCURACY[1]	Accuracy, DC gain
3. OFFSET_ACCURACY[1]	Accuracy, offset
4. ANALOG_BANDWIDTH[1]	Analog bandwidth, DC coupled -50 Ω
5. RANDOM_NOISE[1]	Random noise

Table 4-2: DSO PV/Adjust software performance verification tests (Cont.)

Test name	Specification tested
6. DELAY_BETWEEN_CHAN[1]	Delay between channels, full bandwidth
7. TIMEBASE_ACCURACY[1]	Accuracy, long term sample rate and delay time
8. GLITCH_TRIG_ACC[1]	Accuracy (time) for pulse glitch or pulse width triggering
9. TRIG_MAIN_ACC[1]	Accuracy (DC) for internal and external trigger level, DC coupled
10. TRIG_MAIN_SENS[1]	Sensitivity, edge-type trigger, DC coupled
11. PROBE_COMPENSATION[1]	Probe compensation, output voltage

[1] **Certifiable parameter**

The procedures in this document assume that you will run a full sequence of tests. Each test includes a simple illustration of the test equipment setups and a table summarizing the parameters being verified.

You must perform a full performance verification sequence on the DSO module when replacing any circuit board in the module. If the performance verification tests fail, perform the adjustment procedure as described in the *Adjustment Procedures*, then rerun the performance verification tests.

Using the Software

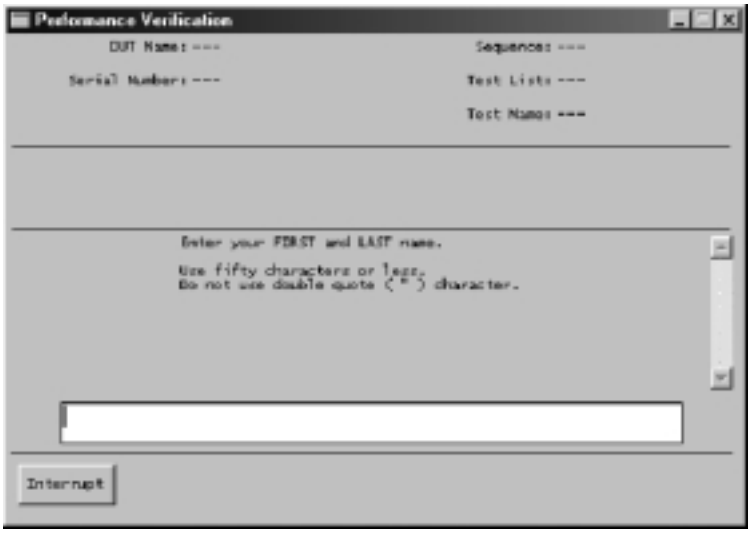
The DSO software consists of executable software files. Use the following steps to start and run the software:

1. Allow the instruments to warm up for at least 30 minutes before beginning the procedure.
2. Quit all applications including the TLA application.
3. Select Start → Programs → TLA Performance Verification.
4. To run the performance verification and adjustment software, select the following:
   - For the TLA7Dx and TLA7Ex DSO modules, select DSO PV.
5. Follow the instructions on the screen to enter the name you want to appear in the User Name field as shown below. This name will appear on the Calibration Data Reports.
6. The program lists several different modules, referred to as DUT (Device Under Test). Enter the number corresponding to the module type that you want to test; then click Enter to continue.

The screen will display an error message if the DUT chosen does not match the installed DUT.

7. Click Enter to continue.

8. Enter the complete serial number of the DUT (for example, B010100). Click Enter to continue.



If you select no, a prompt asks you to enter the serial number again.

9. The program lists sequences for PV (performance verification) and ADJ (adjustments). Enter a number to select which sequence you want and click Enter to continue.

10. If an instrument is being tested, the program lists the different probe types available for testing. Enter the appropriate number corresponding to your probe and then click Enter to continue.

11. Enter the operating temperature in degrees C (entries in the range of 20 to 30 degrees are valid). Click Enter to continue.

12. Enter the operating humidity as a percentage (0% to 100% entries are valid). Click Enter to continue.

13. Determine which sequence to run:

- RUN FULL SEQUENCE runs the entire sequence from beginning to end. This is the recommended selection.
- RUN PARTIAL SEQUENCE runs part of the full sequence. The sequence runs from the selected starting point to the end of the sequence.

- SELECT TEST(S) runs only the selected tests. To run a single test, enter the test number. To run multiple tests, enter a comma-separated list of numbers or a hyphen-separated list of numbers.

Enter the number next to your choice and click Enter to continue.

14. Follow the on-screen instructions to connect and adjust test equipment.

15. When testing is completed, disconnect the test equipment.

Using the Interrupt Button

While the program is running, you can interrupt the program to rerun a test, start over, or to exit the program by clicking the Interrupt button (shown below).

The program will then provide a list of choices. Enter the number next to the choice that you want and click Enter.

***NOTE**. If you interrupt a test before it has completed, you must restart the test to obtain valid test data.*

Some tests such as Internal Cal do not allow interrupts. If you stop these tests using more aggressive methods, you may have to reboot the instrument.

Obtaining Test Results

The results of all tests can be stored in a file on the hard disk. You can view the test results, print the test results to a printer, or save the test results in another file on the hard disk. The software stores the test results in a file containing the module name and serial number (for example, TLA7E2.B020123). The file is located under the following path: C:\Tekcats\Rpt.

***NOTE**. If you want to save the content of the Report file, you must rename or copy the Report file using the Windows file utilities such as Explorer.*

The Report file will be overwritten the next time you run the performance verification and adjustment software and print or view a new set of test data.

After completing a full or partial test sequence (or just before you exit the program) you can generate the test data and write it to a file. You have the option of printing the file, viewing the file on screen, or transferring the file to another directory or host computer.

You can print the test data directly from the program. Ensure that a printer is connected to your logic analyzer and follow the on-screen instructions to print the test results.

If a printer is not available, you can view the test results directly from the screen, or you can copy the test results to a different file or folder/host computer for future use.

Field Adjust/PV Software Housekeeping

The performance verification and adjustment software creates data log files (.dlf files) that store program data. The .dlf files are used by the performance verification and adjustment software to generate the view data and print out options. Each .dlf file is identified by the product serial number; for example, B010100.dlf. The files are stored in the Tekcats folder under each TLA7xx folder. To conserve disk space, you must occasionally delete the .dlf files.

Troubleshooting

If any tests fail, use the following steps to troubleshoot the problems:

1. Check all test equipment for improper or loose connections.
2. Check that all test equipment is powered on and has the proper warm-up time.
3. Run the tests a second time to verify the failure.
4. If tests continue to fail, refer to Table 4–3 to determine the source of the failure.

Table 4-3: DSO module fault isolation

Test name	Possible circuit board failure
1. INTERNAL_CAL	A2 Acquisition board
2. DC_GAIN_ACCURACY	A2 Acquisition board
3. OFFSET_ACCURACY	A2 Acquisition board
4. ANALOG_BANDWIDTH	A2 Acquisition board
5. RANDOM_NOISE	A2 Acquisition board
6. DELAY_BETWEEN_CHAN	A2 Acquisition board
7. TIMEBASE_ACCURACY	A2 Acquisition board / Mainframe
8. GLITCH_TRIG_ACC	A2 Acquisition board
9. TRIG_MAIN_ACC	A2 Acquisition board
10. TRIG_MAIN_SENS	A2 Acquisition board
11. PROBE_COMPENSATION	A1 Processor board

Performance Verification Tests

This section describes the individual tests and the test equipment connections. All tests contain a brief table listing the following information:

- Software test name
- A brief list of test equipment
- A list of prerequisites for each test

Most of the tests include a simple test equipment connection diagram (unless there are no changes from the previous test).

DSO Procedure 1: Internal Calibration

This procedure checks the internal self calibration of the DSO module. The INTERNAL_CAL test is the performance verification and adjustment software equivalent of SELF_CAL.

SW test name	INTERNAL_CAL
Equipment required	None required
Prerequisites	Warm-up time: 30 minutes All probes disconnected Power-up diagnostics pass No previous tests required

1. If the logic analyzer application is running, quit the application.
2. Verify that all of the prerequisites listed previously are met for the procedure.
3. Run the performance verification and adjustment software.
4. Select TLA_dig, then select the correct module type and the PV test option.
5. Follow the on-screen instructions to run the test for the DSO module.
6. Verify that this test passes before continuing with any other tests.

DSO Procedure 2: DC Gain Accuracy

This procedure checks the DC gain accuracy of the DSO module.

SW test name	DC_GAIN_ACCURACY
Equipment required	Voltage reference (item 7) Precision BNC cable (item 12) Dual banana-to-BNC adapter (item 6) Capacitor, 0.1 μF[1] (item 8)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running The performance verification and adjustment software is loaded Test equipment connected as shown in Figure 4-3 Power-up diagnostics pass INTERNAL_CAL test passes

1 **Install the 0.1 μF capacitor across the voltage reference output terminals to reduce noise.**

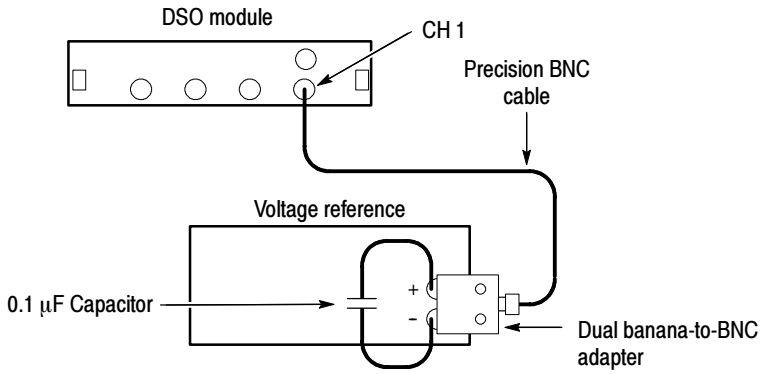


Figure 4-3: Initial setup for the DC gain accuracy test

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for each channel on the DSO module.
3. After the test begins, make changes to test equipment settings and connections when requested by the on-screen instructions.
4. Verify that all of the tests pass. If a test fails, check the *Troubleshooting* section on page 4–12.

DSO Procedure 3: Offset Accuracy

This procedure checks the offset accuracy of the DSO module.

SW test name	OFFSET_ACCURACY
Equipment required	No change from the DC Gain Accuracy test
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running The performance verification and adjustment software is loaded Test equipment connected as shown in Figure 4-3 Power-up diagnostics pass INTERNAL_CAL test passes

1. Verify that all of the prerequisites listed previously are met for the procedure.

WARNING. *These procedures use voltage levels that step through ±99.90 volts. Use caution when using voltages approaching this magnitude.*

2. Follow the on-screen instructions to run the test for each channel on the DSO module.
3. After the test begins, make changes to test equipment settings and connections when requested by the on-screen instructions.
4. Verify that all of the tests pass. If a test fails, check the *Troubleshooting* section on page 4-12.

DSO Procedure 4: Analog Bandwidth

This procedure checks the analog bandwidth, DC coupled specification of the DSO module.

SW test name	ANALOG_BANDWIDTH
Equipment required	Sine wave generator[1] (item 14) Precision BNC cable (item 12) Type N-to-BNC adapter (item 10)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running The performance verification and adjustment software is loaded Test equipment connected as shown in Figure 4-4[2] Power-up diagnostics pass INTERNAL_CAL test passes

1 The output frequency of the sine wave generator must maintain a constant output amplitude within 0.35 dB of the reference frequency (10 MHz) through the bandwidth calibration frequency range (1005 MHz).

2 If you require a power meter to maintain a constant output amplitude use the equipment setup as shown in Figure 4-5.

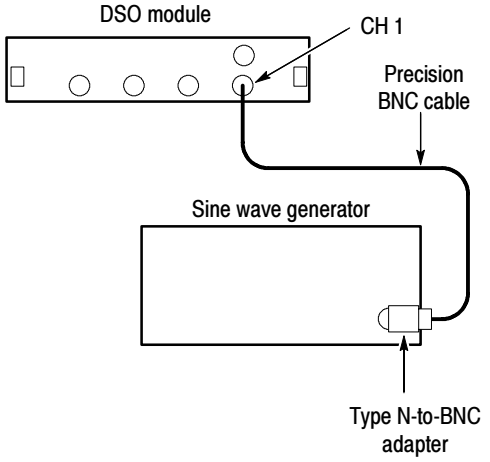


Figure 4-4: Initial setup for the analog bandwidth test

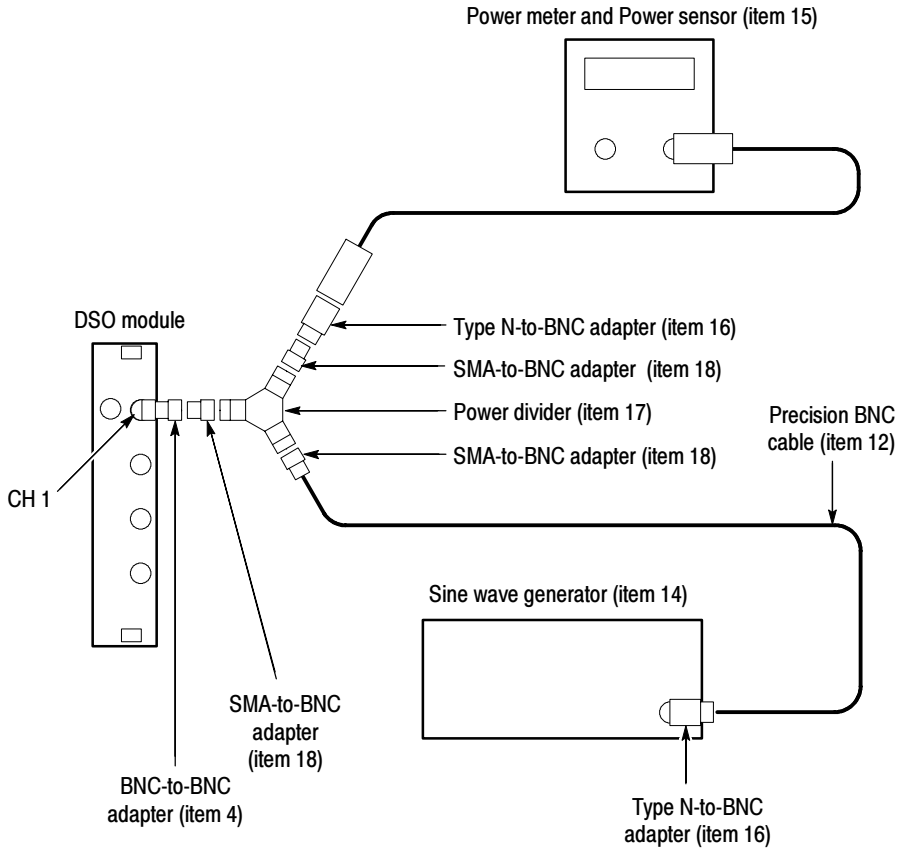


Figure 4-5: Using a power meter to monitor the amplitude of the sine wave generator during the analog bandwidth test

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for each channel on the DSO module.
3. Verify that all of the tests pass. If a test fails, check the *Troubleshooting* section on page 4–12.

DSO Procedure 5: Random Noise

This procedure checks the random noise specification of the DSO module.

SW test name	RANDOM_NOISE
Equipment required	No external test equipment required
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running The performance verification and adjustment software is loaded Power-up diagnostics pass INTERNAL_CAL test passes

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for the DSO module.
3. Verify that all of the tests pass. If a test fails, check the *Troubleshooting* section on page 4–12.

DSO Procedure 6: Delay Between Channels

This procedure checks the delay between channels for the full bandwidth of the DSO module.

