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Service Manual

Tektronix

TVS600 & TVS600A Series Waveform Analyzers

070-9915-02

VXI bus

www.tektronix.com

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

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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)
Five years repair coverage	Option R5	Provides five years of repair coverage for the instrument, including displays and accessories sold with the instrument
Five years of calibration service	Option C5	Provides initial certification on delivery, plus four more annual calibrations from your service center.
Test data	Option D5	Provides last data on delivery, and when annual calibrations services are provided (five total, requires Option C5).

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General Safety Summary

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

Only qualified personnel should perform service procedures.

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

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 markings 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.

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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

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Service Safety Summary

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

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

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

Use 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.

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Preface

This is the service manual for the waveform analyzer. Use the information in this manual to service the waveform analyzer to the module level.

Manual Structure

This manual is divided into chapters, such as *Specifications* and *Performance Verification*. Within each chapter, the information is further divided into subsections such as *Product Description* and *Equipment Required*.

Subsections that contain procedures also contain introductions before the procedures. Be sure to read these introductions because they provide information that is needed to do the service correctly and efficiently. The following list provides a brief description of the chapters contained in this manual:

- *Specifications* describes the waveform analyzer and the characteristics that apply to it.
- *Operating Information* includes general information and operating instructions at the level needed to safely power on and service the waveform analyzer.
- *Theory of Operation* contains circuit descriptions that support general service to the module level.
- *Performance Verification* contains an automatic software procedure to verify that the waveform analyzer functions properly and meets warranted specifications.
- *Adjustment Procedures* refers to the *Performance Verification* section for adjusting the waveform analyzer to meet warranted specifications.
- *Maintenance* contains information and procedures for performing preventive and corrective maintenance. These instructions include cleaning, module replacement, and fault isolation to the module level.
- *Options* describes standard accessories, optional accessories, and options that may be installed in the waveform analyzer.
- *Electrical Parts List* refers you to *Mechanical Parts List*, where both electrical and mechanical modules are listed. See below.
- *Diagrams* contains a block diagram and an interconnection diagram that are useful when isolating failed modules.

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- *Mechanical Parts List* contains an illustration that shows all replaceable modules, and a table that lists the replaceable modules, their descriptions, and their Tektronix part numbers.

Manual Conventions

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

Modules

Throughout this manual, the term *module* refers to a TVS600A Series Waveform Analyzer that mounts inside a Tektronix VXIbus mainframe. A module is composed of circuit cards, interconnecting cables, and a user-accessible front panel.

Slot 0 Controller

References to the Slot 0 controller include the VXIbus Embedded Slot 0 Controller or the MXI/VXI Slot 0 interface and external controller.

Safety

Symbols and terms related to safety appear in the *General Safety Summary* near the front of this manual.

Related Manuals

The following manuals are related to the use of the waveform analyzer:

- The *TVS600 and TVS600A Waveform Analyzers Reference* (Tektronix part number 070-9918-XX) provides an alphabetical listing of the programming commands. It is the quick command reference and is a standard accessory.
- The *TVS600 and TVS600A Waveform Analyzers Command Reference* (Tektronix part number 070-9917-XX) provides an alphabetical listing of the programming commands and details. It is the comprehensive command reference and is a standard accessory.
- The *TVS600 and TVS600A Waveform Analyzers User Manual*.(Tektronix part number 070-9916-XX) provides information on how to operate a waveform analyzer and is a standard accessory.
- The *TVS600A VXIplug&play Driver Online Reference* documents the robust library of functions that ships with this product. The TVS600A VXI-*plug&play* software is a standard accessory included with the user manual.
- The online help for the *VXIplug&play Soft Front Panel* documents the Soft Front Panel, an application that ships with this product. The TVS600A VXI*plug&play* software is a standard accessory included with the user manual.

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Introduction

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

To prevent personal injury or damage to the waveform analyzer, consider the following 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
- Read *Operating Information* beginning on page 2–1

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

Adjustment Interval

Generally, you should perform the adjustments described in the *Adjustment Procedures* only if the Performance Verification procedure fails. Performance Verification is recommended after module replacement, and at yearly intervals.

Strategy for Servicing

This manual supports and contains information needed for periodic maintenance of the TVS621, TVS621A, TVS625, TVS625A, TVS641, TVS641A, TVS645 & TVS645A Waveform Analyzer Modules. (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 of Chapter 10
- Supports removal and replacement of those boards or assemblies
- Supports removal and replacement of fuse, knobs, chassis, and other mechanical parts listed in the replaceable parts list

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

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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 TVS621, TVS621A, TVS625, TVS625A, TVS641, TVS641A, TVS645 & TVS645A Waveform Analyzer Modules. Tektronix technicians train on Tektronix products; they have access to the latest information on improvements to the TVS621, TVS621A, TVS625, TVS625A, TVS641, TVS641A, TVS645 & TVS645A Waveform Analyzer Modules as well as the latest new product upgrades.

Warranty Repair Service

Tektronix warrants this product for three 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 TVS621, TVS621A, TVS625, TVS625A, TVS641, TVS641A, TVS645 & TVS645A Waveform Analyzer Modules.

Service Options. 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. These service options are listed on the *Tektronix Service Options* page on the back of the warranty page of this manual.

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 TVS621, TVS621A, TVS625, TVS625A, TVS641, TVS641A, TVS645 & TVS645A Waveform Analyzer Modules. Service agreements may be customized to meet special turn-around time and/or on-site requirements.

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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.

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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* 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.

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Specifications

This chapter provides the specifications of the waveform analyzer. *Product Description* (below) is a general description of the instrument. The *Specification Tables*, which begin on page 1–1, contain all the specifications.

Product Description

The TVS600 and TVS600A Waveform Analyzers are a family of C-size, two-slot VXI modules suitable for use in a variety of test and measurement applications and systems. Many key features are listed below:

- Eight standard configurations with full-featured, 1 MΩ/50 Ω inputs
- Maximum realtime digitizing rate up to 5 GSamples per 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
TVS645 & TVS645A	4	5 GSamples/second	1 GHz
TVS641 & TVS641A	4	1 GSamples/second	250 MHz
TVS625 & TVS625A	2	5 GSamples/second	1 GHz
TVS621 & TVS621A	2	1 GSamples/second	250 MHz

- Maximum record length of 30,000 samples with 8-bit vertical resolution.
- Full programmability using a SCPI command set.
- Acquisition modes such as sample, envelope, and average.
- Internal triggering modes plus VXI backplane and external trigger sources.

Specification Tables

This section contains tables that list the specifications for the waveform analyzer. All specifications are guaranteed unless noted “typical.” Specifications that are marked with the ✓ symbol are checked in the *Performance Verification* section.

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

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

Table 1-2: 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 <20 mV	
✓	Accuracy, DC Voltage Measurement	±(1.5% of input signal + 1% of full scale range) with instrument temperature within 5° C of the temperature when last Self Cal'ed and for input ranges ≥50 mV full scale	
✓	Accuracy, Delta DC Voltage Measurement	±(1.5% of input signal + 0.1% of full scale range) with instrument temperature within 5° C of the temperature when last Self Cal'ed	
✓	Accuracy, 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 or DC-1 MΩ Coupled	*Full Scale Range Setting*	*Bandwidth[2]*
		10.1 V - 100 V	DC - 500 MHz (TVS625, TVS625A, TVS645 & TVS645A) DC - 250 MHz (TVS621, TVS621A, TVS641 & TVS641A)
		100 mV - 10 V	DC - 1 GHz (TVS625, TVS625A, TVS645 & TVS645A) DC - 250 MHz (TVS621, TVS621A, TVS641 & TVS641A)
		50 mV - 99.8 mV	DC - 750 MHz (TVS625, TVS625A, TVS645 & TVS645A) DC - 250 MHz (TVS621, TVS621A, TVS641 & TVS641A)

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

Characteristic	Description		
	20 mV - 49.8 mV	DC - 600 MHz (TVS625, TVS625A, TVS645 & TVS645A) DC - 250 MHz (TVS621, TVS621A, TVS641 & TVS641A)	
	10 mV - 19.8 mV	DC - 500 MHz (TVS625, TVS625A, TVS645 & TVS645A) DC - 250 MHz (TVS621, TVS621A, TVS641 & TVS641A)	
Bandwidth, Analog, Selections	20 MHz, 250 MHz, and FULL		
Calculated Rise Time, typical[3] Typical full-bandwidth rise times are shown in the chart to the right	*Full Scale Range Setting*	*TVS621, TVS621A, TVS641 & TVS641A*	*TVS625, TVS625A, TVS645 & TVS645A*
	10.1 V - 100 V	900 ps	1.8 ns
	100 mV - 10 V	450 ps	1.8 ns
	50 mV - 99 mV	600 ps	1.8 ns
	20 mV - 49.9 mV	750 ps	1.8 ns
	10 mV - 19.9 mV	900 ps	1.8 ns
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 at 25° C and ≤150 ps with equal Full Scale Range and Coupling settings for CH1 - CH3 and CH1 - CH4 above 35° C		
Frequency Limit, Upper, 20 MHz Bandwidth Limited, typical	20 MHz		
Frequency Limit, Upper, 250 MHz Bandwidth Limited, typical	180 MHz		
Input Channels, Number of	*Product*	*Channels*	
	TVS641, TVS641A, TVS645 & TVS645A	Four	
	TVS621, TVS621A, TVS625 & TVS625A	Two	
Input Coupling	DC, AC, or GND[4]		
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	The greater of ±300 Vrms or 420 Vpeak DC, derated at 20 dB/decade above 1 MHz CAT II (see *Installation Category Descriptions* on page 1-12 for more information)		
Input Voltage, Maximum, DC-50 Ω or AC-50 Ω Coupled	5 V_{RMS}, with peaks ≤ ±25 V		

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

Characteristic	Description				
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 Range)			
	250 MHz	≤(165 μV + 0.5% of the Full Scale Range)			
	20 MHz	≤(75 μV + 0.5% of the Full Scale Range)			
Range, 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%

1 Net offset is the nominal voltage level at the waveform analyzer input that corresponds to the center of the A/D-Converter dynamic range. Offset accuracy describes the precision of the net offset voltage.

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.

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.

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

6 The sensitivity ranges are 10 mV to 100 V full scale, switching in a 1-2-5 sequence of coarse settings. Between these 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.

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Table 1-3: Timebase system

Characteristic	Description
✓ Accuracy, Long Term Sample Rate and Delay Time	±100 ppm over any interval ≥1 ms
Accuracy, Trigger-to-Trigger Measurement (TVS600A models only)	±100 ps + (timebase accuracy x reading))
Range, Extended Realtime Sampling Rate	5 S/s to 10 MS/s in a 1-2.5-5 sequence
Range, Realtime Sampling Rate	
TVS621, TVS621A, TVS641 & TVS641A	20 MS/s to 5 GS/s on all channels simultaneously in a 1-2.5-5 sequence
TVS625, TVS625A, TVS645 & TVS645A	20 MS/s to 1 GS/s on all channels simultaneously in a 1-2.5-5 sequence
Record Length	256, 512, 1024, 2048, 4096, 8192, 15,000 30,000 (extended realtime sampling mode only)
Time Stamping	125 ns resolution 0.1% variance
Digitized Bits, Number of	8 bits

Table 1-4: Trigger system

Characteristic	Description	
✓ Accuracy (Time) for Pulse Glitch or Pulse Width Triggering	*Time Range*	*Accuracy*
TVS600 models only	1 ns to 1 μs	±(20% of Setting + 0.5 ns)
	1.02 μs to 1 s	±(204.5 ns + 0.01% of Setting)
TVS600A models only: limits are valid when using a time-base reference frequency of 10 MHz ±0.01%	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 External Trigger Level	±(5% + 150 mV) for signals having rise and fall times ≥20 ns	
✓ Accuracy (DC) for Internal Trigger Level, DC Coupled	±[(2% × | Setting) | + 0.03 of Full Scale Range + Offset Accuracy)] for signals having rise and fall times ≥20 ns	
Holdoff, Variable Main Trigger, typical[1]	For all sampling rates, the minimum holdoff is 250 ns and the maximum holdoff is 12 s; the minimum resolution is 8 ns for settings ≤1.2 μs	
Input, External Trigger, typical	50 Ω input resistance; ±5 V (DC + peak AC) maximum safe input voltage; DC coupled only	
Range, Delayed Trigger Time[2]	16 ns to 250 s	
Range, Delta-Time, Slew-Rate Triggering	1 ns to 1 second	
Range, Events Delay	1 to 10,000,000	

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Table 1-4: Trigger system (cont.)

Characteristic	Description		
Ranges, (Setup/Hold Times) for Setup/Hold Violation Trigger	*Feature*	*Minimum*	*Maximum*
	Setup time[3]	-100 ns	100 ns
	Hold time[4]	1 ns	102 ns
	Setup + Hold time[5]	2 ns	NA
Range (Time) for Pulse Glitch and Pulse Width Triggering	2 ns to 1 s		
Range (Time) for Time-Qualified Runt Triggering (TVS600A models only)	2 ns to 1 s		
Range, Trigger Level	*Source*	*Range*	
	Any Channel	±100% of full scale range	
	External Input	±1 V	
Range, Trigger Point Position	Minimum: 0 Maximum: 30,000		
Resolution, Trigger Level	0.02% of full scale for any Channel source and 2 mV for the External Input source		
Resolution, Trigger Position	One sample interval at all sample rates		
Sensitivities, Events Delay, DC Coupled, typical	10% of full scale, from DC to 500 MHz, for Full Scale Range settings >100 mV and ≤10 V at the BNC input		
Sensitivities, Logic-Type Trigger (TVS600A models only)	10% of full scale, from DC to 500 MHz, for Full Scale Range settings >100 mV and ≤10 V at the BNC input		
Sensitivities, Pulse-Type Runt Trigger, typical	10% of full scale, from DC to 500 MHz, for Full Scale Range settings >100 mV and ≤10 V at the BNC input		
Sensitivities, Pulse-Type Trigger Width and Glitch, typical	10% of full scale, for Full Scale Range settings >100 mV and ≤10 V at the BNC input		

1 **Main Trigger is controlled with the TRIGger:A commands.**

2 **Delayed Trigger is controlled with the TRIGger:B commands.**

3 **Positive numbers define times before the clock edge and negative numbers define times after the clock edge.**

4 **Positive numbers define times after the clock edge and negative numbers define times before the clock edge.**

5 **The algebraic sum of the setup and hold time set by the user.**

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Table 1–4: Trigger system (cont.)

Characteristic	Description		
✓ Sensitivity, Edge-Type Trigger, DC Coupled[6]	The minimum signal levels required for stable edge triggering of an acquisition when the source is DC-coupled.		
	Products	*Trigger Source*	*Sensitivity*
	TVS625, TVS625A, TVS645 & TVS645A	Any Channel	3.5% of Full Scale Range from DC to 50 MHz, increasing to 10% of Full Scale Range at 1 GHz
	TVS621, TVS621A, TVS641 & TVS641A	Any Channel	3.5% of Full Scale Range from DC to 50 MHz, increasing to 10% of Full Scale Range at 250 MHz
	All models	External	25 mV from DC to 50 MHz, increasing to 50 mV at 100 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	
Time, Minimum Pulse or Rearm, and Minimum Transition Time, for Pulse-Type Triggering, typical	For Full Scale Range settings >100 mV and ≤10 V at the BNC input		
	Pulse Class	*Minimum Pulse Width*	*Minimum Rearm Width*
	Glitch	2 ns	2 ns + 5% of Glitch Width Setting
	Width	1 ns	2 ns + 5% of Width Upper Limit Setting
TVS600A models only	Runt Time-qualified	2 ns 2 ns	2 ns 8.5 ns + 5% of Width Setting
TVS600A models only	Slew Rate	600 ps[7]	8.5 ns + 5% of Delta Time Setting

6 Delayed Trigger has the same specifications as Main Trigger.

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Table 1-4: Trigger system (cont.)

Characteristic	Description			
Time, Minimum Pulse or Rearm, for Events Delay Triggering, typical	The following chart shows the minimum values for input range settings >100 mV and ≤10 V at the BNC input			
	Triggering Type	*Minimum Pulse Width*	*Minimum Rearm Time*	*Minimum Time Between Channels*[8]
	Events Delay	1 ns (for either + or – pulsewidths)	N/A	2 ns
	Logic	N/A	1 ns	1 ns
Trigger Position Error, Edge Triggering, typical	*Acquisition Mode*		*Trigger Position Error*[9]	
	Sample, Average		±(1 Sample Interval + 1 ns)	
	Envelope		±(2 Sample Intervals + 2 ns)	

7 For slew rate triggering, this is actually the minimum transition time defined t be the time the test signal spends between the two trigger threshold settings.

8 For Events Delay, the time is the minimum time between a main and delayed event that will be recognized if more than one channel is used. For Logic, time between channels refers to the length of time a logic state derived from more than one channel must exist to be recognized.

9 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 1-5: Front-panel connectors

Characteristic	Description	
Arm Input	This input provides external arming capability with a BNC connector	
	Characteristic	*Limits*
	Arming Threshold Voltage	≤0.8 V
	Input Voltage Range	0 to 5 V_{pk}, TTL-compatible (arms on a switch closure to ground; internal pull-up resistor to +5 volts is provided)
	Latency	10 μs
	Minimum Pulsewidth	10 μs
Fiducial Input, typical[1]	This input provides fiducial input capability with a BNC connector; the polarity of the signal acquired is inverted with respect to the input	
	Characteristic	*Limits*
	Fiducial Amplitude	75 mV to 207 mV
	Input Impedance	0.01 μF in series with 50 Ω

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Table 1–5: Front-panel connectors (cont.)

Characteristic	Description		
	Input LF Attenuation	Attenuates signals below 100 MHz (high-pass time constant of 5 ns)	
	Input Sensitivity	*CH 1 Full Scale Range*	*Fiducial Full Scale Range*
		10 mV to 1 V	6 times the CH 1 Full Scale Range setting
		1.01 V to 10 V	0.6 times the CH 1 Full Scale Range setting
		10.1 V to 100 V	0.06 times the CH 1 Full Scale Range setting
	Input Voltage Range	±1 V	
	Maximum Input	2 V_{RMS}	
	Rise Time	*Products*	*Rise Time*
		TVS625, TVS625A, TVS645 & TVS645A	≤3.5 ns (10% to 90%)
		TVS621, TVS621A, TVS641 & TVS641A	≤4.0 ns (10% to 90%)
✓ Output, Reference	*Characteristic*	*Limits*	
	Output Voltage	8 V ±1%	
	Internal Frequency Reference	Frequency is 10 MHz ±0.015% Amplitude is ≥1 V_{p-p} into 50 Ω	
Probe Compensation, Output Frequency, typical	1 kHz ±25%		
✓ Probe Compensation, Output Voltage	0.5 V (base-top) ±1% into a ≥50 Ω load		
Serial Interface	This front panel-mounted 9-pin D connector provides a serial interface with the following pin assignments: 1 DCD 2 RXD 3 TXD 4 DTR 5 GND 6 DSR 7 RTS 8 CTS 9 No Connection		

[1] **The FIDUCIAL Input signal should be a short-duration (≤3 ns), fast rise time (≤2 ns) pulse.**

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Table 1-6: VXI interface

Characteristic	Description	
Addressing	Dynamic autoconfigure	
Inputs, ECLTRG	Either of the two ECLTRG lines may be individually selected to arm or trigger an acquisition. Arming can occur on either sense of the ECL signal. Trigger can be specified to occur on either the high-to-low transition or the low-to-high transition.	
Inputs, TTLTRG	Any of the eight TTLTRG lines may be individually selected to arm or trigger an acquisition. Arming can occur on either sense of the TTL signal. Trigger can be specified to occur on either the high-to-low transition or the low-to-high transition.	
Interface Type	Message based (I4)	
Interrupts	Programmable interrupter level 1-7	
Outputs, ECLTRG	Either of the two ECLTRG lines can be driven by the following signals: ARM — The waveform analyzer is armed and waiting for a trigger ATR — Main trigger event has occurred BTR — Delayed trigger event has occurred CALC — DSP Calc function “TRG ()” evaluated TRue OPC — Operation pending complete	
Outputs, TTL	Each of the TTLTRG lines (TTLTRG0*-TTLTRG7*) can be driven by the following signals: ARM — The waveform analyzer is armed and waiting for a trigger ATR — Main trigger event has occurred BTR — Delayed trigger event has occurred CALC — DSP Calc function “TRG ()” evaluated TRue OPC — Operation pending complete	
Outputs, TTLTRG, Logic Levels	Based on the VXIbus Specification RULE B.6.17	
	Characteristic	*Limits*
	Vout(HI)	Determined by the mainframe termination; the TTL outputs are open collector
	Vout(LO)	≤0.6 V when sinking 48 mA
Outputs, TTLTRG, Logic Polarity	Normal polarity: Negative TRUE; high-to-low transition indicates the event occurred Inverted polarity: Positive TRUE; low-to-high transition indicates the event occurred	
Protocols	Word Serial (WSP) Fast Data Channel FDC TEK V2.1	
VXI	Complies with revision 1.4	

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Table 1-7: Power distribution and data handling

Characteristic	Description		
Current Requirements, TVS641, TVS641A, TVS645 & TVS645A	*Voltage*	*DC Current*	*Dynamic Current*
	+12 V	1.3 A	0.45 A
	+5 V	11.0 A	0.8 A
	-5.2 V	4.6 A	0.09 A
	-12 V	1.0 A	0.4 A
Current Requirements, TVS621, TVS621A, TVS625 & TVS625A	*Voltage*	*DC Current*	*Dynamic Current*
	+12 V	1.0 A	0.45 A
	+5 V	8.0 A	0.7 A
	-5.2 V	2.7 A	0.05 A
	-12 V	0.8 A	0.4 A
Nonvolatile Memory Retention Time, typical	Battery life is ≥5 years		
Power Requirements, typical	*Products*	*Power Requirements*	
	TVS641, TVS641A, TVS645 & TVS645A	106.5 Watts	
	TVS621, TVS621A, TVS625 & TVS625A	75.6 Watts	

Table 1-8: Environmental

Characteristic	Description
Airflow Resistance	≤0.204 mm H_2O air pressure with 6.6 l/s airflow
Altitude, Operating and Nonoperating	Operating: to 15,000 feet (4570 m) Nonoperating: to 40,000 feet (12,190 m)
Classification	This instrument is suitable for operation in Tektronix and MIL-T-28800E Class 5 environments, provide that it is operated in a mainframe which has been qualified for Class 5 environments and which imparts stresses to this module within the limits specified in this table. 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 for exterior air when operated in a mainframe with 15° C internal temperature rise Nonoperating: -40° C to +71° C

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Table 1-9: Certifications and compliances

Characteristic	Description
EC Declaration of Conformity - EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities[1]: EN 50081-1 Emissions: EN 55011 Class A Radiated and Conducted Emissions EN 60555-2 AC Power Line Harmonic Emissions EN 50082-1 Immunity: IEC 801-2 Electrostatic Discharge Immunity IEC 801-3 RF Electromagnetic Field Immunity IEC 801-4 Electrical Fast Transient/Burst Immunity IEC 801-5 Power Line Surge Immunity[2] 1 To assure the product operates in conformance with the specifications listed above, the product must be used in a mainframe that is equipped with backplane shields that comply with Rule B.7.US of the VXI specification. 2 TVS600A models only.
Australian/New Zealand Declaration of Conformity - EMC	Complies with EMC provision of Radiocommunications Act per the following standard(s): AN/NZS 2064.1/2 Industrial, Scientific, and Medical Equipment: 1992 AN/NZS 3548 Information Technology Equipment: 1995
EC Declaration of Conformity - Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 73/23/EEC EN 61010-1:1993 Safety requirements for electrical equipment for measurement, control, and laboratory use
Approvals	UL3111-1 - Standard for electrical measuring and test equipment CAN/CSA C22.2 No. 1010.1 - Safety requirements for electrical equipment for measurement, control and laboratory use
Pollution Degree 2 (TVS600 models)	Do not operate in environments where conductive pollutants may be present.
Safety Certification of Plug-in or VXI Modules	For modules (plug-in or VXI) that are safety certified by Underwriters Laboratories, UL Listing applies only when the module is installed in a UL Listed product. For modules (plug-in or VXI) that have cUL or CSA approval, the approval applies only when the module is installed in a cUL or CSA approved product.
Installation Category Descriptions	Terminals on this product may have different installation category designations. The installation categories are: CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location CAT II[3] Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected CAT I Secondary (signal level) or battery operated circuits of electronic equipment 3 See *Input Voltage, Maximum, DC-1 MΩ, AC-1 MΩ, or GND Coupled* on page 1-3)

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Table 1-10: 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*
	TVS641, TVS641A, TVS645 & TVS645A	2.6 kg (5 lbs 12 oz)
	TVS621, TVS621A, TVS625 & TVS625A	2.5 kg (5 lbs 8 oz)
Overall Dimensions	Height: 262 mm (10.3 in) Width: 61 mm (2.4 in) Depth: 373 mm (14.5 in)	

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Operating Information

This chapter describes how to operate the waveform analyzer 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 *TVS600 and TVS600A Waveform Analyzers User Manual* and in the online help.

