

TLA7ACx Tektronix Logic Analyzer Module Service Manual

Revision A

This document applies to TLA application software version 5.6 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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- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

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	iv
Service safety summary	vi
Preface	vii
Related Documentation	vii
Manual Conventions	viii
Introduction	ix
Strategy for Servicing	ix
Service Offerings	ix
Performance Verification Procedures	1
Test Equipment	1
Threshold Accuracy Test	1
Setup and Hold	5
Test Fixtures	9
Threshold Accuracy Test Fixture	9
Setup and Hold Test Fixture	10
Calibration data report	12
Test record	12
Test data	12
Maintenance	13
Related Maintenance Procedures	13
Preventing Electrostatic Discharge	13
Inspection and Cleaning	14
Cleaning the P6864, P6880, P6960, and P6980 Compression Footprints	18
Cleaning the P6864, and P6880 Probe Heads	18
Cleaning the P6900 Probe Heads	19
Storing the P6800 Probe Heads	20
Storing the P6900 Probe Heads	21
Removal and Installation Procedures	23
Tools Required	23
Torque Requirements	23
Injector/Ejector Handles	24
Covers	25
Local Processor Unit Board	30
Acquisition Board	33
Front and Rear EMI Gaskets	37
Side EMI Gaskets	38
Troubleshooting	39
Service Level	39
Required Documentation	40

Check for Common Problems	40
Eliminate Other Problem Sources.....	41
Troubleshoot the Logic Analyzer Module	43
Adjustment After Repair	49
Updating or Restoring the Logic Analyzer Firmware	49
Repackaging Instructions	51
Packaging	51
Shipping to the Service Center	51
Storage	52
Parts List	53
Parts Ordering Information	53
Using the Replaceable Parts List	54

List of Figures

Figure 1: Setting trigger parameters.....	3
Figure 2: Set the trigger states	7
Figure 3: Threshold Accuracy test fixture	9
Figure 4: Solder square pins to the SMA connector.....	10
Figure 5: Solder the SMA connectors together	11
Figure 6: Completed fixture with termination and coupler	11
Figure 7: Cleaning the probe heads	19
Figure 8: Cleaning the P6900 probe heads	20
Figure 9: Storing the probe head.....	20
Figure 10: Storing the P6900 probe heads.....	21
Figure 11: Injector/ejector handle replacement	24
Figure 12: Cover removal	26
Figure 13: Removing the merge cable bracket from the cover.....	27
Figure 14: Installing the cover onto the chassis.....	28
Figure 15: Seating the cover on the chassis	30
Figure 16: LPU board removal	31
Figure 17: Inserting LPU board tabs into front subpanel	32
Figure 18: Remove the single screw from the merge cable bracket	33
Figure 19: Removing the merge cable assembly.....	34
Figure 20: Removing the acquisition board from the chassis	35
Figure 21: Rear EMI gasket removal.....	37
Figure 22: Rear EMI gasket replacement.....	38
Figure 23: Primary troubleshooting chart.....	46
Figure 24: Logic analyzer module exploded view.....	55

List of Tables

Table 1: External inspection check list.....	15
Table 2: Internal inspection checklist	16
Table 3: Tools required for circuit board replacement.....	23
Table 4: Failure symptoms and possible causes.....	40
Table 5: Diagnostic tests.....	47
Table 6: Requirements after replacement.....	49

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 a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

To avoid fire or personal injury

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 markings on the product. Consult the product manual for further ratings information before making connections to the product.

The inputs are not rated for connection to mains or Category II, III, or IV circuits.

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

Power disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do not operate without covers. Do not operate this product with covers or panels removed.

Do not operate with suspected failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

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

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.

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.*

Symbols and 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.

The following symbol(s) may appear on the product:



CAUTION
Refer to Manual



Earth Terminal



Chassis Ground

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, switch off the instrument power, then disconnect the power cord from the mains power.

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.

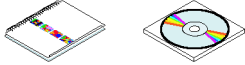


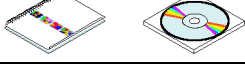





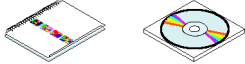
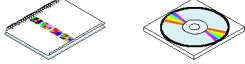
Preface

This is the service manual for the TLA7ACx Series Logic Analyzer Module. 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 important background information needed before using this manual for servicing this product.

Related Documentation

The following manuals are available as part of the TLA Series Logic Analyzer documentation set.

Related Documentation

Item	Purpose	Location
TLA Quick Start User Manuals	High-level operational overview	
Online Help	In-depth operation and UI help	
Installation Quick Reference Cards	High-level installation information	
Installation Manuals	Detailed first-time installation information	
XYZs of Logic Analyzers	Logic analyzer basics	 www.Tektronix.com
Declassification and Security instructions	Data security concerns specific to sanitizing or removing memory devices from Tektronix products	 www.Tektronix.com
Application notes	Collection of logic analyzer application specific notes	
Product Specifications & Performance Verification Procedures	TLA Product specifications and performance verification procedures	
TPI.NET Documentation	Detailed information for controlling the logic analyzer using .NET	
Field upgrade kits	Upgrade information for your logic analyzer	
Optional Service Manuals	Self-service documentation for modules and mainframes	

Manual Conventions

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

Acquisition Board

The acquisition board is one of the circuit boards inside the logic analyzer module. The circuit board receives and stores acquisition data from the probes and works with the local processor unit (LPU) board to provide logic analysis information to the operator of the logic analyzer.

LPU Board

The LPU board is one of the circuit boards inside the logic analyzer module that provides the main communications interface with the acquisition board and the mainframe.

Maintenance Procedures

Maintenance procedures are used for fault isolation and repair to the circuit board level or to the replaceable part level.

Modules

Throughout this manual, the term "module" refers to a logic analyzer or digital oscilloscope, or pattern generator unit that mounts inside a mainframe. A module is composed of circuit boards, interconnecting cables, and a user-accessible front panel.

Performance Verification Procedures

Performance verification procedures confirm that a product meets or exceeds the performance requirements for each of the published specifications.

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 replaceable part is any circuit board or assembly that is listed in the replaceable parts list near the end of this manual.

Introduction

This manual contains information needed to properly service the logic analyzer module, as well as general information critical to safe servicing.

To prevent personal injury or damage consider the following requirements before attempting service:

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

When using this manual for servicing follow all warnings and cautions.

Strategy for Servicing

This manual 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 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 logic analyzer module.

Warranty Repair Service	<p>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 web site at http://www.tektronix.com/Measurement/Service. See our latest service offerings and contact us by email.</p>
Calibration and Repair Service	<p>In addition to warranty repair, Tektronix Service offers calibration and other services that 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.</p> <p>The following services can be tailored to fit your requirements for calibration and/or repair of the logic analyzer module.</p>
Service Options	<p>Tektronix Service Options can be selected at the time you purchase your instrument. You select these options to provide the services that best meet your service needs.</p>
Service Agreements	<p>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 logic analyzer module. Service agreements may be customized to meet special turn-around time and/or on-site requirements.</p>
Service On Demand	<p>Tektronix also offers calibration and repair services on a "per-incident" basis that is available with standard prices for many products.</p>
Self Service	<p>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.</p> <p>When you exchange circuit boards, you must supply the following information to allow the board to be preconfigured to the proper PowerFlex level. You can also return the repaired module to your local service center for configuration.</p> <ul style="list-style-type: none">■ Model number and serial number■ PowerFlex option upgrade number■ Firmware level
For More Information	<p>Contact your local Tektronix service center or sales engineer for more information on any of the Calibration and Repair Services just described.</p>

Performance Verification Procedures

This section contains procedure for performance verification of the logic analyzer. Generally, you should perform these procedures once per year or following repairs that affect certification.

Test Equipment

The procedures in this section use external, traceable signal sources to test key specifications listed in the *TLA Product Specifications & Performance Verification Technical Reference Manual* located on the TLA documentation CD or on the Tektronix Web Site.

Test equipment or test fixture	Minimum requirements	Example
Precision voltage reference or a DC signal generator and precision digital voltmeter	(accurate to within ± 5 mV)	
Logic analyzer probe	One required	P6810
Data Timing Generator	Tektronix DTG 524 with a DTGM30 Output Module	
Test fixture, Threshold Accuracy	One required	Refer to Threshold Accuracy Test Fixture. (See page 9.)
Precision BNC cable	One required	
Test fixture, Setup and Hold	Minimum of two test fixtures required	Refer to Setup and Hold Test Fixture. (See page 10.)

The performance verification procedures check the following specifications:

- Threshold Accuracy
- Setup/Hold Window Size

Threshold Accuracy Test

This procedure verifies the threshold voltage accuracy of the logic analyzer.

Equipment required	Precision voltage reference or a DC signal generator and precision digital voltmeter (accurate to within ± 5 mV) Threshold Accuracy test fixture P6810 Logic analyzer probe
Prerequisites	Warm-up time: 30 minutes

Test Equipment Setup

Connect a P6810 probe from the logic analyzer to the voltage source, using the Threshold Accuracy test fixture. If the voltage source does not have the required output accuracy, use a multimeter with the required accuracy to verify the voltage output levels specified in the procedure.

TLA7000 Setup

To set up the logic analyzer for this test, you must define the characteristics of the channel that you are testing, and then set the trigger parameters:

- 1.** Open the Setup window.
 - a.** In the Group column, enter a name for the probe group that you are testing (“Test” in the example).
 - b.** Define the signals for the group that you are testing.
 - c.** Set the sampling to Asynchronous, 2.0 ns.
 - d.** Set the Acquisition Length to 128K or less.
 - e.** Set Acquire to Samples.
- 2.** Go to the Trigger window and select the Power Trigger tab. Create a trigger program that triggers the logic analyzer when it doesn't see all highs or all lows:
 - a.** Click the If Then button.
 - b.** Set the channel definition to match the figure shown. (See Figure 1.)
 - c.** After you set the channel definitions, click OK.

Clause Definition - LA 1 State 1.1

If

Group Test != 00

And Group Test != FF

Then

Trigger

Group Radix

Hex

Event Name (optional)

OK Cancel Add Delete Help

Figure 1: Setting trigger parameters

Verification Procedure

Complete the following steps to complete this procedure. Record the results on a copy of the Calibration data sheet. (See page 12, *Calibration data report*.)

1. Go to the Setup window of the logic analyzer and set the probe threshold voltages to 4 V.
2. Set the voltage source to 3.850 V.
3. Start the logic analyzer and verify that it does not trigger.
4. Increase the voltage in 10 mV steps, waiting at least 3 seconds between steps to make sure that the logic analyzer continues to run without triggering. Continue until the logic analyzer triggers and then record the voltage.
5. Set the voltage source to 4.150 V.
6. Start the logic analyzer and verify that it does not trigger.
7. Decrease the voltage in 10 mV steps, waiting at least 3 seconds between steps to make sure that the logic analyzer continues to run without triggering. Continue until the logic analyzer triggers and then record the voltage.
8. Add the two voltage values and divide by two. Verify that the result is $4.00\text{ V} \pm 75\text{ mV}$. Record the voltage on the Calibration data sheet.
9. Go to the Setup window and set the logic analyzer threshold voltages to -2.0 V .
10. Repeat steps 3 through 8 for -2.130 V and -1.870 V .
11. Add the two voltage values and divide by two. Verify that the result is $-2.00\text{ V} \pm 55\text{ mV}$. Record the voltage on the Calibration data sheet.
12. Repeat the procedure for each probe channel group that you want to verify.

Setup and Hold

This procedure verifies the setup and hold specifications of the logic analyzer.

Equipment required	Tektronix DTG 524 Data Timing Generator with a DTGM30 Output Module Precision BNC cable Setup and Hold test fixture
Prerequisites	Warm-up time: 30 minutes

Digital Timing Generator Setup

1. Verify that the digital timing generator (DTG) has been calibrated so that the channel-to-channel skew is minimized.
2. Set up the DTG so that a channel (CH1 for example), is set to be a clock pattern of alternating 1 and 0 (101010... binary) starting with 1 (rising edge).
3. Set the output frequency to 250 MHz. (This may require you to set the DTG base clock to 500 MHz for this pattern to represent 250 MHz at the channel output.)
4. Set another channel of the DTG (CH2 for example) to a data pattern representing half the period of CH1 (for example 001100110011...binary, starting with 00).
5. Connect the setup and hold test fixtures to the DTG channels that you have set up. Connect 50 Ω SMA terminations to the test fixtures.
6. Connect the DTG channel that you set up as a clock to the appropriate TLA CK[x] input.
7. Connect the other DTG channel to two of the TLA data channels that you want to test.