SW test name	DELAY_BETWEEN_CHAN
Equipment required	Sine wave generator (item 14) Precision BNC cable (item 12) Dual input BNC cable[1] (item 9) Type N-to-BNC adapter (item 10)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running The performance verification and adjustment software is loaded Test equipment connected as shown in Figure 4-6 Power-up diagnostics pass INTERNAL_CAL test passes

1 **Use the dual input cable or a set of matched cables when running this test. If you use unmatched coaxial cables, the test may fail or may be miscalibrated due to an electrical mismatch between the cables.**

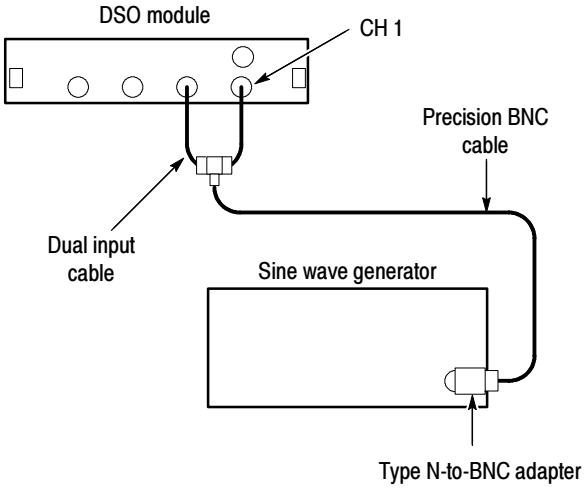


Figure 4-6: Initial setup for the delay between channels test

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for the DSO module.
3. Verify that all of the tests pass. If a test fails, check the *Troubleshooting* section on page 4-12.

DSO Procedure 7: Timebase Accuracy

This procedure checks the long-term sample rate and delay time accuracy of the DSO module.

SW test name	TIMEBASE_ACCURACY
Equipment required	Sine wave generator (item 14) Precision BNC cable (item 12) Type N-to-BNC adapter (item 10)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running The performance verification and adjustment software is loaded Test equipment connected as shown in Figure 4-7 Power-up diagnostics pass INTERNAL_CAL test passes

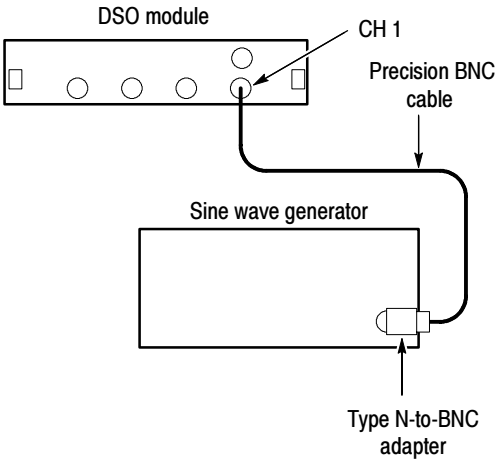


Figure 4-7: Initial setup for the timebase accuracy test

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for the DSO module.
3. Verify that all of the tests pass. If a test fails, check the *Troubleshooting* section on page 4–12.

DSO Procedure 8: Glitch Trigger Accuracy

This procedure checks the time accuracy for the pulse glitch or for the pulse width triggering of the DSO module.

SW test name	GLITCH_TRIG_ACC
Equipment required	No change from the previous test (Timebase Accuracy)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running The performance verification and adjustment software is loaded Test equipment connected as shown in Figure 4–7 Power-up diagnostics pass INTERNAL_CAL test passes

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for the DSO module.
3. Verify that all of the tests pass. If a test fails, check the *Troubleshooting* section on page 4–12.

DSO Procedure 9: Main Trigger Accuracy

This procedure checks the DC accuracy for the internal and external trigger level (DC coupled) of the DSO module.

SW test name	TRIG_MAIN_ACC
Equipment required	Function generator (item 13) Precision BNC cable (item 12)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running The performance verification and adjustment software is loaded Test equipment connected as shown in Figure 4-8 Power-up diagnostics pass INTERNAL_CAL test passes

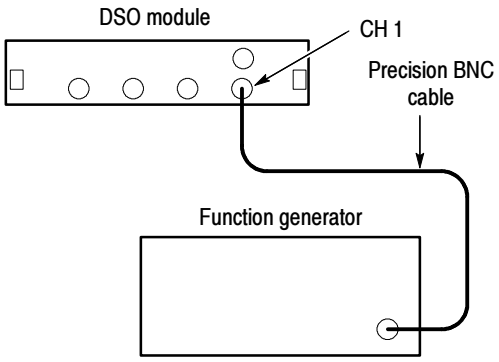


Figure 4-8: Initial setup for the main trigger accuracy test

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for the DSO module.
3. Verify that all of the tests pass. If a test fails, check the *Troubleshooting* section on page 4–12.

DSO Procedure 10: Main Trigger Sensitivity

This procedure checks the sensitivity of the edge-type trigger (DC coupled) of the DSO module.

SW test name	TRIG_MAIN_SENS
Equipment required	Sine wave generator (item 14) Precision BNC cable (item 12) Type N-to-BNC adapter (item 10)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running The performance verification and adjustment software is loaded Test equipment connected as shown in Figure 4-9 Power-up diagnostics pass INTERNAL_CAL test passes

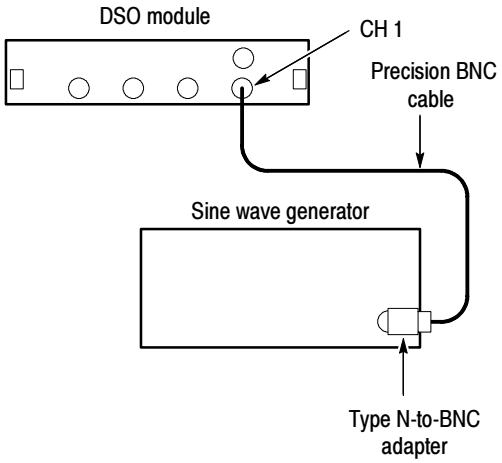


Figure 4-9: Initial setup for the main trigger sensitivity test

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for the DSO module.
3. Verify that all of the tests pass. If a test fails, check the *Troubleshooting* section on page 4-12.

DSO Procedure 11: Probe Compensation

This procedure checks the probe compensation output voltage of the DSO module.

SW test name	TRIG_MAIN_SENS
Equipment required	Digital multimeter (item 5) Precision BNC cable (item 12) Dual banana-to-BNC adapter (item 6)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running The performance verification and adjustment software is loaded Test equipment connected as shown in Figure 4-10 Power-up diagnostics pass INTERNAL_CAL test passes

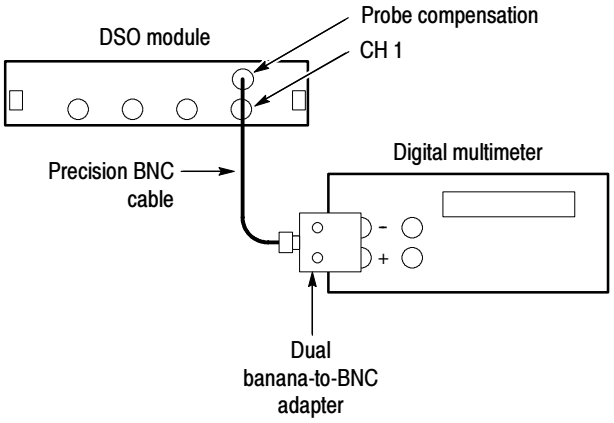


Figure 4-10: Initial setup for the probe compensation test

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for the DSO module.
3. Verify that all of the tests pass. If a test fails, check the *Troubleshooting* section on page 4–12.

Adjustment Procedures

This section contains information needed to adjust the DSO module. Adjustments are performed using the performance verification and adjustment software. The performance verification and adjustment software contains instructions and control programs for adjusting the DSO module.

The software describes test equipment connections and settings, selects DSO module setup parameters, and loads calibration constants into the DSO module memory.

These procedures adjust the DSO module for conformance with the warranted characteristics listed in the *Specifications* chapter of this manual.

These adjustments should be done whenever the DSO module fails the performance verification procedure.

Prerequisites

These procedures ask for the serial number of the DSO module under test. Before installing the DSO module in the benchtop chassis or portable mainframe, record the serial number of the DSO module.

Alternatively, you can access the module serial number through the logic analyzer application. In the logic analyzer application, go to the System menu, select System Properties, and then click the DSO module tab. You must quit the logic analyzer application before continuing with the performance verification and adjustment software procedures.

Only trained service technicians should perform this procedure after meeting the following requirements:

- When multiple DSO modules of the same model number are installed in the mainframe, the performance verification and adjustment software will address only the module in the highest slot number.

  If you are testing a TLA7E1 module for example, move it to a higher slot number than all other TLA7E1 modules in the mainframe. This method avoids unnecessary module warm-up time.

- The logic analyzer application must not be running.

- The performance verification and adjustment software must be loaded.

- The DSO module requires a 30-minute warm-up time in a +20° C to +30° C environment before it is adjusted. Adjustments performed before the operating temperature has stabilized may cause errors in performance.

Using the Software

This section describes how to perform adjustments using the performance verification and adjustment software.

Performing the Adjustments

There are no manual adjustments for the DSO module. The performance verification and adjustment software adjusts the instrument hardware using external test equipment connection you provide in response to prompts on the screen.

Upon successful completion of each adjustment, the performance verification and adjustment software automatically loads the new calibration data into the DSO module memory.

Adjustment Sequences and Dependencies

The performance verification and adjustment software allows you to run groups of adjustments, or sequences. A sequence consists of one or more individual adjustments. Normally you will perform a RUN FULL SEQUENCE, which executes each adjustment in the proper order. The performance verification and adjustment software also provides instructions for running each adjustment individually. However, you should only perform individual adjustments while troubleshooting the DSO module.

Some adjustments depend on successful prior completion of other adjustments. For example, all the tests associated with the Base Calibration must pass before any other adjustments can be successfully completed.

Table 5–1 lists the tests and dependencies for each adjustment.

Table 5-1: DSO Adjustments and dependencies

Adjustment procedure	Tests	Prior completion requirements
1. Base Calibration Adjustment[1]	EXTERNAL_CAL INTERNAL_CAL	None
2. Frequency Response Adjustment (TLA7E1 and TLA7E2 only)	BANDWIDTH_CAL	Base Calibration
3. Pulse Trigger Adjustment[2]	GLITCH_TRIG_CAL PNP_LATENCY_CAL	Base Calibration
4. Setup and Hold Adjustment	SETUP_HOLD	Base Calibration Pulse Trigger Adjustment
5. Channel to Channel Skew Adjustment	CHAN_SKEW_CAL	Base Calibration
6. Probe Compensation Adjustment	PROBE_COMP_CAL	None

1 You must complete the EXTERNAL_CAL test before running the INTERNAL_CAL test.

2 You must complete the GLITCH_TRIG_CAL test before running the PNP_LATENCY_CAL test.

Adjustment After Repair

You must perform a full performance verification sequence following replacement of any circuit board in the DSO module. If the performance verification tests fail, then perform the adjustment procedure.

Test Equipment

Table 4-1 on page 4-3 lists the test equipment required to adjust the DSO module. Item numbers under each test in these procedures correspond to the test equipment listed in the Table 4-1.

Adjustment Instructions

This section describes how to perform adjustments using the performance verification and adjustment software.

Using the PV/Adjust Software

The performance verification and adjustment software contains instructions for performing the adjustments. The basic steps for completing the procedures follow:

1. Start the program and enter user and product identification information.
2. Select a full adjustment sequence.
3. Connect the test equipment.
4. Run each adjustment step as instructed.
5. After completing all the adjustment steps, view the test results to confirm that the adjustment was successful.

When a test passes, the software automatically loads new calibration data into the DSO module memory.

NOTE. *Use the dual input cable or a set of matched cables (for electrical length) when running the CHAN_SKEW_CAL test.*

If you use unmatched separate coaxial cables, the adjustment may fail or may be miscalibrated due to an electrical mismatch between the cables.

Troubleshooting

If any adjustments fail, use the following steps to troubleshoot the problems:

1. Check all test equipment for improper or loose connections.
2. Check that all test equipment is powered on and has the proper warm-up time.
3. Run the adjustment procedures a second time to verify the failure.
4. If the adjustment procedures continue to fail, refer to Table 5–2 to determine the source of the failure and then refer to the *TLA7Dx/TLA7Ex Digitizing Oscilloscope Service Manual* for corrective action.

Table 5-2: Fault isolation

Adjustment procedure	Tests	Possible circuit board failure
1. Base calibration adjustment	EXTERNAL_CAL INTERNAL_CAL	A2 Acquisition board
2. Frequency response adjustment	BANDWIDTH_CAL	A2 Acquisition board
3. Pulse trigger adjustment	GLITCH_TRIG_CAL PNP_LATENCY_CAL	A2 Acquisition board
4. Setup and hold adjustment	SETUP_HOLD	A2 Acquisition board
5. Channel to channel skew adjustment	CHAN_SKEW_CAL	A2 Acquisition board
6. Probe compensation adjustment	PROBE_COMP_CAL	A1 Processor board

Adjustment Procedures

Each of the following adjustment procedures corresponds to one or more adjustment control programs in the performance verification and adjustment software. Refer to the following procedures to identify the initial setup for each test. Then follow the program instructions to complete the tests.

DSO Procedure 1: Base Calibration

This procedure performs an internal and external calibration on the DSO module. The INTERNAL_CAL test is the performance verification and adjustment software equivalent of SELF_CAL.

SW test names	EXTERNAL_CAL, INTERNAL_CAL
Equipment required	Voltage reference (item 7) Precision BNC cable (item 12) Dual banana-to-BNC adapter (item 6) Capacitor, 0.1 μF[1] (item 8)
Prerequisites	Warm-up time: 30 minutes Test equipment connected as shown in Figure 5-1 Power-up diagnostics pass No previous tests required

1 **Install the 0.1 μF capacitor across the voltage reference output terminals to reduce noise.**

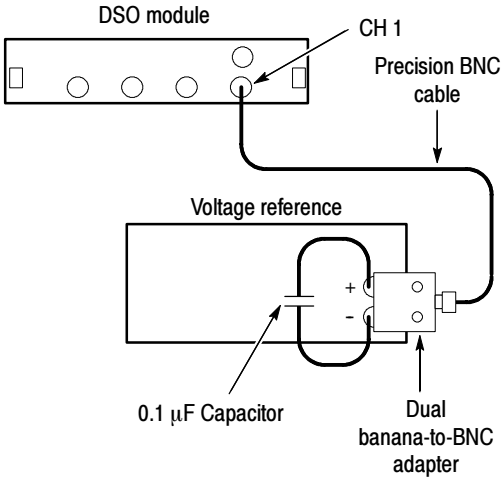


Figure 5-1: Initial setup for the base calibration adjustment

1. If the logic analyzer application is running, quit the application.
2. Load the performance verification and adjustment software as described in the *Software Installation and Removal* on page 2–4.
3. Verify that all of the prerequisites listed previously are met for the procedure.
4. Run the performance verification and adjustment software as described in Using the *Software* on page 4–9. Select TLA_dig, then select the correct module type and the ADJ test option.
5. Follow the on-screen instructions to run the EXTERNAL_CAL test for the DSO module.
6. Verify that the EXTERNAL_CAL test passes before disconnecting the test equipment and performing the INTERNAL_CAL test.
7. Verify that these tests pass before continuing with any other tests.

DSO Procedure 2: Frequency Response Adjustment

This procedure adjusts the frequency response of the TLA7E1 and the TLA7E2 DSO modules.

SW test names	BANDWIDTH_CAL
Equipment required	Sine wave generator[1] (item 14) Precision BNC cable (item 12) Type N-to-BNC adapter (item 16)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running Test equipment connected as shown in Figure 5-2[2] Power-up diagnostics pass Base Calibration completed

1 The output frequency of the sine wave generator must maintain a constant output amplitude within 0.35 dB of the reference frequency (10 MHz) through the bandwidth calibration frequency range (1005 MHz).