The *Operating Information* is divided into the following sections:

- *Installation* describes how to install the waveform analyzer into a VXIbus mainframe
- *Operating Information* on page 2–6 describes front panel connectors and indicators, the power-on procedure, self cal, self tests, and instrument commands used for maintenance

Installation

This section describes how to configure and install the waveform analyzer into a VXIbus mainframe. You will learn how to perform the following tasks:

- Set the logical address
- Configure the VXIbus mainframe
- Install the waveform analyzer into a Tektronix VXIbus mainframe
- Remove the waveform analyzer from a Tektronix VXIbus mainframe

Setting the Logical Address

Every module within a VXIbus system must have a unique logical address; no two modules can have the same address. On the waveform analyzer, two rotary switches on the rear panel select the logical address. Refer to Figure 2–1 for the switch locations.

The factory default switch setting (FF) allows the Slot 0 controller to assign a logical address to the waveform analyzer. This is called Dynamic Auto Configuration. You can also select static addresses between 01 and FE hexidecimal (1 to 254 decimal). Read the following descriptions before setting the logical address.

***NOTE**. Do not set the waveform analyzer logical address to 00. Logical address 00 is reserved for the Slot 0 controller.*

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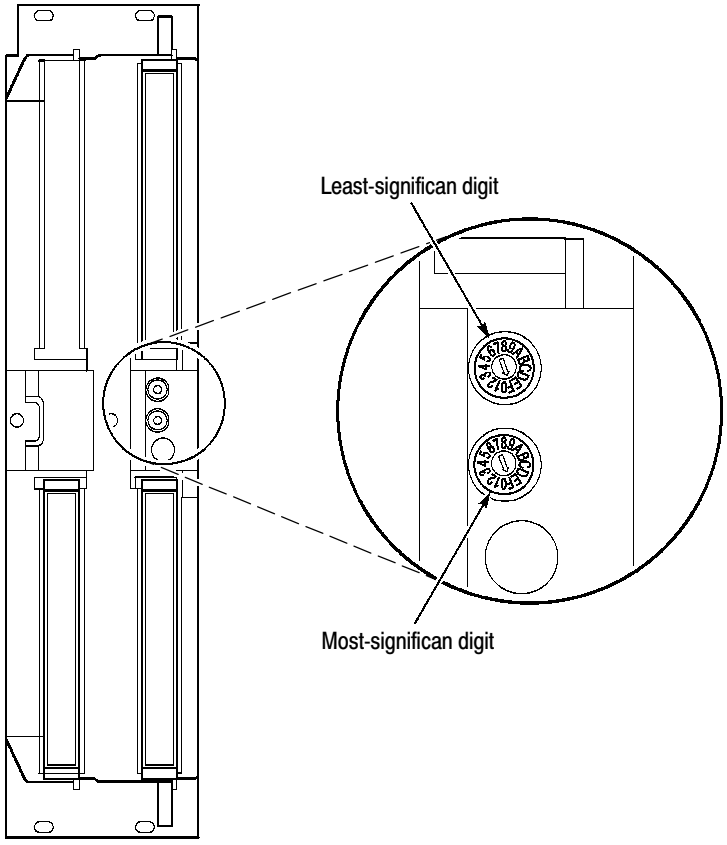


Figure 2–1: Logical address switches

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

Static Logical Address. Static logical address selections set the address to a fixed value. A static logical address ensures that the waveform analyzer address remains fixed for compatibility with systems that require a specific address value. Remember that each device within your system must have a unique address to avoid communication problems.

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Configuring the VXIbus Mainframe

This section describes how to configure a Tektronix VXIbus mainframe before you install the waveform analyzer. If you are installing the waveform analyzer into a different mainframe, refer to the instruction manual for that mainframe for any pertinent installation or capacity information.

Voltage, Current, Power, and Cooling Requirements. Voltage, current, power, and cooling requirements for the waveform analyzer are listed in the *Specifications* section at the following locations:

- Voltage, current, and power requirements; see Table 1–7 on page 1–11
- Cooling requirements; see Table 1–8 on page 1–11

These requirements are also printed on the side of the waveform analyzer. Be sure your mainframe can supply adequate current and cooling to the waveform analyzer and the other modules you plan to install into the same mainframe.



WARNING. *Shock hazards exist due to high voltages within the mainframe compartment. Do not change configuration of the Bus Grant and Interrupt Acknowledge jumpers unless you are qualified to do so. Consult your VXIbus mainframe manual for safety warnings and configuration information.*

Jumper Settings. Many VXIbus mainframes contain daisy-chain jumper straps that you must configure before installing the waveform analyzer. The jumper straps set up the Bus Grant (BG0-BG3) and Interrupt Acknowledge (IACK) signals. If you are using a Tektronix mainframe, the jumper straps are located beside the P1 connectors. The names of the jumper straps (BG0-BG3 and IACK) are often printed on the circuit board facing the front of the mainframe. Refer to your VXIbus mainframe manual for detailed information about jumper strap locations and requirements.

Some VXIbus mainframes, such as the Tektronix VX1410 Intelliframe™, have an autoconfigurable backplane with electronic jumpering. You do not need to set jumpers on these VXIbus mainframes.

If your VXIbus mainframe has IACK and BG0–BG3 jumper straps, follow the procedure below to set the jumpers for the waveform analyzer:

1. On the mainframe, set the power ON/STANDBY switch to STANDBY.
2. Remove the jumper straps for the left-most slot in which you will install the waveform analyzer (retain the straps for future reconfiguration).

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3. Install the jumper straps for the right-most slot in which you will install the waveform analyzer.

For example, if you want to install the waveform analyzer into the third and fourth mainframe slots, remove all jumper straps for the third slot. Install all jumper straps for the fourth slot.

Installation into the Mainframe

The waveform analyzer may 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).



CAUTION. *If you install the waveform analyzer into a D-size mainframe, be sure to connect the P1 and P2 connectors of the module to the P1 and P2 connectors on the mainframe. Electrical damage will result when connecting the P1 and P2 connectors on the module to the P2 and P3 connectors on the mainframe.*

To avoid damage, look for bent pins on P1 and P2 before installation.

Use the following procedure and Figure 2–2 to install the waveform analyzer into the mainframe:

1. On the mainframe, set the power ON/STANDBY switch to STANDBY.
2. Insert the waveform analyzer into the mainframe top and bottom module guides and push it partially into the mainframe (Figure 2–2). Then slide the waveform analyzer into the mainframe as far as it will go without forcing it.
3. Be sure the front panel is flush with the front of the mainframe chassis. If so, 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.

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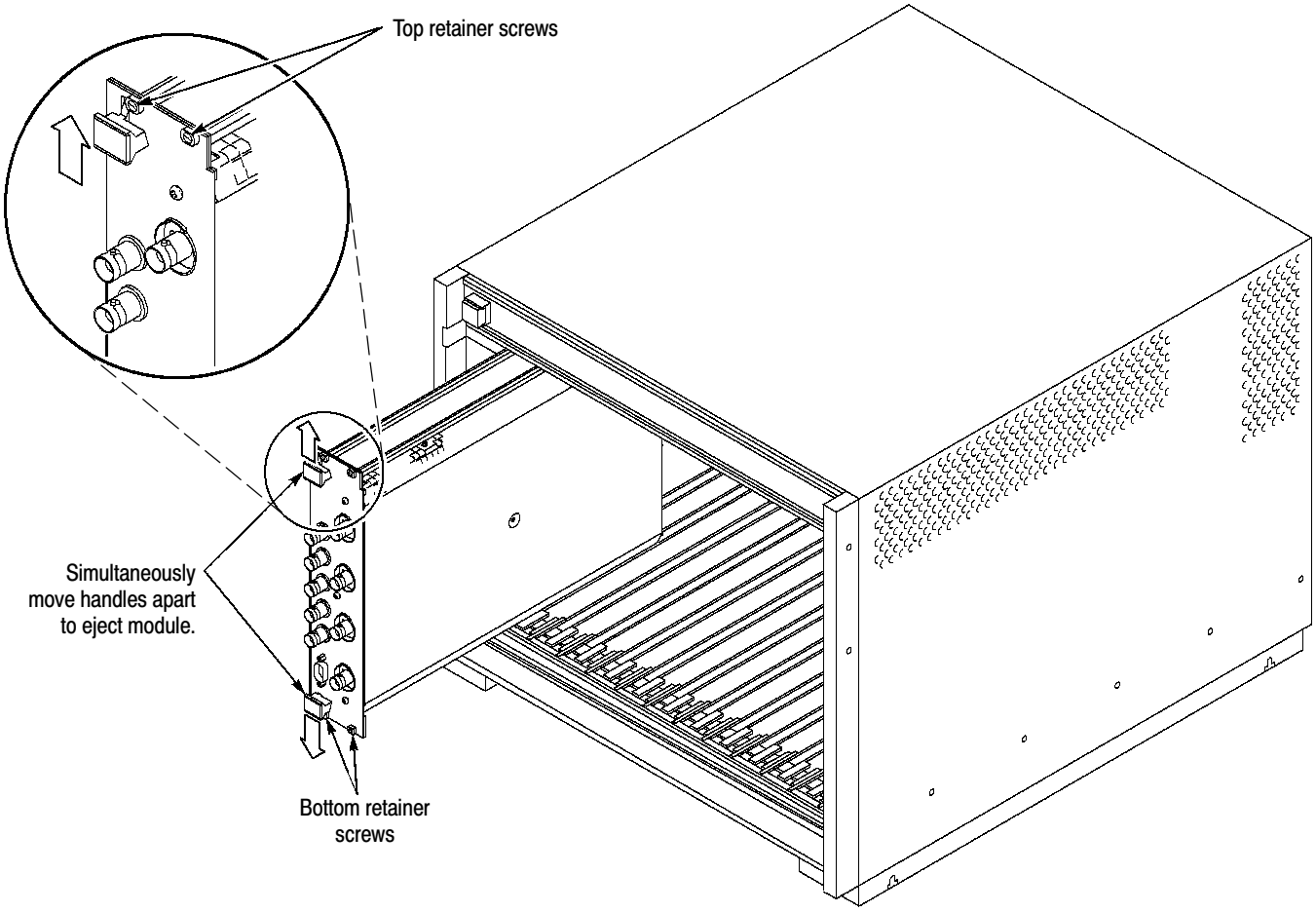


Figure 2-2: Module retainer screws and ejector mechanism

Removal from the Mainframe

Use the following procedure to remove the waveform analyzer from a Tektronix VXIbus mainframe. If you are using a different mainframe, this procedure may need modification.

1. On the mainframe, set the power ON/STANDBY switch to STANDBY.
2. Using a screwdriver, loosen the top and bottom retainer screws (Figure 2-2).
3. Grasp both handles of the waveform analyzer. At the same time, move the top handle upward and the bottom handle downward to eject the waveform analyzer.
4. Pull the waveform analyzer out of the mainframe.

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Operating Information

This section provides the information you will need to operate the waveform analyzer when performing the procedures in this manual. The following operating information is provided:

- Descriptions of each front panel connector and indicator
- Power-on procedure
- Online help
- Self cal mode
- Self tests
- List of instrument commands used for maintenance

There are two ways to operate the waveform analyzer: send commands over the VXIbus using talk/listen software, or select control settings using menus displayed by the *Tektronix TVS600A Soft Front Panel* software (a standard accessory for the waveform analyzer). You will perform procedures within this manual using talk/listen software.

***NOTE**. The procedures in this manual have been written generically so that you can perform them using any talk/listen software installed on your system. An example of talk/listen software that you might use is the* Tektronix TVS600A Soft Front Panel *software talk/listen utility.*

Connectors and Indicators

Figure 2–3 shows the connectors and indicators on the front panel of a four-channel waveform analyzer. 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.

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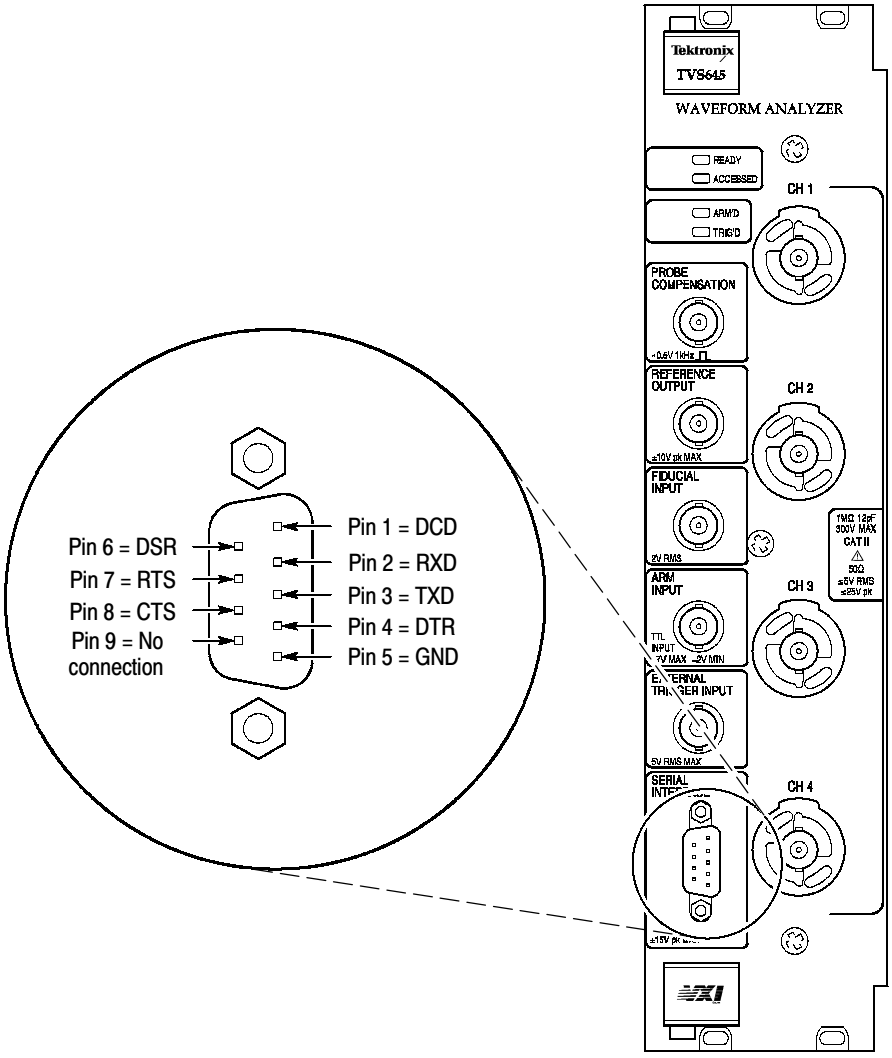


Figure 2–3: Waveform analyzer front panel

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 TVS641, TVS641A, TVS645 & TVS645A have four input channels as shown in Figure 2–3. The TVS621, TVS621A, TVS625 & TVS625A 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.

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READY Indicator. The green LED lights continuously after the waveform analyzer 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 waveform analyzer occurs
- When the Slot 0 controller asserts the Module Identification (MODID) line

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

TRIG'D Indicator. The green LED lights for 300 ms when a trigger is received for the most recent acquisition. If triggers repeat more often than three per second, the indicator lights continuously.

PROBE COMPENSATION. The BNC output provides a signal for adjusting probe compensation. You can select either a square wave (`CLOC`) or a 500 mV DC level (`VOLT`). The square wave frequency is approximately 1 kHz. Amplitude is 500 mV_{p-p} into a $\geq 50\ \Omega$ load. To enable the compensation signal, send the command `OUTP:PCOM ON`.

REFERENCE OUTPUT. The BNC output provides access to two internal references; the DC calibrator reference voltage or the time base clock. The precision calibrator reference voltage (`VOLT`) is +8 V. The time base clock frequency (`CLOC`) is 10 MHz. Signal amplitude is $\geq 1\ V_{p-p}$ into a $\geq 50\ \Omega$ load. Figure 2–4 shows a typical time base clock signal waveform. To enable the selected signal to the REFERENCE OUTPUT connector, send the command `OUTP:REF ON`.

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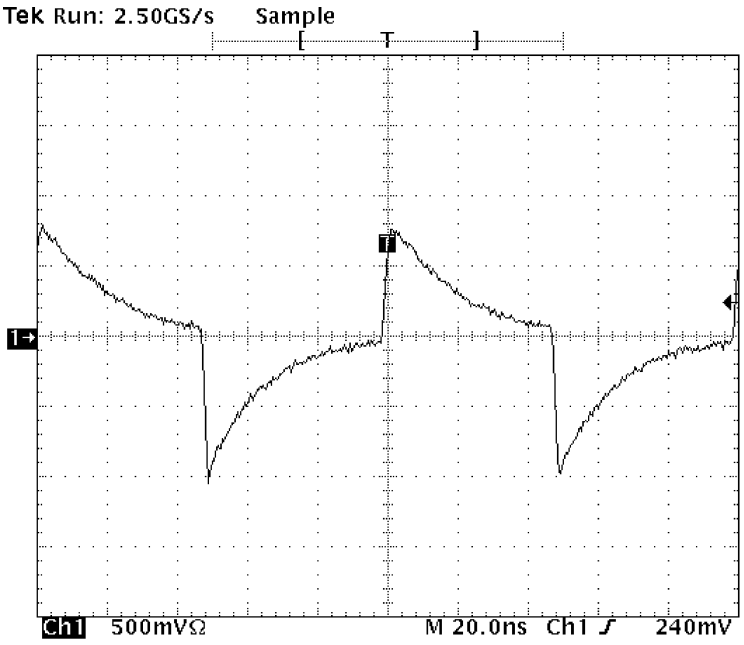


Figure 2–4: Typical time base clock signal waveform (50 Ω impedance)

FIDUCIAL INPUT. The BNC input provides a way to add a signal component to the Channel 1 input signal. The input range is ±1 V. The input impedance is 0.01 μF in series with 50 Ω.

ARM INPUT. The BNC input allows you to arm the acquisition system by grounding the center lead. An internal pull up resistor connected to +5 V maintains a high level until you ground the input. When the center lead is grounded, the waveform analyzer is armed.

EXTERNAL TRIGGER INPUT. The BNC input provides a way to trigger the time base from an external source. The 50 Ω input is DC coupled. Trigger signals as large as ±5 V (DC + Peak AC) may be applied.

SERIAL INTERFACE. This 9-pin D connector provides a serial interface for controlling the waveform analyzer and reading acquired data. See Figure 2–3 on page 2–7 for the RS-232 pin assignments. You can configure the serial interface with the commands in the SYST:COMM:SER subsystem.

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Power-On Procedure

This section describes how to configure and install the waveform analyzer before performing the maintenance procedures in this manual. You will learn about the following topics:

- *Connect the VXIbus Test System* provides instructions for installing the waveform analyzer and Slot 0 controller into a VXIbus mainframe.
- *Power-On Self Tests* on page 2–12 describes the internal self tests the waveform analyzer performs at power-on.
- *Basic Communication* on page 2–13 provides a way to verify the installation. You will query the waveform analyzer identification, and then read the query response.

If the waveform analyzer will not complete the power-on procedure, refer to *Troubleshooting* on page 6–25 for further assistance.

Connect the VXIbus Test System. Perform the following procedure to connect a VXIbus test system similar to the one shown in Figure 2–5 or Figure 2–6, respectively. Due to the wide range of possible system configurations, these instructions only provide general guidelines. If necessary, refer to the manual for the system components to determine specific setup and configuration parameters.