If you want to test other TLA data channels simultaneously and your DTG has additional outputs available, set up those DTG channels like the first data channel, and connect them to the other logic analyzer channels that you want to test. (The channels must be in the same probe, and you will need another test fixture for each additional channel pair.) Otherwise, repeat the procedure for each new pair of logic analyzer channels.

8. Set the termination to open on each DTG channel.
9. Set the DTG output voltage levels to 2.0 V High and 0.0 V Low, with no offset.

TLA7000 Setup

1. Start the TLA Application and open the Setup Window.
2. Click the DM button to default the module.
3. Click on the Synchronous tab and set the following parameters:
 - a. Clock Signal: Choose the clock that you connected the DTG output to.
 - b. Max Clock Rate: 450 MHz
 - c. Global Threshold: Set to 500 mV.

With the 50 Ω external termination attached at the SMA fixture end, this sets the logic analyzer threshold voltage levels to one-half the resulting termination voltage, which should be about 500 mV (not 1 V).

4. In the Acquisition Options box, select the following:
 - a. Acquisition Length: 1K or greater
 - b. Storage Options: Normal
5. Create a new group: right click in the Group Name column.
6. Select Add Group from the pop-up window. Rename the new group Test.
7. In the Probe Channels column, enter the names of the two adjacent data channels that will be used to connect to CH2 of the DTG.

NOTE. *These procedures test two channels. If you want to check more than two channels, be sure to set the group and trigger word widths to the same amount.*

Trigger Logic. To complete the setup, you must configure a trigger to occur whenever the two data lines are neither 00 nor 11 (binary). This will capture the condition when the two data signals are 01 or 10, as they transition to their common values. To set this up, do the following:

8. Open the LA Trigger window and select the Power Trigger tab. Set up three states as shown. (See Figure 2.)



Figure 2: Set the trigger states

Verification Procedure

Complete the following steps to complete this procedure. Record the results on a copy of the Calibration data sheet. (See page 12, *Calibration data report*.)

1. Set the DTG sequencer to RUN and the outputs ON.
2. Press the RUN button on the TLA and wait a few seconds to verify that it doesn't trigger.
3. Starting from 0.000 ns, increase the delay of the DTG clock channel in 100 ps steps until triggering begins to occur. When the TLA begins to trigger, decrease the delay in 10 ps steps to find the trigger threshold to within 10 ps. Record this delay amount.

Note that the logic analyzer might trigger because of a glitch when you make a delay change. If the data in the waveform window is correct (all data transitioning at the same time and at the correct frequency), then ignore this "false trigger" and start the logic analyzer again.

As an alternative, you may want to run the logic analyzer in continuous loop mode if the DTG causes a false trigger on the logic analyzer each time you change the delay. Then observe if the data is correct in the waveform window and ignore any false triggers. Continue increasing the clock delay until the waveform window displays data that was not acquired correctly. Record this delay.

4. Add 0.75 ns to the delay value that you recorded in step 3 and increase the DTG clock delay to match this cumulative value. (For example, if you measured 0.85 ns, increase the delay to 1.60 ns.)
5. Press Run and wait a few seconds to verify that it doesn't trigger. This verifies that the setup and hold window is less than 0.75 ns, which is the guaranteed specification for a single channel.

If you want to measure the actual setup and hold window size for your application, slowly decrease the clock delay in steps (waiting a few seconds between steps to verify that it doesn't trigger), until the logic analyzer triggers. Record this second value. The difference between this second value and the value that you measured in step 3 is the measured setup and hold window size. Record the results in the Calibration data report.

Test Fixtures

To complete the procedures in this section, you need to build the Threshold Accuracy test fixture and the Setup and Hold test fixture.

Threshold Accuracy Test Fixture

Use this fixture to gain access to the logic analyzer probe pins. The fixture connects all ground pins together, and all signal pins together.

Equipment Required You will need the following items to build the test fixture:

Item	Description	Example part number
Square-pin strip	0.100 x 0.100, 2 x 8 contacts (or two 1 x 8 contacts)	SAMTEC part number TSW-102-06-G-S
Wire	20 gauge	
Soldering iron and solder	50 W	

Build Procedure Use the following procedure to build the test fixture.

1. Set the square-pin strip down and lay a wire across one row of pins on one side of the insulator as shown. Leave some extra wire at one end for connecting to a test lead. (See Figure 3.)
2. Solder the wire to each pin in the row.
3. Repeat for the other row of pins.

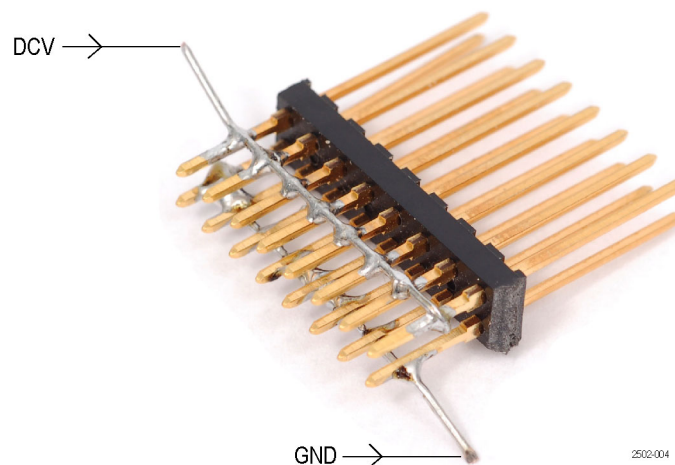


Figure 3: Threshold Accuracy test fixture

Setup and Hold Test Fixture

This fixture provides square-pin test points for logic analyzer probes when they are used to probe in-line SMA connections. Note that you need a minimum of two test fixtures to complete the procedure.

Equipment Required You will need the following items to build the test fixture:

Item	Description	Example part number
SMA connector (two required for each fixture)	Female, PCB mount	SV Microwave part number 2985-6035, -6036, or -6037
Square-pin strip	0.100 x 0.100, 2 x 2 contacts (or two 1 x 2 contacts)	SAMTEC part number TSW-102-06-G-S
SMA termination	50 Ω , ≥ 2 GHz bandwidth	Johnson part number 142-0801-866
SMA adapter	Male-to-male	Johnson part number 142-0901-811
Soldering iron and solder	50 W	

Build Procedure Use the following procedure to build the test fixture.

1. Arrange one SMA connector as shown. (See Figure 4.)
2. Align the square pins at a right angle to the connector.

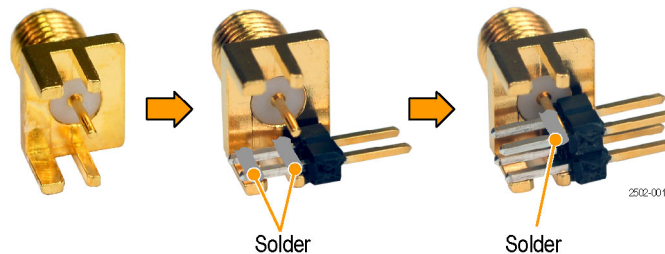


Figure 4: Solder square pins to the SMA connector

3. Solder one set of square pins to the SMA ground conductor.
4. Solder the other set of square pins to the SMA center conductor.

5. Align the second SMA connector to the first as shown and solder the center conductors of the connectors together. (See Figure 5.)

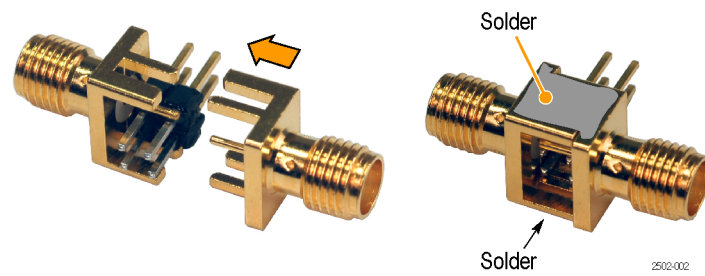


Figure 5: Solder the SMA connectors together

6. Solder the ground conductors of the SMA connectors together.
7. Attach the termination and coupler to the fixture.

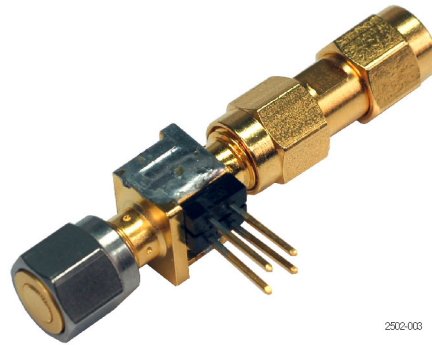


Figure 6: Completed fixture with termination and coupler

Calibration data report

Photocopy this page and use it to record the performance test results for your instrument.

Test record

Instrument model number: _____

Serial number: _____

Certificate number: _____

Verification performed by: _____

Verification date: _____

Test data

Characteristic	Specification	Tolerance	Incoming data	Outgoing data
Threshold accuracy	+4.0 V	±75 mV (4.075 V to 3.925 V)		
	-2 V	±55 mV (-1.945 V to -2.055 V)		
Setup and hold window:				
	single channel	≤300 ps	none	

Maintenance

This section contains the information needed for periodic and corrective maintenance of the Logic Analyzer Modules. The following sections are included.

- This *Maintenance* section provides general information on preventing damage to internal circuit boards when doing maintenance, procedures for inspecting the logic analyzer module, and cleaning external and internal circuit boards.
- The *Removal and Installation Procedures* provide procedures for removing and installing circuit boards and other common replaceable parts.
- *Troubleshooting* provides information for isolating faulty circuit boards, probes, and other faults.
- *Repackaging Instructions* provides packaging information for shipment or storage.

Related Maintenance Procedures

The *TLA7KUP Mainframe Field Upgrade Instruction Manual* contains some maintenance procedures not included in this manual. Refer to the *TLA7KUP Mainframe Field Upgrade Instruction Manual* for information on upgrading the mainframe software or module firmware.

Preventing Electrostatic Discharge

When performing any service that requires internal access to the logic analyzer module, adhere to the following precautions to avoid damaging internal modules and their components due to electrostatic discharge (ESD).



CAUTION. *Static discharge can damage any semiconductor component.*

- Minimize handling of static-sensitive modules.
- Transport and store static-sensitive modules in their static protected containers. Label any package that contains static-sensitive modules.
- Wear a grounded antistatic wrist strap while handling these modules. Service static-sensitive modules only at a static-free work station.
- Nothing capable of generating or holding a static charge should be allowed on the work surface.
- Handle circuit boards by the edges when possible.

- Do not slide the modules over any surface.
- Avoid handling the modules in areas that have a floor or work surface capable of generating a static charge.

Inspection and Cleaning

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 instrument, and using general care when operating it. How often to perform maintenance depends on the severity of the environment in which the instrument is used. A proper time to perform preventive maintenance is just before having performance verification procedures performed or as an incoming inspection.

General Care The side cover keeps dust out of the instrument and should be in place during normal operation.

Inspection and Cleaning Procedures Inspect and clean the instrument as often as operating conditions require. 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 can cause failures, especially under high-humidity conditions.



CAUTION. *Avoid using chemical cleaning agents that might damage the plastics and external labels used in the instrument.*

Use a cloth dampened with water to clean external surfaces. To prevent damage to electrical components from moisture during external cleaning, use only enough liquid to dampen the cloth or applicator.

Use a 75% isopropyl alcohol solution to clean internal surfaces and rinse with deionized water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

Exterior Inspection Inspect the outside of the instrument for damage, wear, and missing parts using the following table 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 can cause personal injury or lead to further damage to the logic analyzer module or mainframe where it is used.