2 If you require a power meter to maintain a constant output amplitude use the equipment setup as shown in Figure 5-3.

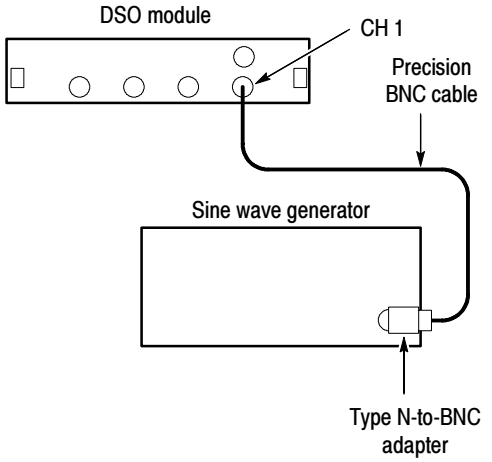


Figure 5-2: Initial setup for the frequency response adjustment

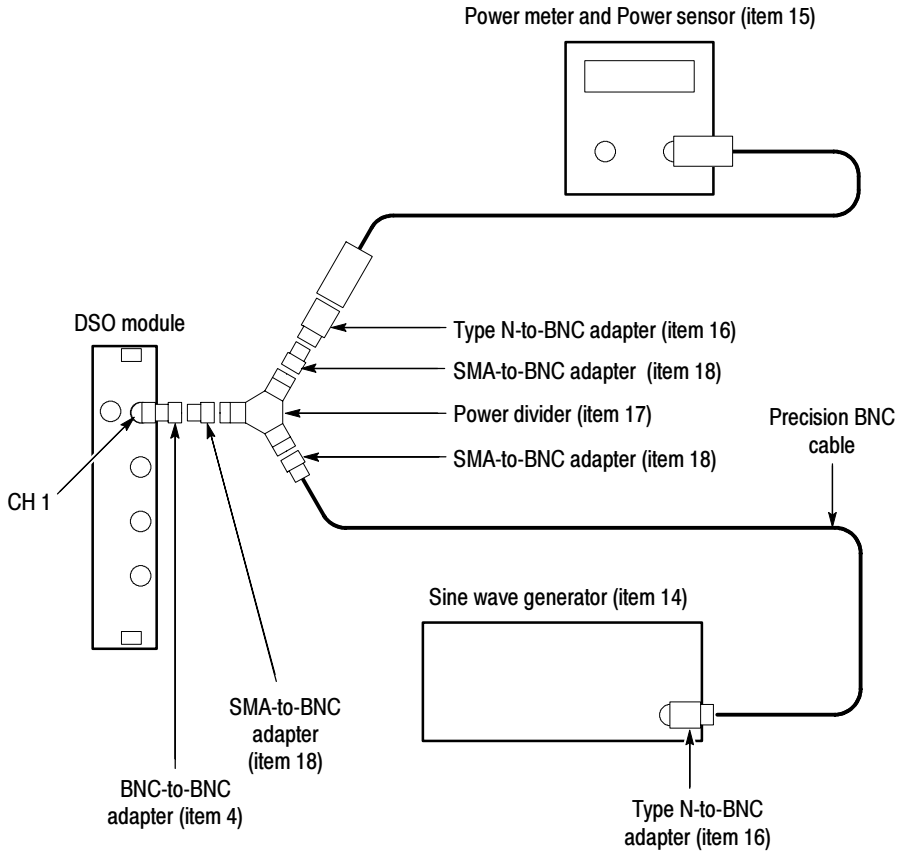


Figure 5-3: Using a power meter to monitor the amplitude of the sine wave generator during the frequency response adjustment

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run all of the tests for the DSO module.

***NOTE**. All of the tests that are listed must be run. There are no optional tests.*

3. Verify no failures occur for each test. If a test continues to fail, check the *Troubleshooting* section on page 5–5.

DSO Procedure 3: Pulse Trigger Adjustment

This procedure adjusts the pulse trigger of the DSO module.

SW test names	GLITCH_TRIG_CAL, PNP_LATENCY_CAL
Equipment required	No changes from the previous test (Frequency Response Adjustment), unless power meter was used
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running Test equipment connected as shown in Figure 5-2 Power-up diagnostics pass Base Calibration completed

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run all of the tests for the DSO module.

***NOTE**. All of the tests that are listed must be run. There are no optional tests.*

3. Verify no failures occur for each test. If a test continues to fail, check the *Troubleshooting* section on page 5–5.

DSO Procedure 4: Setup and Hold Adjustment

This procedure adjusts the setup and hold parameters of the DSO module.

SW test names	SETUP_HOLD_CAL
Equipment required	No change from previous test
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running Test equipment connected as shown in Figure 5-2 Power-up diagnostics pass Base Calibration and Pulse Trigger adjustment completed

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for the DSO module.
3. Verify no failures occur for each test. If a test continues to fail, check the *Troubleshooting* section on page 5–5.

DSO Procedure 5: Channel-to-Channel Skew Adjustment

This procedure adjusts the channel-to-channel skew parameters of the DSO module.

SW test names	CHAN_SKEW_CAL
Equipment required	Sine wave generator (item 14) Precision BNC cable (item 12) Dual input BNC cable[1] (item 9) Type N-to-BNC adapter (item 10)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running Test equipment connected as shown in Figure 5-4 Power-up diagnostics pass Base Calibration completed

1 **Use the dual input cable or a set of matched cables when running this test. If you use unmatched coaxial cables, the test may fail or may be mis-calibrated due to an electrical mismatch between the cables.**

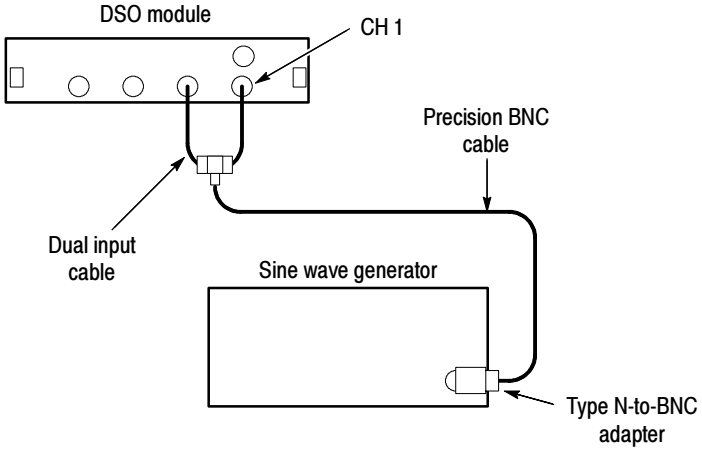


Figure 5-4: Initial setup for the channel-to-channel skew adjustment

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for the DSO module.
3. Verify no failures occur for each test. If a test continues to fail, check the *Troubleshooting* section on page 5–5.

DSO Procedure 6: Probe Compensation Adjustment

This procedure adjusts the probe compensation output voltage of the DSO module.

SW test names	PROBE_COMP_CAL
Equipment required	Digital multimeter (item 5) Precision BNC cable (item 12) Dual banana-to-BNC adapter (item 6)
Prerequisites	Warm-up time: 30 minutes The logic analyzer application is not running Test equipment connected as shown in Figure 5-5 Power-up diagnostics pass INTERNAL_CAL test pass

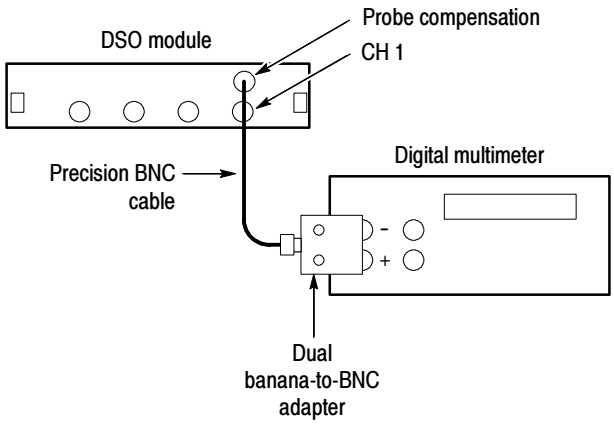


Figure 5-5: Initial setup for the probe compensation test

1. Verify that all of the prerequisites listed previously are met for the procedure.
2. Follow the on-screen instructions to run the test for the DSO module.
3. Verify no failures occur for each test. If a test continues to fail, check the *Troubleshooting* section on page 5-5.

Completing the Adjustment Steps

After completing the adjustments, obtain a copy of the test results and verify that all tests passed. Run the *Performance Verification Procedures* to verify that all the parameters are within the allowable specifications.

Maintenance

This chapter contains the information needed to do periodic and corrective maintenance on the DSO module. The following sections are included:

- The *Maintenance* section provides general information on preventing damage to internal circuit boards when doing maintenance, lithium battery warnings and disposal instructions, and procedures for inspecting the DSO module and cleaning its external and internal parts.
- The *Removal and Installation Procedures* (page 6–7) provide procedures for the removal and installation of circuit boards.
- *Troubleshooting* (page 6–25) provides information for isolating failed circuit boards. Included are system-level instructions that isolate faults within your system, and troubleshooting trees that use the internal self tests and DC voltage measurements to isolate faults to a faulty circuit board.
- *Repackaging Instructions* provides packaging information for shipment or storage.

Related Maintenance Procedures

The following chapters contain information/procedures related to maintenance.

- The *Performance Verification* chapter contains tests that may be useful in isolating problems by testing DSO module performance.
- The *Adjustment Procedures* chapter contains a procedure for adjusting the internal circuits of the DSO module. The procedure may be used after repairs are made, or for periodic adjustments.

Preventing ESD

When performing any service which requires internal access to the DSO module, adhere to the following precautions to avoid damaging internal circuit boards and their components due to electrostatic discharge (ESD).

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

1. Minimize handling of static-sensitive circuit boards.

2. Transport and store static-sensitive circuit boards in their static protected containers or on a metal rail. Label any package that contains static-sensitive boards.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these circuit boards. Do service of static-sensitive circuit boards 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 circuit boards over any surface.
7. Avoid handling circuit boards in areas that have a floor or work-surface covering capable of generating a static charge.

Battery Disposal

WARNING. *To avoid personal injury, observe the proper procedures for handling lithium batteries. Improper handling can cause fire, explosion, or severe burns. Do not recharge, crush, disassemble, heat above 100° C (212° F), incinerate, or expose the battery to water.*

The DSO module contains one lithium battery, A1U70, located on the Processor Board (A1). Battery replacement is accomplished by installing a new Processor Board (A1). Read the following information before replacing the battery. See *Processor Board* on page 6–13 for replacement instructions.

Dispose of lithium batteries according to local, state, and federal regulations.

In the United States, you can typically dispose of small quantities (less than 20) of batteries with ordinary garbage in a sanitary landfill. You must send larger quantities by surface transport to a hazardous waste disposal facility. Package the batteries individually to prevent shorting. Then, pack them in a sturdy container that is clearly labelled: Lithium Batteries — DO NOT OPEN.

Inspection and Cleaning

This section describes how to inspect for dirt and damage, and how to clean the DSO module. Inspection and cleaning are done as preventive maintenance. Preventive maintenance, when done regularly, may prevent malfunctions and enhance reliability.

Preventive maintenance consists of visually inspecting and cleaning the DSO module, and using general care when operating it. How often to do maintenance depends on the severity of the environment in which the DSO module is used. A proper time to perform preventive maintenance is just before adjustment of the DSO module.

General Care

The side cover keeps dust out of the DSO module and should be in place during normal operation.

Inspection and Cleaning Procedures

Inspect and clean the DSO module as often as operating conditions require. The collection of dirt on internal components 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 a DSO module failure, especially under high-humidity conditions.

CAUTION. *Avoid the use of chemical cleaning agents that might damage the plastics and external labels used in the DSO module.*

Use a cloth dampened with water to clean external surfaces.

To clean internal surfaces, 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 DSO module for damage, wear, and missing parts. Use Table 6–1 as a guide. Instruments 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 DSO module or the mainframe in which it is used.

Table 6-1: External inspection check list

Item	Inspect for	Repair action
Front panel and side cover	Cracks, scratches, deformations, missing or damaged retainer screws, ejector handles, or gaskets.	Replace defective or missing parts.
Front panel connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.	Replace defective parts. Clear or wash out dirt.
Rear connectors	Cracked or broken shells, damaged or missing contacts. Dirt in connectors.	Replace defective parts. Clear or wash out dirt.
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors.	Replace damaged or missing parts, frayed cables, and defective circuit boards.

CAUTION. *To prevent damage to electrical components from moisture during external cleaning, use only enough liquid to dampen the cloth or applicator.*

Cleaning Procedure — Exterior. To clean the DSO module exterior, perform the following steps:

1. Remove loose dust on the outside of the DSO module with a lint free cloth.
2. Remove remaining dirt with a lint free cloth dampened with water. Do not use abrasive cleaners.

Inspection — Interior. Remove the module cover to access the inside of the DSO module for inspection and cleaning.

Inspect the internal portions of the DSO module for damage and wear using Table 6–2 as a guide. Defects found should be repaired immediately.

Table 6-2: Internal inspection check list

Item	Inspect for	Repair action
Circuit boards	Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.	Remove failed board and replace with a new part.
Resistors or semi-conductors	Burned, cracked, broken, blistered condition.	Remove failed board and replace with a new part.
Solder connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Remove failed board and replace with a new part.
Wiring and cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace parts with defective wires or cables.
Chassis	Dents, deformations, and damaged hardware.	Straighten, repair, or replace defective hardware.

CAUTION. *To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the DSO module.*

Cleaning Procedure — Interior. To clean the DSO module interior, perform the following steps:

1. Blow off dust with dry, low-pressure, deionized air (approximately 9 psi).
2. Remove any remaining dust with a lint free cloth dampened in isopropyl alcohol (75% solution) and rinse with warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)

NOTE*. If, after performing steps 1 and 2, a part is clean upon inspection, skip the remaining steps.*

If steps 1 and 2 do not remove all the dust or dirt, the DSO module may be spray washed using a solution of 75% isopropyl alcohol (see steps 3 through 7).

3. Gain access to the parts to be cleaned by removing easily accessible shields and panels.

4. Spray wash dirty parts with the isopropyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate.
5. Use hot (48.9° C to 60° C/120° F to 140° F) deionized water to thoroughly rinse the parts.
6. Dry all parts with low-pressure, deionized air.
7. Dry all components and assemblies in an oven or drying compartment using low-temperature (51.7° C to 65.6° C/125° F to 150° F) circulating air.

Removal and Installation Procedures

This section describes how to remove and install the major mechanical and electrical modules.

WARNING. *Before doing this or any other procedure in this manual, read the* General Safety Summary *and* Service Safety Summary *found at the beginning of this manual.*

To prevent possible injury to service personnel or damage to electrical components, read Preventing ESD *on page 6–1.*

Summary of Procedures

The procedures are listed below in the order in which they appear in this section:

- *Injector/Ejector Handles* on page 6–8 describes how to replace the module ejector handles
- *Cover* on page 6–10 describes how to replace the module cover
- *Processor Board* on page 6–13 describes how to replace the Processor Board (A1) (Performance verification is required if this board is replaced)
- *Probe Compensation BNC Connector* on page 6–16 describes how to replace the five front panel BNC connectors (not channel input connectors)
- *Fuses* on page 6–17 describes how to replace the BNC connector fuses, and fuses related to power supplies
- *Probe Interface* on page 6–19 describes how to replace the probe interface flex circuit
- *Acquisition Board* on page 6–22 describes how to replace the Acquisition Board (A2) (Performance verification is required if this board is replaced)
- *Rear EMI Gaskets* on page 6–23 describes how to replace the EMI gaskets at the rear of the module

Tools Required

Most modules in the DSO module can be removed using a screwdriver handle mounted with size T-10 and T-15 Torx® screwdriver bits. Table 6–3 lists the tools needed to replace modules in the DSO module.

Table 6-3: Tools required for parts replacement

Item number	Name	Description
1	Screwdriver handle	Accepts Torx® driver bits
2	T-10 Torx tip	Torx® driver bit for T-10 size screw heads
3	T-15 Torx tip	Torx® driver bit for T-15 size screw heads
4	One-half inch (1/2) nut driver	Standard tool
5	One-quarter (1/4) inch nut driver	Standard tool
6	Soldering iron	Standard tool
7	Solder wick	Standard tool
8	Three-sixteenth (3/16) inch nut driver	Standard tool

Injector/Ejector Handles

You will need a screwdriver with a size T-10 Torx® tip (Table 6–3, items 1 and 2) to replace the ejector handles.