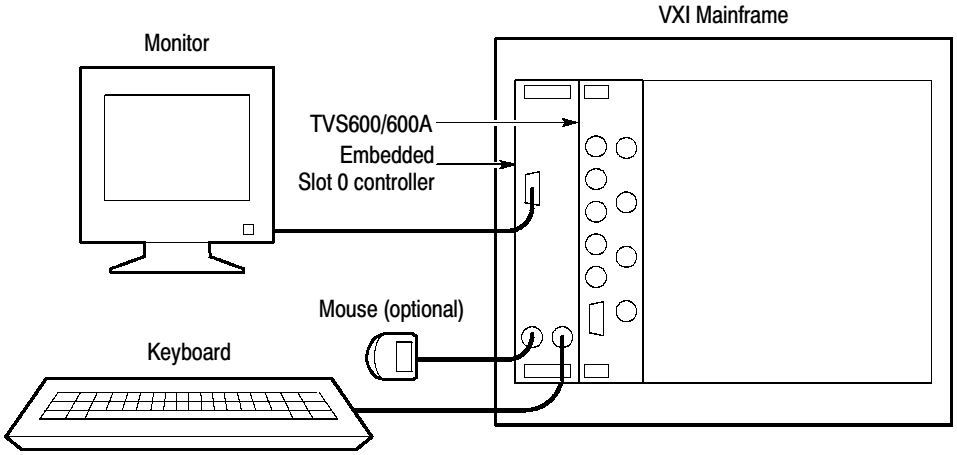


Figure 2–5: Configuration with an Embedded Slot 0 VXIbus controller

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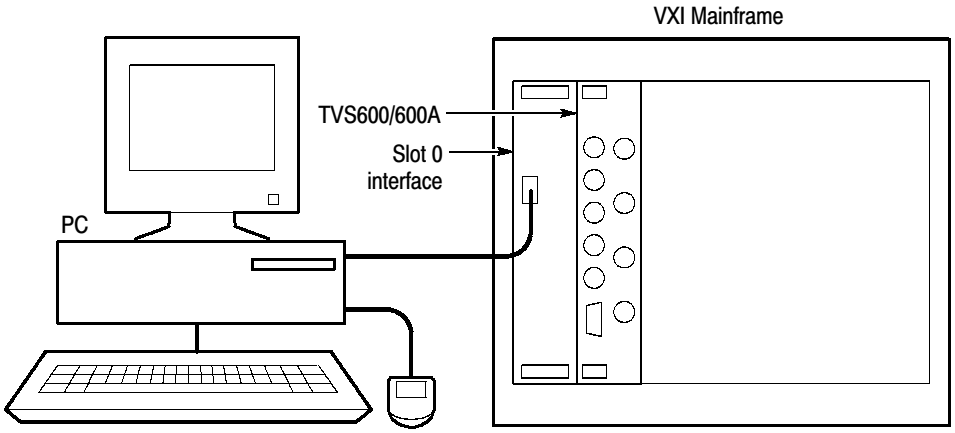


Figure 2–6: Configuration with a Slot 0 interface to an external controller

To communicate with the waveform analyzer once power-on is complete, you will need to install a talk/listen software application on your computer. You can use the *Tektronix TVS600A Soft Front Panel*, a standard accessory for the waveform analyzer.

***NOTE**. If you are performing the* Performance Verification Procedure *or* Adjustment Procedures*, use the Slot 0 controller shown in Table NO TAG or Table NO TAG, respectively. The Field Adjust/PV software that is used for these procedures only supports the Slot 0 controller listed.*

1. Configure the VXIbus mainframe. Set the jumpers as needed for the Slot 0 controller and waveform analyzer.
   - Refer to the manual for the Slot 0 controller for detailed configuration requirements
   - See *Installation*, beginning on page 2–1, for detailed waveform analyzer configuration requirements
2. Configure and install the Slot 0 controller. Refer to the manual for the Slot 0 controller for detailed instructions.
   a. Set the logical address as required, typically to 00.
   b. Set the interrupt handler as required, typically to 4.
   c. Install the Slot 0 controller into the left-most slot(s) in the VXIbus mainframe.
3. Configure and install the waveform analyzer. See *Installation*, beginning on page 2–1, for detailed instructions.

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a. Set the logical address to one of the following settings:

- Use 02 to perform the *Performance Verification Procedure* or the *Adjustment Procedures*
- Use FF (Dynamic Auto Configuration) to perform only the *Incoming Inspection Procedure*

b. Install the waveform analyzer into the VXIbus mainframe slots that you configured for it in step 1.

4. Connect the monitor, keyboard, and mouse. Refer to the manual for the computer or Slot 0 controller for detailed instructions.

5. Install the talk/listen software. Refer to the manual for the software package for detailed instructions.

Online Help. Most user information for operating the digitizing oscilloscope module is available through the online help within the TVS600A Series application.

Power-On Self Tests. During power-on, the waveform analyzer performs a kernel self test to verify its functionality. Power-on requires approximately five seconds 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

***NOTE**. The READY indicator blinks at power-on if the waveform analyzer has an event to report. The indicator does not light if the power-on self test fails.*

Once the power-on self tests are complete, the waveform analyzer recalls settings from nonvolatile memory. Values are equal to the settings that were active when the waveform analyzer was last powered off.

Most parameters have a default value that you can implement by sending the `*RST` command. For more information, see the *TVS600 and TVS600A Waveform Analyzers User Manual*.

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Basic Communication. The following procedure helps you to establish communication with your waveform analyzer. At the same time, you will check the firmware version installed in the instrument. To query the waveform analyzer identification, you can use any talk/listen software that allows your Slot 0 controller to communicate over the VXIbus.

1. Power on each component within your VXIbus system (mainframe and monitor).
2. Wait for internal self tests to complete. Verify that the front panel indicators have the proper states.
3. Send the following command to query the instrument type and firmware version:

   `*IDN?`

4. Read the waveform analyzer response to the `*IDN?` query.

   The response includes information about the waveform analyzer such as Manufacturer, Model Number, Serial Number, SCPI version, and Firmware Version. A typical response is shown below:

   `TEKTRONIX,TVS641A,B010100,SCPI:94.0 FVER:2.0`

Self Cal Mode

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

NOTE*. Performing the self cal does not verify that all waveform analyzer parameters operate within limits. Operation within limits is verified by performing the* Performance Verification Procedure*, which begin on page NO TAG.*

When to Perform Self Cal. You can run a self cal at any time during normal operation. To maintain measurement accuracy, always perform a self cal under the following conditions:

- Operating temperature is not within ±5° C of the temperature when self cal was last performed
- More than 24 hours have elapsed since the last self cal
- You are preparing to make an important series of measurements

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If the waveform analyzer loses power during self cal, rerun the self cal following the next power-on. The self cal data generated before power was interrupted must be replaced with a complete set of new data. For best results, always perform the self cal at least 20 minutes after power-on.

Running Self Cal. The waveform analyzer requires approximately four to six minutes to run a self cal. Depending on the results you need, either of the following commands might be used:

- `CAL` runs a complete self cal and saves the resulting data in memory
- `*CAL?` runs a complete self cal, saves the resulting data in memory, and returns a numeric value showing the results

See Table 6–4 on page 6–26 for a more detailed description of the self cal commands.

Self Cal Results. When queried, the waveform analyzer returns a numeric value that shows the self cal results. Use either `CAL:RES?` or `CAL:RES:VERB?` to read the self cal results. Table 2–1 defines the values the waveform analyzer can return. If values between 2000 and 2999 are returned, see *Troubleshooting* on page 6–25 for instructions.

Table 2–1: Self Cal results

Numeric value	Definition
-1	Self cal is still in progress
0	Self cal completed successfully
2000 through 2999	Self cal failed; the numeric value identifies the failed self cal function

Self Tests

Self tests are internal tests that check the functionality of circuits within the waveform analyzer. The self tests provide a more complete check of the waveform analyzer than the power-on self test. No external equipment or user actions are needed to complete the self tests.

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When to Perform Self Tests. A self test can be performed whenever you need to confirm instrument functionality. These tests, when successfully completed, provide a high level of confidence that the waveform analyzer is functional. You can often use results from failed self tests to isolate faults to a module.

Running Self Tests. The waveform analyzer runs the complete set of self tests in approximately 10 minutes. Depending on the results you need, either of the following commands might be used:

- `TEST` runs all available self tests (1000 to 2999); the resulting self cal data is not saved in memory
- `TEST?` runs all available self tests (1000 to 2999) and returns a numeric value showing the results; the resulting self cal data is not saved in memory

See Table 6–4 on page 6–26 for a summary of all the self test commands.

Self-Test Results. When queried, the waveform analyzer returns a numeric value that shows the self test results. Use either `TEST:RES?` or `TEST:RES:VERB?` to read the self test results. Table 2–2 defines the test values the waveform analyzer can return. If values between 1000 and 2999 are returned, see *Troubleshooting* on page 6–25 for instructions.

Table 2–2: Self Test results

Numeric value	Definition
–1	A self test is still in progress
0	Self tests completed successfully
1000 through 2999	A self test failed; the numeric value identifies the failed test

Instrument Commands Used for Maintenance

Refer to *Troubleshooting* in chapter 6 for a list of insrtument commands used for maintenance.

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Theory of Operation

This chapter describes the electrical operation of the waveform analyzer. 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 waveform analyzer. Except for the number of channels, the basic operation is the same for each model. The TVS641, TVS641A, TVS645 & TVS645A models have four input channels. The TVS621, TVS621A, TVS625 & TVS625A have two input channels.

Input/Output Connectors

Input signals to be measured enter the waveform analyzer 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.

Five additional front-panel BNCs provide signal connections for functions such as external triggering and probe compensation. A coaxial cable assembly routes the input/output 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
- VXI Triggers

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Attenuators. Signals applied to each channel input (CH 1, CH 2, CH 3, and CH 4) connect to an attenuator. The Main Processor System, by way of the DSP 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. Signals from an internal 10 MHz clock, or the VXIbus P2 connector, provide a reference for the VCO.

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

- Attenuator — internal triggering
- Front-panel EXTERNAL TRIGGER connector — external triggering
- VXI Triggers — triggering from the VXIbus

The front-panel ARM INPUT connector accepts signals from external devices to enable triggering.

VXI Triggers. The VXI Triggers circuit routes system-generated TTLTRG and ECLTRG trigger signals to the Trigger circuit. Under control of the Main Processor System, the VXI 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
- VXI Interface
- Serial Interface
- Power Supplies

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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 VXIbus pass through the VXI Interface, which resides on the 68330 bus. The 68330 bus also routes data between the Main Processor System, the DSP Processor System, and the Serial Interface.

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.

VXI Interface. The VXI Interface transfers commands and data between the VXIbus, and the Main Processor System. Signals pass between the instrument and the VXIbus through the P1 VXIbus connector.

Serial Interface. The Serial Interface transfers data between the Main Processor System and the front-panel SERIAL INTERFACE connector. The connector is RS-232 compatible. Data transfer occurs over the 68330 bus.

Power Supplies. The Power Supplies receive +5 V, –5 V, and ± 12 V from the VXIbus mainframe to power the waveform analyzer. 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.

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Performance Verification

This chapter describes an automated procedure you can use to verify the performance of a TVS600/A Series WaveformAnalyzer. The procedure checks all the specifications that are marked with the ✓ symbol.

This procedure requires the specific test equipment and materials listed in Table 4–1.

Description

The *Performance Verification Procedure* is divided into the following parts:

- *Equipment Required* Table 4–1, lists the test equipment needed to perform the tests.
- *Initial GPIB Hardware Setup* on page 4–4, provides setup instructions for the National Instrument software drivers.
- *Performance Verification Instructions* on page 4–23, provides written procedures for installing and using the PV .
- *VXI Communication Troubeshooting* test procedure on page 4–34 provides an overview of the help system.

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Table 4-1: Required equipment and materials

Category	Specific equipment required	Quantity
Signal source	Wavetek 9500 Oscilloscope Calibrator, with Option 100 (high-stability time base)	1 ea
	Wavetek 9510 or 9530 Standard Output Module	5 ea
Instrument controller	PC-compatible computer with 866 MHz CPU, 128 Mbyte RAM, Integrated PCI IDE, 10 GB hard disk, Internal 12XDVD-ROM, 8MB PCI Video card, 3.5 inch 1.44 MByte Floppy Disk Drive, 3COM 3C900 (PCI-10baseT) Ethernet Adapter, Windows 2000 or NT, version 4.0	1 ea
	National Instruments PCI-GPIB Controller card for Windows NT/2000 and National Instruments NI-488.2 for Windows software version 1.7 (to install in the VXI mainframe)	2 ea
VXIbus Mainframe	Minimum of four plug-in slots	1 ea
	National Instruments GPIB-VXI/C Resource Manager	1 ea
Test software	PVsoftware, setupTV600 Cal.exe, located on *TVS600 Series Product Disk* CD-ROM that is included as standard equipment with theTVS600	1 ea
Frequency Counter	Tegam DC5010	1 ea
Digital Multimeter	Tegam DM511	1 ea
Printer with cable (optional, used to print test record)	PC-compatible, continuous feed, prints ASCII text, connects to DB-25 female connector	1 ea
GPIB cables	GPIB cable, 10 m minimum length, Tektronix part number 002-0991-01 or similar	2 ea

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Overview of the Procedure

To perform this procedure you must have the specific equipment listed in Table 4–1.

After the controller is set up, you need to install the performance verification test program from a CD-ROM that was shipped with the VXI mainframe. An installation wizard will assist you with the installation of the test program.

Table 4–2: Field Adjust/PV Software PV tests

PV test name	Specification tested
1. INTERNAL_CAL	Runs the internal self cal
2. DC_GAIN_ACCURACY	Accuracy, DC Gain
3. OFFSET_ACCURACY	Accuracy, Offset
4. VERT_DCACCUR	Accuracy, DC Voltage Measurement Accuracy, Delta DC Voltage Measurement
5. VERT_BANDWIDTH	Analog Bandwidth, DC–50 Ω Coupled
6. RANDOM_NOISE	Random Noise
7. DELAY_MATCH	Delay Between Channels, Full Bandwidth
8. TIMEBASE_ACCURACY	Accuracy, Long Term Sample Rate and Delay Time
9. GLITCH_TRIG_ACC	Accuracy (Time) for Pulse Glitch or Pulse Width Triggering
10. TRIG_MAIN_ACC	Accuracy (DC) for Internal and External Trigger Level, DC Coupled
11. TRIG_MAIN_SENS	Sensitivity, Edge-Type Trigger, DC Coupled
12. TRIG_DELAY_ACC	Accuracy (DC) for Internal Trigger Level, DC Coupled
13. TRIG_DELAY_SENS	Sensitivity, Edge-Type Trigger, DC Coupled
14. REFERENCE_OUT	Output, Reference
15. PROBE_COMPENSATION	Probe Compensation, Output Voltage

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Initial GPIB Hardware Setup

Before you can execute the test program, you need to set up the instrumentation. GPIB hardware. Connect GPIB cables per Figure 4–1 on page 4–4.

The test software utilizes one GPIB card (GPIB0) to control the signal generators. The second GPIB card (GPIB1) controls the device under test.

***NOTE**. You will need to record the GPIB card's serial numbers and slot locations for later reference when installing the National Instrument's software.The GPIB card's serial numbers are located on the top right corner on the component side.*

1. Install 2 PCI-GPIB cards into the PC, use 2 non-adjacent PCI slots.

***NOTE**. To avoid GPIB connections problems do to the GPIB cable's connector widths, make sure you have at least one empty slot between GPIB cards.*

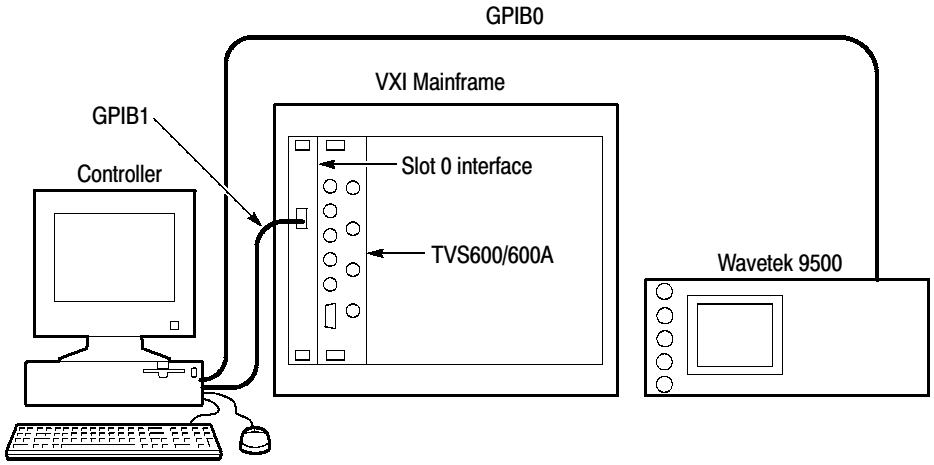


Figure 4–1: Initial GPIB hardware setup

Once the connections have been made, follow these steps:

2. *Power on the instruments:* Power on the PC, VXI Mainframe, and signal source. The TVS600 and the signal source must warm up for 20 minutes before you can begin to execute the test. However, while you are waiting you can continue with the next steps in this procedure.

3. *Configure the PC controller:* Use the GPIB software and hardware on the controller as necessary to make the following settings:

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4. *Windows NT GPIB Setup Procedure*; perform steps 4 through 9. If using Windows 2000 skip to step 10 on page 4–10.

   a. Insert the National Instruments NI-488.2 version 1.7 or later CD into the PC controller.

   b. Wait for the autorun to display the CD selection menu. If autorun does not start, in the **Start** menu, select **Run**. Use the Browse button to find the **setup.exe** on the CD.

   c. Select the **Install NI-488.2 Software for Windows** or **NT** in the selection menu.

   d. When the setup is complete, select **Explore** CD, double click the **SetupVisa.exe**. Accept all default settings.

   e. Select the **Yes** button to exit and restart the PC.

   f. When the installation is complete, remove the CD.

5. After the PC restarts the **NI-488.2 Getting Started Wizard** dialog box will display. Make the following *GPIB Setup Wizard* settings:



Figure 4–2: NI-488.2 Getting Started Wizard dialogbox

   a. Select the **Do not show at Windows startup** check box.

   b. Click on **Configure your GPIB interface**.

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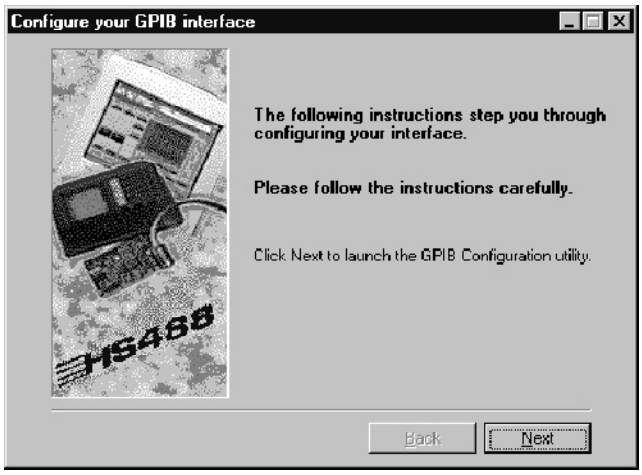


Figure 4-3: Configure your GPIB interface dialog box

6. Click on the **Next** button in the **Configure your GPIB Interface** dialog box.

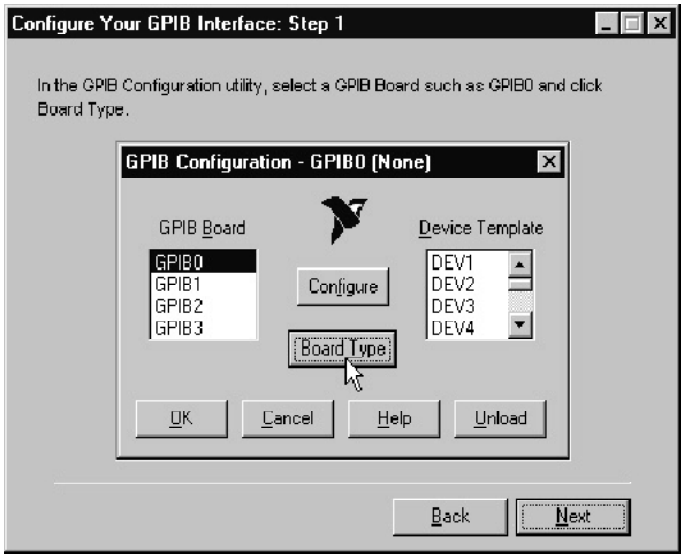


Figure 4-4: Configure Your GPIB Interface: Step 1 dialog box

7. Make the following selections in the **Configure Your GPIB Interface: Step 1** dialog box.

   a. Select **GPIB0** in the GPIB list.

   b. Select **Board Type** button in the **GPIB Configuration** window.

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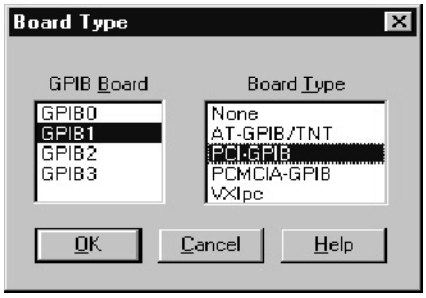


Figure 4–5: Board Type dialog box

8. Make the following *GPIB0 configuration* settings in the **Board Type** dialog box:

   a. Select the type of GPIB card installed for GPIB0, click on **GPIB1** in the GPIB Board list.

   b. Select the correct GPIB card type in the Board Type list. Install for GPIB1.

   c. When the setup is complete, click **OK** to close the dialog box.

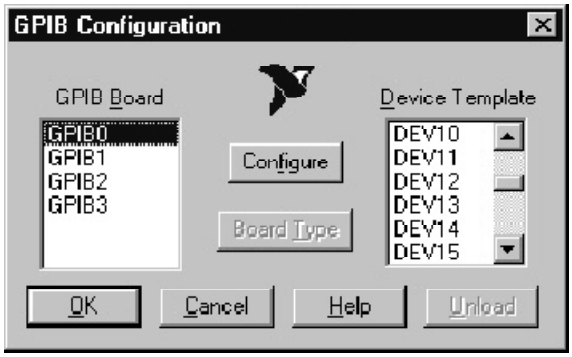


Figure 4–6: GPIB0 Configuration dialog box

   d. Click on the **GPIB0** in the GPIB Board list in the **GPIB Configuration** dialog box .

   e. Click on the **Configuration** button in the **GPIB Configuration** dialog box.

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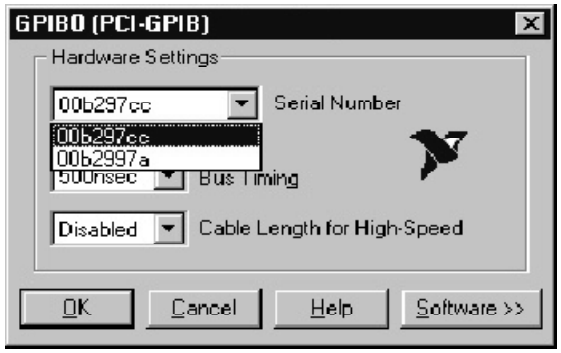


Figure 4-7: GPIB0 {PCI-GPIB} dialog box

f. In the **GPIB0 [PCI-GPIB]** dialog box; click on the **Serial Number** down arrow to select the serial number that will be used as GPIB0 (System Instrument Bus). Both GPIB cards should appear in this list.

g. Click on the **Software** button in the **GPIB0 [PCI-GPIB]** as GPIB0 dialog box.