Table 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 EMI shields.	Replace defective or missing mechanical parts.
Front panel connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.	Replace defective parts or clean parts based on the cleaning procedures.
Rear connectors	Cracked or broken shells, damaged or missing contacts. Dirt in connectors.	Replace defective parts or clean parts based on the cleaning procedures.
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors.	Replace damaged or missing items, frayed cables, and defective modules.

Exterior Cleaning Procedure

To clean the exterior, perform the following steps:

1. Remove loose dust on the outside of the logic analyzer module with a lint free cloth.
2. Remove remaining dirt with a lint-free cloth or applicator and water, using only enough liquid to dampen the cloth or applicator. Do not use abrasive cleaners.

Interior Inspection

Inspect the internal portions of the logic analyzer module for damage and wear using the following table as a guide. When found, defects should be repaired immediately. If you must replace an internal component, refer to the *Removal and Installation Procedures*. (See page 23.)



CAUTION. Do not attempt to repair any circuit boards with a soldering iron. Most of the internal components are surface mounted devices. Using a soldering iron can damage the surface-mounted components and internal circuit boards. Refer the replacement of surface-mounted components to qualified service personnel with the appropriate tools.

Table 2: Internal inspection checklist

Item	Inspect for	Repair action
Circuit boards	Loose, broken, or corroded connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.	Remove failed circuit board and replace with a new one.
Resistors	Burned, cracked, broken, blistered condition.	Remove failed circuit board and replace with a new one.
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Remove failed circuit board and replace with a new one.
Semiconductors	Damaged parts or distorted pins.	Replace circuit board if parts are damaged.
Wiring and cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace circuit boards with defective wires or cables.



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

Interior Cleaning Procedure

To clean the 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 module is clean upon inspection, skip the remaining steps. If steps 1 and 2 do not remove all the dust or dirt, the 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. (See page 23.)
4. Spray wash dirty parts with the isopropyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate.
5. Use warm (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.

Cleaning the Probes

To clean the exterior surfaces of the probes, remove dirt and dust with a soft brush. For more extensive cleaning, use only a damp cloth. Never use abrasive cleaners or organic solvents



CAUTION. *Static discharge can damage any semiconductor component in the probe head. Always wear a grounded antistatic wrist strap whenever handling the probe head. Also verify that anything to which the probe head is connected does not carry a static charge.*

NOTE. *Never clean the elastomers. Always replace them instead. Refer to the P6800 Series Logic Analyzer Probe Instruction Manual for information on replacing the probe elastomers and other probe accessories.*

Cleaning the P6864, P6880, P6960, and P6980 Compression Footprints



CAUTION. *To avoid electrical damage, always turn off the power of your target system before cleaning the compression footprint.*

Prior to connecting the probe to the target system, the compression footprints on the target system must be properly cleaned. Clean the compression footprints according to the following steps:

1. Use a lint-free cloth moistened with isopropyl alcohol and gently wipe the footprint surface.
2. Remove any remaining lint using a nitrogen air gun.

NOTE. *Use alcohol sparingly and be sure that you have removed any remaining lint or residue with the nitrogen air gun.*

Cleaning the P6864, and P6880 Probe Heads

Before connecting the P6864 or P6880 probes to the target system, ensure that the probe heads are free from dust, dirt, and contaminants. If necessary, clean the probe heads according to the following steps.



CAUTION. *Static discharge can damage semiconductor components in the probe head. Always wear a grounded antistatic wrist strap whenever handling the probe head. Also verify that anything to which the probe head is connected does not carry a static charge.*

NOTE. *Never clean the elastomers. Always replace them instead. Refer to the Operating Basics section of the P6800 Series Logic Analyzer Probe Instruction Manual for information on replacing elastomers.*

1. Remove elastomer holder. (See Figure 7.)
2. Moisten a cotton swab with isopropyl alcohol.

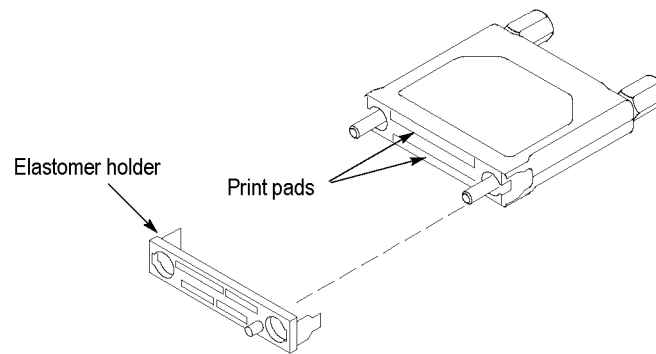


Figure 7: Cleaning the probe heads

3. Gently wipe the edge print pads of the hybrid.
4. Remove any remaining lint using a nitrogen air gun.
5. Put the elastomer holder back in place.



CAUTION. Do not touch the elastomers to avoid damaging the probe contacts.

Cleaning the P6900 Probe Heads

To maintain a reliable electrical contact, keep the probes free from dirt, dust, and contaminants. Remove dirt and dust with a soft brush. Avoid brushing or rubbing the c-spring contacts. For more extensive cleaning, use only a damp cloth. Never use abrasive cleaners or organic solvents.



CAUTION. Static discharge can damage semiconductor components in the probe head. Always wear a grounded antistatic wrist strap whenever handling the probe head. Also verify that anything to which the probe head is connected does not carry a static charge.



CAUTION. To prevent damage during the probe connection process, do not touch the exposed edge of the interface clip. Do not drag the contacts against a hard edge or corner.

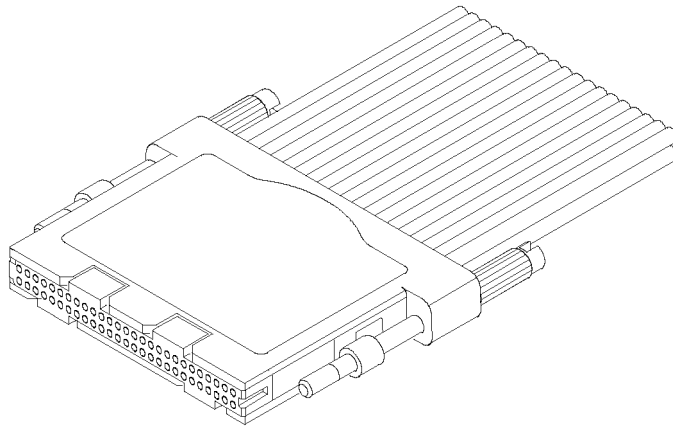


Figure 8: Cleaning the P6900 probe heads

Storing the P6800 Probe Heads

To protect the elastomer, it is important to properly store the probe heads when the probes are not in use. (See Figure 9.)

1. Locate the keying pin on the probe end and align it to the keying pin hole on the nutbar.
2. While holding the probe end at a perpendicular angle to the nutbar, finger-tighten both probe head screws until snug (no more than 1 in-lbs of torque).

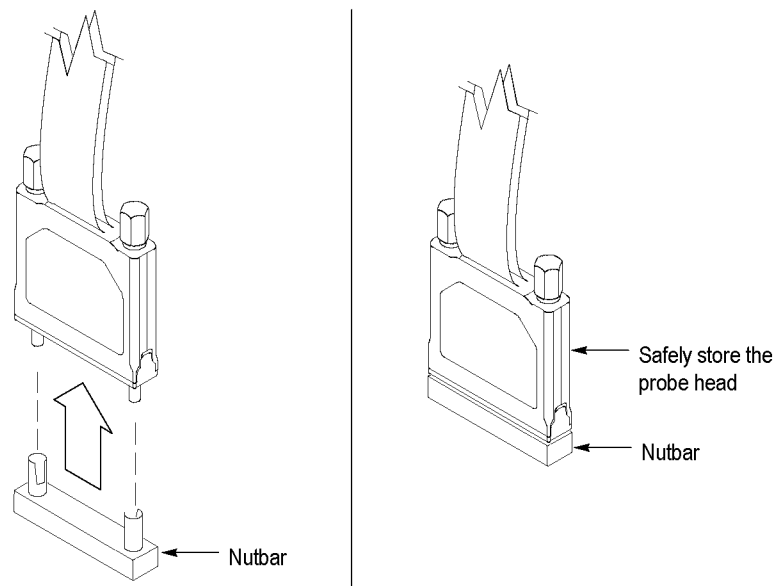


Figure 9: Storing the probe head

Storing the P6900 Probe Heads

To protect the probe head, when the probes are not in use place the probe head cover on the probe. (See Figure 10.)

1. Gently slide the probe cover over the probe end.

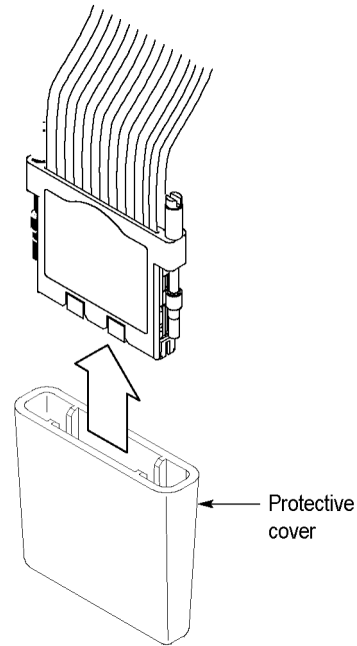


Figure 10: Storing the P6900 probe heads

Removal and Installation Procedures

This section describes how to remove and install the major mechanical and electrical modules. The procedures in this section assume that you already have removed the module from the mainframe.



WARNING. *Before doing any procedures in this manual, read the General Safety Summary and Service Safety Summary located at the beginning of this manual.*

To prevent possible injury to service personnel or damage to electrical components, read Preventing Electrostatic Discharge. (See page 13.)

Tools Required

The following table lists the tools needed to replace the internal components of the logic analyzer module.

Table 3: Tools required for circuit board replacement

Name	Description
Screwdriver with a T-9 and a T-10 Torx tip	Standard tool
1/4-inch nut driver	Standard tool
9/16-inch nut driver	Standard tool
Needle-nose pliers	Standard tool

Torque Requirements

Tighten all T-9 and T-10 screws to 4 in. lbs. Tighten standoff posts to 8 in. lbs.

Injector/Ejector Handles

You will need a screwdriver with a T-10 tip to complete the following procedures.

Removal Use the following procedure to remove the injector/ejector handles:

1. Place the module on the right side. (See Figure 11.)
2. Remove the two screws that secure the injector/ejector handle to the chassis.
3. Remove the injector/ejector handle from the module.

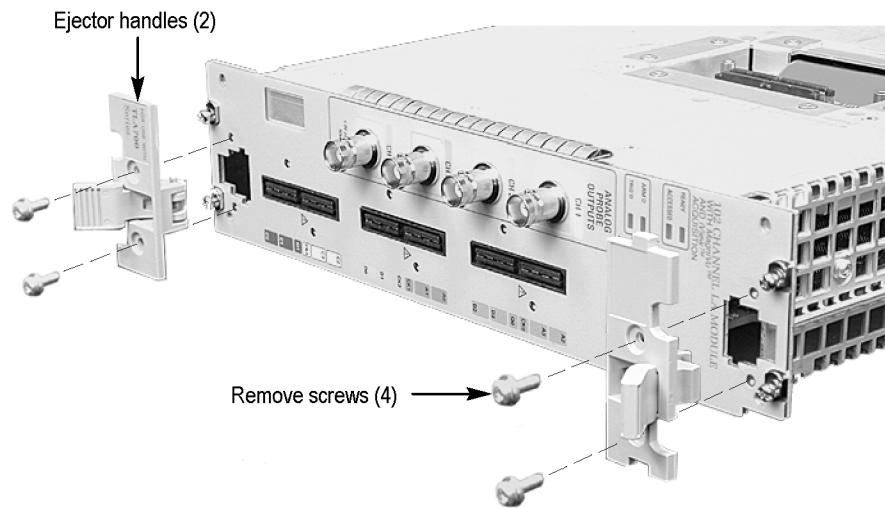


Figure 11: Injector/ejector handle replacement

Installation Use the following procedure to install the injector/ejector handles by referring the figure. (See Figure 11.)