Removal

Use the following procedure and Figure 6–1 to remove the injector/ejector handles.

1. Place the DSO module on its right side.
2. Remove the two screws that secure the injector/ejector handle to the chassis.
3. Remove the injector/ejector handle from the DSO module.

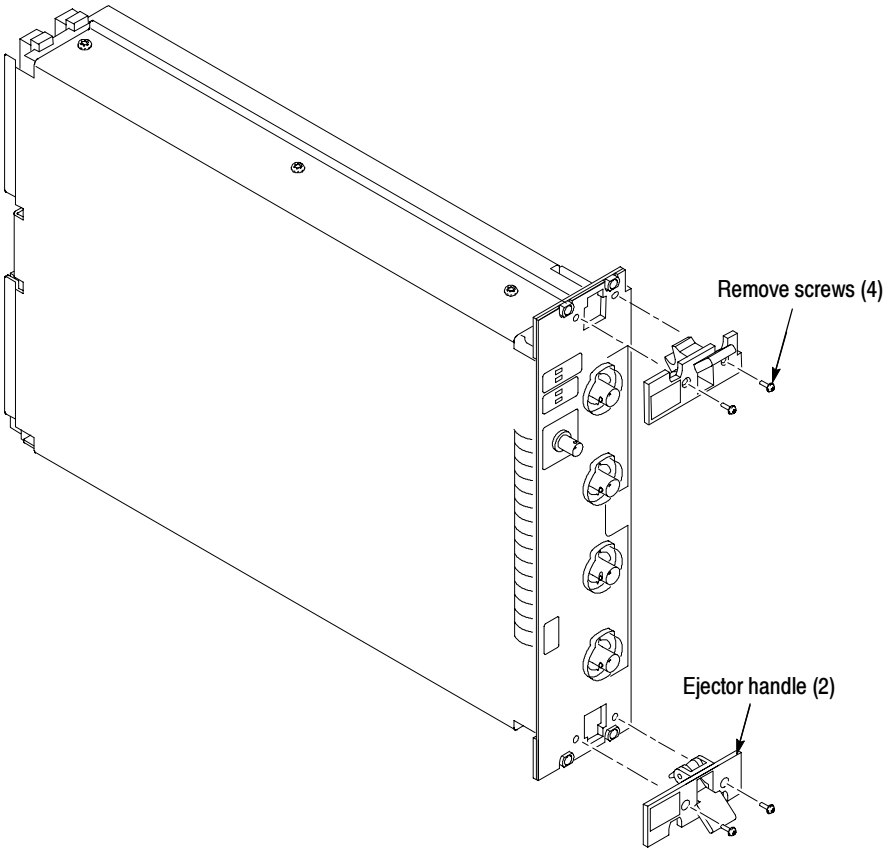


Figure 6-1: Injector/ejector handle replacement

Installation

Use the following procedure and Figure 6–1 to install the ejector handles.

***NOTE**. The top and bottom injector/ejector handles are not interchangeable. The top injector/ejector handle assembly has a notch on the right side and a tab on the left side; the bottom injector/ejector assembly does not have a notch or a tab.*

1. Install the ejector handle through the front panel cutout onto the mounting post.
2. Install the screws to secure the injector/ejector handle to the chassis.
3. Apply the proper replacement label.

Cover

You will need a screwdriver with a size T-10 Torx® tip (Table 6–3, items 1 and 2) to replace the cover.

Removal

Use the following procedure and Figure 6–2 to remove the cover.

1. Place the module on its right side (power-requirements label facing down).
2. Remove four (4) screws that secure the rear panel to the chassis (Figure 6–2). Set the rear panel aside.
3. Remove four (4) screws that secure the cover to the chassis.
4. Lift the cover from the chassis.

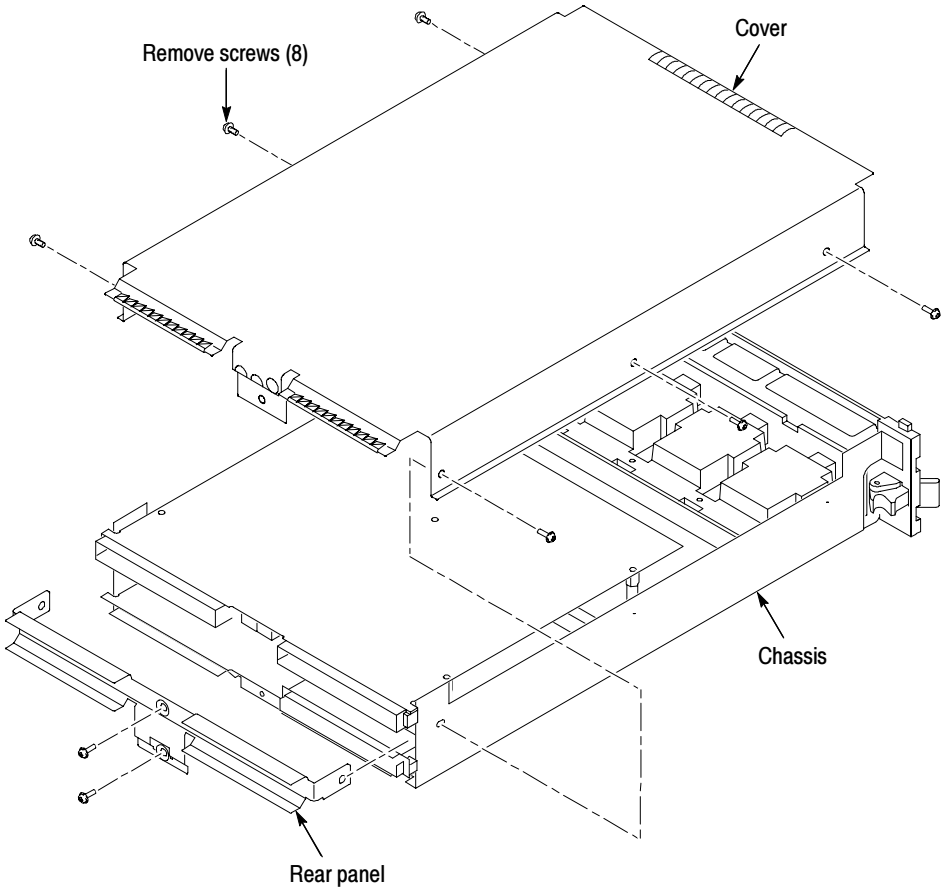


Figure 6-2: Cover removal

Installation

Use the following procedure and Figures 6–2 and 6–3 to install the cover.

***NOTE**. The cover must be installed tightly against the chassis. This will ensure that the DSO module fits into any two adjacent slots in the mainframe.*

1. Place the module on its right side.
2. Place the cover onto the chassis.

***CAUTION.** To prevent damage to the module during the installation process, reinstall the cover exactly as described in steps 3 through 5. If the cover is not properly seated, the module can be damaged when you install it in a mainframe or it will not meet EMC requirements.*

3. Push forward on the cover so the tab on the front edge of the cover inserts into the rear of the front subpanel. Make sure that the cover is fully seated (no gaps) against the front and rear chassis flanges (see Figure 6–3).
4. While holding the module cover in place, install the four (4) screws nearest the front of the module, to secure the cover to the chassis.
5. Install four (4) screws that secure the rear panel to the chassis.

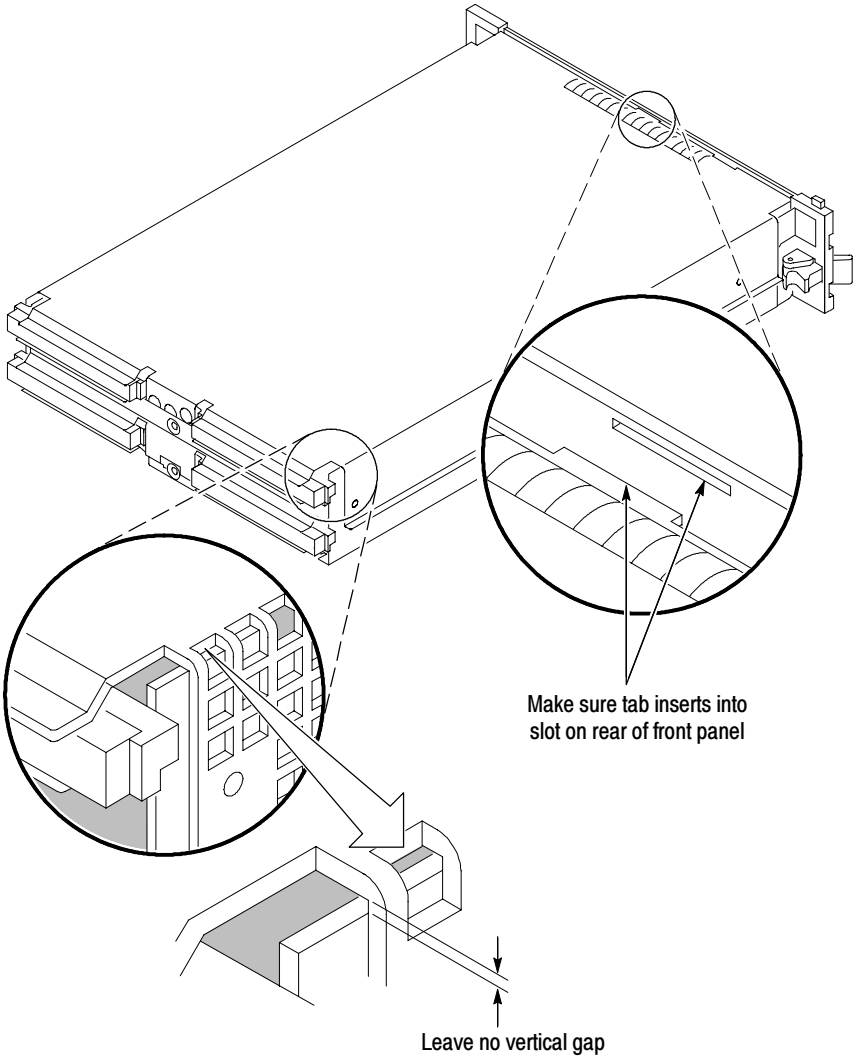


Figure 6-3: Seating the cover on the chassis

Processor Board

You will need a screwdriver with a size T-10 Torx® tip (Table 6–3, items 1 and 2) to replace the Processor Board.

Removal

Use the following procedure and Figure 6–4 to remove the Processor Board.

***NOTE**. After replacing the Processor Board, you must verify operation and you must perform the adjustment and Performance Verification procedures as described in the TLA 700 Series Performance Verification and Adjustment Technical Reference (070–9776–XX).*

When ordering a replacement or exchange processor board from Tektronix, you must supply the following information: model number, serial number, and firmware level.

1. Perform the *Cover* removal procedure (see page 6–10).
2. Unplug two 100-pin ribbon cables from J6 and J9.
3. Remove six (6) screws that secure the Processor Board to the chassis.
4. Carefully move the Processor Board away from the front panel until the tab (Figure 6–4) clears the front subpanel.
5. Lift the board above the chassis. Then unplug the yellow/white coaxial cable from J3.

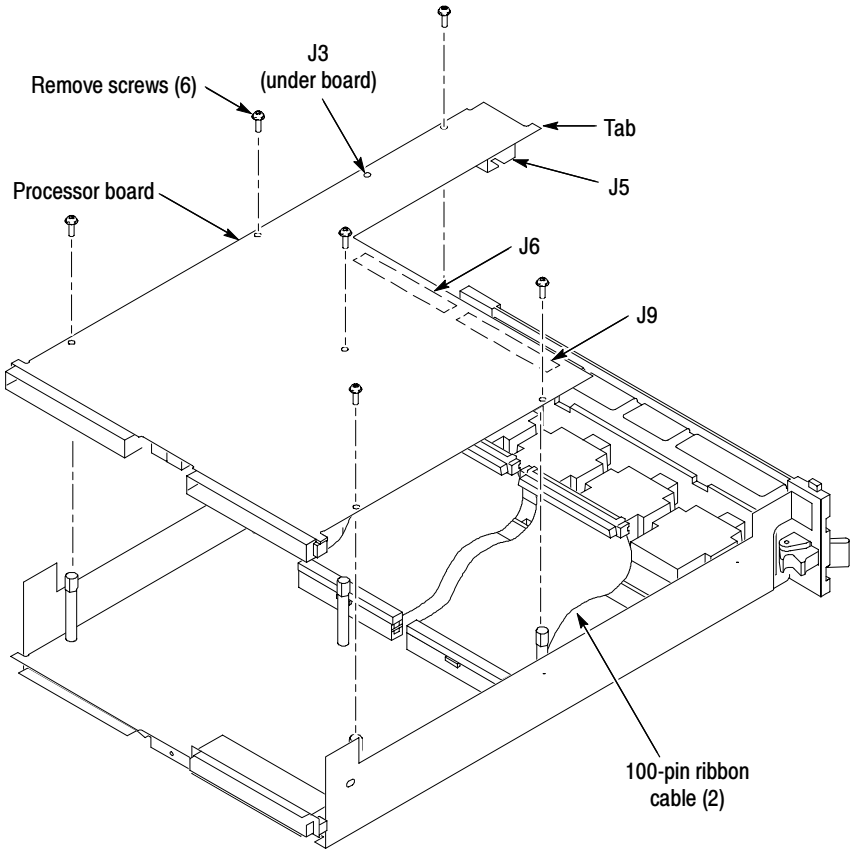


Figure 6-4: Processor board removal

Installation

Use the following procedure and Figure 6–4 to install the Processor Board.

***NOTE**. After replacing the Processor Board, you must verify operation and you must perform the adjustment and Performance Verification procedures as described in this manual.*

When ordering a replacement or exchange processor board from Tektronix, you must supply the following information: model #, serial #, and firmware level.

1. Hold the Processor Board above the chassis and install the yellow/white coaxial cable at J3.
2. Insert the tab on the Processor Board into the front subpanel as shown in Figure 6–5. Then set the Processor Board in place on the chassis.

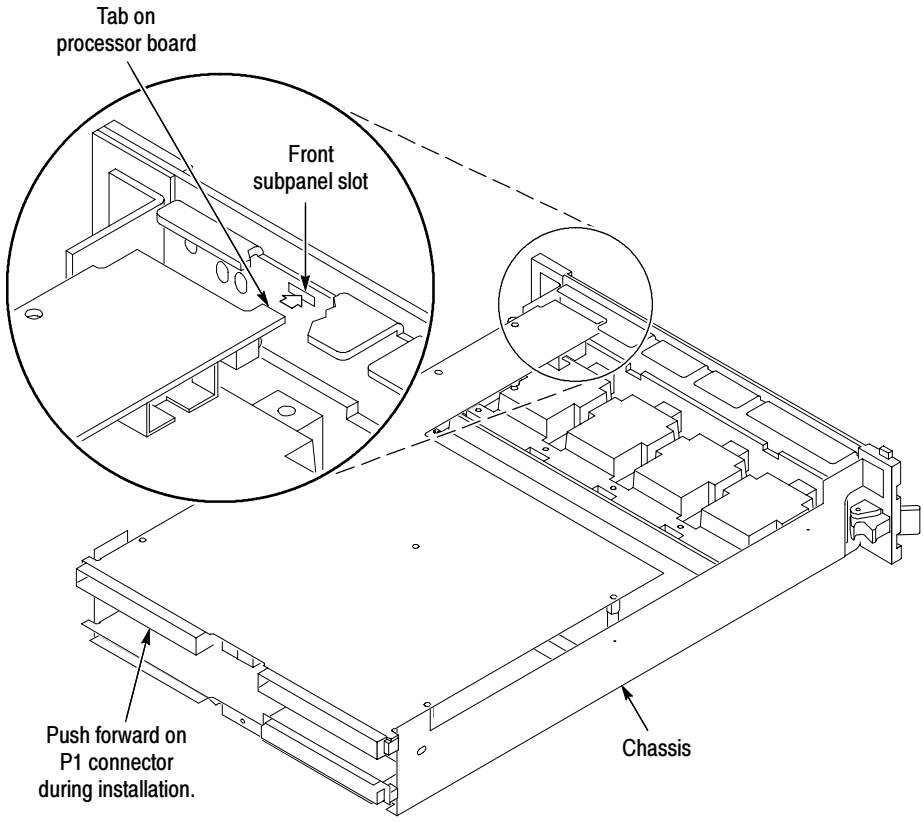


Figure 6-5: Inserting processor board tab into front subpanel

3. Push forward on the Processor Board P1 connector. To ensure proper alignment, the tab must be fully inserted into the front subpanel slot.
4. While holding the Processor Board in place, install the six (6) screws that secure the Processor Board to the chassis.
5. Install the two 100-pin ribbon cables at J6 and J9.
6. Perform the *Cover* installation procedure (see page 6-11).