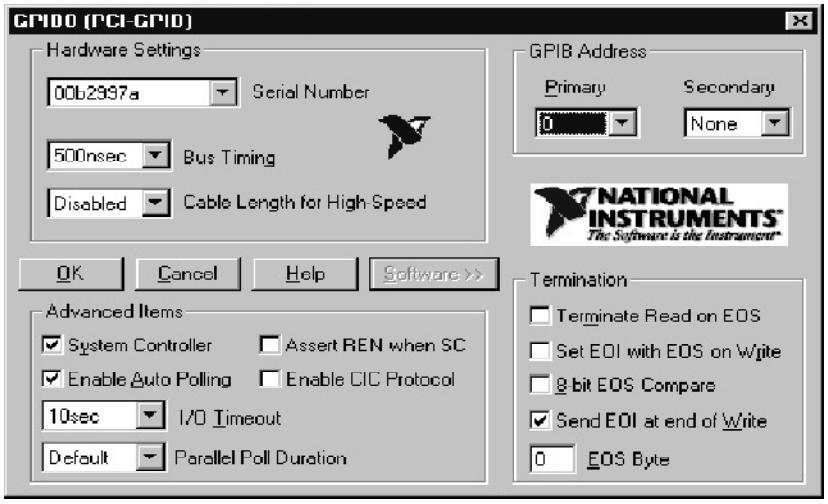


Figure 4-8: GPIB0 {PCI-GPIB} dialog box

h. Verify the setup matches the configuration shown in the **GPIB0 [PCI-GPIB]** dialog box

i. When the setup is verified, click **OK** to close the dialog box.

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9. Make the following *GPIB1 configuration* settings in the **GPIB Configuration** dialog box.

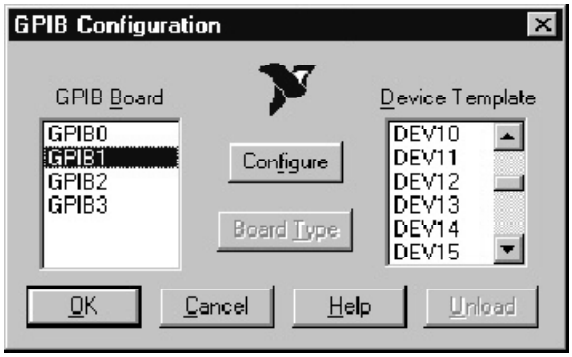


Figure 4–9: GPIB Configuration dialog box

a. Select **GPIB1** in the GPIB Board list.

b. Click on the **Configuration** Button in the **GPIB Configuration** dialog box.

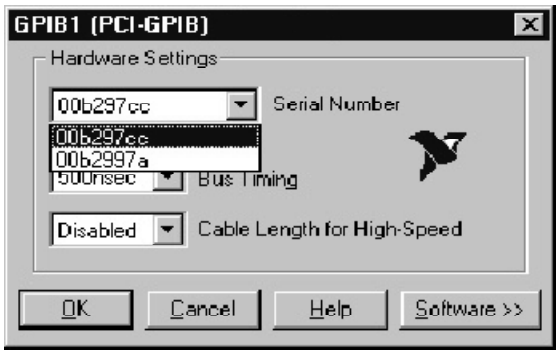


Figure 4–10: GPIB1 [PCI-GPIB] dialog box

c. In the **GPIB1 [PCI-GPIB]** dialog box, click on the Serial Number down arrow to select the serial number that will be used as GPIB1 (DUT Bus). Both GPIB cards will appear in this list.

d. Click on the **Software** button in the **GPIB1 [PCI-GPIB]** dialog box.

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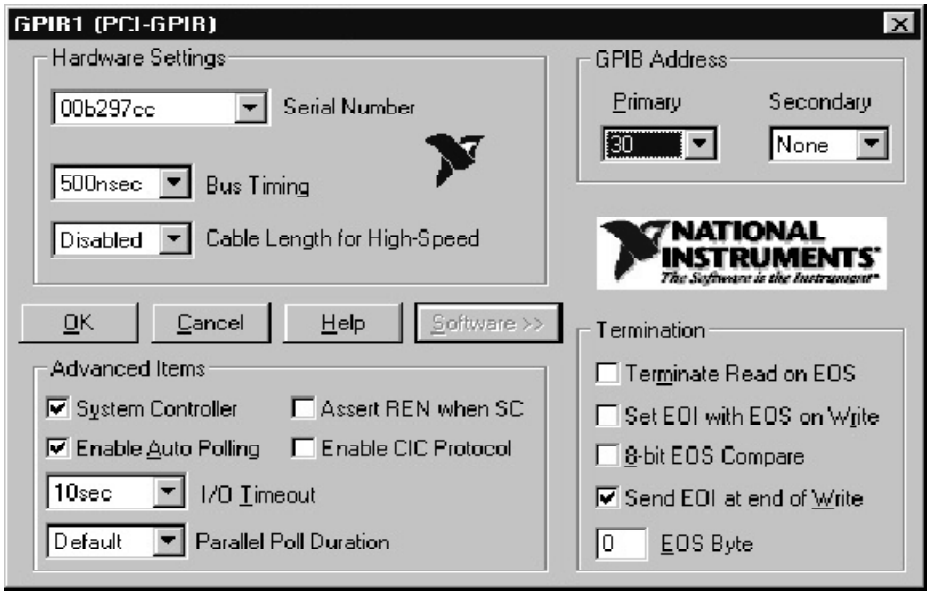


Figure 4–11: GPIB1 [PCI-GPIB] dialog box

e. Verify the setup matches the configuration shown in the **GPIB1 [PCI-GPIB]** dialog box. The GPIB address is primary set to 30.

f. When the setup is verified, click **OK** to close the dialog box.

g. Click on **OK** again to exit the configuration menu.

h. For Windows NT, go to page 4–20 and perform steps a through c.

10. *Windows 2000 GPIB Setup Procedure;* perform steps 10 through 19. If you are using Windows NT skip to Step 20 on page 4–14.

11. When the PC reboots, the **Window New Hardware Found** screen will appear. Then following National Instruments **Found New Hardware** screen will appear.



Figure 4–12: Found New Hardware dialog box

12. Wait until the new hardware installation completes.

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Figure 4-13: NI-488.2 Getting Started Wizard dialog box

13. Select the **Do not show at Windows startu**p check box.
14. Click on **Verify your hardware and software installation**.

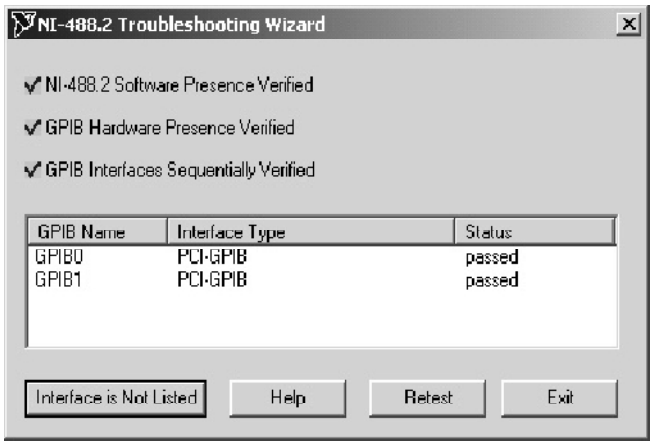


Figure 4-14: NI-488.2 Troubleshooting Wizard dialog box

15. After the Troubleshooting Wizard has verified that all software and hardware functions are operating properly it will display both GPIB cards.
16. Select the **Exit** button if everything passes.
17. If only one GPIB card appears, power down the PC and select another PCI slot in the PC controller, for the board that was not displayed. Reboot the PC and repeat step 10 on page 4-10 through step 15.

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Figure 4–15: NI-488.2 Getting Started Wizard

18. Click the **X** to close window.

19. Make the following *GPIB1 Software Configuration:*

a. In the **Start** menu, select **Control Panel**, **GPIB**, and the following dialog box will appear.

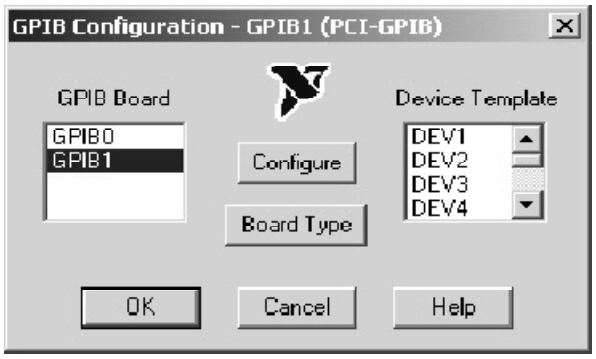


Figure 4–16: GPIB Configuration – GPIB1 (PCI-GPIB) dialog box

b. Select GPIB1 in the board list.

c. Click on the Configure button in the **GPIB Configuration – GPIB1 (PCI-GPIB)** dialog box.

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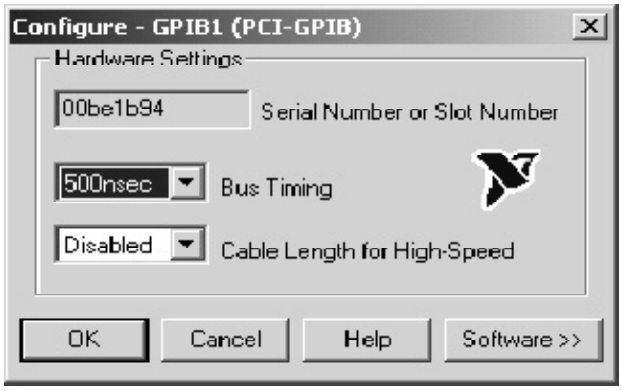


Figure 4-17: Configure - GPIB1 (PCI-GPIB) dialog box

d. Note the serial number that has been assigned to GPIB1.

e. Click on the Software button in the **Configure - GPIB1 (PCI-GPIB)** dialog box.

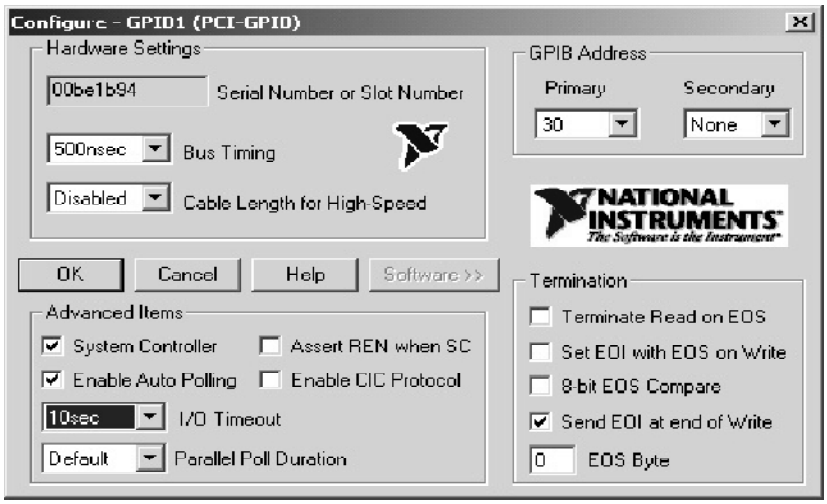


Figure 4-18: Configure - GPIB1 (PCI-GPIB) dialog box

f. Set the **GPIB Address**, **Primary** to **30**.

g. Click **OK** to close the dialog box.

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20. Make the following *Device Template Setup and Configuration* settings:.

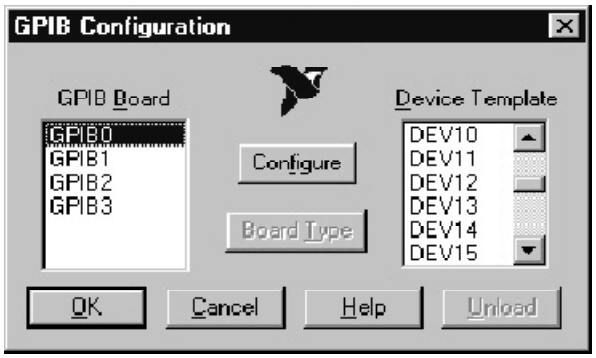


Figure 4–19: GPIB Configuration dialog box

a. Double click on the **DEV1** Device Template list in the **GPIB Configuration** dialog box.

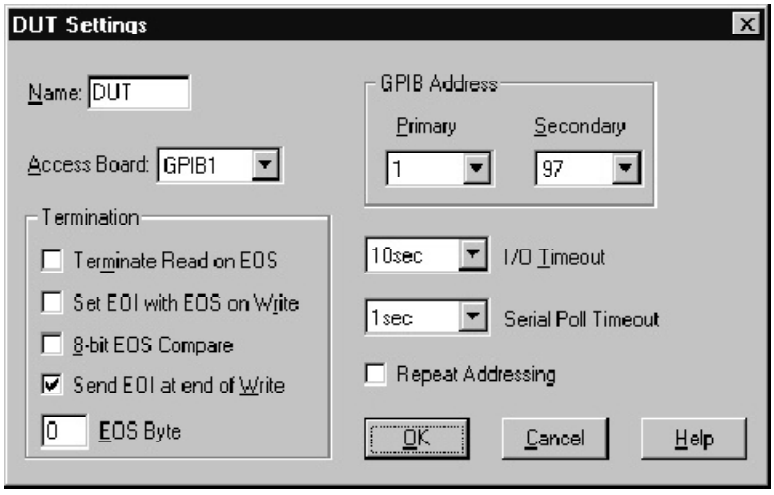


Figure 4–20: DUT Configure dialog box

b. Enter the following information into the **DUT Settings** dialog box:

- Name: **DUT**
- Access Board: **GPIB1**
- GPIB Primary Address: **1**
- GPIB Secondary Address: **97**

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c. When the setup is complete, click **OK**.

d. Double click on the **DEV2** Device Template list in the **GPIB Configuration** dialog box.

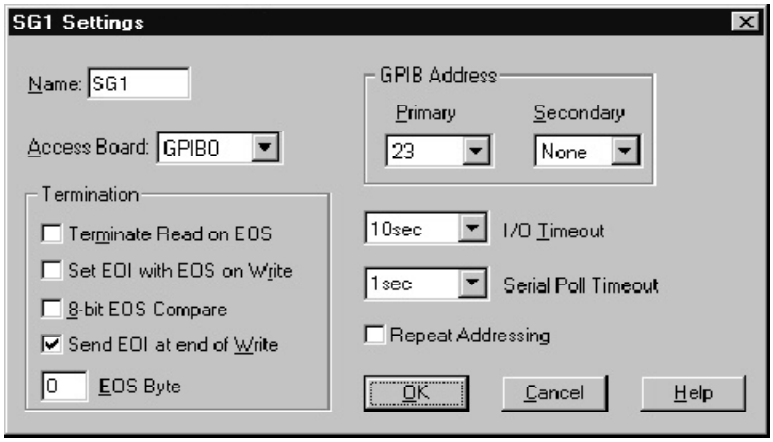


Figure 4-21: SG1 Settings dialog box

e. Enter the following information into the **SG1 Settings** dialog box:

- Name: **SG1**
- Access Board: **GPIB0**
- GPIB Primary Address: **23**

f. When the setup is complete, click **OK** to close the dialog box.

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g. Double click on the **DEV3** Device Template list in the **GPIB Configuration** dialog box.

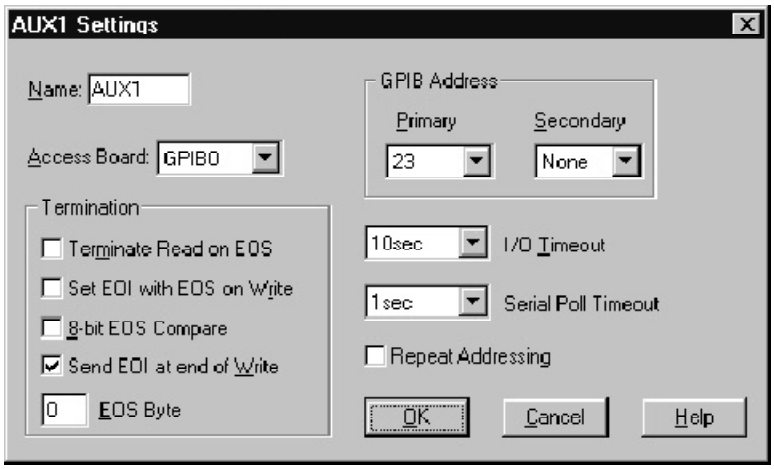


Figure 4-22: AUX1 Settings dialog box

h. Enter the following information into the **AUX1 Settings** dialog box:

- Name: **AUX1**
- Access Board: **GPIB0**
- GPIB Primary Address: **23**

i. When the setup is complete, click **OK** to close the dialog box.

j. Double click on the **DEV4** Device Template list in the **GPIB Configuration** dialog box.

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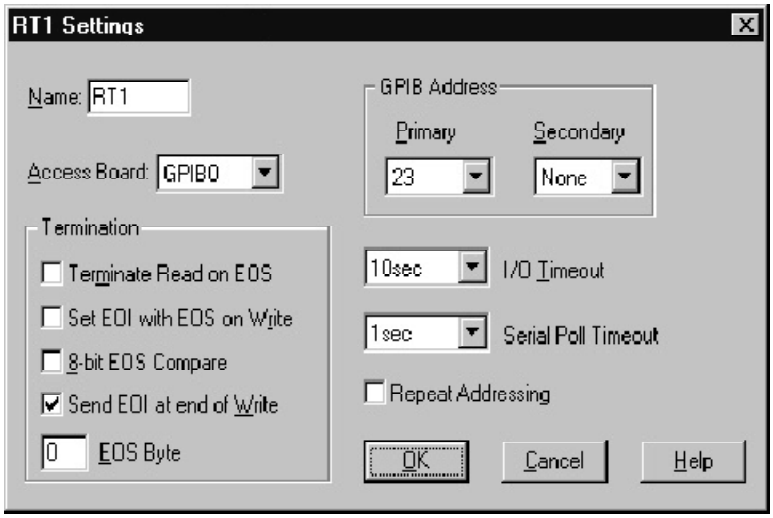


Figure 4-23: RT1 Settings dialog box

k. Enter the following information into the **RT1 Settings** dialog box:

- Name: **RT1**
- Access Board: **GPIB0**
- GPIB Primary Address: **23**

l. When the setup is complete, click **OK** to close the dialog box.

m. Double click on the **DEV5** Device Template list in the **GPIB Configuration** dialog box.

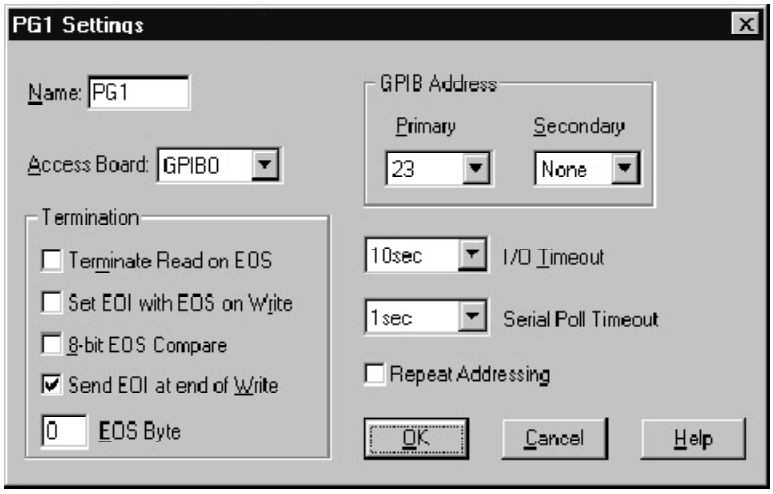


Figure 4-24: PG1 Settings dialog box

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n. Enter the following information into the **PG1 Settings** dialog box:

- Name: **PG1**
- Access Board: **GPIB0**
- GPIB Primary Address: **23**

o. When the setup is complete, click **OK** to close the dialog box.

p. Double click on the **DEV6** Device Template list in the **GPIB Configuration** dialog box.

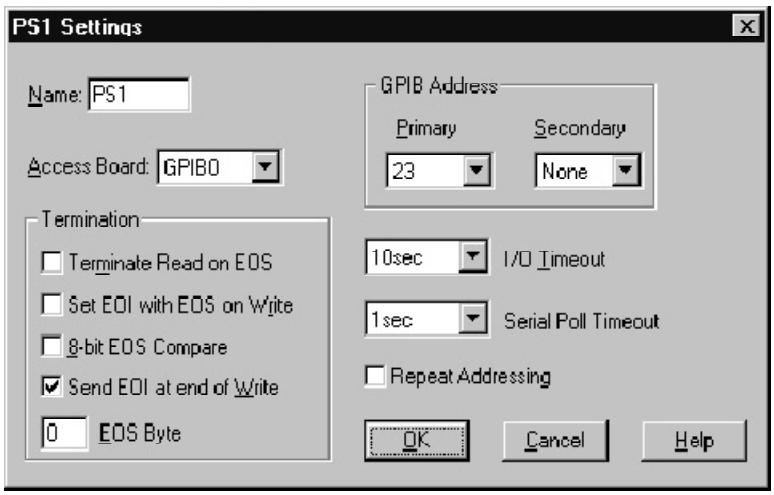


Figure 4-25: PS1 Settings - read-only dialog box

q. Enter the following information into the **PS1 Settings** dialog box:

- Name: **PS1**
- Access Board: **GPIB0**
- GPIB Primary Address: **23**

r. When the setup is complete, click **OK** to close the dialog box.

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s. Double click on the **DEV7** Device Template list in the **GPIB Configuration** dialog box.

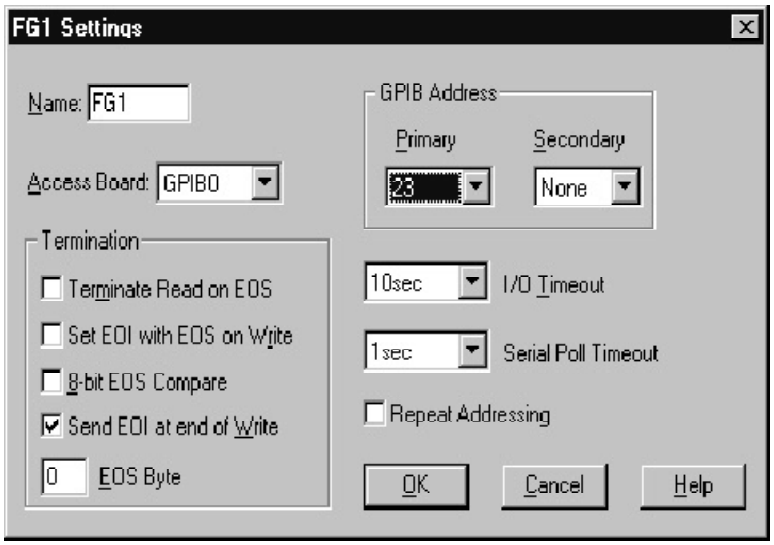


Figure 4–26: FG1 Settings dialog box

t. Enter the following information into the **FG1 Settings** dialog box:

- Name: **FG1**
- Access Board: **GPIB0**
- GPIB Primary Address: **23**

u. When the setup is complete, click **OK** to close the dialog box.

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21. Make the following *GPIB Hardware Diagnostics* settings:



Figure 4-27: NI-488.2 Getting Started Wizard dialog box

a. Click on **Verify your hardware and software installation** in the dialog box.