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

1. Install the injector/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 (see the *Replaceable Mechanical Parts List* for label part numbers if necessary).

Covers

You will need a screwdriver with a T-9 and a T-10 tip to complete the following procedures.

Removal Use the following procedure and figures to remove the covers:

1. Place the module on the right side. (See Figure 12.)
2. Remove the two screws on the rear of the chassis and the two rear screws, located on either side of the rear panel, that secure the rear panel to the chassis.
3. Remove the rear panel and set it aside.
4. Remove the two top screws and the two bottom screws that secure the cover to the chassis.
5. If you have a 102-channel module or a 136-channel module with a merge cable, complete to following steps. (See Figure 13.)
 - a. Remove the eight T-9 countersunk screws holding the bracket to the cover.
 - b. Lift the assembly out of the cover and then reach into the hole and disconnect the merge cable from the circuit board.
6. Slide the cover back to disengage the tab and lift the cover from the chassis.

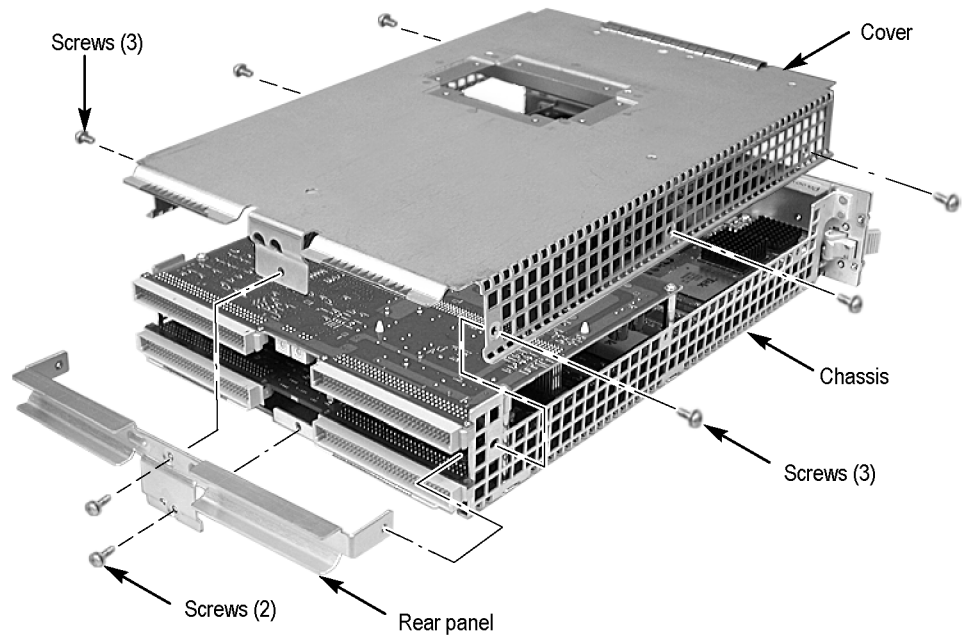


Figure 12: Cover removal

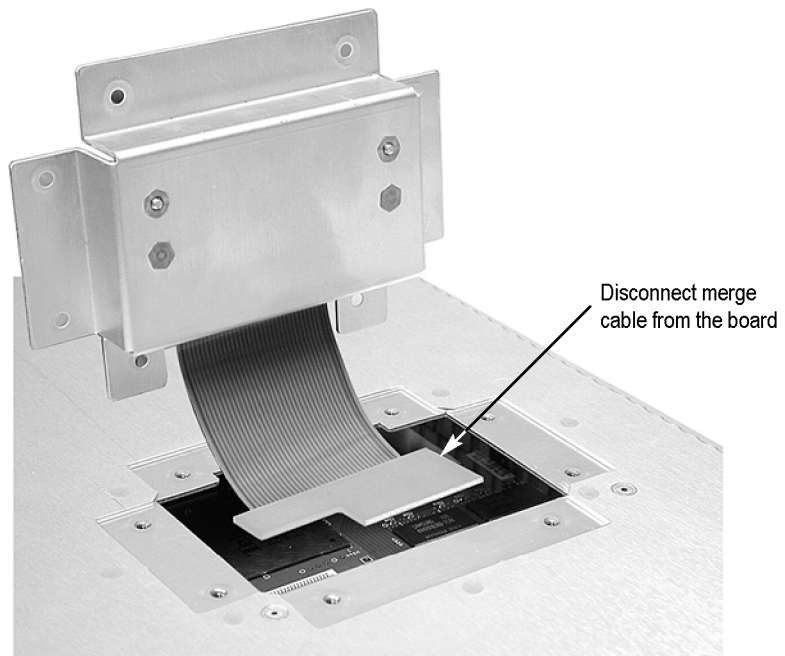
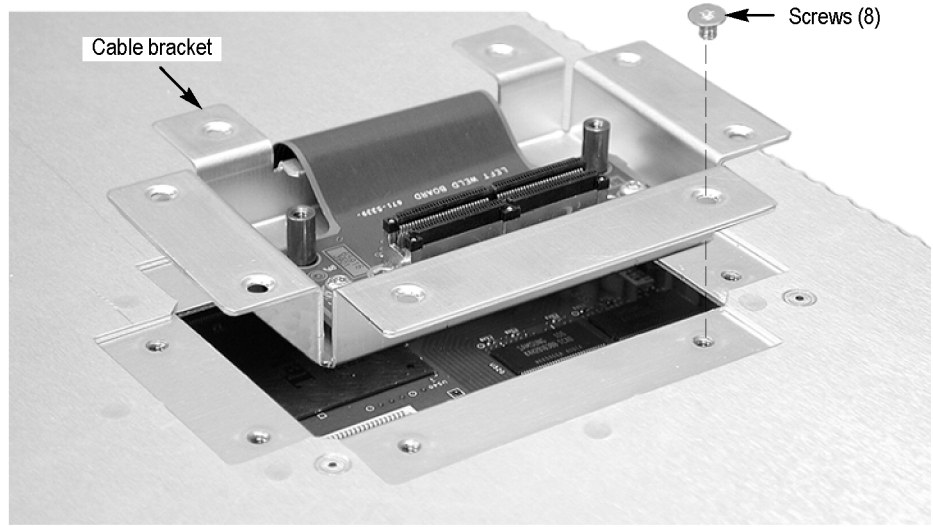


Figure 13: Removing the merge cable bracket from the cover

Installation Use the following procedure and figures to install the covers:

NOTE. *Install the cover tightly against the chassis. This will ensure that the module fits into adjacent slots in the mainframe.*

1. Place the module on its right side. (See Figure 12.)



CAUTION. *To prevent damage to the module during the installation process, reinstall the cover exactly as described in steps 2 through 8.*

If the cover is not properly seated, the module can be damaged when you install it in a mainframe.

2. Insert the cover at an angle (step 1) such that the front edge of the cover engages with the EMI gaskets on the back of the front panel. Then push the rear of the cover in place (step 2). (See Figure 14.)

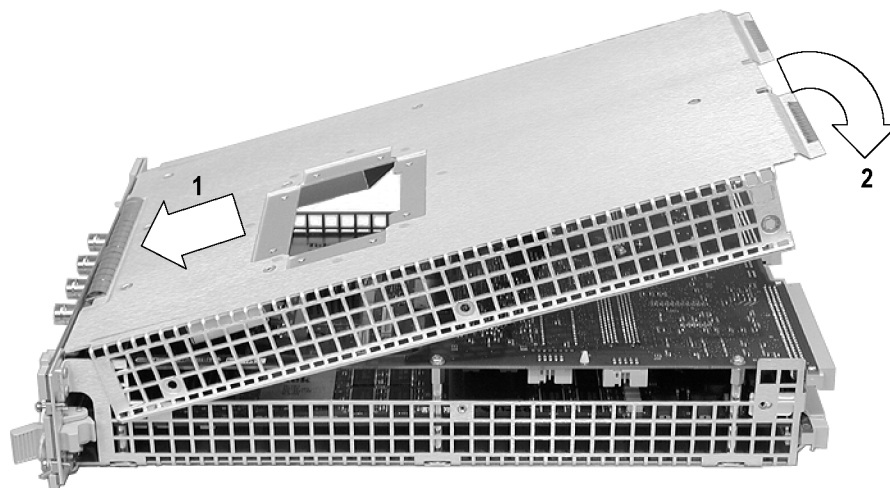


Figure 14: Installing the cover onto the chassis

3. Make sure that the cover is fully seated (no gaps) against the front and rear chassis flanges. (See Figure 15.)
4. While holding the cover in place, install the four T-10 Torx-drive screws nearest the front of the module (two on each side of the cover), to secure the cover to the chassis.
5. Slide the rear panel on the chassis and install the two rear panel T-10 Torx-drive screws.
6. Gently squeeze the chassis flange and rear panels flange together while tightening the screws on the sides. This ensures that the rear panel does not

rotate, otherwise the module may not seat properly when installed in the mainframe.

7. Install the two remaining T-10 Torx-drive screws nearest the rear of the module (one on each side of the cover).
8. Place the cover onto the chassis.
9. If your instrument has a merge cable, complete the following steps to install the merge cable assembly:
 - a. Feed the merge cable through the cover.
 - b. Carefully connect the merge cable to the circuit board. (See Figure 13.)
 - c. Insert the bracket assembly into the hole in the cover.
 - d. Install the eight T-9 countersunk screws on the bracket.
10. Check and tighten all screws to 4 in lbs.

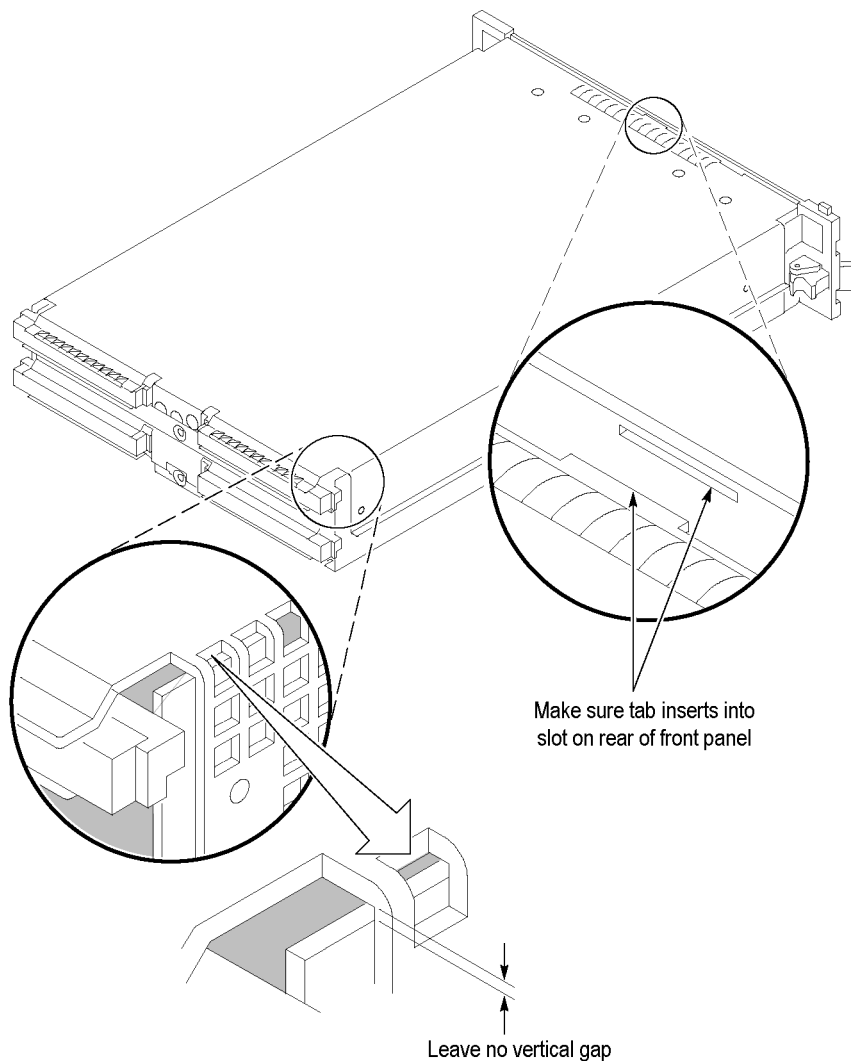


Figure 15: Seating the cover on the chassis

Local Processor Unit Board

You will need a screwdriver with a T-10 tip to complete the following procedures.