Probe Compensation BNC Connector

You will need a screwdriver with a size T-10 Torx® tip and a 1/2 inch nut driver (Table 6–3, items 1, 2, and 4) to replace the BNC connector for PROBE COMPENSATION.

***NOTE**. Only remove and replace the Probe Compensation BNC Connector. Do not remove and replace the Channel 1 through 4 BNC's.*

Removal

Use the following procedure and Figure 6–6 to remove the Probe Compensation BNC connector.

1. Perform the *Processor Board* removal procedure (see page 6–13).
2. Unplug the coaxial cable from the rear of the BNC.
3. Using a 1/2 inch nut driver, remove the securing nut and washer from the rear of the connector.
4. Remove the BNC from the front panel.

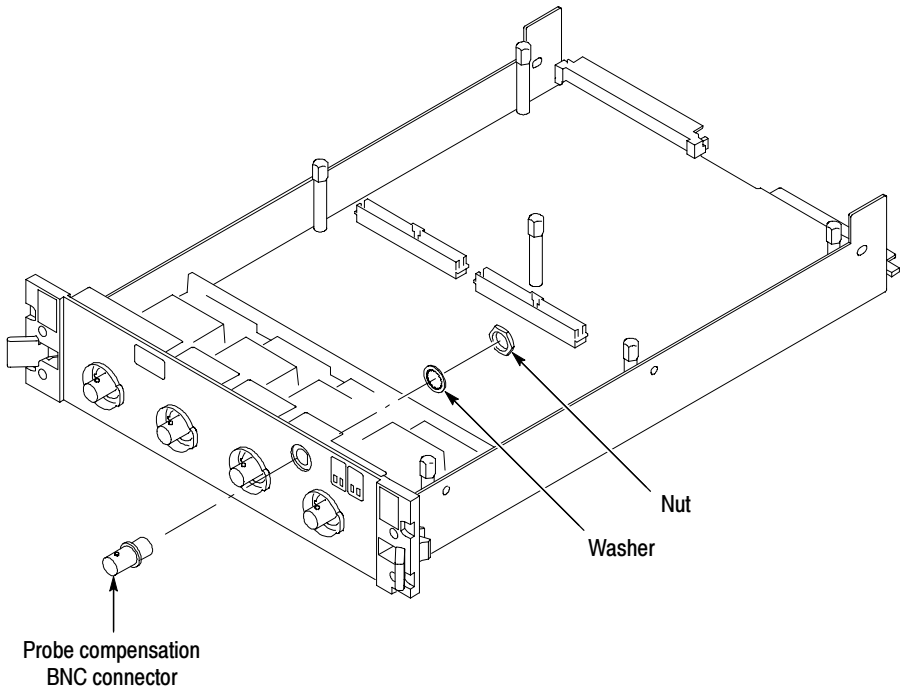


Figure 6- 6: BNC replacement

Installation

Use the following procedure and Figure 6–6 to install the Probe Compensation BNC connector.

1. Insert the BNC through the hole in the front panel.
2. Slide the washer onto the BNC, so it rests against the back side of the front panel.
3. Using a 1/2 inch nut driver, install the securing nut onto the rear of the connector.
4. Plug the coaxial cable into the rear of the BNC.
5. Perform the *Processor Board* installation procedure (see page 6–14).

Fuses

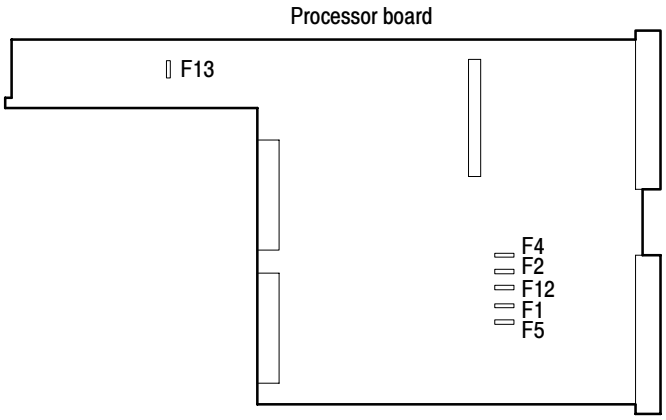
CAUTION. *To avoid damage to the DSO module, use only replacement fuses that match the type, voltage, and current rating of the original fuse. See the* Mechanical Parts List *section for the part number of replacement fuses.*

You will need a screwdriver with a size T-10 Torx® tip, a soldering iron, and solder wick (Table 6–3, items 1, 2, 6, and 7) to replace the fuses.

Removal

Use the following procedure and Figure 6–7 to remove the fuses.

1. Perform the *Processor Board* removal procedure (see page 6–13).
2. Use Figure 6–7 to locate the fuse to be replaced.
3. Using a soldering iron and solder wick, unsolder and discard the fuse.



Circuit number	Circuit board	Purpose
F1	Processor Board	+12 V
F2	Processor Board	+5 VD
F4	Processor Board	-5.2 V
F5	Processor Board	-12 V
F12	Processor Board	+5V
F13	Processor Board	Probe Compensation Output

Figure 6-7: Fuse replacement

Installation

Use the following procedure and Figure 6–7 to install the fuses.

CAUTION. *To avoid damage to the DSO module, use only replacement fuses that match the type, voltage, and current rating of the original fuse. See the* Mechanical Parts List *section for the part number of replacement fuses.*

1. Using a soldering iron, solder the new fuse into place.
2. Perform the *Processor Board* installation procedure (see page 6–14).

Probe Interface

You will need a screwdriver with size T-10 and T-15 Torx® tips and a 1/4 inch nut driver (Table 6–3, items 1, 2, 3, and 5) to replace the probe interface.

Removal

Use the following procedure and Figure 6–8 to remove the probe interface.

1. Perform the *Cover* removal procedure (see page 6–10).
2. Perform the *Processor Board* removal procedure (see page 6–13).
3. Using a 1/4 inch nut driver, remove six (6) spacer posts that secure the Acquisition Board to the chassis.
4. Using a screwdriver with a T-15 Torx® tip, remove three (3) screws that secure the Acquisition Board to the front panel.

CAUTION. *To avoid damage to the plastic probe adapter rings during Acquisition Board removal, be sure the BNC connectors do not get caught on the probe adapter rings during removal.*

5. Carefully slide the Acquisition Board away from the front panel until the BNC connectors clear the front subpanel. Then lift the module from the chassis.
6. If necessary, remove the plastic probe adapter rings from the BNC connectors on the attenuator housing. The plastic rings often remain in the front panel during Acquisition Board removal.
7. Unlock socket J1163 (slide the lock tabs away from the attenuator housing).
8. Remove the probe interface from J1163. Then carefully slide the probe interface from around each BNC connector on the Acquisition Board.

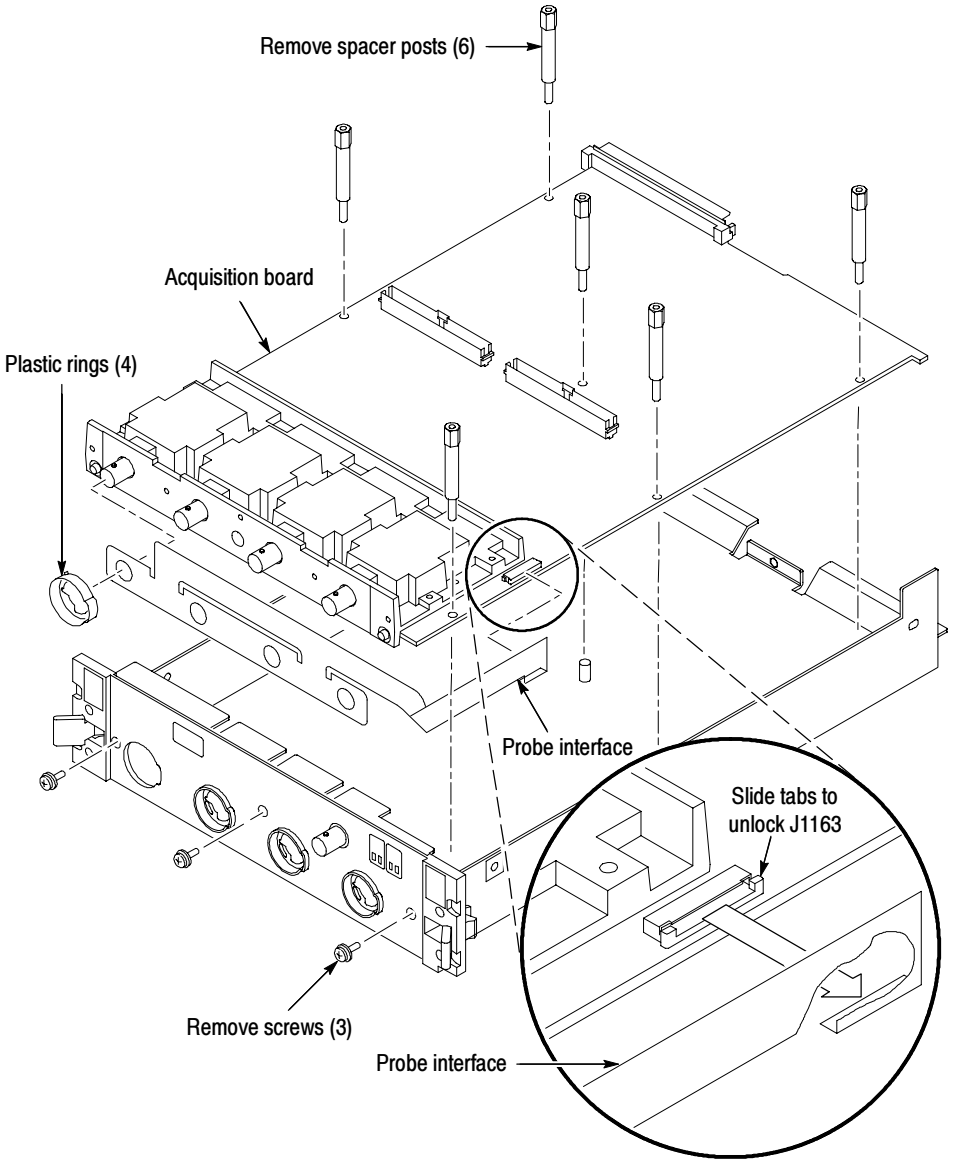


Figure 6- 8: Probe interface replacement

Installation

Use the following procedure and Figure 6–8 to install the probe interface.

***NOTE**. Be sure the RF shielding gasket is installed on the BNC connectors before installing the probe interface.*

1. Install the probe interface over the BNC connectors on the Acquisition Board.
2. Carefully bend the probe interface cable as shown in Figure 6–8. Then install the probe interface into socket J1163 on the Acquisition Board.
3. Lock J1163 (slide the lock tabs toward the attenuator housing).
4. If necessary, turn the front panel face down and insert the plastic rings into holes in the front panel. The plastic rings may already be installed if they stayed in the front panel during Acquisition Board removal.
5. Turn the front panel face down and carefully slide the Acquisition Board into the front panel until the BNC connectors clear the front subpanel. Then lay the module onto the chassis. Be sure the attenuator housing is flush with the back side of the front panel.
6. Using a screwdriver with a T-15 Torx® tip, install three (3) screws that secure the Acquisition Board to the front panel.
7. Using a 1/4 inch nut driver, install six (6) spacer posts that secure the Acquisition Board to the chassis.
8. Perform the *Processor Board* installation procedure (see page 6–14).

Acquisition Board

You will need a screwdriver with size T-10 and T-15 Torx® tips and a 1/4 inch nut driver (Table 6–3, items 1, 2, 3, and 5) to replace the Acquisition Board.

Removal

Use the following procedure and Figure 6–9 to remove the Acquisition Board.

***NOTE**. After replacing the Acquisition Board, you must verify operation and perform the adjustment and Performance Verification procedures.*

1. Perform the *Probe Interface* removal procedure (see page 6–19).
2. Remove the RF shielding gasket from the BNC connectors. Set the shield aside.
3. Unplug two (2) 100-pin ribbon cables from J100 and J101 as follows:
   a. Grasp and squeeze the metal cable retainers (Figure 6–9) to unlock the cable from its connector.
   b. Unplug the cable from the Acquisition Board. Set the cable aside.

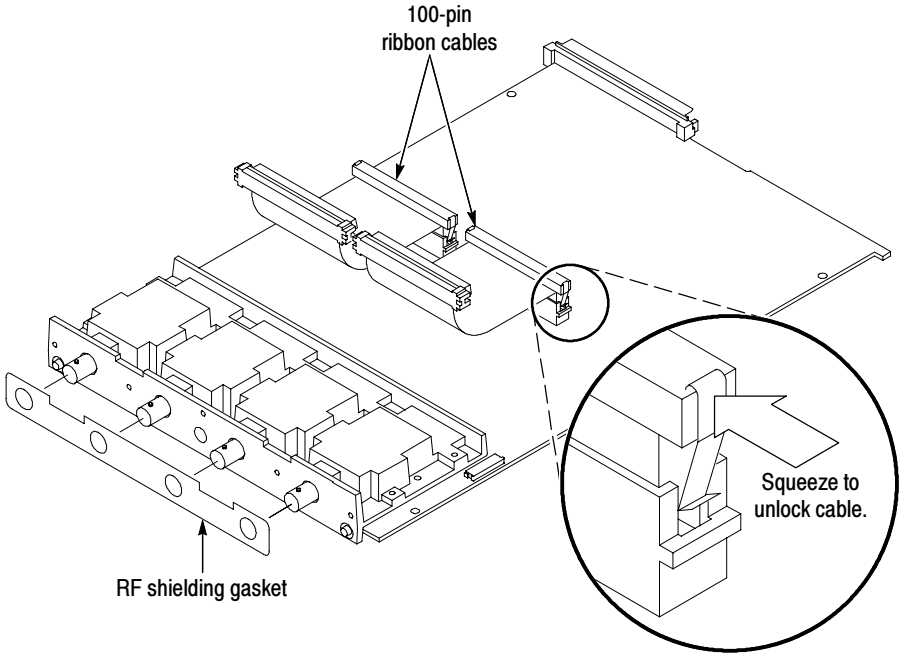


Figure 6–9: Acquisition board replacement

Installation

Use the following procedure and Figure 6-9 to install the Acquisition Board.

***NOTE**. After replacing the Acquisition Board, you must verify operation and perform the adjustment and Performance Verification procedures.*

1. Plug two (2) 100-pin ribbon cables onto J100 and J101. Be sure to firmly seat the cables into their sockets so the cable retainers snap into place.
2. Install the RF shielding gasket onto the BNC connectors.
3. Perform the *Probe Interface* installation procedure (page 6-21).

Rear EMI Gaskets

You will want to use both hands to replace the four rear EMI Gaskets.

Removal

Use the following procedure to remove the rear EMI gaskets.

1. Remove the cover (page 6-10).
2. For the two rear gaskets on the chassis, remove the processor board (page 6-13) and the acquisition board (page 6-22).
3. Lift the gasket fingers and rotate the gasket off.