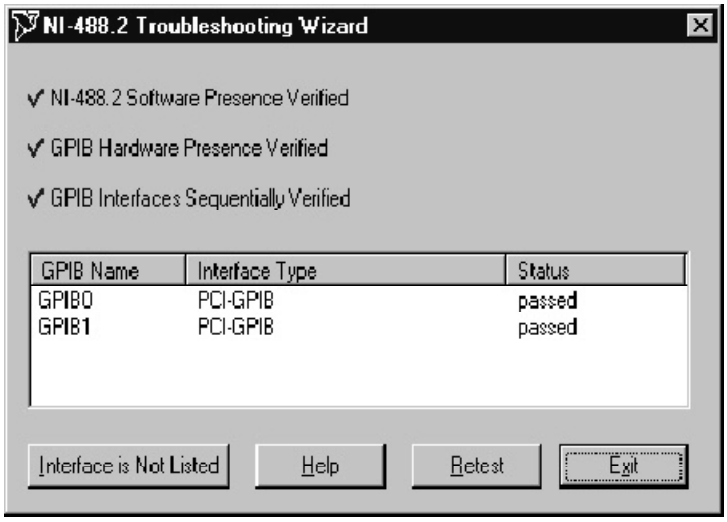


Figure 4-28: NI-488.2 Troubleshooting Wizard dialog box

b. In the **NI-488.2 Troubleshooting Wizard** dialog box, verify that both GPIB0 and GPIB1 have passed.

c. Click on **Exit** to close dialog box.

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System Communication Verification

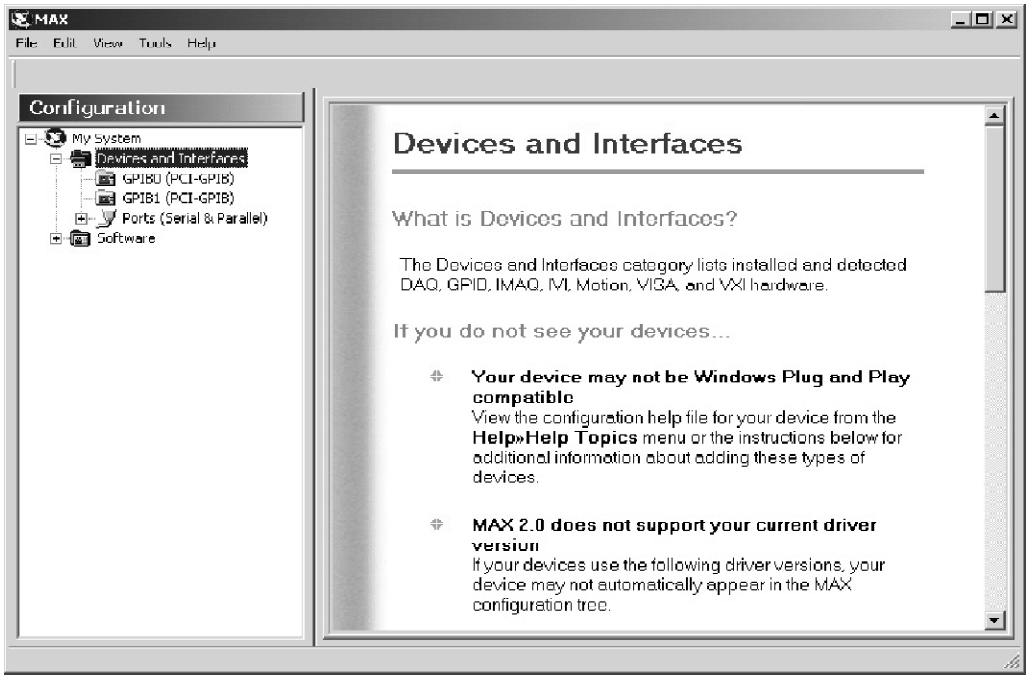


Figure 4–29: Max window

1. Select **Measurement & Automation** icon from the desktop.
2. The **Max** window will appear.
3. Click the **User Preferences**.
   Uncheck **Show this dialog the next time I launch Max**.
4. Click **OK** to maximize this window.
5. The following screen will appear.

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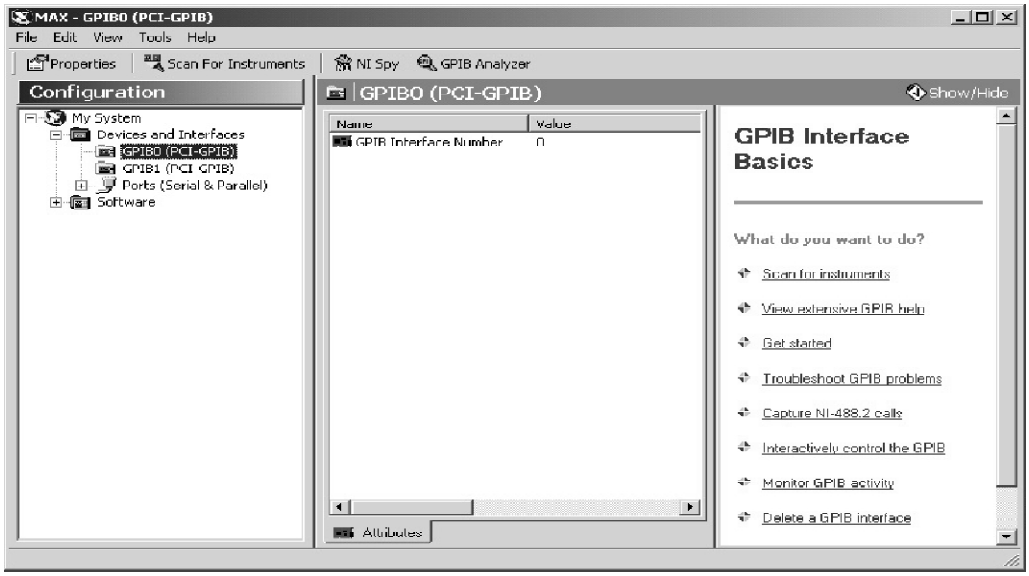


Figure 4-30: Max - GPIB (PCI-GPIB) window

6. Under **Devices and Interfaces** double-click on **GPIB0 (PCI-GPIB)**.
7. Click on the **Show-Hide** button to remove the GPIB Interface Basics window.
8. Click on **Scan for Instruments**. The Fluke 9500B will appear at address 23.
9. The GPIB cards are now correctly configured.

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Performance Verification Instructions

TVS600 Calibration System Hardware Setup

Configure the Wavetek 9500 calibrator and active heads to the DUT as follows:

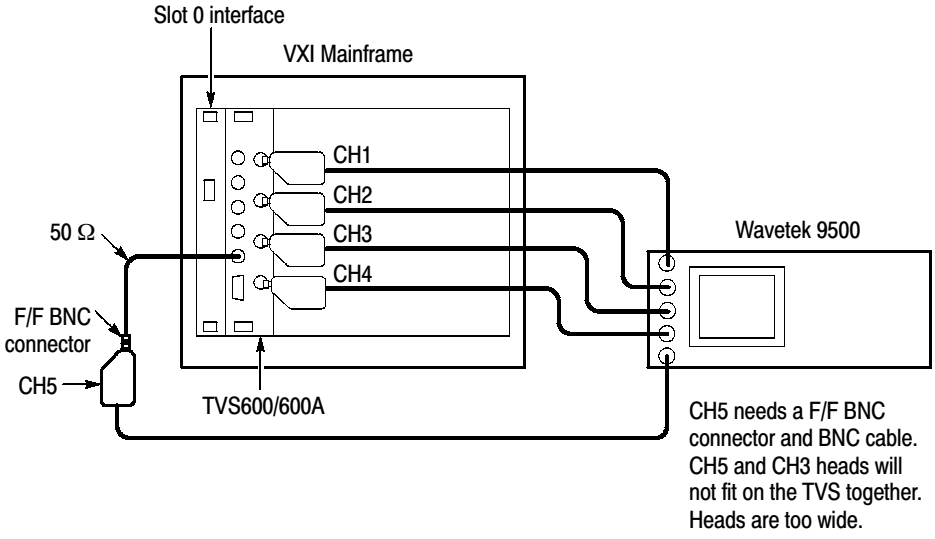


Figure 4-31: Calibration system setup

TVS600 Test Software Installation

Follow these steps to install the TVS600 Test software on the PC, instrument controller. This procedure assumes that the GPIB card and accompanying controller software are already installed and configured as necessary.

1. Refer to the Wavetek 9500 documentation for information about setting the GPIB address, set the Wavetek 9500 address to 23.
2. Insert the TVS600/TVS600A Field Adjust/PV software into the CD-ROM reader on the instrument controller.
3. Select **Programs** then **NT Explorer**.... in the **Start** menu to locate the CD-ROM drive.
4. Double click on **setupTVS600Cal.exe**. Install shield will install all files into the PC.
5. The system will reboot the PC.
6. Follow the instructions to Edit the g_config file.

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***NOTE**. The g_config file contains equipment calibration and driver information required by the program to communicate with the device under test and the signal source generators. The data is queried by the program at start-up, and if any date information is past due, then the test sequence will be aborted until the test equipment that is past due has been replaced. The g_config file will then need to be edited with the new calibration dates.*

7. Select **Explore....** in the **Start** menu locate **C:\tekcats** directory and then double click on **g_config**.
8. Use Wordpad to open the file.
9. Edit calibration data for the five heads as follows:

```
CEDAT (                                  Items to Edit
   ISYSTEMNO "1"
   INAME     "*Head1" ---------          Edit all 5 heads sections
   IIDNO     "185855" ---------          Asset or Cal#
   ITYPEID   "WT9530"
   IDDRIVER  "head"
   IUNIT     "1"
   ISERIALNO "41046" ----------          Head Serial#
   ICALDATE  "03/22/2000" -----          Enter Calibration Date
   IDUEDATE  "03/22/2001" -----          Enter Calibration Due Date
   IADDRESS  "n/a"
)
```

10. Edit the Wavetek 9500 calibration informations for the **Aux1, Sg1, Fg1, Rt1, Pg1 and Ps1** sections as follows:

```
CEDAT (
   ISYSTEMNO "1"
   INAME     "Aux1"
   IIDNO     "175317"---------Asset or Cal#
   ITYPEID   "WT9500"
   IDDRIVER  "wt9500"
   IUNIT     "1"
   ISERIALNO "35688"----------9500B Serial#
   ICALDATE  "03/10/2000"-----Enter Calibration Date
   IDUEDATE  "03/10/2001"-----Enter Calibration Due Date
   IADDRESS  "23"-------------Verify that the GPIB address
)                                of the Wavetek 9500 is set to 23
```

11. Select **Save** in the **File** menu, when all editing has been completed.
12. To start the test program, select **Explore....** in the **Start** menu locate **C:\tekcats** directory and then double click on **launch.bat**.

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Figure 4–32: Operator entry

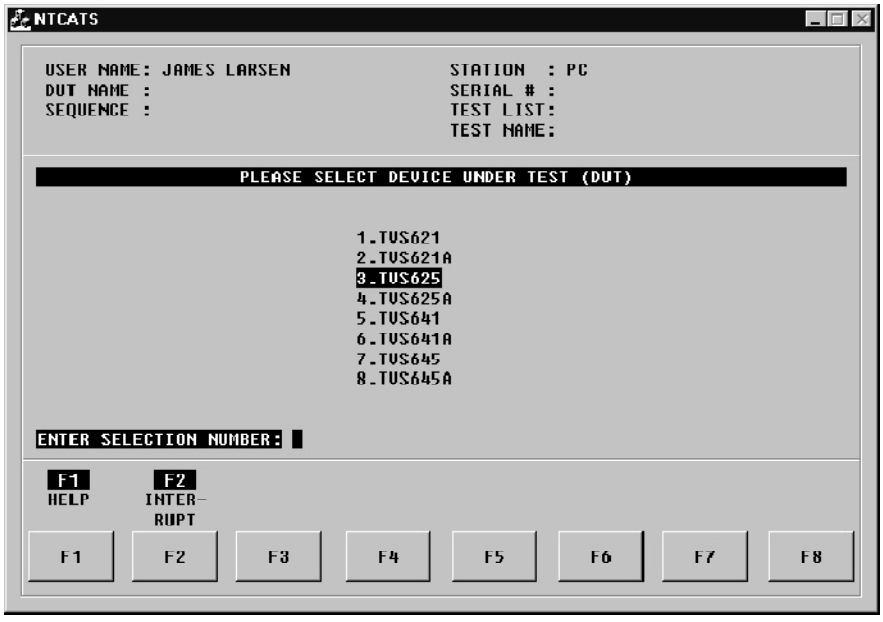


Figure 4–33: Device under test list

13. Select the product to be tested, then enter the product serial number.

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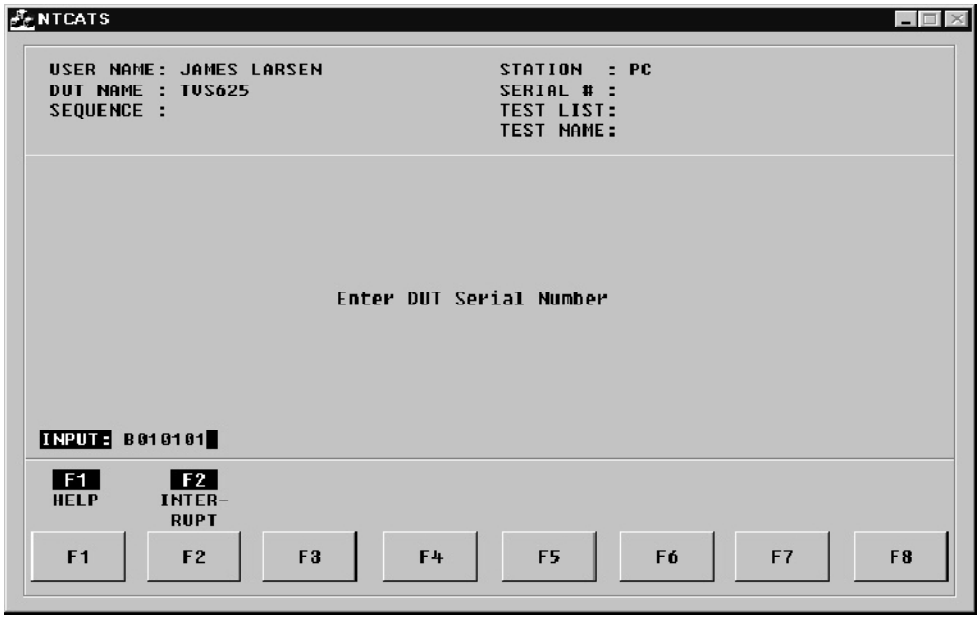


Figure 4-34: Serial number entry screen

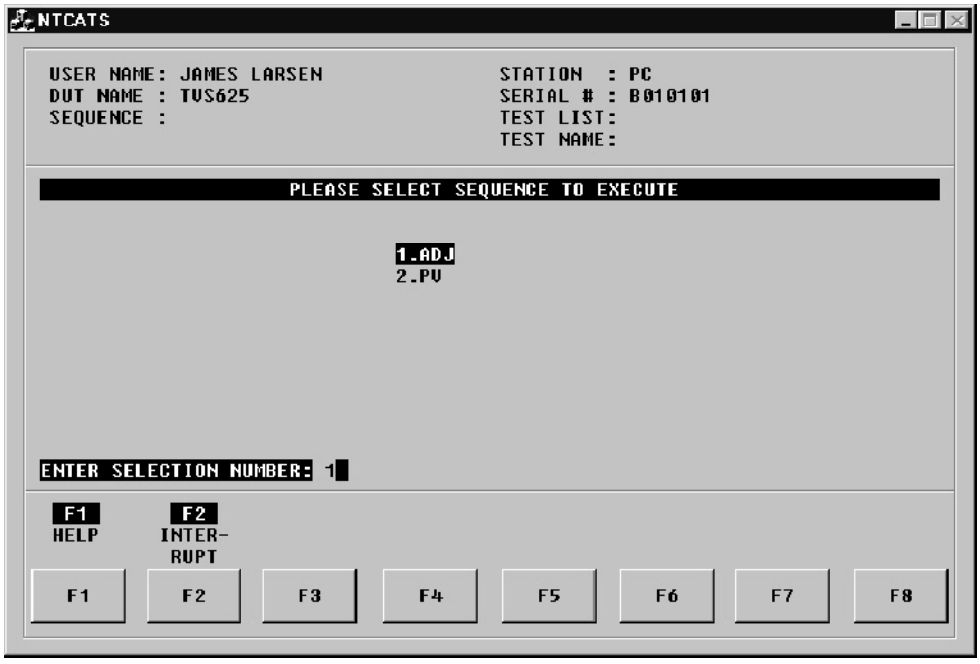


Figure 4-35: Sequence menu

14. **ADJ**, adjusts all instrument parameters.

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15. FPV, tests all published and warranted specificatons.

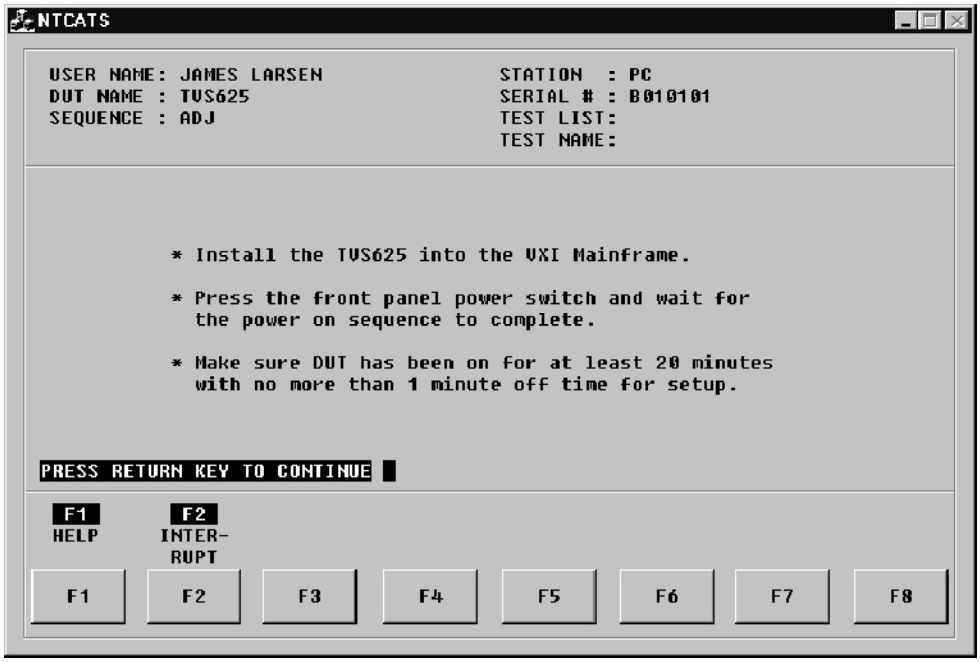


Figure 4-36: Plug-in installation

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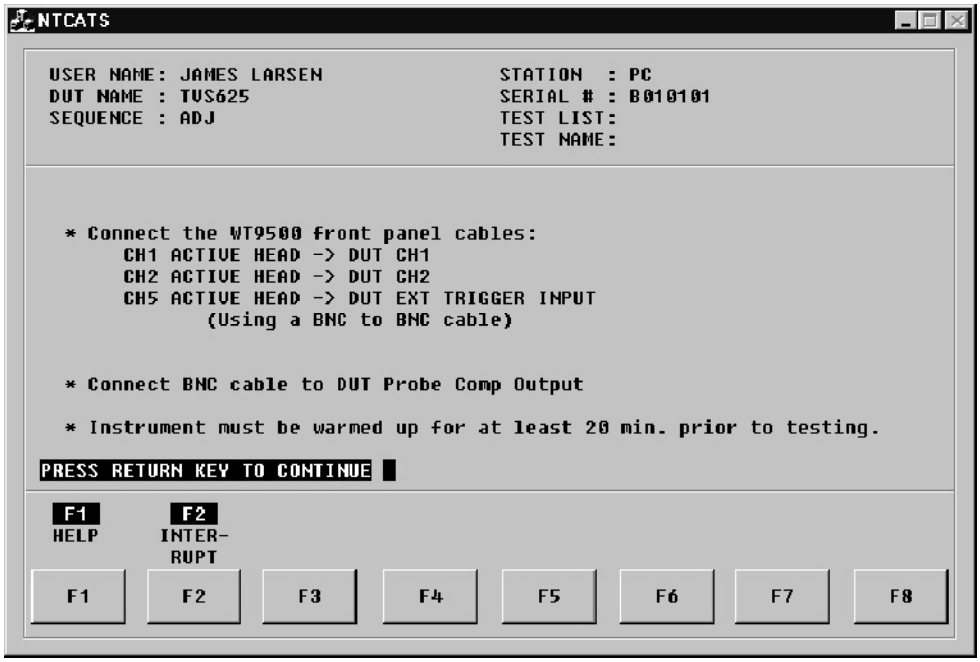


Figure 4–37: Test generator hook-up

16. Connect the Wavetek 9500 active heads as indicated in the **Test generator hook-up** dialog box.
17. Continue with the Temparture and Humity entry screens.
18. If the sequence needs to be interrupted, press F2. The following dialog box will then appear.

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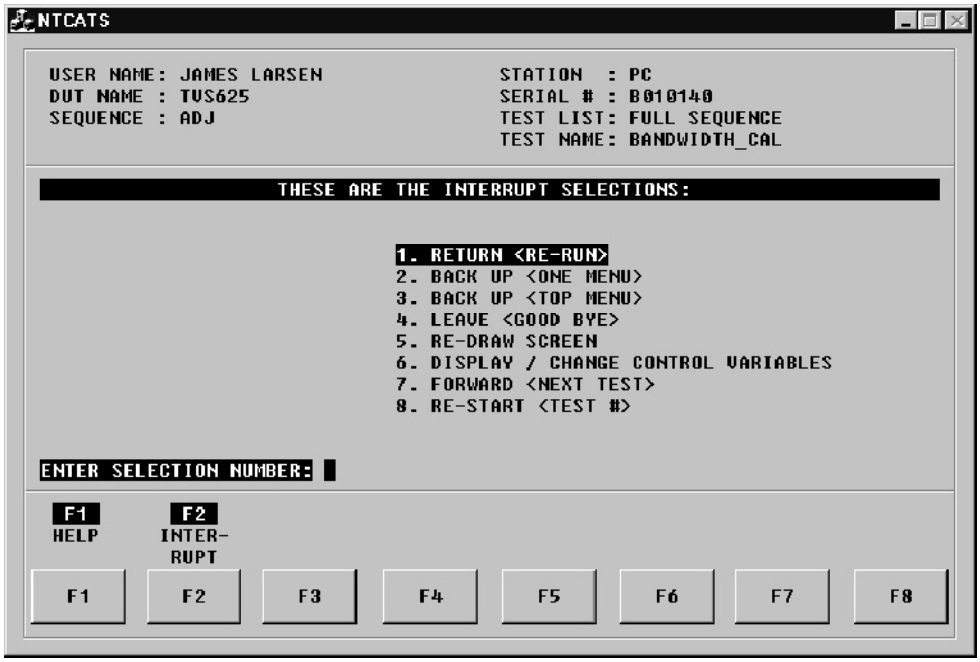


Figure 4–38: Interrupt menu

Table 4–3: Interrupt menu selections

Interrupt selections	Descriptions
RETURN <RE-RUN>	Returns to the beginning of the test just interrupted.
BACK UP <ONE MENU>	Backs up one menu screen level.
BACKUP <TOP MENU>	Backs up to the Product Selection Menu.
LEAVE<GOOD BYE>	Exits the test program and returns to the Windows desktop.
RE-DRAW SCREEN	Reloads current menu selection.
DISPLAY / CHANGE CONTROL VARIABLES	Opens following menu.