NOTE. When placing an order for a replacement LPU board or an LPU exchange board from the Tektronix Exchange Center, you must supply the model number, serial number, PowerFlex Option upgrade number and firmware level.

Removal Use the following procedure and figure to remove the LPU board:

1. Perform the *Covers* removal procedure. (See page 31.)
2. Remove the five T-10 Torx-drive screws that secure the LPU board to the chassis.



CAUTION. Handle the LPU board gently to avoid breaking the front panel LED extension.

3. Carefully lift the LPU board up from the chassis to disengage the 160-pin connector from the acquisition board.
4. Move the LPU board away from the front panel until the tabs clear the front subpanel and then remove the LPU board from the chassis. (See Figure 16.)

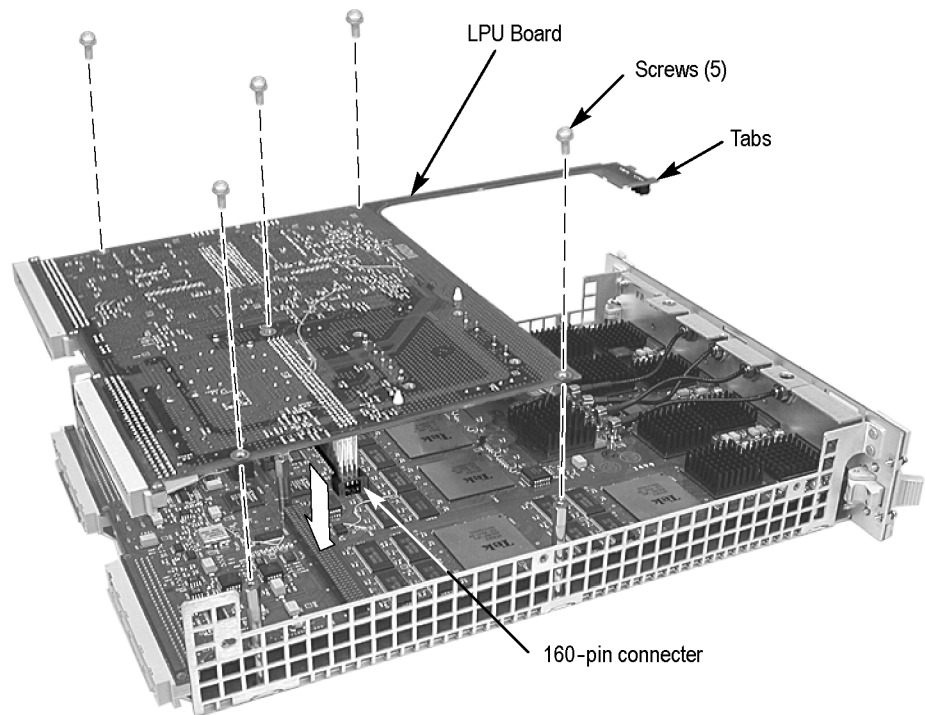


Figure 16: LPU board removal

Installation Use the following procedure and figure to install the LPU board:

1. Place the LPU board (component side down) over the chassis and insert the tabs on the LPU board into the front subpanel as shown in following figure.
2. Line up the pins on the 160-pin connector from the LPU board to the acquisition board and gently press the LPU board in place.
3. Install the five T-10 Torx-drive screws that secure the LPU board to the chassis.
4. Perform the *Covers* installation procedure. (See page 28.)

NOTE. After replacing the LPU board, you must verify the proper PowerFlex level. The PowerFlex configuration information is listed on the side panel of the logic analyzer module. This information should match the module specific information on the System Properties tab in the TLA application.

If the PowerFlex level does not match the information on the side panel label, you must return the entire logic analyzer module to your local Tektronix service center.

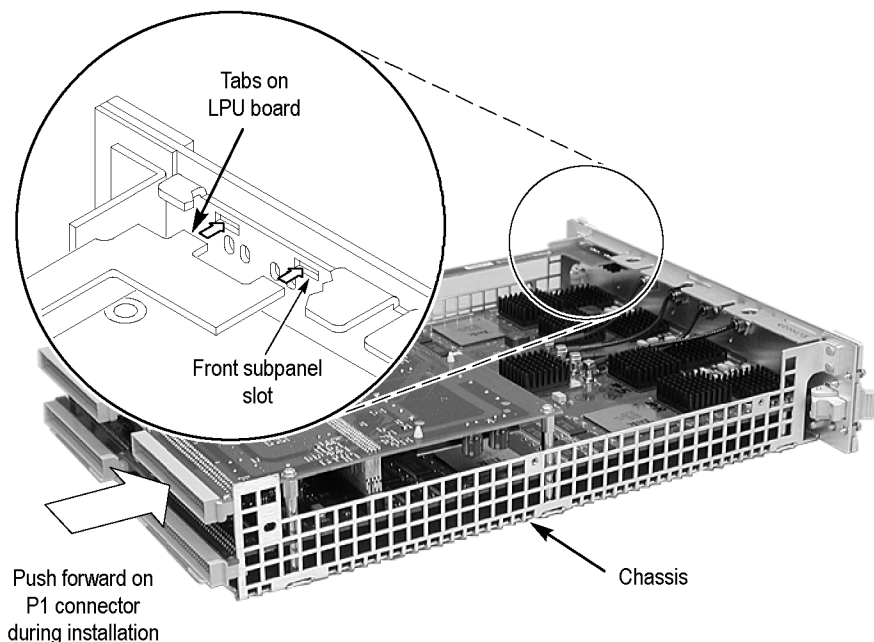


Figure 17: Inserting LPU board tabs into front subpanel

Acquisition Board

You will need a $\frac{1}{4}$ inch nut driver in addition to the T-10 Torx tip screwdriver to complete the following procedures.

Removal Use the following procedure to remove the acquisition board by referring the figure. (See Figure 20.)

1. Perform the *Covers* removal procedure. (See page 25.)
2. Perform the *Local Processor Unit Board* removal procedure. (See page 31.)

NOTE. *The 34-channel and 68-channel modules do not have a left side or right side merge cable. For these modules, ignore the steps dealing with the merge cable.*

3. Complete the following steps and figures to remove the merge cable assembly.
 - a. Turn the chassis over and remove the two T-10 screws from the merge cable assembly bracket as shown in the following figure.

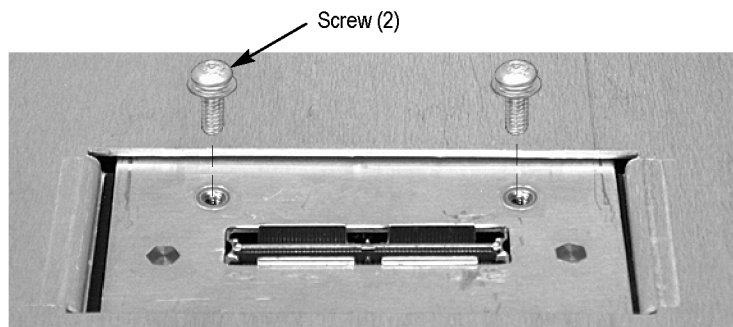


Figure 18: Remove the single screw from the merge cable bracket

- b. Carefully slide the bracket back underneath the cover until you can grasp the edge as shown in the following figure.
- c. Lift the merge cable assembly bracket out of the hole being careful not to damage the assembly.
- d. Disconnect the merge cable from the acquisition board and set the assembly aside.

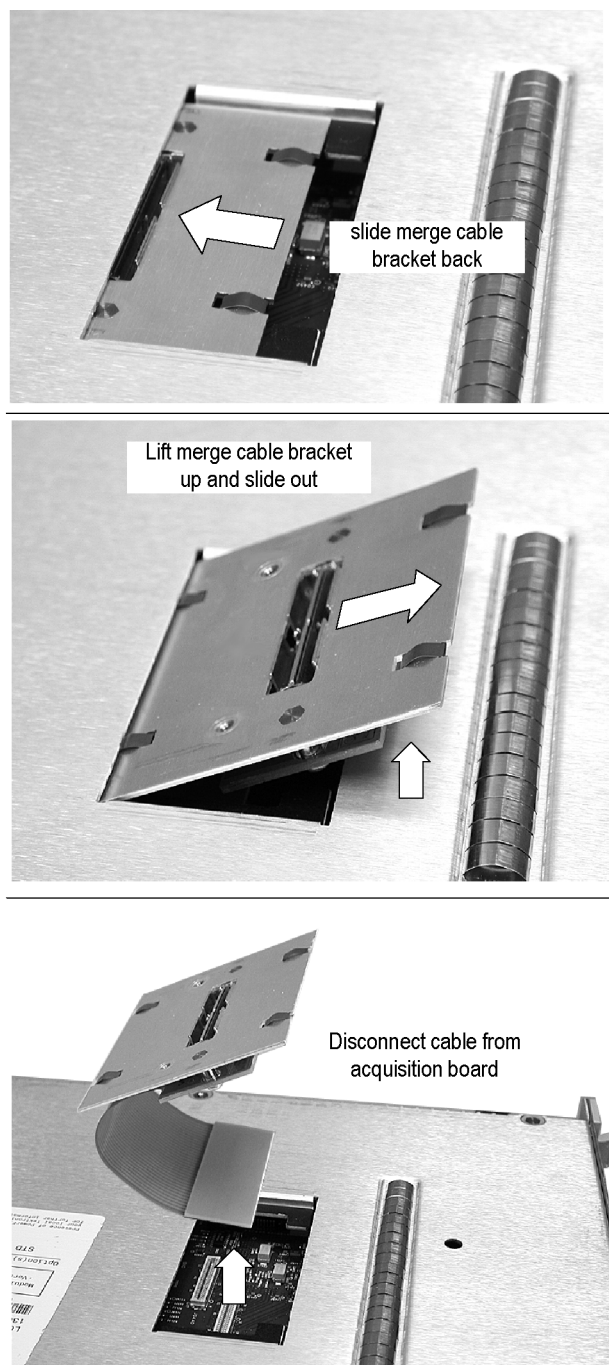


Figure 19: Removing the merge cable assembly

4. Turn the chassis over and then remove the five spacer posts with the $\frac{1}{4}$ nut driver from the acquisition board.
5. Disconnect the four analog output cables on the acquisition board.