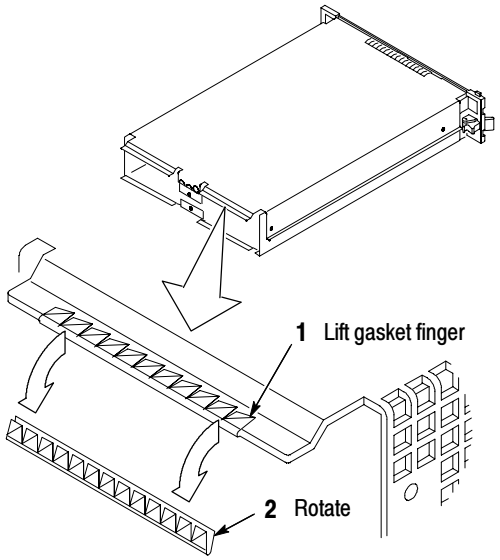


Figure 6-10: Rear EMI gasket removal

Installation

Use the following procedure to install the rear EMI gaskets.

1. Position each gasket so the gasket fingers face the outside of the digitizing oscilloscope.
2. Pick up each gasket at the end where the gasket finger is formed up. Then rotate the gasket on. As you do this, lift up any fingers that bind to the chassis or cover.
3. Slide each gasket gently from side to side to ensure that the gasket snaps in place.

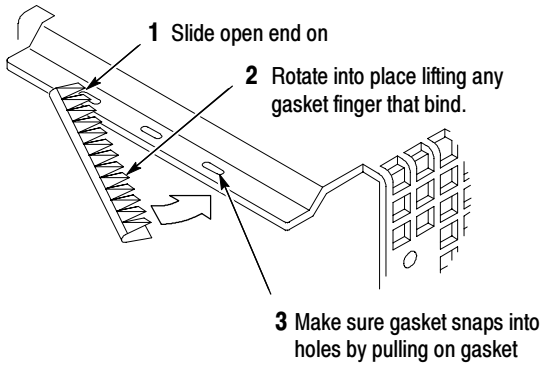


Figure 6-11: Rear EMI gasket replacement

Troubleshooting

WARNING. *Before doing this or any other procedure in this manual, read the* General Safety Summary *and* Service Safety Summary *found at the beginning of this manual. Also, to prevent possible injury to service personnel or damage to electrical components, read* Preventing ESD *on page 6–1.*

This section contains information and procedures designed to help you isolate faults to within the DSO module. The process is as follows:

- Do *Check for Common Problems* on page 6–26 to eliminate easy to find problems first.
- Do *Eliminate Other Problem Sources* on page 6–26 to eliminate the mainframe, probes, and other modules as the fault(s) source next.
- Do *Troubleshoot the Digitizing Oscilloscope Module*, beginning on page 6–27, to isolate locate the failed replaceable part within the module.

If you have replaced a faulty circuit board or assembly found using these procedures, you must complete the performance verification and adjustment procedures as described earlier in this manual.

Service Level

This section supports isolation of faults within the DSO module to the replaceable part level that's reflected in the replaceable parts list in Chapter 10. In most cases, faults are isolated to circuit boards or assemblies, but not to individual components on those boards. Fault isolation is supported to the following replaceable parts:

- Processor Board (A1)
- Acquisition Board (A2)
- Power supply fuses
- Probe interface flex cable
- 100 pin ribbon cables

Check for Common Problems

Use Table 6–4 to quickly isolate possible failures. The table lists problems related to the DSO module and possible causes. The list is not exhaustive, but it may help you eliminate a problem that's quick to fix, such as a blown fuse or loose cable.

Table 6-4: Failure symptoms and possible causes

Symptom	Possible cause(s)
Modules not recognized	■ Modules not fully inserted; make sure front of module is flush with front panel ■ Mainframe power supply failure; contact local Tektronix service center ■ Open fuses in module/s ■ Corrupted module firmware; reinstall firmware.
DSO module does not pass the normal power on diagnostics (READY indicator not green)	■ Module not fully inserted; make sure front of module is flush with front panel ■ Module failure; see *Troubleshoot the Digitizing Oscilloscope Module* on page 6–27, or contact local Tektronix service center
DSO module loses settings when power is turned off	■ DSO module failure; see *Troubleshoot the Digitizing Oscilloscope Module* on page 6–27, or contact local Tektronix service center ■ DSO module battery failure; refer to page 6–13 for Processor Board (A1) replacement instructions
DSO module will not acquire data or the acquired data is incorrect	■ DSO module failure; see *Troubleshoot the Digitizing Oscilloscope Module*, or contact local Tektronix service center ■ Faulty probe or lead set

Eliminate Other Problem Sources

The DSO module is part of the TLA700 Series Logic Analyzer, which comprises modules installed in one of two mainframes (benchtop or portable). The following procedures will help you eliminate the mainframe and other modules as possible sources of the failure(s) that you troubleshoot.

Substitute a Good Module

If you have available a known-good DSO module, perform the following procedure:

1. Remove the suspect DSO module from the mainframe.
2. Install a known-good DSO module in the same slot as the suspected module. Remember to set the logical address to FF (see *Setting the Logical Address* on page 2–1).
3. Power-on the mainframe and check for normal operation.
4. If the failure symptoms are still present with the known-good DSO module installed, the problem most likely is in the mainframe, not in the DSO module.

***NOTE**. Viewing the diagnostic window from the Logic Analyzer application may help you isolate failures to individual modules or to the mainframe.*

5. If your DSO module operates normally, the suspect DSO module needs to be repaired. Refer to *Troubleshoot the Digitizing Oscilloscope Module* on page 6–27 for the troubleshooting procedures you need to locate faults within the DSO module.

Check the Mainframe

If you do not have a known-good module and are not sure the problem is in the DSO module, perform the following procedure to make sure the mainframe is not the source of the failure:

- Perform the troubleshooting procedures in either the portable mainframe service manual or those in the benchtop controller service manual.

Troubleshoot the DSO Module

Follow the procedure in this section to identify the failed part within the DSO module.

***NOTE**. In addition to the procedure for fault isolation found here, you may choose to substitute for a suspect Processor Board (A1) or Acquisition Board (A2) to expedite troubleshooting if you have known-good boards available. See the* Mechanical Parts List *section to locate the Tektronix part numbers for replacement parts.*

This procedure requires that the module is installed in a fully functional mainframe. If you have not determined that the mainframe is functional, or if you suspect the problem might be in a probe or in another module, refer to *Eliminate Other Problem Sources* on page 6–26, above.

Equipment Required

The test equipment needed to troubleshoot the DSO module depends on the type of failure. Many faults can be detected using a digital multimeter. Testing and adjustments might be required to correct some faults. Under those circumstances, you will need the test equipment listed in the *Performance Verification* chapter.

Preparation

The fault isolation procedure requires that you:

- recognize codes flashed by the front-panel LEDs during power up.
- be familiar with the power-on diagnostics.
- know how to run extended diagnostics and self calibration.

Front-Panel LEDs. The READY, ARM'D, and TRIG'D front-panel LEDs provide information about the DSO module at power on. You will use these indicators while performing the Fault Isolation Procedure. LED behavior follows:

- Under normal conditions, the ARM'D and TRIG'D indicators light for a short time after power is turned on. Approximately five seconds after power-on, the READY indicator turns on and the remaining indicators may turn off.
- The green READY LED indicates that the module has passed the power-on diagnostics and is ready to communicate with the controller.

Self Calibration. Use the self calibration to calibrate the installed modules. Run the self calibration after a minimum of a 30 minute warm-up.

Power On Diagnostics. Power-on diagnostics check basic functionality of the DSO module at every power-on. If any failures occur at power on, the screen displays the calibration and diagnostics property sheet. The power-on diagnostics page shows a list of the diagnostic tests with a Pass or Fail indication for each board in the module.

***NOTE**. If there are no diagnostic failures when you power on the instrument, you can display and run the calibration and diagnostics property sheet by selecting Calibration and Diagnostics from the System menu.*

Extended Diagnostics. The extended diagnostics execute more thorough tests than the power-on diagnostics. Using the extended diagnostics, you can do the following tasks:

- Run test individually or as a group
- Run tests once or continuous
- Run tests until a failure occurs

While the test are executing, the word Running displays adjacent to the test. When the tests are complete, the tests display either a Pass or Fail indication.

Fault Isolation Procedure

This section contains two troubleshooting charts that will help you locate faulty DSO module circuit boards:

- The *Primary Troubleshooting Procedure* chart on page 6–30 provides troubleshooting steps that test the DSO module circuit boards
- The *Power Supply Troubleshooting Procedure* chart on page 6–31 locates power supply faults within the DSO module

1. Install the DSO module into a mainframe.
2. Before you power on the mainframe, watch the READY, ARM'D, and TRIG'D front panel indicators.
3. Power on the mainframe and note how the front panel indicators respond.
4. Use the *Primary Troubleshooting Procedure* chart on page 6–30 to determine how to proceed.
5. If diagnostic failures occur, the tree will refer you to Table 6–6 on page 6–33. Using that table, you can correlate the failed test displayed with a failed board, *but first check the "special cases" of diagnostic failures below:*
   - If the "Calibration Checksums" repeatedly fails but Nonvolatile RAM passes, replace the ACQ board.
   - If "Phase Lock Loop" and "VXI Time Correlation" fail, check the backplane 10 MHz clock and, if needed, then replace the ACQ board.
   - Large numbers of acq failures could indicate an interconnect problem between MPU and ACQ boards; check the interconnections.
   - If you replace a board that is not calibrated, an uncalibrated error can occur even though both boards are good. Calibration can fix the error.

***NOTE**. Before replacing circuit boards, be sure to inspect all associated cables and connectors for damage and proper installation.*

6. If necessary, replace the faulty circuit board.

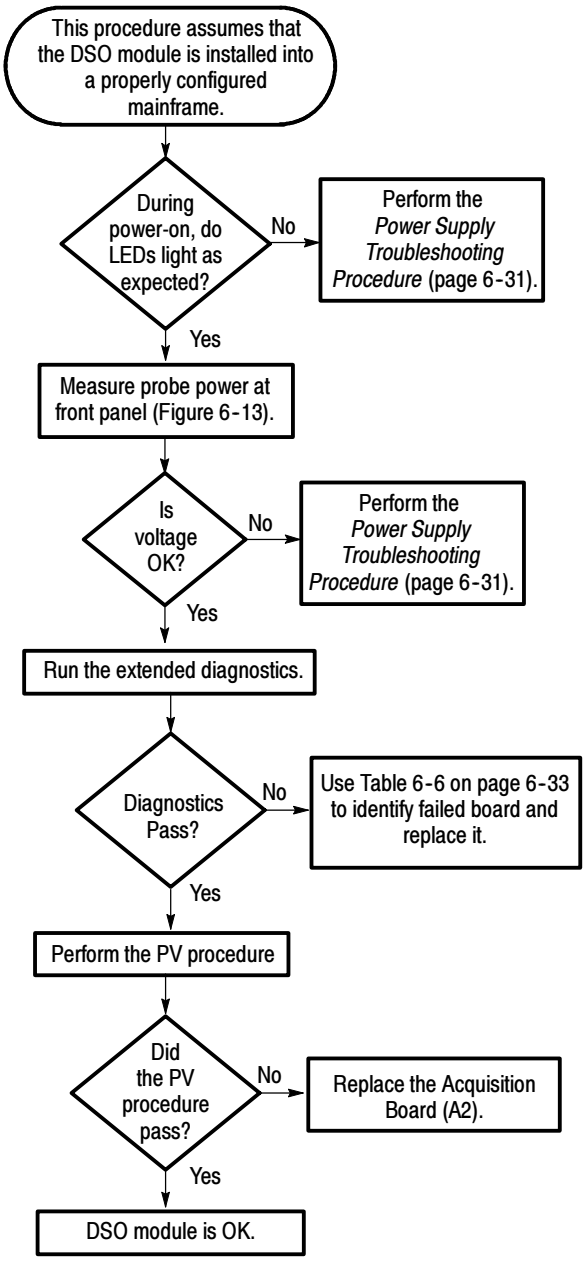
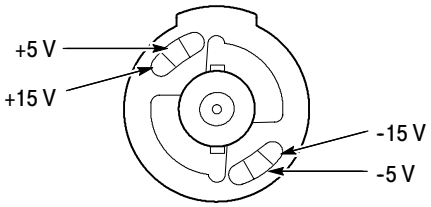


Figure 6-12: Primary troubleshooting procedure



Power supply	Limits
+5 V	+4.85 V to +5.25 V
+15 V	+14.55 V to +15.30 V
-15 V	-14.55 V to -15.30 V
-5 V	-4.85 V to -5.25 V

Figure 6-13: Probe power voltage check

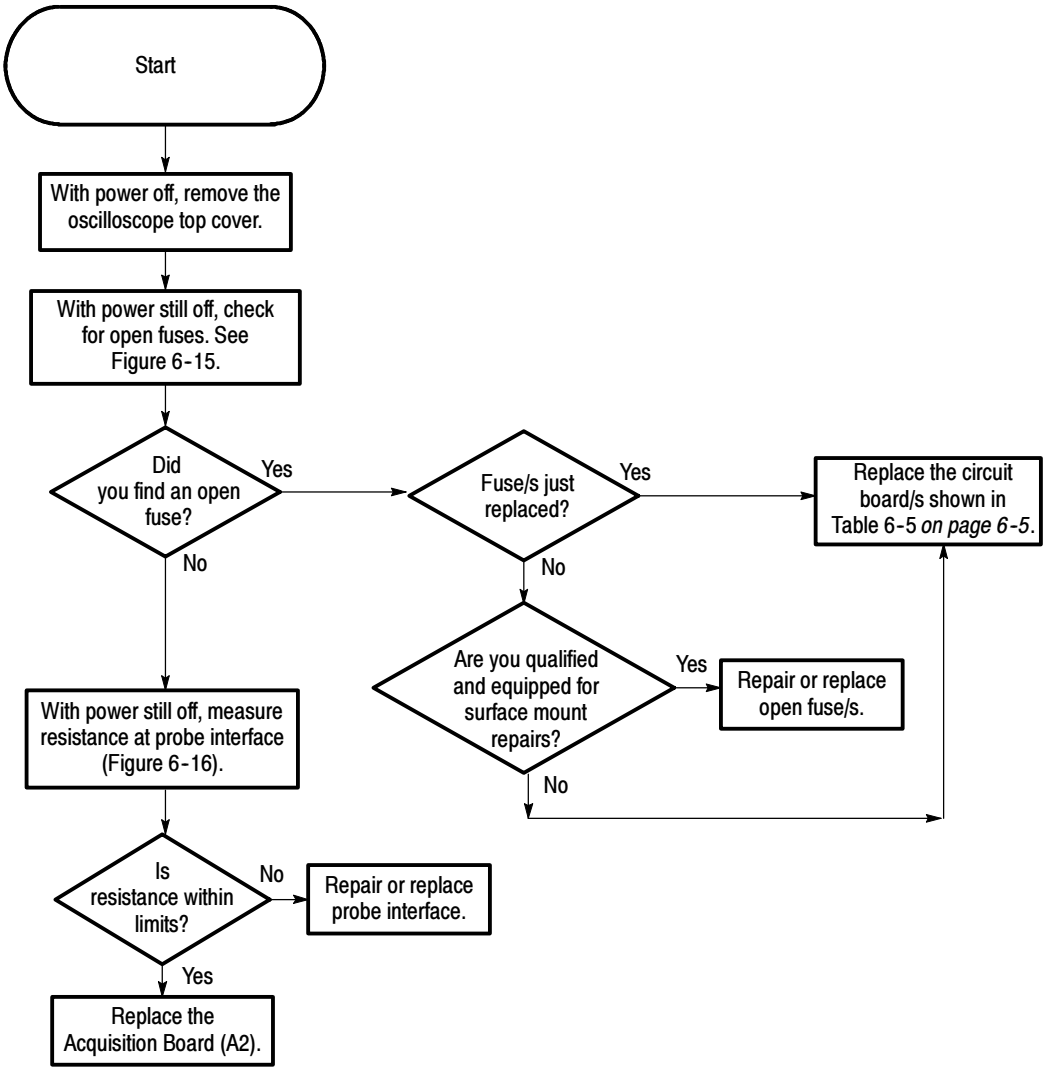


Figure 6-14: Power supply troubleshooting procedure

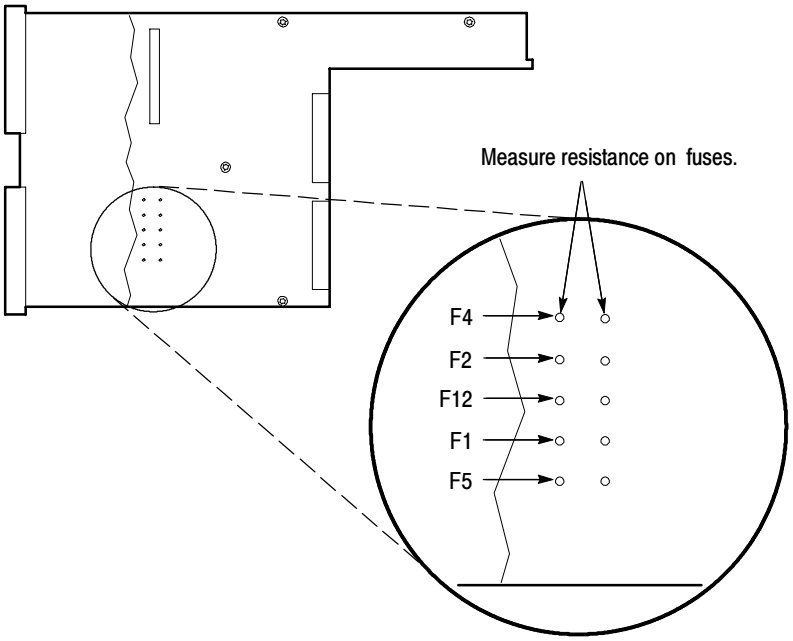
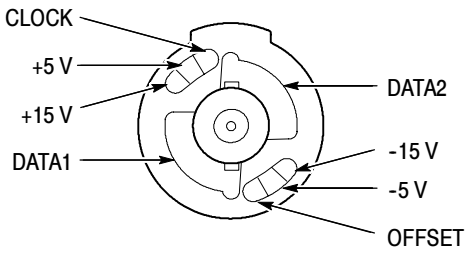