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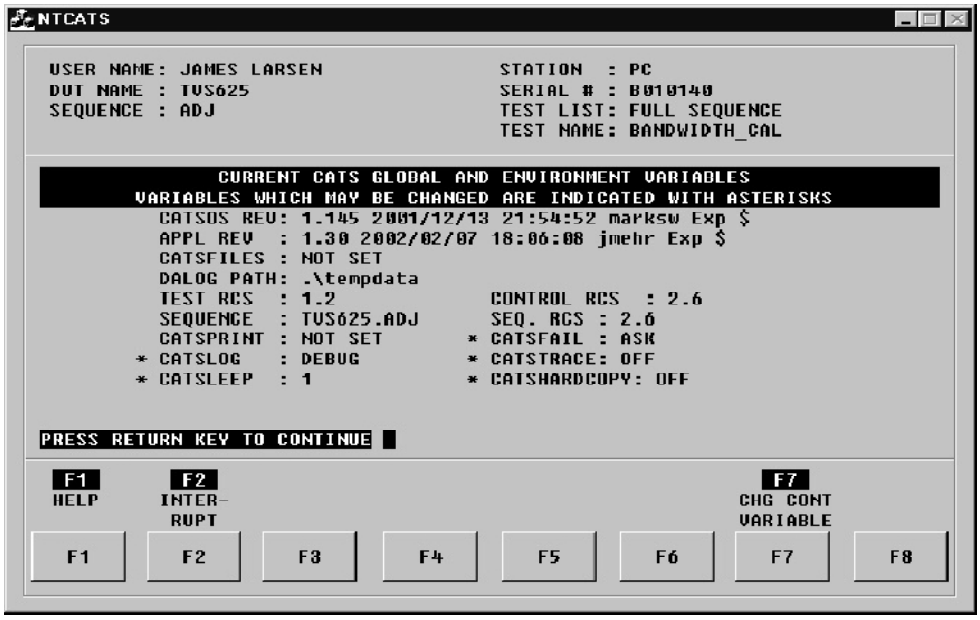


Figure 4-39: Display/change control variables

***NOTE**. This display shows the current test system parameters. Changing these values will only affect the current test session. Once the current test is completed and the user has exited the desktop, all changes are lost.*

19. You can edit any environmental variables noted with an asterisk. To edit environmental variables press **F7**.

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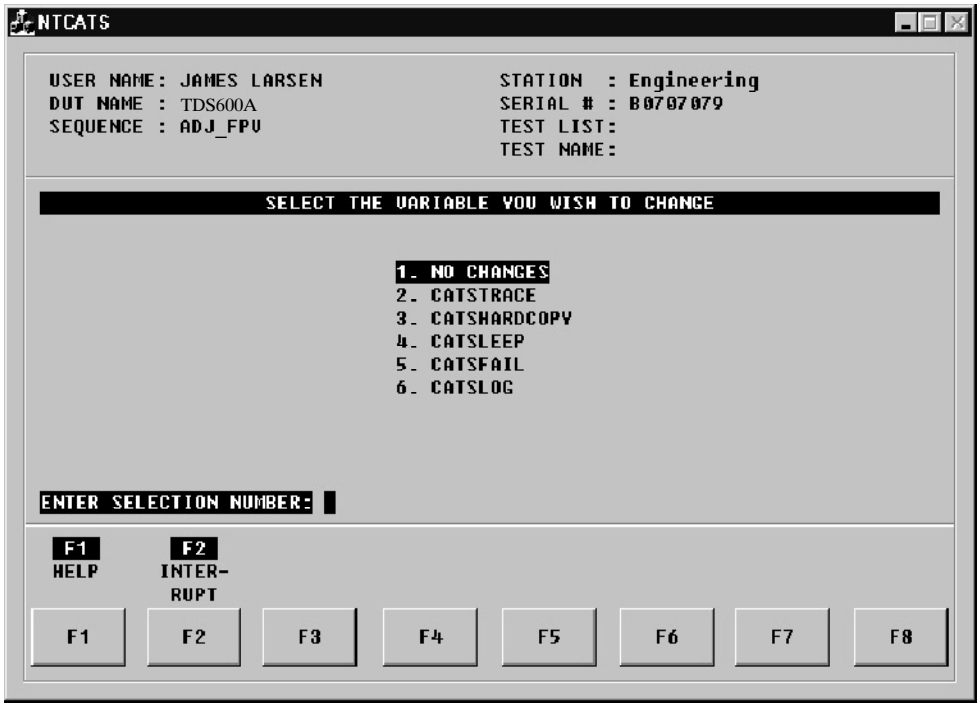


Figure 4–40: Environmental variables selection menu

Table 4–4: Environmental variables selection

Environmental selections	Descriptions
1 CATSTRACE	Not edited.
2. CATSHARDCOPYS Select one of the following:	
DON'T CHANGE	Keeps current setup
NORMAL	System will print all errors as they occur
FAIL	System will print all Failures as they occur
OFF	Turns off hardcopy activity to printer
3. CATSLEEP	Select value between 1 and 10 seconds.

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Table 4-4: Environmental variables selection (Cont.)

Environmental selections	Descriptions
4. CATSFAIL Select one of the following:	
DON'T CHANGE	Keeps current setup
ASK	When a failure occurs, system will stop and asked to continue the test sequence
CONTINUE	When a failure occurs, error is sent to the printer the system will continue test sequence
ABORT	When a failure occurs, error is sent to the printer and exits test sequence
5. CATSLOG Select one of the following:	
DON'T CHANGE	Keeps current setup
ON	
OFF	
DEBUG	
FAIL	

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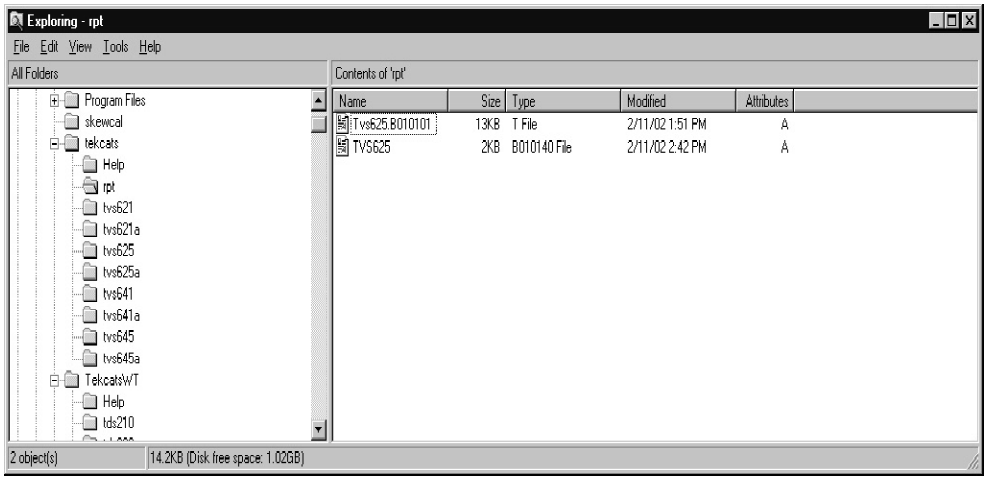


Figure 4–41: Data report

20. To view the Data Report, **Start > NT Explorer**. Select the **C:\tekcats\rpt** directory. Double click on the product and serial number to be viewed/ printed. File name is [product].[serial#].

21. Use Wordpad or Word to open the file.

End of procedure.

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VXI Communication Troubleshooting

Description

This section will help troubleshoot the GPBI-VXI/C communication setup.

1. The GPIB-VXI/C must be installed into slot 0 in the VXI mainframe.
2. The DUT address must be set to 02.
3. Make sure the DUT GPIB cable is connected to the GPIB port on the GPIB-VXI/C.
4. When the VXI mainframe is powered on, the Green **ON LINE** led on the VXI mainframe's front panel should be illuminated.
5. If the the Green **ON LINE** led is not illuminated, the GPIB-VXI/C delay time for initialization my be too short. Proceed with the following procedure to configure the GPIB-VXI/C resource manager (VXI slot 0 manager).

Troubleshooting equipment

You will need the following equipment to configure GPIB-VXI/C resource manager:

- National Instrument's VXI-1000 mainframe (1).
- National Instrument's GPIB-VXI/C resource manager and manual.
- Computer terminal or host computer running a terminal-emulator connected to the serial port of the GPIB-VXI/C. The terminal emulator used will be KERMIT.EXE.
- National Instrument's Type S5 serial port cable, 25-pin (or equivalent) or National Instrument's Type S6 serial port 9-pin (or equivalent).

The following instructions describe how to make the necessary changes in the nonvolatile RAM of the GPIB/VXI/C. The changes will be stored in the nonvolatile RAM and only will have to be performed once. Changes to the nonvolatile RAM are necessary to insure that the GPIB/VXI/C gives other instruments on the backplane sufficient time to initialize before starting resource manager operations.

All resource manager's dip switches and jumpers on the GPIB-VXI/C circuit board are set to factory default set. For slot 0 modules (resource manager) that are not set to factory default configuration refer to Chapter 2, *Configuration and Startup Procedures*, in the TVS600 User manual and restore the resource manager to the factory default configuraton.

1. Referring to the GPIB/VXI/C manual locate S12 and S13 Start Mode Switches.

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2. Referring to the GPIB/VXI/C manual, *Startup Mode Switch Settings*, set S12 and S13 to the nonvolatile configuration mode.
3. Install the resource manager into the slot 0 VXI mainframe.
4. Connect a Type S5 or Type S9 cable (with a DB-9 connectors on both ends) between the terminal or host computer and the GPIB/VXI/C's RS-232 port.
5. If a host computer is used with KERMIT, use COM1 (the .INI file sent with KERMIT is set up for use with COM1).
6. Starting KERMIT:
   a. At the DOS command line, type: KERMIT
   b. After KERMIT has initialized, make sure that speed = 9600, port = 1, parity = none.
7. Power on the VXI-1000 mainframe.
8. As the VXI system (GPIB/VXI/C and VXI-1000 mainframe) boots, the KERMIT screen will appear as follows:

```
GPIB-VXI Nonvolatile Configuration Main Menu
        (C) 1995  National Instruments
 ================================================
  1). Read In Nonvolatile Configuration
  2). Print Configuration Information
  3). Change Configuration Information
  4). Set Configuration to Factory Settings
  5). Write Back (Save) Changes
  6). Quit Configuration          Choice (1-6): 2
```


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9. Enter 2, for “2). Print Configuration Information”. The KERMIT screen will appear as shown below:

```
GPIB-VXI Nonvolatile Configuration Changer
        (C) 1995  National Instruments
  ================================================
   0). Edit Local Register Configuration
   1). Edit pSOS Configuration
   2). Edit VXI Interrupt Handler Logical Addresses
   3). Edit Resource Manager Configuration
   4). Edit Servant Area and DC Configuration
   5). Edit FAILED Device Handling Mode
   6). Edit GPIB Configuration
   7). Edit Default CI Configuration
   8). Edit Resident CI Base Locations
   9). Edit CI User Configuration Variables
   Q). Quit Editor         Choice (0-9,Q): 3
```

10. Enter 3, for “3). Edit Resource Manager Configuration”. The following lines of text will be displayed:

```
----- Resource Manager Configuration -----

Seconds to wait before starting Resource Manager (default 0x0003): 3
```

11. Enter 3, for 3 seconds. The following line of text will be displayed:

```
A24 Base Address to Start Assigning Memory Map (default 0x200000):
```

12. Press the “Enter” key to preserve the default value. The following line of text will be displayed:

```
A32 Base Address to Start Assigning Memory Map (default 0x20000000):
```

13. Press the “Enter” key to preserve the default value. The following line of text will be displayed:

```
<<Press A Key to Return to Main Menu>>
```


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14. Enter a, to Return to Main Menu. The following Menu will be displayed:

```
GPIB-VXI Nonvolatile Configuration Changer
        (C) 1995  National Instruments
 ================================================
  0). Edit Local Register Configuration
  1). Edit pSOS Configuration
  2). Edit VXI Interrupt Handler Logical Addresses
  3). Edit Resource Manager Configuration
  4). Edit Servant Area and DC Configuration
  5). Edit FAILED Device Handling Mode
  6). Edit GPIB Configuration
  7). Edit Default CI Configuration
  8). Edit Resident CI Base Locations
  9). Edit CI User Configuration Variables
  Q). Quit Editor         Choice (0-9,Q): q
```

15. Enter q, for "Quit Editor." The following Menu will be displayed:

```
GPIB-VXI Nonvolatile Configuration Main Menu
        (C) 1995  National Instruments
 ================================================
  1). Read In Nonvolatile Configuration
  2). Print Configuration Information
  3). Change Configuration Information
  4). Set Configuration to Factory Settings
  5). Write Back (Save) Changes
  6). Quit Configuration          Choice (1-6): 5
```

16. Enter 5, for "Write Back (Save) Changes." The following lines of text will be displayed:

```
Saving Nonvolatile Configuration Information.
     Will take 5-10 seconds, Please wait.....Done!

<<Press A Key to Return to Main Menu>>
```


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17. Enter a, to Return to Main Menu. The following Menu will be displayed:

```
GPIB-VXI Nonvolatile Configuration Main Menu
          (C) 1995  National Instruments
  ================================================
    1). Read In Nonvolatile Configuration
    2). Print Configuration Information
    3). Change Configuration Information
    4). Set Configuration to Factory Settings
    5). Write Back (Save) Changes
    6). Quit Configuration          Choice (1-6): 6
```

18. Enter 6, for "Quit Configuration." The following lines of text will be displayed:

```
Must Re-Initialize pROBE or re-boot for pSOS changes to take effect.
Other changes made automatically when configuration saved.

****************************************
*        DONE WITH CONFIGURATION   *
* Change Startup mode Settings to enter      *
* different mode or push RESET to re-boot. *
****************************************
```

19. Turn the Mainframe power-switch OFF.

20. EXIT KERMIT:

- **a.** Press ctrl-] (i.e. press the Ctrl key and the ']' key at the same time).
- **b.** Press the 'c' key.
- **c.** At this point you should see the KERMIT prompt ("MS-Kermit>").
- **d.** Type "exit".

21. Referring to "Figure 2-8. Startup Mode Switch Settings" of the GPIB-VXI/C manual, restore switches S12 and S13 as shown in "a. 488-VXI Runtime System Mode (Factory Configuration)". The GPIB-VXI/C Resource Manager is now configured for use with the oscilloscope calibration software.

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Connecting DUT and Mainframe into the Test System

Make the following connections to DUT and Mainframe:

1. Insert the resource manager into slot-0 of the VXI mainframe.
2. Set the address of the DUT to 02 (Refer to the TVS600 Series manual for instructions on how to set the address on the DUT).
3. Insert the DUT into any slot in the VXI mainframe EXCEPT slot-0 (The Resource Manager should occupy slot-0).
4. Connect the DUT GPIB cable to the GPIB port on the GPIB-VXI/C Resource Manager.
5. Make sure the VXI mainframe is plugged into a 117 volt convenience outlet.
6. Power up the VXI mainframe and allow the system to boot. At this time the **GREEN ON LINE** LED should be illuminated. The TVS600 test software can now be invoked.

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Adjustment Procedures

Description

Adjustments are performed using the Field Adjust/PV software, provided with this manual. See the *Performance Verification* section.

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Maintenance

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

- The *Maintenance* section provides general information on preventing damage to internal modules when doing maintenance, lithium battery warnings and disposal instructions, and procedures for inspecting the waveform analyzer and cleaning its external and internal modules.
- The *Removal and Installation Procedures* (page 6–7) provide procedures for the removal and installation of modules.
- *Troubleshooting* (page 6–25) provides information for isolating failed modules. 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 locate faults within the waveform analyzer.
- *Repackaging Instructions* (page 6–39) provides packaging information for shipment or storage.

Related Maintenance Procedures

The following chapters contain information/procedures related to maintenance.

- The *Operating Information* section provides instructions for operating the waveform analyzer in order to perform the maintenance procedures within this manual.
- The *Theory of Operation* section contains a circuit description to the module, or block, level.
- The *Performance Verification* section contains tests that may be useful in isolating problems to modules by testing waveform analyzer performance.
- The *Adjustment Procedures* section contains a procedure for adjusting the internal circuits of the waveform analyzer. The procedure may be used after repairs are made, or for periodic adjustments.
- The *Diagrams* section contains a block diagram using individual modules as blocks and an interconnection diagram showing connections between the modules.
- The *Mechanical Parts List* section lists all field replaceable modules by part number.

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Preventing ESD

When performing any service which requires internal access to the waveform analyzer, 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 in this waveform analyzer.*

1. Minimize handling of static-sensitive modules.
2. Transport and store static-sensitive modules in their static protected containers or on a metal rail. Label any package that contains static-sensitive modules.
3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules. Do service of static-sensitive modules only at a static-free work station.
4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Handle circuit boards by the edges when possible.
6. Do not slide the modules over any surface.
7. Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.

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 waveform analyzer 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 6–11 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.

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Inspection and Cleaning

This section describes how to inspect for dirt and damage, and how to clean the waveform analyzer. 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 waveform analyzer, and using general care when operating it. How often to do maintenance depends on the severity of the environment in which the waveform analyzer is used. A proper time to perform preventive maintenance is just before adjustment of the waveform analyzer.

General Care

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

Inspection and Cleaning Procedures

Inspect and clean the waveform analyzer 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 waveform analyzer 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 waveform analyzer. Use a cloth dampended 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 waveform analyzer 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 waveform analyzer.

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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 modules.
Front panel connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.	Replace defective modules. Clear or wash out dirt.
Rear connectors	Cracked or broken shells, damaged or missing contacts. Dirt in connectors.	Replace defective modules. 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 items, frayed cables, and defective modules.



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 waveform analyzer exterior, perform the following steps:

1. Remove loose dust on the outside of the waveform analyzer 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 (see page 6-10) to access the inside of the waveform analyzer for inspection and cleaning.

Inspect the internal portions of the waveform analyzer for damage and wear using Table 6-2 as a guide. Defects found should be repaired immediately. If any electrical module is replaced, check Table NO TAG on page NO TAG to determine if you need to adjust the waveform analyzer.

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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 module and replace with a new module.
Resistors	Burned, cracked, broken, blistered condition.	Remove failed module and replace with a new module.
Solder connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Remove failed module and replace with a new module.
Semiconductors	Loosely inserted in sockets. Distorted pins.	Firmly seat loose semiconductors. Remove devices that have distorted pins. Carefully straighten pins (as required to fit the socket), and reinsert firmly. Ensure that straightening action does not crack pins, causing them to break off.
Wiring and cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace modules with defective wires or cables.
Chassis	Dents, deformations, and damaged hardware.	Straighten, repair, or replace defective hardware.



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

Cleaning Procedure — Interior. To clean the waveform analyzer 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.)

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***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 waveform analyzer 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 *Removal and Installation Procedures* on page 6–7).
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.

Lubrication. There is no periodic lubrication required for the waveform analyzer.

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Removal and Installation Procedures

This section describes how to remove and install the major mechanical and electrical modules. It provides the following information:

- *List of Modules* on page 6–7 describes where to locate a list of replaceable modules
- *Summary of Procedures* on page 6–7 lists the procedures for removal and installation of modules
- *Tools Required* on page 6–8 describes the tools needed to perform the procedures
- Beginning with *Ejector Handles* on page 6–9, detailed procedures describe the removal and installation of modules

Preparation — Please Read

Read this warning statement and general instructions before removing a module.



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 6–2.*

- Read the *Summary of Procedures* on page 6–7 to understand how the procedures are grouped. Then read *Tools Required* on page 6–8 for a list of tools needed to remove and install modules in the waveform analyzer.
- If you are disassembling the waveform analyzer for cleaning, refer to the *Inspection and Cleaning* procedure on page 6–3 for cleaning instructions.

List of Modules

The *Mechanical Parts List* section provides a list of all replaceable modules. Any electrical or mechanical module, assembly, or part listed in the parts list is referred to as a module.

Summary of Procedures

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

- *Ejector Handles* on page 6–9 describes how to replace the module ejector handles

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- *Module Cover* on page 6–10 describes how to replace the module cover
- *Processor Board* on page 6–11 describes how to replace the Processor Board (A1)

  The Processor Module cannot be serviced by the customer. If the Processor Module is defective, you must return it to a Tektronix service center.
- *Serial Interface Cable Assembly* on page 6–14 describes how to replace the front panel SERIAL INTERFACE connector
- *BNC Connectors* on page 6–15 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
- *Coaxial Cable Assembly* on page 6–18 describes how to replace the coaxial cable assembly
- *Probe Interface* on page 6–20 describes how to replace the probe interface flex circuit
- *Acquisition Board* on page 6–23 describes how to replace the Acquisition Board (A2)

Tools Required

Most modules in the waveform analyzer 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 waveform analyzer. All tools required to remove and install each module are listed before the procedure.

Table 6–3: Tools required for module 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

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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 ejector handles.

***NOTE**. The ejector labels can be replaced without removing the ejector handles.*

1. Place the instrument on its right side (power requirements label facing down).
2. Remove the screw and flat washer that secure the ejector handle to the chassis.
3. Lift up on the ejector handle until it clears the mounting post.
4. Remove the ejector handle from the waveform analyzer.