6. Remove the five T-10 screws from the acquisition board located near the front of the chassis.

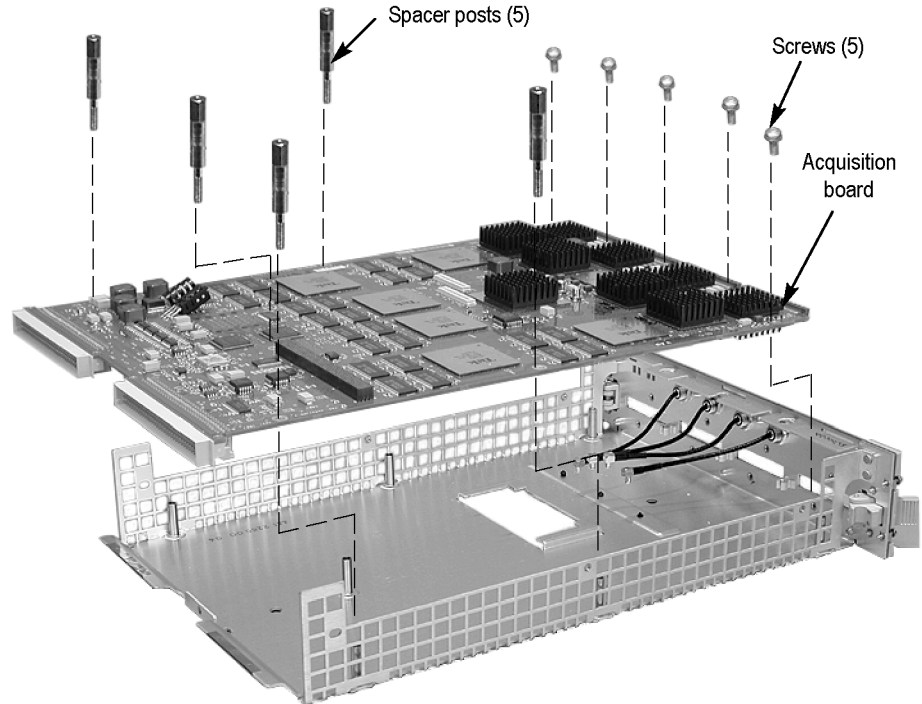
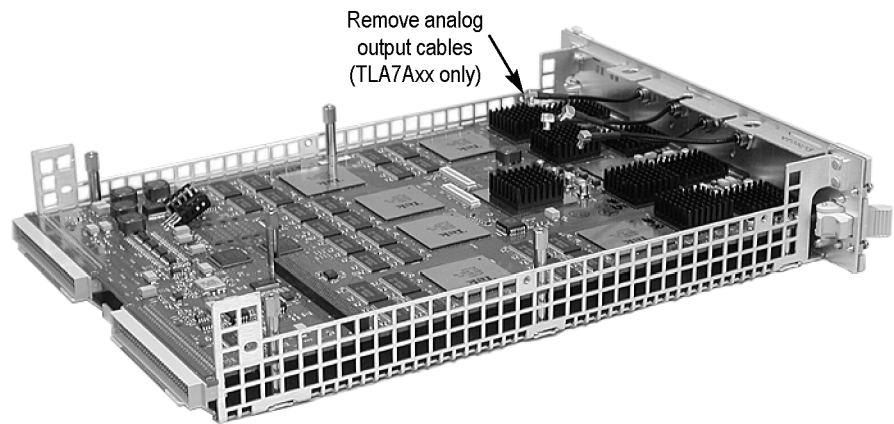


Figure 20: Removing the acquisition board from the chassis

7. Carefully slide the acquisition board away from the front panel until the probe connectors clear the front panel. Then lift the circuit board out of the chassis.

Installation

Use the following procedure to install the acquisition board:

1. Place the acquisition board into the chassis.
2. Carefully slide the acquisition board into the chassis until the probe connectors fit snugly into the front panel slots.
3. Install five T-10 screws on the acquisition board at the front of the chassis.
4. Install the five spacer posts that secure the acquisition board to the chassis.
5. Connect the four analog output cables from the front panel to the acquisition board.
6. Complete the following steps to install the merge cable assembly (skip these steps if your instrument does not have a merge cable assembly):
 - a. Turn the chassis over.
 - b. Feed the merge cable into the hole and connect it to the circuit board. (See Figure 19.)
 - c. Carefully slide the merge cable assembly into the hole.
 - d. Slide the bracket forward and install the two T-10 screws to hold the bracket in place.
7. Perform the *Local Processor Unit Board* installation procedure. (See page 32.)
8. Perform the *Covers* installation procedure. (See page 32.)

Front and Rear EMI Gaskets

Removal Use the following procedure to remove the front and rear EMI gaskets:

1. Perform the *Cover* removal procedure. (See page 33.)
2. For the front EMI gaskets:
 - a. Locate the gasket to be replaced.
 - b. Lift the gasket fingers and rotate the gasket off.
3. For the two rear gaskets on the chassis:
 - a. Perform the *Local Processor Unit Board* removal procedure. (See page 31.)
 - b. Perform the *Acquisition Board* removal procedure. (See page 33.)
 - c. Lift the gasket fingers and rotate the gasket off. (See Figure 21.)

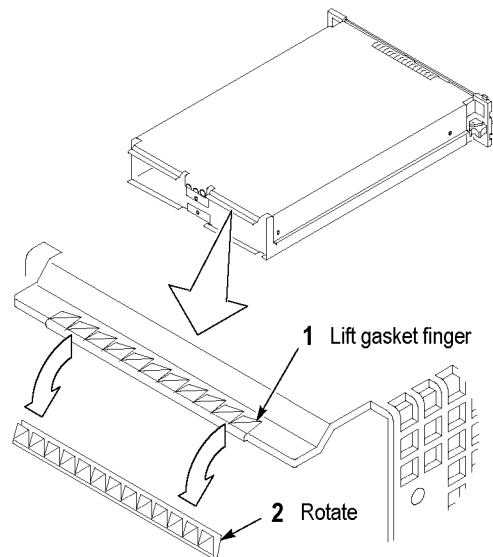


Figure 21: Rear EMI gasket removal

Installation Use the following procedure and figure to install the EMI gaskets:

1. Position each gasket so the gasket fingers face the outside of the module.



CAUTION. To avoid breaking the gasket fingers, do not lift the fingers too high.

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.

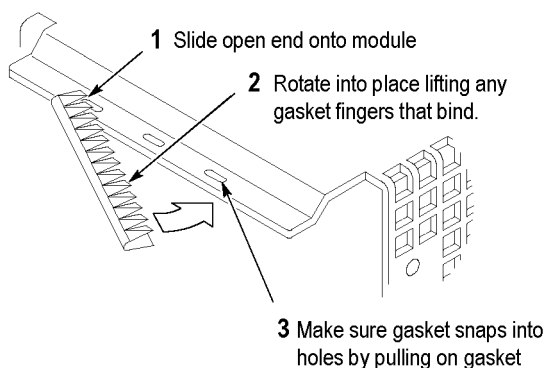


Figure 22: Rear EMI gasket replacement

4. Reinstall the Acquisition board if you removed them to install the rear EMI gaskets. (See page 36.)
5. Reinstall the LPU board if you removed them to install the rear EMI gaskets. (See page 32.)
6. Install the module covers. (See page 32.)

Side EMI Gaskets

To remove the side EMI gaskets, remove the covers and circuit boards as necessary to access the EMI gaskets. (See Figure 24.) Pop the EMI gaskets out of the cover.

To install the side EMI gaskets, pop them into place on the covers.

Troubleshooting



WARNING. Before performing this or any other procedure in this manual, read the *General Safety Summary and Service Safety Summary* located in the Tektronix Logic Analyzer Family Product Safety & Compliance Instructions (Tektronix part number 071-2591-xx). Also, to prevent possible injury or damage to electrical components, read *Preventing Electrostatic Discharge*. (See page 13.)

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

1. Review *Check for Common Problems* to eliminate easy to find problems. (See page 40.)
2. Perform procedures outlined in *Eliminate Other Problem Sources* to eliminate the mainframe, probes, and other modules as the source of the fault(s). (See page 41.)
3. Perform the *Troubleshoot the Logic Analyzer Module* procedure to identify the failed replaceable part within the module. (See page 43.)

If you replace a faulty circuit board or assembly found using these procedures, you must follow any verification and adjustment procedures identified in Table 5-6 for the replaced board. (See Table 6.)

Service Level

This section supports isolation of faults within the logic analyzer module to the replaceable-part level that's reflected in the replaceable parts lists in Mechanical Parts List section. (See page 53.) In most cases, faults are isolated to circuit boards or assemblies, but not to individual components on those boards. (See page ix.)

Fault isolation is supported to the following circuit boards and replaceable parts:

- LPU board
- Acquisition board

Required Documentation

You may need to refer to the additional service manuals to isolate faults. In addition, other manuals and other sections in this manual contain instructions you will need to complete repairs after locating a faulty part. For a list of supplemental documentation, refer to the following table.

Manual or Section	Purpose
<i>TLA7000 Series Mainframe Service Manual</i>	To eliminate benchtop or portable mainframe as problem source (whichever configuration is in use)
<i>TLA7000 Series Logic Analyzer Installation Manual</i>	To remove and reinstall modules in mainframe
<i>TLA7KUP Mainframe Field Upgrade Instruction Manual</i>	To reinstall the TLA application software

Check for Common Problems

Use the following table to quickly isolate possible failures. The table lists problems related to the logic analyzer module and possible causes. The list is not exhaustive, but it may help you eliminate problems that are easy to fix.



CAUTION. To avoid damaging the logic analyzer module or the mainframe, be sure to power down the mainframe before removing or reinstalling any modules.

Table 4: Failure symptoms and possible causes

Symptom	Possible cause(s)
Mainframe does not power on	<ul style="list-style-type: none"> ■ Power connection faulty; check or substitute power cord ■ Fuse blown; check line fuse ■ Mainframe power supply failure; contact local Tektronix service center ■ Mainframe controller is not installed properly (or not at all)
Mainframe does not boot	<ul style="list-style-type: none"> ■ Non-system disk or floppy in external drive; make sure logic analyzer boots from hard drive (Refer to the <i>TLA7000 Series Logic Analyzer Installation Manual</i> for software reinstallation procedures) ■ Hard drive failure or corrupted files on hard drive; contact local Tektronix service center
Modules not recognized	<ul style="list-style-type: none"> ■ Modules not fully inserted; make sure front of module is flush with front panel ■ Mainframe power supply failure; contact local Tektronix service center ■ Corrupted module firmware; reinstall firmware. Refer to the <i>TLA7KUP Mainframe Field Upgrade Instruction Manual</i> for information on reinstalling the latest firmware ■ Module logical address switches set to 00. Reset the switches to FF

Table 4: Failure symptoms and possible causes (cont.)

Symptom	Possible cause(s)
Controller does not power on	<ul style="list-style-type: none"> ■ Module not fully inserted; make sure front of module is flush with front panel ■ Module failure; try substituting a known-good controller module and if necessary, contact local Tektronix service center
Module does not pass the normal power on diagnostics (READY indicator not green)	<ul style="list-style-type: none"> ■ Module not fully inserted; make sure front of module is flush with front panel ■ Module failure; see <i>Troubleshoot the Logic Analyzer Module</i>, or contact local Tektronix service center ■ Open fuses on logic analyzer module circuit boards
Module loses settings when power is turned off	<ul style="list-style-type: none"> ■ Module failure; see <i>Troubleshoot the Logic Analyzer Module</i>, or contact local Tektronix service center ■ NV RAM failure; refer to the Local Processor Unit Board for LPU board replacement instructions. (See page 30.)
Module will not acquire data or the acquired data is incorrect	<ul style="list-style-type: none"> ■ Module failure; see <i>Troubleshoot the Logic Analyzer Module</i>, or contact local Tektronix service center ■ Faulty probe, leadset, or probe adaptor

Eliminate Other Problem Sources

The logic analyzer module is part of the Tektronix Logic Analyzer Family, which consists of modules installed in either a benchtop or portable mainframe. The following procedures will help you eliminate the mainframe and other modules as possible sources of failures.

Substitute a Good Module

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

1. Remove the suspect logic analyzer module from the mainframe.
2. Install a known-good logic analyzer module in the same slot as the suspected module (verify that address switches on the rear of the module are set to same address as the module that you are replacing).
3. Power-on the logic analyzer and check for normal operation.
4. If the failure symptoms are still present with the known-good logic analyzer module installed, the problem most likely is in the mainframe or in the attached probes, not in the logic analyzer module.
5. To eliminate the probes, use known-good probes and verify that the probes are properly connected to the target system.

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

6. If the logic analyzer operates normally with the known-good logic analyzer module and with known-good probes, the suspect logic analyzer module needs to be repaired. For additional troubleshooting procedures, refer to the *Troubleshoot the Logic Analyzer Module*. (See page 43.)

Probe-Level Troubleshooting

If the logic analyzer module acquires no data or faulty data, the probes may be at fault. Perform the following procedure to isolate faults to a probe or to the logic analyzer module.

NOTE. *The procedure below requires that the logic analyzer is functional and operates normally when the modules are installed.*

1. Verify that the probe is correctly connected to the module and to the target system.
2. Move the suspected probe to another probe connector and observe if the problem follows the probe. If the problem does not follow the probe, the module may be faulty.
3. Substitute the suspected probe with a known good probe and observe if the problem is still present. If the problem still occurs, the module may be faulty. To isolate the problems within that module, refer to the *Troubleshoot the Logic Analyzer Module*. (See page 43.)
4. If you are using a general purpose probe with lead sets and you have determined that the probe is faulty, try to isolate the problem to an individual

channel. A faulty channel may indicate a faulty probe podlet. Isolate faulty podlets by switching single podlets and observing if the problem tracks with the suspected podlet.