Figure 6-15: Fuse locations for troubleshooting

Table 6-5: Power supply fault-location table

Open fuse	Module to replace
F1 (+12 V power supply)	Processor Board (A1) and Acquisition Board (A2)
F2 (+5 VD power supply)	Processor Board (A1)
F4 (-5.2 V power supply)	Processor Board (A1) and Acquisition Board (A2)
F5 (-12 V power supply)	Processor Board (A1) and Acquisition Board (A2)
F12 (+5 V power supply)	Processor Board (A1) and Acquisition Board (A2)



Signal	Approximate resistance to ground
Clock	1 kW
+5 V	20 W
+15 V	590 W
Data1	950 W
Data2	950 W
-15 V	150 W
-5 V	30 W
Offset	870 W

Values shown are typical when using a Fluke 8842A DMM on the 2K scale. Allow the meter to stabilize for 10 seconds before reading the measured value.

Figure 6-16: Probe interface resistance

Diagnostic Tests Table

Table 6–6 can help you isolate problems to one of the two circuit boards in the module (use the *Removal and Installation Procedures* beginning on page 6–7 to replace the faulty circuit board).

***NOTE**. If there are a majority of Acquisition items failing or the system can't find a unit, the problem may be a Processor Board or a ribbon card failure.*

Table 6-6: Diagnostic tests

Group & test	Most likely cause	Power on	Extended
Kernel			
Power-On Kernel	MPU	✓	✓
MPU Static RAM	MPU		✓
Nonvolatile RAM	MPU		✓
DSP Shared RAM	MPU		✓
VXI Shared RAM	MPU		✓
Calibration Checksums	MPU; ACQ	✓	✓
Factory Calibration Status	Recalibrate with CATS; ACQ	✓	✓

Table 6-6: Diagnostic tests (Cont.)

Group & test	Most likely cause	Power on	Extended
Acquisition			
Timebase Control Register	ACQ	✓	✓
Acquisition RAM Data Line	ACQ	✓	✓
Acquisition RAM Pattern	ACQ		✓
Acquisition RAM Address Line	ACQ		✓
Timebase Control Formatter	ACQ	✓	✓
Low Speed Trigger Register	ACQ	✓	✓
High Speed Trigger Register	ACQ	✓	✓
Phase Lock Loop	ACQ	✓	✓
Timebase Control Functional	ACQ		✓
Timebase/Trigger Counter	ACQ	✓	✓
Sampler heater	ACQ	✓	✓
VXI Trigger Control Register	ACQ	✓	✓
VXI Trigger Control Functional	ACQ		✓
VXI Trigger Control Arm	ACQ	✓	✓
VXI Time Correlation	ACQ		✓
Control Voltage Serial Loop	ACQ	✓	✓
Extended Trigger Serial Loop	ACQ	✓	✓
Trigger Comparitor Serial Loop	ACQ	✓	✓
Preamp Serial Loop	ACQ	✓	✓
Attenuator Serial Loop	ACQ	✓	✓
Acquisition Processor			
Acquisition Processor	ACQ; MPU	✓	✓
Trigger			
Trigger Functional	ACQ	✓	✓

Adjustment After Repair

After removing and replacing the processor board or the acquisition board, refer to the *Adjustment Procedures* and the *Performance Verification* chapters in this manual to run the adjustment procedures and the performance verification procedures

Repackaging Instructions

This section contains the information needed to repackage the DSO module for shipment or storage.

Packaging

Use a corrugated cardboard shipping carton having a test strength of at least 275 pounds (125 kg) and with an inside dimension at least six inches (15.25 cm) 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
- 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.

Storage

The DSO module should be stored in a clean, dry environment. The following environmental characteristics apply for both shipping and storage:

- Temperature range: -40° F to +159.8° F (-40° C to +71° C)
- Altitude: To 40,000 feet (12,190 meters)

Options

This chapter lists the advertised options for each DSO module. Refer to the *Replaceable Mechanical Parts* chapter for a list of standard and optional accessories for each module.

Tektronix Service Options

Tektronix offers the following service options. These options are modular, flexible, and easy to order with your instrument. Designed to ease installation and start up, to support tracking of calibration to requirements of ISO9000, and to provide for extended repair coverage, these options help fix your long-term maintenance costs and eliminate unplanned expenditures.

Product installation service	Option IN	Provides initial installation of the product and familiarizes new users with some of its operation features
Three years of calibration services	Option C3	Provides initial Certification on delivery, plus two more annual calibrations from your service center
Test data	Option D3	Provides test data on delivery and when annual calibration services are provided (three total, requires Option C3)
Three years repair coverage	Option R3	Provides three years of repair coverage for the instrument, including displays and accessories sold with the instrument
Cal data report	Option D1	Provides a calibration (test data) report

Tektronix Service Options are available at the time you order your instrument. Contact your local Tektronix Sales Office for more information.

Replaceable Electrical Parts

Refer to the *Replaceable Mechanical Parts* chapter for a complete listing and description of replaceable parts for the DSO module.

Diagrams

This chapter contains the block diagram and the interconnection diagram for the DSO module.

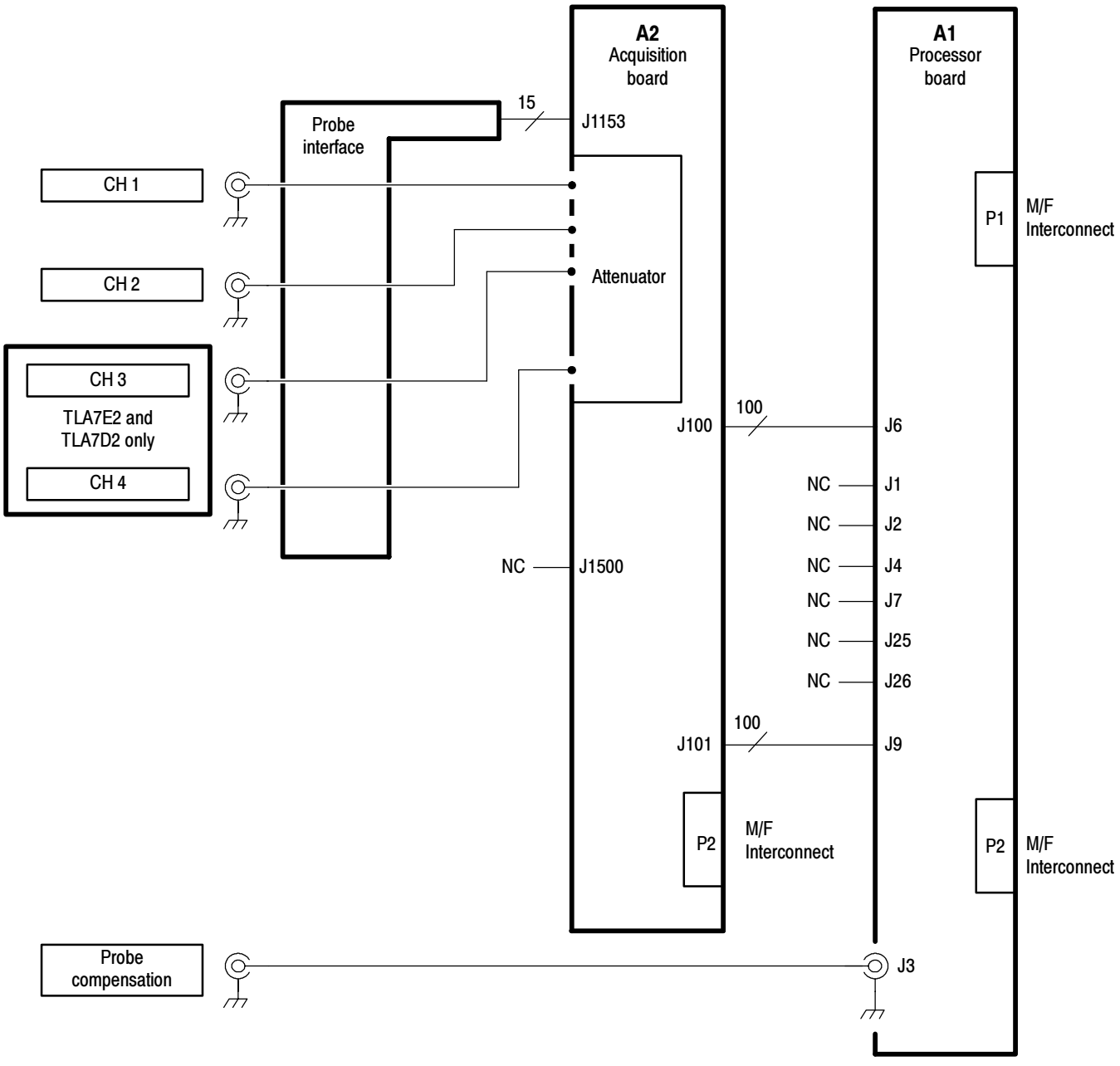


Figure 9- 1: Interconnections

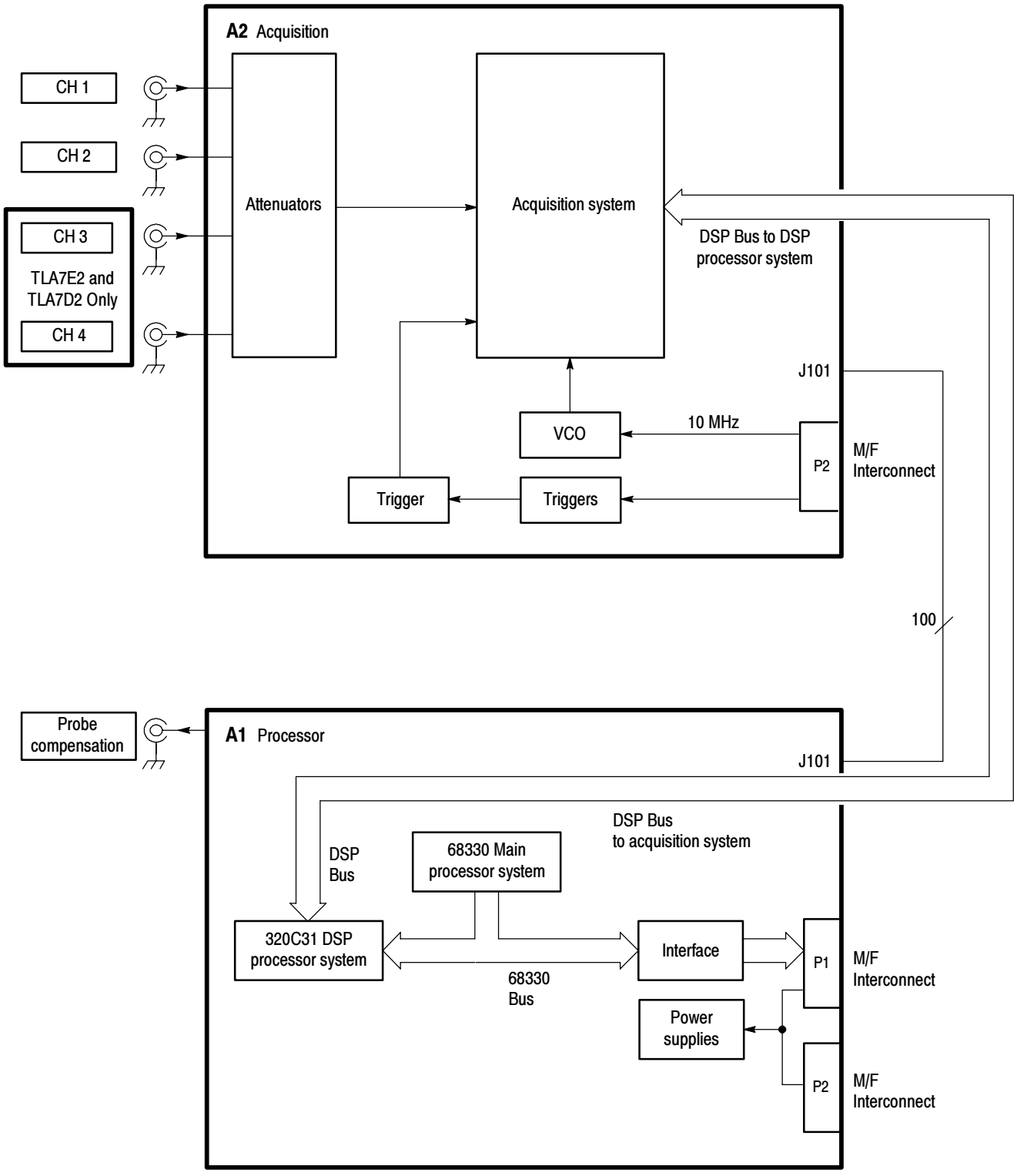


Figure 9-2: Block diagram

Replaceable Parts List

This chapter contains a list of the replaceable modules for the DSO Module. Use this list to identify and order replacement parts.

Standard Accessories

The oscilloscope comes standard with the accessories listed in Table 10–1.

Table 10- 1: Standard accessories

Accessory	Part number
Probes:	
TLA 7D1: Two P6243 1GHz Active FET probes	P6243
TLA 7D2: Four P6243 1GHz Active FET probes	P6243
TLA 7E1: Two P6245 1GHz Active FET probes	P6245
TLA 7E2: Four P6245 1GHz Active FET probes	P6245
DSO Probe Calibration Adapter	671-3930-XX
Male-to-Male BNC Connector	103-0029-XX
Certificate of Traceable Calibration	
TLA 7D1 or 7D2 or 7E1 or 7E2 Shipping List	
Tektronix Logic Analyzer Family User Manual	071-0863-00

Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

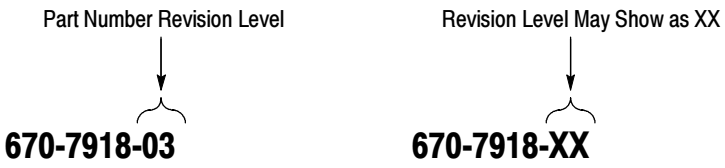
Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number (see Part Number Revision Level below)
- 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.