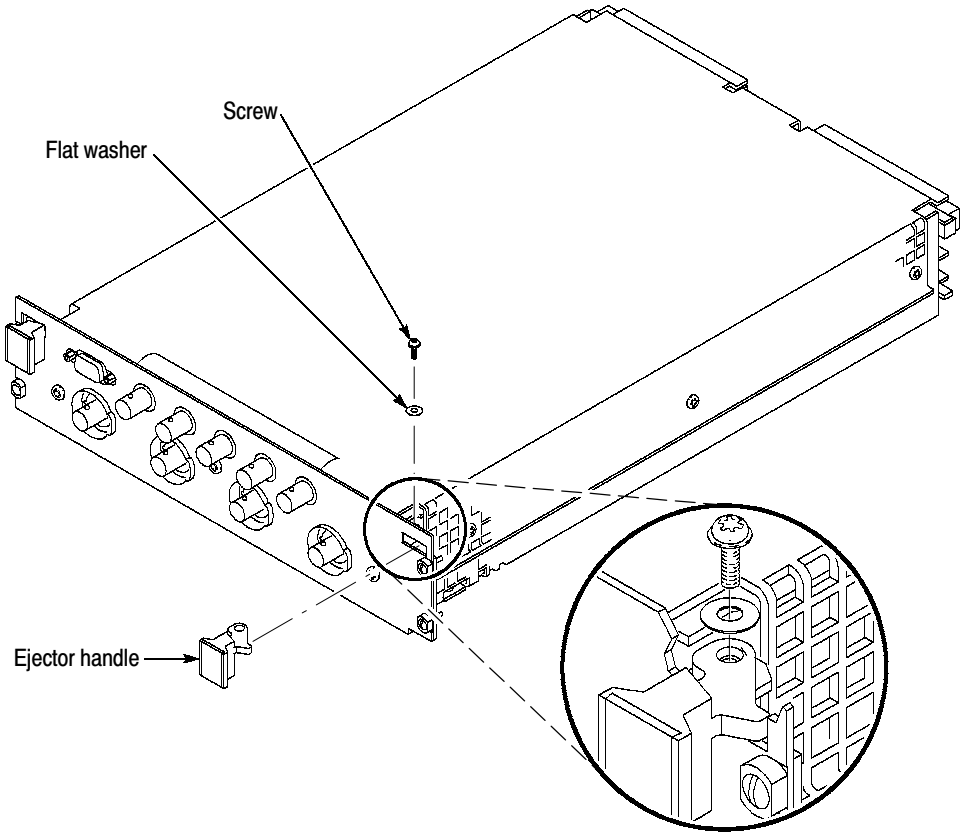


Figure 6–1: Ejector handle replacement

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Installation

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

***NOTE**. The top and bottom ejector handles are not interchangeable.*

1. Install the ejector handle through the front panel cutout onto the mounting post.
2. Install the screw and flat washer to secure the ejector handle to the chassis.

Module Cover

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

Removal

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

1. Place the instrument 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 module cover to the chassis.
4. Lift the module cover from the chassis.

Installation

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

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

1. Place the instrument on its right side.
2. Place the module cover onto the chassis.
3. Push forward on the module cover so the front edge of the module cover is next to the rear of the front subpanel.
4. While holding the module cover in place, install the four (4) screws nearest the front of the module, to secure the module cover to the chassis.
5. Install four (4) screws that secure the rear panel to the chassis.

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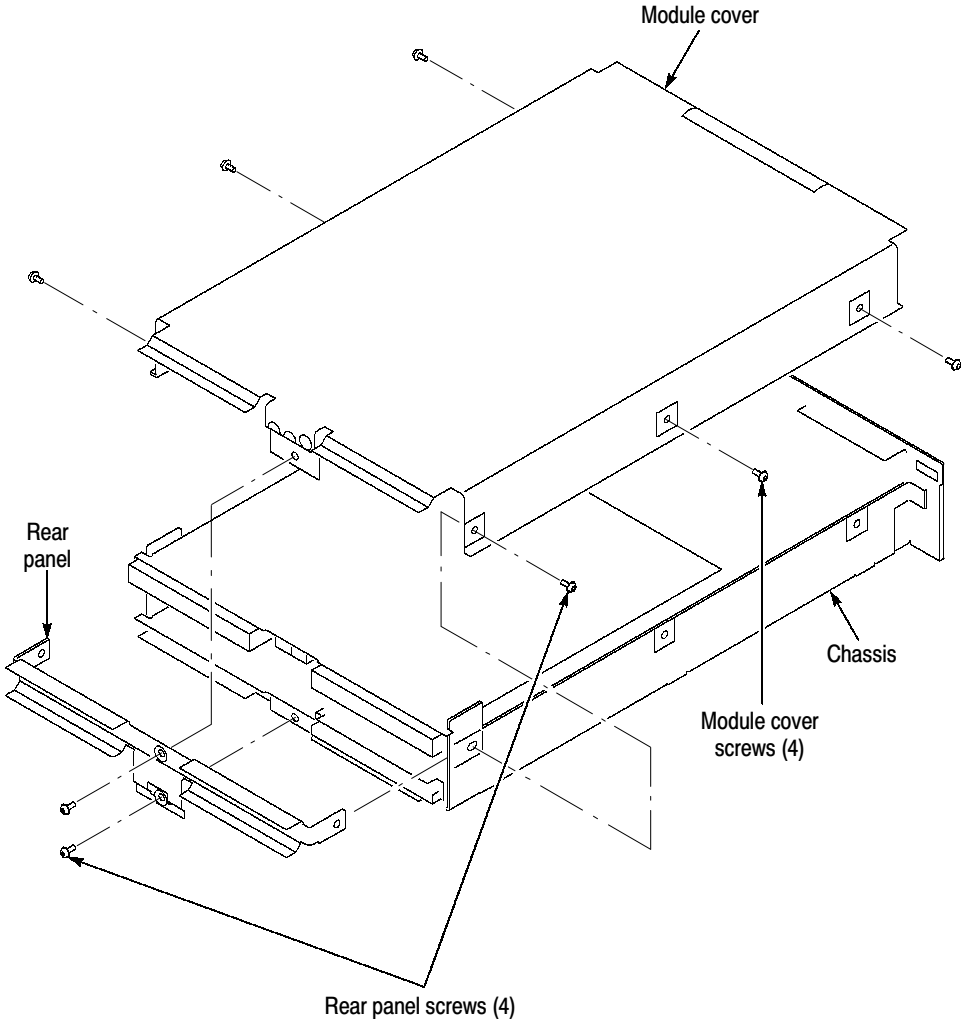


Figure 6–2: Module cover removal

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.

***NOTE**. The Processor Module cannot be serviced by the customer. If you replace the module, you must return it to a Tektronix service center.*

Removal

Use the following procedure and Figure 6–3 to remove the Processor Board.

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***NOTE**. After replacing the Processor Board, you must reprogram the FlashROM and self cal the waveform analyzer. To restore the self cal settings, refer to* Self Cal Mode *on page 2-13.*

1. Perform the *Module Cover* removal procedure (see page 6-10).
2. Unplug two 100-pin ribbon cables from J6 and J9, and one 9-pin ribbon cable from J5.

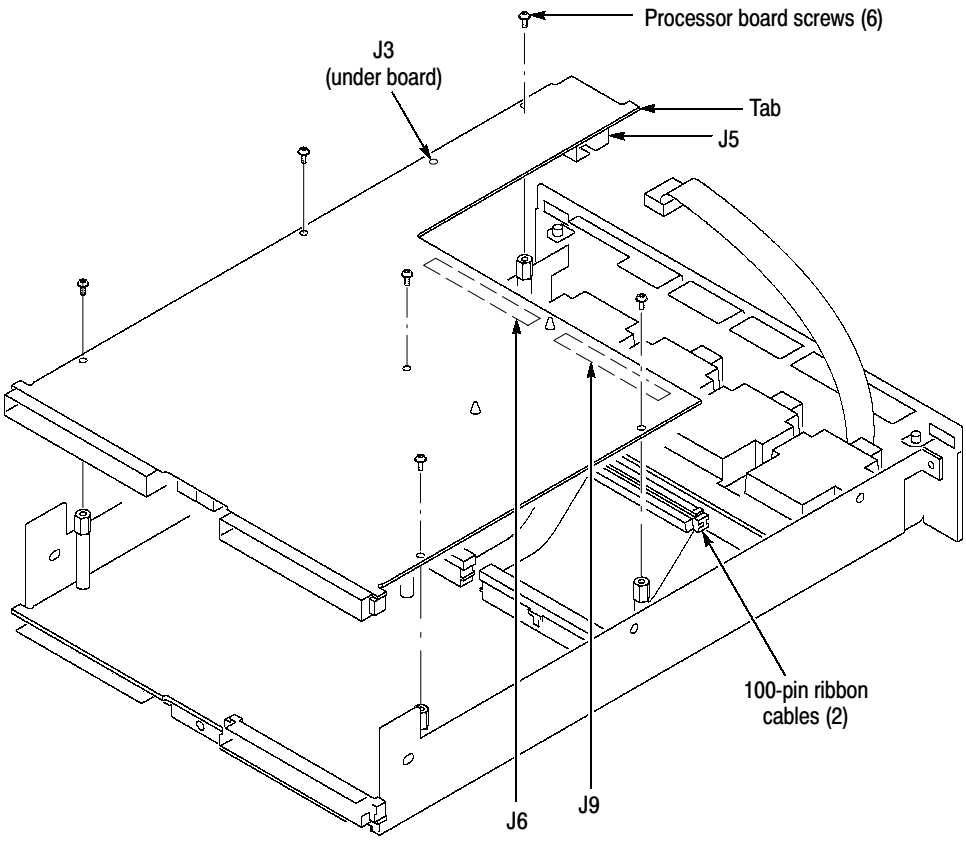


Figure 6-3: Processor board removal

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 6-3) clears the front subpanel.
5. Lift the board above the chassis. Then unplug the yellow/white coaxial cable from J3.

Installation

Use the following procedure and Figure 6-3 to install the Processor Board.

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***NOTE**. After replacing the Processor Board, you must reprogram the FlashROM and self cal the waveform analyzer. To restore the self cal settings, refer to* Self Cal Mode *on page 2-13.*

1. Hold the Processor Board above the chassis and install the yellow/white coaxial cable at J3.

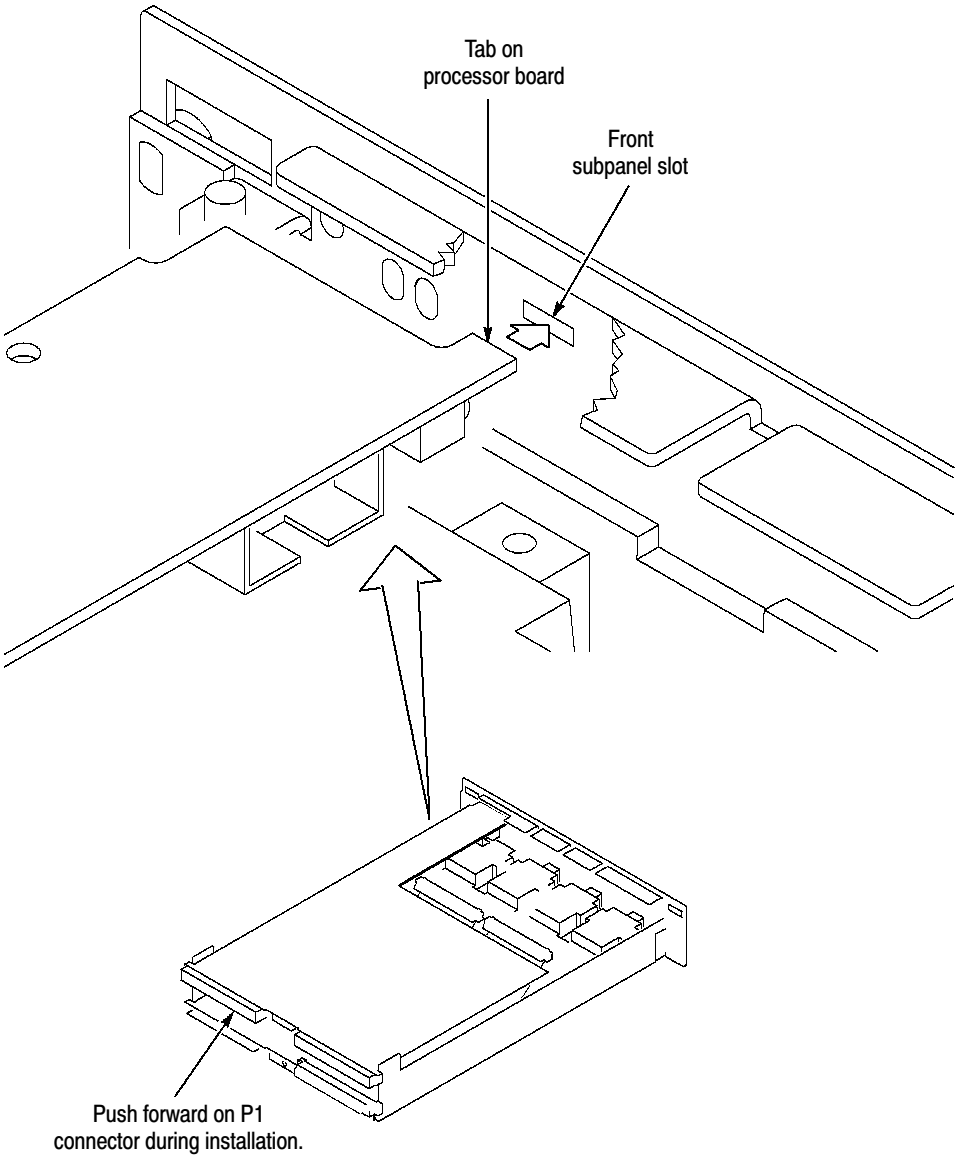


Figure 6-4: Inserting processor board tab into front subpanel

2. Insert the tab on the Processor Board into the front subpanel as shown in Figure 6-4. Then set the Processor Board in place on the chassis.

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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 9-pin ribbon cable at J5.
6. Install the two 100-pin ribbon cables at J6 and J9.
7. Perform the *Module Cover* installation procedure (see page 6–10).

Serial Interface Cable Assembly

You will need a screwdriver with a size T-10 Torx® tip, and a 3/16 inch nut driver (Table 6–3, items 1, 2, and 8) to replace the serial interface cable assembly.

Removal

Use the following procedure and Figure 6–5 to remove the serial interface cable assembly.

1. Perform the *Module Cover* removal procedure (see page 6–10).
2. Unplug the serial interface cable from J5 on the Processor Board.



CAUTION. *To avoid damage to the SERIAL INTERFACE connector shell, do not force the nut driver between the jack screws and the connector.*

3. Using a 3/16 inch nut driver, remove two (2) jack screws that secure the SERIAL INTERFACE connector to the front panel.
4. Lift the serial interface cable assembly from the chassis.

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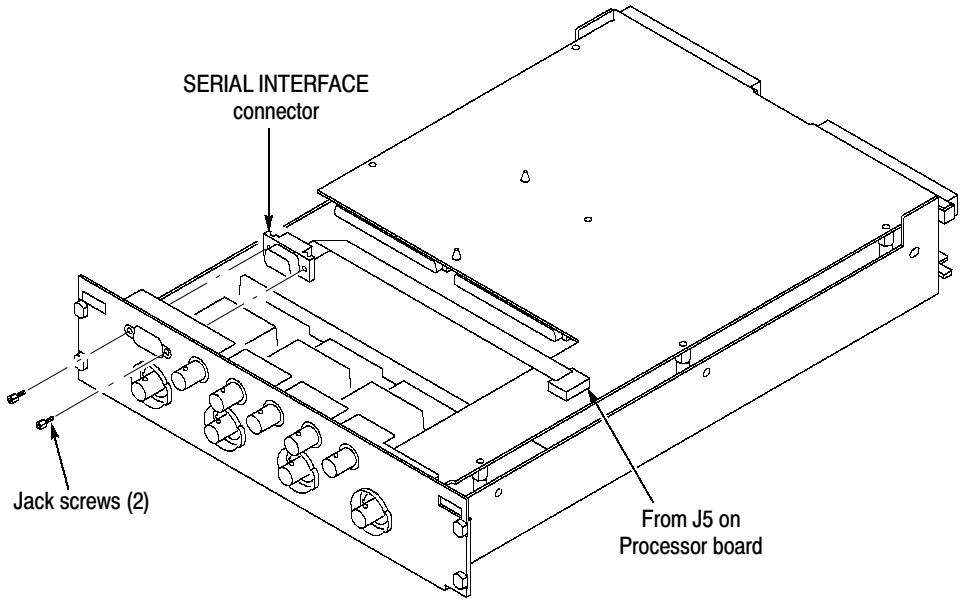


Figure 6-5: Serial interface connector removal

Installation

Use the following procedure and Figure 6-5 to install the serial interface cable assembly.

1. Insert the SERIAL INTERFACE connector, from the rear of the front panel, into the front panel cutout.



CAUTION. *To avoid damage to the SERIAL INTERFACE connector shell, do not force the nut driver between the jack screws and the connector shell.*

2. Using a 3/16 inch nut driver, install two (2) jack screws that secure the connector to the front panel.
3. Plug the serial interface cable connector into J5 on the Processor Board. When installing a new cable, fold it as shown in Figure 6-5 to ensure proper polarity of the connector.
4. Perform the *Module Cover* installation procedure (see page 6-10).

BNC Connectors

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 following BNC connectors:

- PROBE COMPENSATION

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- REFERENCE OUTPUT
- FIDUCIAL INPUT
- ARM INPUT
- EXTERNAL TRIGGER INPUT

Removal

Use the following procedure and Figure 6–6 to remove the BNC connectors.

1. Perform the *Processor Board* removal procedure (see page 6–11).
2. Unplug the coaxial cable from the rear of the BNC that is being replaced.
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.

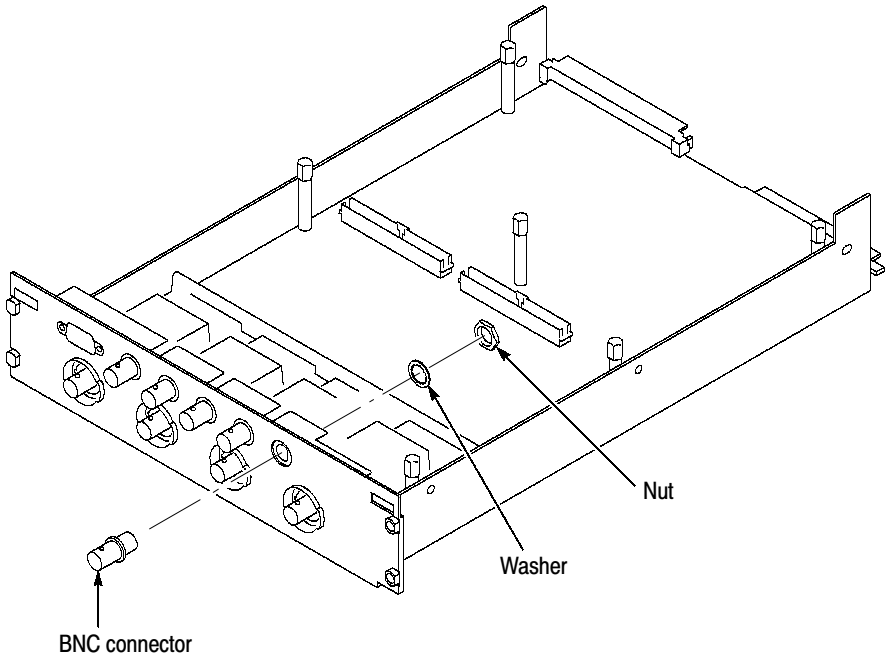


Figure 6–6: BNC replacement

Installation

Use the following procedure and Figure 6–6 to install BNC connectors.

1. Insert the BNC through the hole in the front panel.
2. Slide the washer onto the BNC, next to the back side of the front panel.

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3. Using a 1/2 inch nut driver, install the securing nut onto the connector.
4. Plug the coaxial cable into the rear of the BNC (see Figure 6–8 on page 6–19 for a detailed description of the cable connections).
5. Perform the *Processor Board* installation procedure (see page 6–12).

Fuses

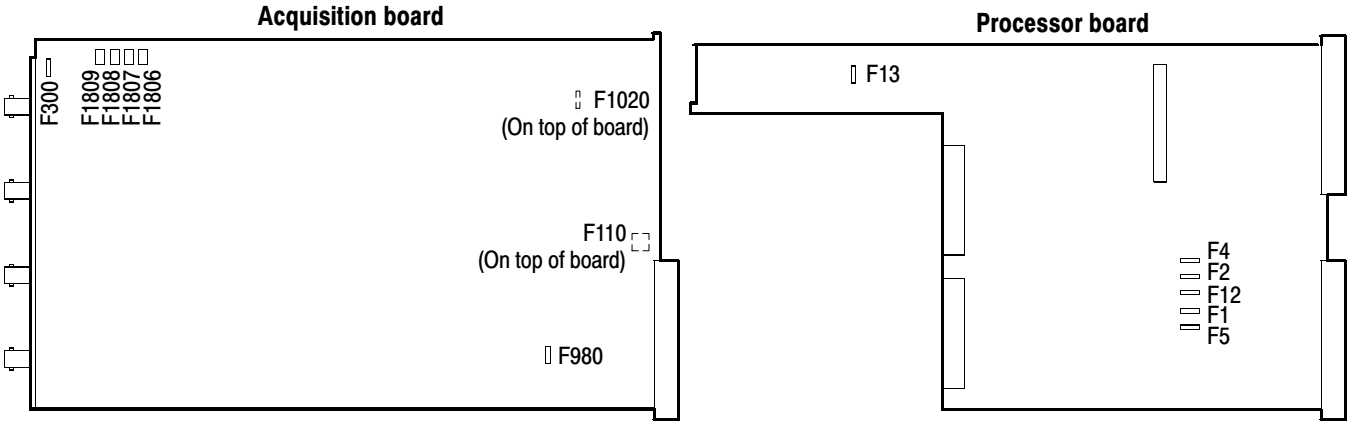
CAUTION. *To avoid damage to the waveform analyzer, use only replacement fuses that match the type, voltage, and current rating of the original fuse. See the* Mechanical Parts List *section for the part number of replacement fuses.*

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 6–11).
2. Use Figure 6–7 to locate the fuse to be replaced.



Circuit number	Circuit board	Purpose
F110	Acquisition Board	+5 V
F300	Acquisition Board	Fiducial input
F980	Acquisition Board	Reference output
F1020	Acquisition Board	External trigger input
F1806	Acquisition Board	+5 V to probe interface
F1807	Acquisition Board	-5 V to probe interface
F1808	Acquisition Board	+15 V to probe interface
F1809	Acquisition Board	-15 V to probe interface

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	Calibrator output

Figure 6–7: Fuse replacement

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3. If the fuse is mounted on the back side of the Acquisition board (A2), perform the *Probe Interface* removal procedure (see page 6–20). If you can already access the fuse, proceed to step 4.
4. Using a soldering iron and solder wick, unsolder and discard the fuse.

Installation

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



CAUTION. *To avoid damage to the waveform analyzer, 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. If the Acquisition Board (A2) was removed, perform the *Probe Interface* installation procedure (page 6–22).
3. Perform the *Processor Board* installation procedure (see page 6–12).