Troubleshoot the Logic Analyzer Module

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

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 the *Eliminate Other Problem Sources*. (See page 41.)

Equipment Required

The basic troubleshooting procedures require minimal test equipment. There are no accessible test points to measure voltages. An ohmmeter is recommended for checking fuses.

Preparation

The fault isolation procedure requires that you:

- Recognize codes flashed by the front-panel LEDs during power up
- Are familiar with the power-on diagnostics

To fill these requirements, read the topics below before performing the *Fault Isolation Procedure*. (See page 45.)

Calibration and Diagnostic Procedures

The following calibration and diagnostic procedures will help you diagnose problems.

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

Power-On Diagnostics. Power-on diagnostics check basic functionality of the logic analyzer at every power on. If any failures occur at power on, the screen displays the calibration and diagnostics property sheet.

If there are no diagnostic failures when you power on the logic analyzer, 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 tests individually or as a group
- Run tests once or continuously
- Run tests until failures occur

NOTE. *Certain diagnostic tests will fail if probes are attached. For best results, run the diagnostics with probes disconnected from the module.*

To run the extended diagnostics, do the following steps:

1. Disconnect the probes from the logic analyzer module.
2. Start the TLA application if it is not already running.
3. From the System menu, select Calibration and Diagnostics.
4. Select the Extended Diagnostics property page.
5. Select the individual tests, group of tests, or all tests.
6. Click the Run button.

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

Merged Modules. The extended diagnostics include a special merge test that verifies the correct pipeline adjustment for the master module, inside slave module, and outside slave module. This test does not require the modules to be physically merged together.

Every time modules are merged in the System Configuration window, a calibration is performed between the merged modules. An error message will appear if there are any problems with the merge cables, circuit board traces, or if the calibration fails.

Fault Isolation Procedure

The Primary Troubleshooting Tree provides troubleshooting steps that test the logic analyzer module. (See Figure 23.) Use the following procedure with that tree:

To determine if module is recognized, perform the following steps:

1. Install the logic analyzer module into a known-good mainframe.
2. Before you power on the mainframe, look at the READY, ACCESSED ARM'D, and TRIG'D front panel indicators.
3. Power on the mainframe and note how the front panel indicators respond.
 - a. Verify that the green READY indicator turns on while the diagnostics are being checked. If the green READY indicator does not turn on, the module is not being recognized which indicates possible problems on the LPU board.
 - b. Verify that after a few seconds the ACCESSED indicator turns on. The indicator stays on while the module is accessed by the controller. After the System window displays, the indicator blinks anytime the controller accesses the module.
4. If steps a and b are verified, the module is recognized; if not verified, the module is not recognized. Proceed as the troubleshooting tree instructs.
5. If diagnostic failures occur, replace the circuit board indicated by the troubleshooting tree. For further confirmation, you can correlate the failed test displayed with a board using the following table. (See Table 5.) *You should also first check the "special cases" of diagnostic failures below:*
 - Note from the tree, that if all the diagnostics pass, but self calibration fails, replace the Acquisition board.
 - If any of the Kernel test groups fail (ROM check, LPU RAM, LPU Address decode, etc.) replace the LPU board.
 - If the kernel group passes, but there are other failures, replace the Acquisition board. Also, ensure that the probes are disconnected from the module before running the diagnostics.
 - If multiple tests fail, the problem could be power-supply related problems or the mainframe. If replacing the acquisition board does not remedy the failures, try replacing the LPU board.

NOTE. *Due to the module design, there are no accessible test points on the module to connect external test equipment, to help isolate faults to an individual circuit board.*

6. Use the *Removal and Installation Procedures* to replace the faulty circuit board. (See page 23.)
7. Refer to the Table 5-6 after module replacement and perform *all* verification and adjustment procedures identified for the replaced module. (See Table 6.)

Primary Troubleshooting Chart

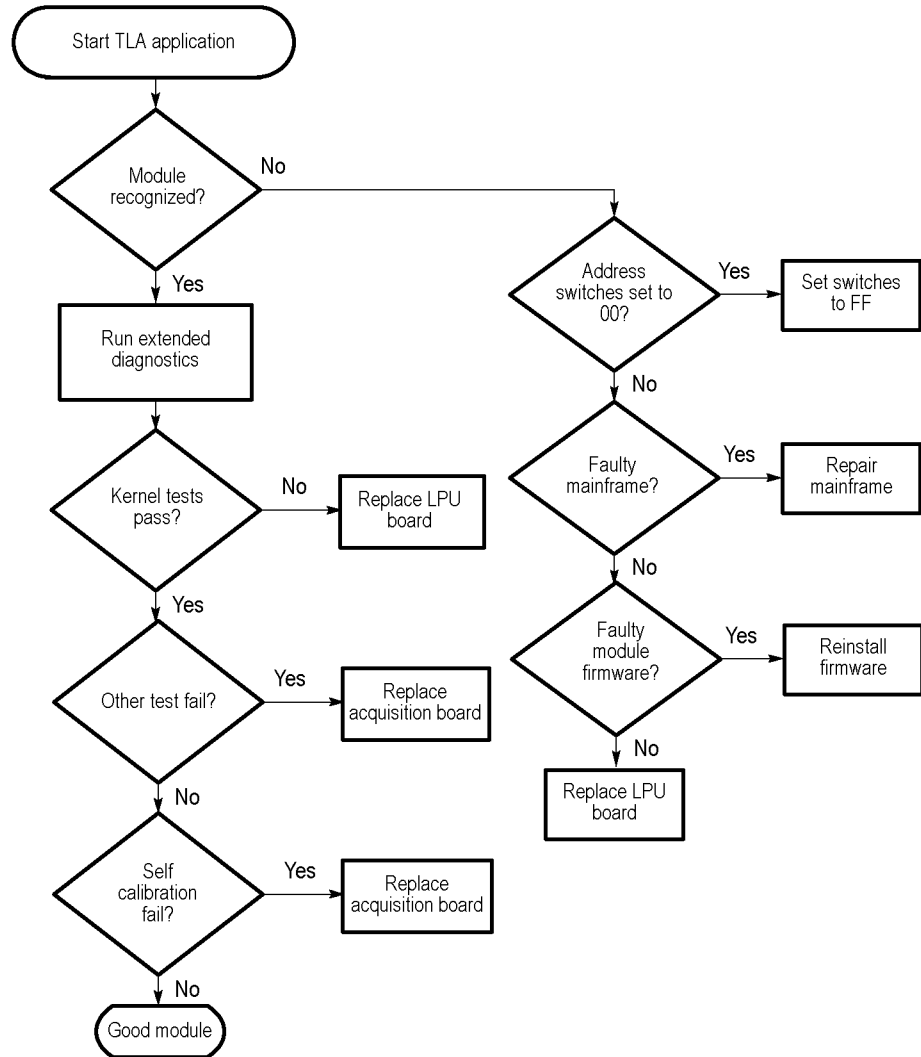


Figure 23: Primary troubleshooting chart

Diagnostics Table The following table can help you isolate problems to one of the circuit boards in the module (use the *Removal and Installation Procedures* to replace the faulty circuit board). (See page 23.)

Table 5: Diagnostic tests

Circuit board	Group	Test	Power on	Extended
LPU board	Kernel	ROM Check	✓	✓
		LPU RAM	✓	✓
		Address Decode	✓	✓
		NVRAM Check	✓	✓
Acquisition board	Timestamp	Timestamp Rollover	✓	✓
		Acquisition RAM Data Bus	✓	✓
		Acquisition RAM Address Bus	✓	✓
		Timestamp Acquire		✓
	Clock	Qualifier/Combiner RAM	✓	✓
		Clock State Machine RAM	✓	✓
	Acquisition Data Path	Address/Data Bus	✓	✓
		MagniVu RAM		✓
	Trigger	Internal RAM	✓	✓
		Trigger Crossbar	✓	✓
		Signal/Trigger Lines	✓	✓
		Trigger State Machine Counters	✓	✓
		Prefill Counter	✓	✓
		Word Recognizer	✓	✓
		Transition Detector	✓	✓
		Clock Group Detector	✓	✓
		At-speed Transition Detect		✓
		Snapshot		✓
	Acquisition RAM	RAM Select		✓
		Acquisition Memory		✓

Table 5: Diagnostic tests (cont.)

Circuit board	Group	Test	Power on	Extended
Acquisition board	Miscellaneous Tests	Acquisition Address Decode	✓	✓
		Threshold	✓	✓
		At-speed Async Acquire		✓
		Pseudo Random		✓
		SFDL-1	✓	✓
		SFDL-2	✓	✓
		PLL	✓	✓
		Demux		✓
		Edge Detector		✓
		Setup and Hold		✓
		Glitch		✓
		Memory Interface Controller	AD Bus	✓
	MAR Rollover		✓	✓
	Waveform 0		✓	✓
	Waveform 1		✓	✓
	Waveform Pins		✓	✓
	Waveform Change		✓	✓
	Search Stack		✓	✓
	Internal Search		✓	✓
	External Search		✓	✓
	Counters		✓	✓
	RAM Data		✓	✓
	RAM Address		✓	✓
	High-Speed Memory Compare		✓	✓
	Pattern Acquire			✓
	Miscellaneous 2 Tests	Counters		✓
		Timers		✓
		Store Stretch		✓
		Range Recognizer		✓
		Global Storage		✓
		CSM Input Path		✓

Adjustment After Repair

After replacing a circuit board or assembly due to electrical failure, locate the board removed in the following table and perform the indicated procedures.

Table 6: Requirements after replacement

Board replaced	Adjustment required	Verification checks
LPU board	Adjustment: PowerFlex ¹ , Firmware level restoration ² , Deskew, Self Calibration, Threshold tests	Self Calibration, Power-on and Extended Diagnostics, performance verification procedures
Acquisition board	Adjustment: Self Calibration, Deskew, Threshold tests	Self Calibration, Power-on and Extended Diagnostics, performance verification procedures

¹ The PowerFlex restoration or changes can only be made by Tektronix service personnel.

² Refer to the TLA7KUP Mainframe Field Upgrade Instruction Manual for instructions for updating module firmware.

Updating or Restoring the Logic Analyzer Firmware

You may have to update the firmware on the logic analyzer module if the module does not appear in the TLA System window after you have serviced the module or after you have updated the TLA application software on the mainframe. You can update multiple modules and module types during a single firmware update session. The most current firmware resides on a file on the hard disk of the logic analyzer mainframe.

1. Note which of the modules that may require new firmware.

If any modules are missing from the System window, you can verify the status of the modules by doing the following steps:

- Select System Properties from the System menu.
 - Click the Modules tab.
 - Note the information under the Messages column for any installed modules. If any modules indicate invalid or similar messages, you must update the firmware for those modules.
2. Disconnect any probes connected to the modules that you want to update.
 3. Exit the logic analyzer application.
 4. Click Start > Programs > Tektronix Logic Analyzer > TLA Firmware Loader.
 5. When you see the pop-up prompting you to cycle the power on the mainframe after completing the upgrade operation, click Yes.

The logic analyzer will scan the mainframe to determine which modules are installed and which modules can have their firmware upgraded. If you have any older modules, you may see them listed in the bottom half of the window.

These modules cannot be updated until you install the flash jumper on the rear of the modules.

6. Select the modules that you want to update from the list of modules displayed in the Supported list box near the top of the window. If you are updating more than one module at a time, note the slot location of the module in the selection box.
7. Select Load Firmware from the Execute menu.
8. Click the “TLA7AXX.lod file.”

NOTE. *Be sure to select the proper .lod file for each module. Note the slot number in the title bar so that you select the correct module for the .lod file.*

9. Click OK. You will be asked to confirm your action; click Yes when prompted.

NOTE. *The program will not allow you to load firmware to an incompatible module. For example, the program will not load DSO firmware to a logic analyzer module.*

The program will load the firmware for each module one at a time. The process may take several minutes per module.