Part Number Revision Level

Tektronix part numbers contain two digits that show the revision level of the part. For most parts in this manual, you will find the letters XX in place of the revision level number.



When you order parts, Tektronix will provide you with the most current part for your product type, serial number, and modification (if applicable). At the time of your order, Tektronix will determine the part number revision level needed for your product, based on the information you provide.

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 DSO Module. Use this list to identify and order replacement parts. The following table describes each column in the parts list.

Parts List Column Descriptions

Column	Column name	Description
1	Figure & Index Number	Items in this section are referenced by figure and index numbers to the exploded view illustrations that follow.
2	Tektronix Part Number	Use this part number when ordering replacement parts from Tektronix.
3 and 4	Serial Number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers.
5	Qty	This indicates the quantity of parts used.
6	Name & Description	An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.
7	Mfr. Code	This indicates the code of the actual manufacturer of the part.
8	Mfr. Part Number	This indicates the actual manufacturer's or vendor's part number.

Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1–1972.

Mfr. Code to Manufacturer Cross Index

The table titled Manufacturers Cross Index shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

Manufacturers Cross Index

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC.	CUSTOMER SERVICE DEPT PO BOX 3608	HARRISBURG, PA 17105-3608
0J9P9	GEROME MFG CO INC	PO BOX 737 403 NORTH MAIN	NEWBERG, OR 97132
0JR05	TRIQUEST PRECISION PLASTICS	3000 LEWIS & CLARK HWY PO BOX 66008	VANCOUVER, WA 98666-6008
0KB01	STAUFFER SUPPLY CO	810 SE SHERMAN	PORTLAND, OR 97214-4657
0KB05	NORTH STAR NAMEPLATE INC	5750 NE MOORE COURT	HILLSBORO, OR 97124-6474
22526	BERG ELECTRONICS INC	825 OLD TRAIL ROAD	ETTERS, PA 17319
24931	BERG ELECTRONICS INC	BERG ELECTRONICS RF/COAXIAL DIV 2100 EARLYWOOD DR PO BOX 547	FRANKLIN, IN 46131
27264	MOLEX PRODUCTS COMPANY	2222 WELLINGTON CT.	LISLE, IL 60532
52961	NORTHWEST STAMPING INC.	86365 COLLEGE VIEW RD.	EUGENE, OR 97405
53387	3M COMPANY	ELECTRONICS PRODUCTS DIV 3M AUSTIN CENTER	AUSTIN, TX 78769-2963
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077-0001
81073	GRAYHILL INC	561 HILLGROVE AVE PO BOX 10373	LAGRANGE, IL 60525
TK0588	UNIVERSAL PRECISION PRODUCT	1775 NW CORNELIUS PASS RD	HILLSBORO, OR 97124
TK1943	NEILSEN MANUFACTURING INC	3501 PORTLAND RD NE	SALEM, OR 97303
TK2338	ACC MATERIALS	ED SNYDER BLDG 38-302	BEAVERTON, OR 97077
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK HWY SUITE 2	VANCOUVER, WA 98661
TK2597	MERIX CORP	1521 POPLAR LANE	FOREST GROVE, OR 97116
TK2647	INSTRUMENT SPECIALTIES CO INC.	C/O TEMCO NW 1336 SE 51ST STREET	HILLSBORO, OR 97123

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
10-1-1	200-4321-00			1	COVER:COVER,TWO WIDE,0.063 ALUM,	80009	200-4321-00
-2	211-0409-00			18	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL,ZINC,T-10 TORX DR,SEMS	0KB01	211-0409-00
-3	348-1537-00			4	GASKET,EMI:CLIP-ON,1.98 L, BE CU,TIN PLATED,W/T LANCES	TK2647	97-563-17 W/2 T LANCES
-4	671-3233-01			1	CIRCUIT BD ASSY:PROCESSOR,389-1898-00 WIRED	80009	671-3233-01
	159-5009-00			1	FUSE,SMD:1.5A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT, (F13)	80009	159-5009-00.5
	159-5014-00			2	FUSE,SMD:2.0A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT, (F1, F5)	80009	159-5014-00
	159-5015-00			2	FUSE,SMD:10.0A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT, (F4, F12)	80009	159-5015-00
	159-5018-00			1	FUSE,SMD:3.0A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT,T&R (F2)	80009	159-5018-00
-5	129-1474-00			6	POST SPACER:0.250 HEX,1.508 L,4-40 INT,THD X 0.5 L,6-32 EXT THD,STEEL,	TK0588	129-1474-00
-6	260-2597-00			2	SWITCH,ROTARY:HEXADECIMAL,100MA AT 50VDC,RIGHT ANGLE,0.430 W X 0.400 H X 0.202 L	81073	94HAB16RA
-7	131-3766-00			1	CONN,HDR:PCB,MALE,RTANG,1 X 2,0.1 CTR,0.318 MLG X 0.110 TAIL,30 GOLD,0.025 SQ,	00779	87232-2
-8	131-3692-00			2	CONN,DIN:PCB,MALE,RTANG,3 X 32,0.1CTR,0.209 MLG X 0.104 TAIL0.437 H,BD RETENTION,HIGH TE	00779	536416-5
-9	131-5980-00			2	CONN,HDR:SMD,MALE,STR,2 X 50,0.05 X 0.1 CTR,0.480 H,SHRD/4 SIDES,CTR PLZ,LATCHING,W/BD R	00779	1-104549-0
-10	671-3843-XX			1	CIRCUIT BD ASSY:ACQUISITION,1GHZ,5GS/SEC,4CH (TLA7E2)	80009	671-3843-XX
	159-5009-00			3	FUSE,SMD 1.5A,125V,FAST	80009	159-5009-00
-10	671-3844-XX			1	CIRCUIT BD ASSY:ACQUISITION,1GHZ,5GS/SEC,2CH (TLA7E1)	80009	671-3844-XX
	159-5009-00			3	FUSE,SMD 1.5A,125V,FAST	80009	159-5009-00
-10	671-3845-XX			1	CIRCUIT BD ASSY:ACQUISITION,500MHZ,2.5GS/SEC, 4CH. (TLA7D2)	80009	671-3845-XX
	159-5009-00			3	FUSE,SMD 1.5A,125V,FAST	80009	159-5009-00
-10	671-3846-XX			1	CIRCUIT BD ASSY:ACQUISITION,500MHZ,2.5GS/SEC,2CH, (TLA7D1)	80009	671-3846-XX
	159-5009-00			3	FUSE,SMD 1.5A,125V,FAST	80009	159-5009-00
-11	386-6868-00			1	TWO-WIDE BACK PANEL	TK1943	386-6868-00
-12	441-2096-00			1	CHASSIS ASSY:TWO WIDE BOTTOM CHASSIS,METAL,4 CH (TLA7D2/E2)	80009	441-2096-00
-12	441-2097-00			1	CHASSIS ASSY:TWO WIDE BOTTOM CHASSIS,METAL2 CH (TLA7D1/E1)	80009	441-2097-00
-13	214-4762-00			4	SPRING,CONICAL	8X345	ORDER BY DESCR

Replaceable Parts List (Cont.)

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
-14	211-0911-00			4	RETAINER SCREW,MACHINE:M2.5, PITCH 0.45MM, LENGTH 11MM, HEAD DIA 5MM, HEAD HEIGHT 2MM	18677	322401-05
-15	367-0484-00			1	HANDLE,EJECTOR:INJECTOR/EJECTOR ASSEMBLY,TWO WIDE,W/OUT KEYING,SPRING LOADED,PLASTIC,20% GL	80009	367-0484-00
-16	335-0646-00			1	MARKER INDENT:EJECTOR LABEL,BOTTOM	0KB05	335064600
-17	211-0721-00			3	SCREW,MACHINE:6-32 X 0.375,PNH,STL,CDPL,T-15 TORX DR	0KB01	ORDER BY DE-SCRIPTION
-18	354-0654-01			4/2	RING,CONN:BNC (TLA7D2 and TLA7E2 use 4, TLA7D1 and TLA7E1 use 2)	0JR05	ORDER BY DE-SCRIPTION
-19	334-9233-00			1	MARKER,IDENT:CONFIGURATION LABEL,500MHZ,0.010 LEXAN,W/0.002 ADHESIVE,EMBOSSED, (TLA7D1/TLA7D2)	0KB05	OBD
-19	334-9234-00			1	MARKER,IDENT:CONFIGURATION LABEL,1GHZ,0.010 LEXAN (TLA7E1/TLA7E2)	0KB05	OBD
-20	131-1315-01			1	CONN,RF JACK:BNC/PNL,50 OHM,FEMALE,STR,PELTOLA/ REAR PNL,SILVER/BRIGHT ALLOY,0.576 MLG X 0.36	24931	28JR306-1
-20	131-1315-01			1	CONN,RF JACK:BNC/PNL,50 OHM,FEMALE,STR,PELTOLA/ REAR PNL,SILVER/BRIGHT ALLOY,0.576 MLG X 0.36	24931	28JR306-1
-20	131-1315-01			1	CONN,RF JACK:BNC/PNL,50 OHM,FEMALE,STR,PELTOLA/ REAR PNL,SILVER/BRIGHT ALLOY,0.576 MLG X 0.36	24931	28JR306-1
-21	367-0486-00			1	HANDLE,EJECTOR:INJECTOR/EJECTOR, ASSEMBLY,TWO WIDE,WITHOUT KEYING,TOP,SPRING LOADED,20%	80009	367-0486-00
-22	334-9190-00			1	MARKER INDENT:EJECTOR LABEL.TOP,4CH,1GHZ,0.745 X 0.520 (TLA7E2)	0KB05	334919000
-22	334-9191-00			1	MARKER INDENT:EJECTOR LABEL,TOP,4CH,500MHZ,0.745 X 0.520 (TLA7D2)	0KB05	334919100
-22	334-9192-00			1	MARKER INDENT:EJECTOR LABEL,TOP,2 CH,1 GHZ,0.745 X 0.520 (TLA7E1)	0KB05	334919200
-22	334-9193-00			1	MARKER INDENT:EJECTOR LABEL,TOP,2 CH,500MHZ (TLA7D1)	0KB05	334919300
-23	259-0101-XX			1	FLEX CIRCUIT:TEK PROBE INTERFACE	TK2597	259-0101-XX
-24	174-2031-00			1	CABLE ASSY:COAX,RFP,50 OHM,6.5L,PELTOLA BOTH ENDS,210-0775-00 & 210-0800-00	TK2338	174-2031-00
-25	348-1422-00			1	GASKET,RF:SHIELDING,0.005 BERYLLIUM COPPER ALLOY C17200 1/2 HARD,0.0003 MIN BRIGHT NICKEL	0J9P9	348-1422-00
-26	131-5658-00			1	CONN,BOX:PCB,FFC/ZIF,FEMALE,RTANG,1 X 15,0.039 CTR,(1MM),0.197 H X 0.126 TAIL,TIN,ACCOM,0	27264	52207-1590
-27	131-1003-00			1	CONN,RCPT,ELEC:PCB,PELTOLA,FEMALE,STR,0.277 H X 0.094 TAIL,3 POS IN PCB, SHIELD,USE WITH 136-02	52961	131-1003-00
-	136-0252-07			1	SOCKET,PIN CONN:SINGLE,PCB,T/G,0.030 H,0.054 DIA PTH,0.012-0.22 PIN SIZE,W/O DIMPLE,25000/REEL	22526	75060-012
-28	174-3458-00			2	CA ASSY,SP:RIBBON,IDC,30AWG,0.025 CTR,3.325 L,100 POS,MINI RIBBON,0.05 CTR X 2 X 50,0.05 X	TK2469	174-3458-00

Replaceable Parts List (Cont.)

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
-29	131-4619-00			2	CONN,RIBBON:PCB,MALE,RTANG,100 POS,0.050 CTR,0.307 MLG X 0.110 TAIL,4 X 25 STAGGERED PCB,2	53387	91100-1201BP
-30	348-1365-01			1	SHLD GSKT,ELEC:SYMETRICAL SLOTTED FINGER,0.350 W X 7.5 L,RIVIT MTG,SNAP-IN,RIVIT SPACING 1.5 IN	TK2647	0493-0069-01

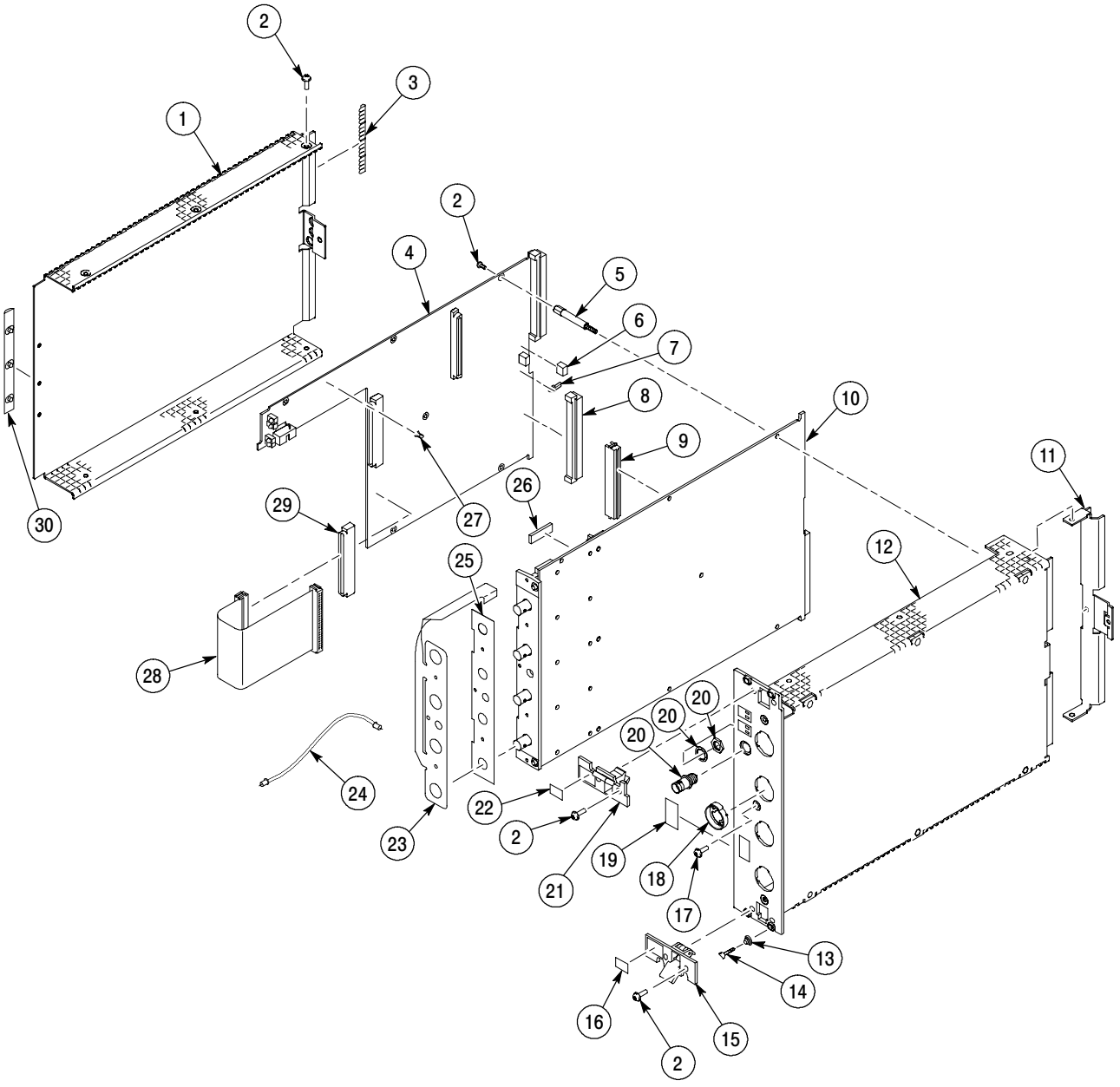


Figure 10-1: Digitizing oscilloscope exploded view