10. Exit the firmware loader program and power down the logic analyzer. You must power down the logic analyzer to allow the TLA application to start up properly.
11. Remove the logic analyzer module from the mainframe.
12. Locate the big label on the side of the module.
13. Record the firmware version that is printed on the label. You will need this information to see that the firmware version matches the label.
14. Reinstall the module in the mainframe and power on the mainframe.
15. After the logic analyzer completes the power-on diagnostics, select System Properties from the System menu.
16. Click the module tab (for example, LA1).
17. Verify that the firmware version for the selected module matches the version on the label that you recorded in step 13.
18. If the firmware versions do not match, power down the mainframe, remove the module from the mainframe and update the label.

Repackaging Instructions

This section contains the information needed to repack the logic analyzer module for shipment or storage.

Packaging

If at all possible, use the original packaging to ship or store the instrument. If the original packaging is not available, 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. Add cushioning material to prevent the instrument from moving around in the shipping container. Seal the shipping carton with an industrial stapler or strapping tape.

Shipping to the Service Center

Contact the Service Center to get an RMA (return material authorization) number, and any return or shipping information you may need.

If the instrument is being shipped to a Tektronix Service Center, enclose the following information:

- The RMA number.
- The owner's address.
- Name and phone number of a contact person.
- Type of instrument and serial number.
- Reason for returning.
- A complete description of the service required.

NOTE. *When ordering the LPU board for exchange or repair, you will need to supply the above information, including the firmware level and PowerFlex configuration information.*

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



CAUTION. *When returning the LPU board separately, be sure to properly support the narrow LED arm of the circuit board so it will not be damaged during transit or storage.*

Storage

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

- Temperature range: -40 °F to +160 °F (-40 °C to +71 °C).
- Altitude: To 40,000 feet (12,190 meters).

Parts List

This section contains a list of the replaceable parts for the Tektronix logic analyzer module. Use this list to identify and order replacement parts, modules, and subcomponents.

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
- 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 representing 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 that you provide.

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the logic analyzer module. Use this list to identify and order replacement parts. The following table describes each column in the parts list.

Column	Column name	Description
1	Figure and 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 entry indicates the part is good for all serial numbers.
5	Qty	This indicates the quantity of parts used.
6	Name and 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.

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

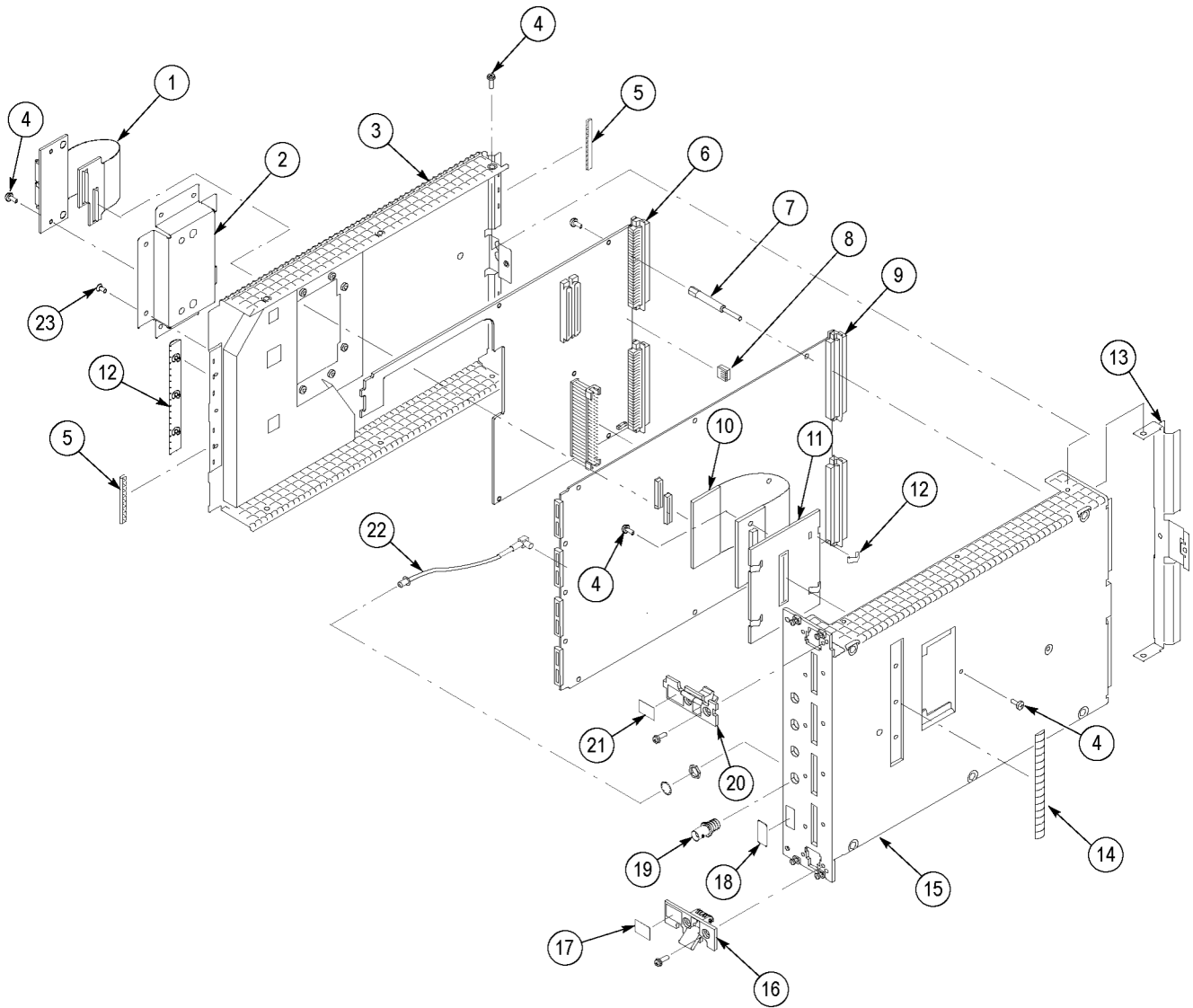


Figure 24: Logic analyzer module exploded view

Fig. index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
24-1	671-5339-XX			1	CIRCUIT BD ASSY:MERGE CONNECTOR, LEFT SIDE, TESTED
-2	407-4859-XX			1	BRACKET:MERGE, COVER, LEFT SIDE,0.050 AL
	407-4860-XX			1	BRACKET:BLANK FLAT,MERGE, COVER, LEFT SIDE, 0.050 AL
-3	200-4672-XX			1	COVER:TWO WIDE, 0.062 AL, TLA7000 SERIES,
-4	211-0409-XX			22	SCR, ASSEM WSHR:4-40 X 0.312, PNH, STL, CDPL, T-10 TORX DR
-5	348-1537-XX			6	GASKET, EMI:CLIP-ON, 1.98 L, BE CU, TIN PLATED, W/T LANCES

Parts List

Fig. index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
-6	671-5312-XX			1	CIRCUIT BD ASSY:LPU, LOCAL PROCESSOR UNIT
	150-1278-XX			3	DIODE,OPTO:LED, GRN, 569NM, 2MCD AT 5V, 60 DEG VIEW ANGLE, INTEGRAL RES, TINTED, DIFFUSED, RIGHT AN (NOT SHOWN)
	150-1279-XX			1	DIODE,OPTO:LED, YELLOW, 585NM, 2MCD AT 5V, 60 DEG VIEW ANGLE, INTEGRAL RES, TINTED DIFFUSED, RIGHT (NOT SHOWN)
-7	129-1478-XX			5	SPACER, POST:1.738 L, 1.113 SPACING, W/ 0.35 L, 0.25 HEX, W/ 4-40 INT THD X 6-32 EXTERNAL THD, NIC
-8	260-2597-XX			2	SWITCH,ROTARY:HEXADECIMAL, 100MA AT 50VDC, RIGHT ANGLE, 0.430 W X 0.400 H X 0.202 L
-9	671-6442-XX			1	CIRCUIT BD ASSY:68 CH, 128MB, ACQUISITION, TLA7AC2
	671-6443-XX			1	CIRCUIT BD ASSY:102 CH, 128MB, ACQUISITION, TLA7AC3
	671-6444-XX			1	CIRCUIT BD ASSY:136 CH, 128MB, ACQUISITION, TLA7AC4
-10	671-5340-XX			1	CIRCUIT BD ASSY:MERGE CONNECTOR, RIGHT SIDE, TESTED, TLA7AA3, TLA7AA4, TLA7AB4, TLA7NA3, TLA7NA4
-11	407-4861-XX			1	BRACKET:MERGE,CHASSIS, RIGHT SIDE, 0.062 AL
	407-4862-XX			1	BRACKET:BLANK FLAT, MERGE, CHASSIS, RIGHT SIDE, 0.062 AL
-12	131-6643-XX			4	CONTACT, ELEC:GROUNDING, 0.169 L, 0.320 DEEP, ELECTROLESS NICKEL
-13	386-6868-XX			1	PANEL, VXI:VXI APPLICATION, TWO-WIDE, BACK PANEL
-14	348-1365-XX			2	SHLD GSKT, ELEC:SYMETRICAL SLOTTED FINGER, 0.350 W X 7.5 L, RIVIT MTG, SNAP-IN, RIVIT SPACING 1.5 IN
-15	441-2258-XX			1	CHASSIS ASSY:68 CH, W/SUB FRONT PANEL LEXAN, 0.62 AL, TLA7AC2
	441-2259-XX			1	CHASSIS ASSY:102 CH, W/SUB FRONT PANEL LEXAN, 0.62 AL, TLA7AC3
	441-2260-XX			1	CHASSIS ASSY:136 CH, W/SUB FRONT PANEL LEXAN, 0.62 AL, TLA7AC4
-16	367-0484-XX			1	HANDLE,EJECTOR:INJECTOR/EJECTOR ASSEMBLY, TWO WIDE VXI, W/OUT KEYING, SPRING LOADED, PLASTIC, 20% GL
-17	335-0646-XX			1	MARKER, IDENT:LABEL, MKD FOR USE WITH TLA7000 SERIES, BOTTOM INJECTOR/EJECTOR, 0.745 X 0.520, 0.010
	335-1163-XX			1	MARKER, IDENT:LABEL, MKD FOR USE WITH TLA7000 SERIES, BOTTOM INJECTOR/EJECTOR, 0.745 X 0.520, 0.010
-18	335-0639-XX			1	MARKER, IDENT:CONFIGURATION LABEL, MKD TIMING, STATE SPEED, RAM DEPTH, 0.475 X 0.975, 0.010 POLY, GE
-19	131-1315-XX			4	CONN, RF JACK:BNC, PNL, 50 OHM, FEMALE, STR, PELTOLA/PNL MNT, SILVER ALLOY, 0.576 MLG X 0.366 TERMN
-20	367-0483-XX			1	HANDLE:INJECTOR/EJECTOR ASSEMBLY, TWO WIDE VXI, W/KEYING, SPRING LOADED, PLASTIC, 20% GLASS-
-21	335-2074-XX			1	LABEL, IDENTIFICATION, TLA7AC2
	335-2075-XX			1	LABEL, IDENTIFICATION, TLA7AC3
	335-2076-XX			1	LABEL, IDENTIFICATION, TLA7AC4
-22	174-4542-XX			4	CA ASSY, RF:COAXIAL, 50 OHM, 8.0 L, MCX TO PELTOLA

Fig. index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description
-23	211-0486-XX			8	SCREW, MACHINE:4-40 X 0.168 L, FLH, 100 DEG, TORX T-9
	174-4595-XX			4	CABLE ASSY:BNC - BNC, 10X ATTENUATION, 50 OHM COAX
	174-4596-XX			1	CABLE ASSY; STRANDED 7 INDIVIDUAL 16 AWG
	174-4597-XX			1	CABLE ASSY;RIBBON, EXTENDER CABLE FIXTURE, 28 AWG STRANDED CABLE 2 X 17, 0.1 INCH PITCH, CENTER POLARIZED