Coaxial Cable Assembly

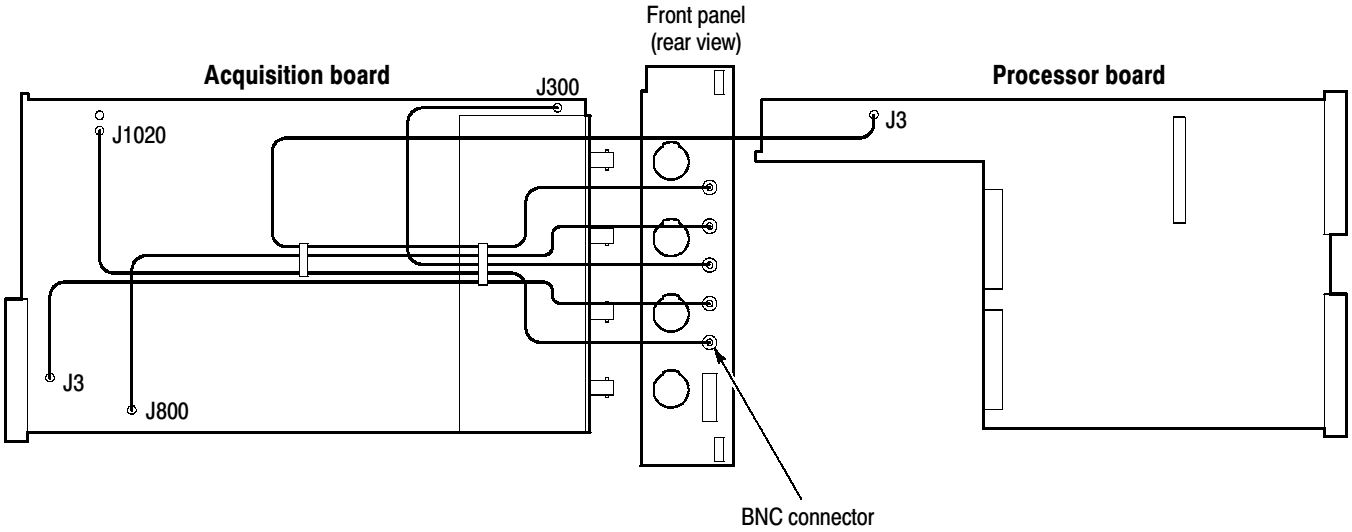
You will need a screwdriver with a size T-10 Torx® tip (Table 6–3, items 1 and 2) to replace the coaxial cable assembly.

Removal

Use the following procedure and Figure 6–8 to remove the coaxial cable assembly.

1. Perform the *Processor Board* removal procedure (see page 6–11).
2. Unplug the five (5) coaxial cables from the front panel BNC connectors.
3. Unplug the four (4) coaxial cables from the Acquisition Board connectors.

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Connector	Color code	Circuit board	Circuit number
Probe Compensation	Yellow/white	Processor Board	J3
Reference Output	Green/white	Acquisition Board	J980
Fiducial Input	Red/white	Acquisition Board	J300
Arm Input	Purple/white	Acquisition Board	J800
External Trigger Input	Blue/white	Acquisition Board	J1020

Figure 6-8: Coaxial cable assembly replacement

Installation

Use the following procedure and Figure 6-8 to install the coaxial cable assembly.

1. Install the five (5) coaxial cables into the front panel BNC connectors as shown in Figure 6-8.
2. Install the four (4) coaxial cables into connectors on the Acquisition Board as shown in Figure 6-8. The yellow/white coaxial cable will be installed later.



CAUTION. *To avoid damage to the coaxial cable assembly during Processor Board installation, be sure the cables lay as shown in Figure 6-9.*

3. Dress the coaxial cable assembly as shown in Figure 6-9. Route it between the center post and the top side of the instrument.

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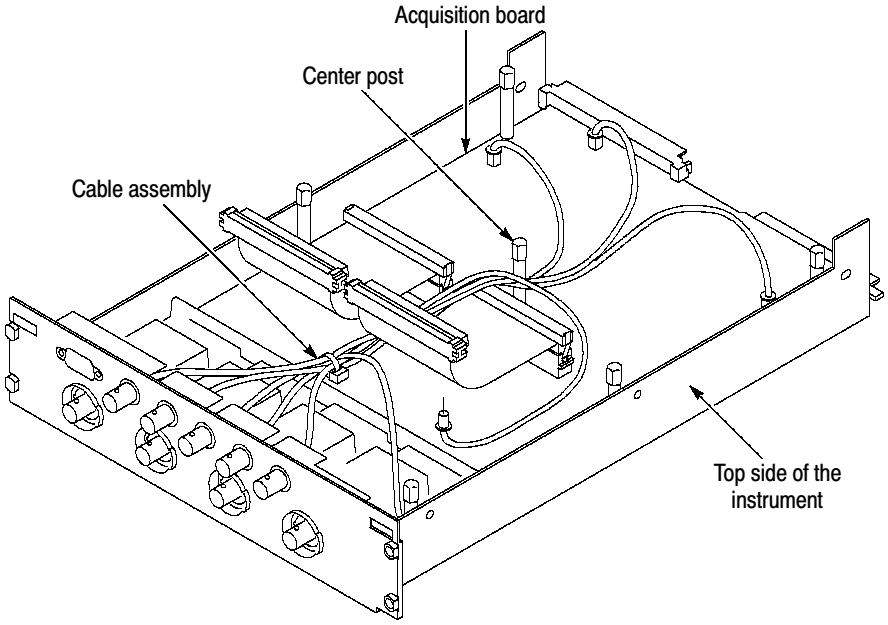


Figure 6-9: Dress of coaxial cable assembly

4. Perform the *Processor Board* installation procedure (see page 6-12).

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 6-10 to remove the probe interface.

1. Perform the *Module Cover* removal procedure (see page 6-10).
2. Perform the *Coaxial Cable Assembly* removal procedure (see page 6-18).
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..*

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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.

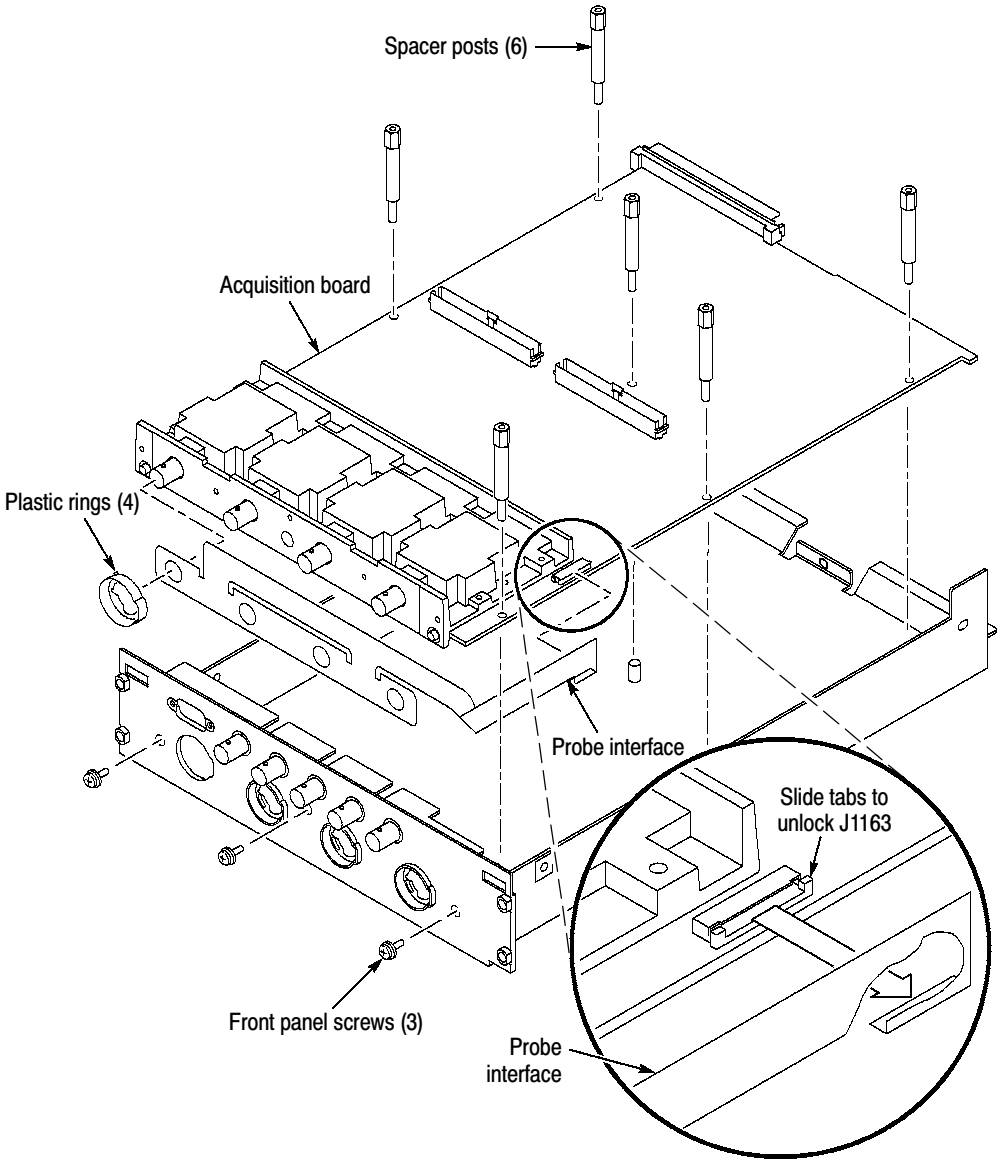


Figure 6–10: Probe interface replacement

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).

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8. Remove the probe interface from J1163. Then carefully slide the probe interface from around each BNC connector on the Acquisition Board.

Installation

Use the following procedure and Figure 6–10 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 6–10. 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 *Coaxial Cable Assembly* installation procedure (see page 6–19).

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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 6–11 to remove the Acquisition Board.

***NOTE**. After replacing the Acquisition Board, you must perform the Performance Verification procedure on the waveform analyzer. See the* Adjustment Procedures *section for detailed instructions. If the unit fails the Performance Verification, then run the* Adjustment Procedures.

1. Perform the *Probe Interface* removal procedure (see page 6–20).
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 6–11) to unlock the cable from its connector.
   b. Unplug the cable from the Acquisition Board. Set the cable aside.

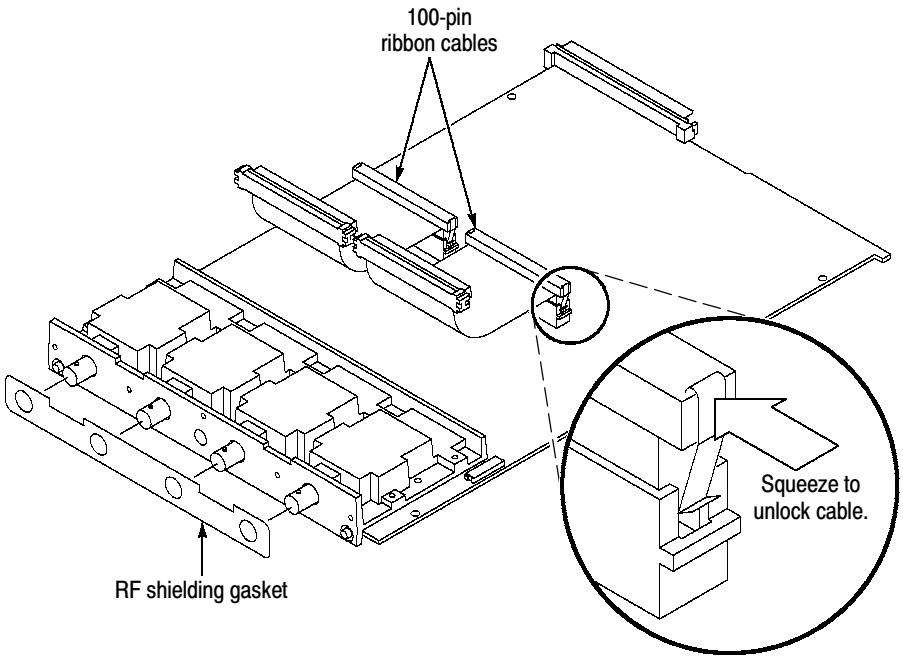


Figure 6–11: Acquisition board replacement

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Installation

Use the following procedure and Figure 6–11 to install the Acquisition Board.

***NOTE**. After replacing the Acquisition Board, you must adjust the waveform analyzer. See the* Adjustment Procedures *section for detailed instructions.*

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 6–22).

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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 6-2.*

This section contains information and procedures designed to help you isolate faults within your system. There are two levels of troubleshooting instructions:

- *System Diagnostics* on page 6-27 helps to isolate faults to a system component
- *TVS600 and TVS600A Diagnostics* on page 6-29 helps to isolate faults to a module within the waveform analyzer

The troubleshooting instructions in the *TVS600 and TVS600A Diagnostics* section isolate faults to one of the following waveform analyzer modules:

- Processor Board (A1)
- Acquisition Board (A2)
- Power supply fuses
- Probe interface flex cable

Other sections in this manual contain instructions you will need to complete repairs after locating the faulty module. Refer to the following sections:

- Use the *Removal and Installation Procedures* that begin on page 6-7 for module replacement instructions
- Refer to Table NO TAG on page NO TAG after module replacement to determine if adjustments are required
- Complete the procedures found in the *Performance Verification* section to verify instrument functionality following repairs or adjustment

Instrument Commands Used for Maintenance

The waveform analyzer command set contains several commands that execute self tests. You can use the self tests for diagnostic purposes, or for optimizing instrument performance (self cal). Each self test is identified by a number as shown below:

- 1000 to 1999 — functional tests
- 2000 to 2999 — self cal functions

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Self tests are initiated using the CAL and TEST command headers. The command header determines whether the waveform analyzer uses the self test results.

CAL Commands. The CAL and *CAL? commands execute a self cal of the waveform analyzer. A self cal runs all self tests within the range 2000 to 2999. Upon successful completion of the self cal, the waveform analyzer stores the resulting data in memory. The self cal data is only replaced when another self cal is successfully completed. See *Self Cal Mode* on page 2–13 for additional information.

TEST Commands. The TEST, TEST?, and *TST? commands execute all self tests within the range of 1000 to 2999. Self tests executed using these commands do not store data in the waveform analyzer memory. For this reason, you can safely execute self tests that perform self cal functions (2000 to 2999) without changing the waveform analyzer performance. See *Self Tests* on page 2–14 for additional information.

Command Summary. Table 6–4 contains an alphabetical listing of the maintenance-related commands. The table provides arguments, syntax examples, and descriptions for each command header. Commands are shown in their abbreviated form. The parenthesized question symbol (?) identifies commands that also have a query form. For a more detailed description of these or any other commands, refer to the *TVS600 and TVS600A Waveform Analyzers User Manual*.

Table 6–4: Service-related commands

Header	Arguments	Example syntax	Description
CAL (?)	N/A	CAL CAL?	Executes a self cal of all internal subsystems. Self cal stops if a failure occurs. Query executes a self cal and returns a numeric value showing results. The value 0 indicates no failures. Values between 2000 and 2999 identify unique self cal functions.
CAL:RES?	N/A	CAL:RES?	Returns a numeric value showing results of the last self cal. The value 0 indicates no failures. Values between 2000 and 2999 identify unique self cal functions. The value -1 indicates a self cal is in progress.
CAL:RES:VERB?	N/A	CAL:RES:VERB?	Same as CAL:RES?, but appends the error number with an error-specific message.
OUTP:REF (?)	0 or OFF 1 or ON	OUTP:REF ON OUTP:REF?	Turns the REFERENCE OUTPUT on or off, or returns the on/off status of the REFERENCE OUTPUT. Responses are 0 (off) and 1 (on).
OUTP:REF:FUNC (?)	CLOC VOLT	OUTP:REF:FUNC VOLT OUTP:REF:FUNC?	Selects the signal for output at the REFERENCE OUTPUT connector, or returns signal selection for the REFERENCE OUTPUT. Responses are CLOC and VOLT.

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Table 6-4: Service-related commands (cont.)

Header	Arguments	Example syntax	Description
TEST (?)	N/A	TEST TEST?	Executes all internal self tests. If a failure occurs and halt control is enabled, the test will stop immediately. The query executes all internal self tests and returns a numeric value showing results. The value 0 indicates no failures. Values between 1000 and 1999 identify unique test functions. Values between 2000 and 2999 identify unique self cal functions. The data resulting from self cal test execution is not used.
TEST:RES?	N/A	TEST:RES?	Returns the results of the last self test. If a failure occurs, the number returned identifies the first failed test within the sequence. The value 0 indicates no failures. Values between 1000 and 2999 identify unique test functions. The value -1 indicates a test is in progress.
TEST:RES:VERB?	N/A	TEST:RES:VERB?	Same as TEST:RES?, but appends the error number with an error-specific message.
*CAL?	N/A	*CAL?	Executes a self cal of all internal subsystems. Returns a numeric value showing results. The value 0 indicates no failures. Values between 2000 and 2999 identify unique self cal functions.
*IDN?	N/A	*IDN?	Returns identification message in the following format: Manufacturer, Model Number, Options, Serial Number, SCPI and Firmware Version.
*LRN?	N/A	*LRN?	Returns a sequence of program message units that show the current settings. You can return this data to the instrument to place it in a known state.
*RST	N/A	*RST	Returns the instrument settings to the default, (power-on) state.
*TST?	N/A	*TST?	Executes all internal self tests. Returns a numeric value showing results. The value 0 indicates no failures. Values between 1000 and 1999 identify unique diagnostic functions. Values between 2000 and 2999 identify unique self cal functions. The data resulting from self cal test execution is not used.

System Diagnostics

Table 6-5 provides a list of common problems that will cause your VXIbus system to malfunction. The list is not exhaustive; other conditions may exist that prevent your system from operating properly. If you are not able to complete the *Power-On Procedure* (page 2-10), try to repair your system using the suggestions found in the **Possible Cause(s)** column of Table 6-5.

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It is possible that you will not identify which system component is faulty after checking for the symptoms in Table 6–5. You should use a working VXIbus module to quickly determine if the waveform analyzer is at fault. Perform the following steps:

1. Remove the waveform analyzer from the VXIbus mainframe.
2. Configure the VXIbus mainframe for the working VXIbus module. Be sure to use the plug-in slots where you want to install the waveform analyzer.
3. Install the working VXI module or MXI/VXI interface.
4. Power-on the system and check for normal operation of the working VXIbus module.

If your system operates normally with the working VXIbus module installed, the waveform analyzer needs to be repaired. The *TVS600 and TVS600A Diagnostics* section on page 6–29 provides the troubleshooting procedures you need to locate faults within the waveform analyzer.

Table 6–5: Failure symptoms and possible causes

Symptom	Possible cause(s)
Computer does not power on	■ Power connection faulty; check or substitute power cord ■ Line voltage setting incorrect; check setting and line fuse ■ Hardware failure; consult manufacturer or product literature
Mainframe does not power on	■ Power connection faulty; check or substitute power cord ■ Fuse blown; check line fuse ■ Mainframe power supply failure; contact local Tektronix service center
Monitor does not power on	■ Power connection faulty; check or substitute cord ■ Fuse blown; check line fuse ■ Monitor power supply failure; contact local Tektronix service center
Monitor display is blank	■ Adjust monitor controls for brightness and contrast ■ VGA cable connection faulty; check or substitute VGA cable ■ Monitor failure; contact local Tektronix service center
Computer does not boot	■ Non-system diskette or floppy in external drive; make sure computer is booting from hard drive ■ Hard drive failure or corrupted files on hard drive; consult manufacturer or product literature for service information
TVS600 and TVS600A *and* Slot 0 controller do not power on	■ Modules not fully inserted; make sure front of module is flush with front panel ■ Mainframe not configured properly; consult manufacturer or product literature for information ■ Mainframe power supply failure; contact local Tektronix service center

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Table 6–5: Failure symptoms and possible causes (cont.)

Symptom	Possible cause(s)
Slot 0 controller does not power on	■ Module not fully inserted; make sure front of module is flush with front panel ■ Mainframe not configured properly; consult manufacturer or product literature for information ■ Module failure; contact local Tektronix service center
TVS600 and TVS600A does not power on (READY indicator not green)	■ Module not fully inserted; make sure front of module is flush with front panel ■ Mainframe not configured properly; consult manufacturer or product literature for information ■ Module failure; see *TVS600 and TVS600A Diagnostics* on page 6–29, or contact local Tektronix service center
TVS600 and TVS600A or Slot 0 controller does not respond to *IDN? query	■ Module not fully inserted; make sure front of module is flush with front panel ■ Incorrect address for TVS600 and TVS600A; set logical address to expected address of the TVS600 and TVS600A; refer to page 2–1 for instructions ■ TVS600 and TVS600A failure; see *TVS600 and TVS600A Diagnostics* on page 6–29, or contact local Tektronix service center
TVS600 and TVS600A loses settings when power is turned off	■ TVS600 and TVS600A failure; see *TVS600 and TVS600A Diagnostics* on page 6–29, or contact local Tektronix service center ■ TVS600 and TVS600A battery failure; refer to page 6–11 for Processor Board (A1) replacement instructions

TVS600 and TVS600A Diagnostics

This section provides troubleshooting charts that help you identify faulty modules within the waveform analyzer. The procedures require that your system is functional; it operates normally when modules other than the waveform analyzer are installed. If you have not determined that the waveform analyzer needs repair, refer to *System Diagnostics* on page 6–27 before troubleshooting the waveform analyzer.

Equipment Required

The test equipment needed to troubleshoot the waveform analyzer depends on the type of failure. Many faults can be detected using a digital multimeter. However, waveform analyzer testing and adjustments might be required to correct some faults. Under those circumstances, you will need the test equipment listed in the *Performance Verification* and *Adjustment Procedures* sections.

You will be required to install a new Processor Board (A1) and fuses to isolate certain faults. See the *Mechanical Parts List* section to locate the Tektronix part number for replacement parts.

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.

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- 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 waveform analyzer 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 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.

  If the READY indicator blinks at power-up, then the waveform analyzer has an event to report. To read the event , send the `SYST:ERR?` query.

  The returned event message contains the event number and a text description of the event. When you read the event, the event is removed from the queue. If the READY indicator continues to blink, send another query to retrieve additional event numbers and descriptions.

Self Calibration. Use the self calibration to calibrate the installed modules. Run the self calibration after a minimum of a 30 minute warm-up. For more information on when to run the self calibration, refer to *When to Perform the Self Calibration* on page 2–13.

Power On Diagnostics. Power-on diagnostics check basic functionality of the digitizing oscilloscope 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 digitizing oscilloscope.

***NOTE**. If there are no diagnostic failures when you power on the digitizing oscilloscope, 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

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- 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 waveform analyzer modules:

- The *Primary Troubleshooting Procedure* chart on page 6–32 provides troubleshooting steps that test the waveform analyzer modules
- The *Power Supply Troubleshooting Procedure* chart on page 6–34 locates power supply faults within the waveform analyzer

To begin the procedure, perform the following steps:

***NOTE**. Install the waveform analyzer into the VXIbus mainframe so that you have access to the left side of the instrument. The troubleshooting procedures require voltage measurements on the Processor Board (A1).*

1. Install the waveform analyzer into a functional VXIbus mainframe that is configured for the waveform analyzer. See the *Operating Information* section for installation instructions.
2. Before you power on the VXIbus mainframe power, look at the READY, ARM'D, and TRIG'D front panel indicators.
3. Power on the VXIbus mainframe power and note how the front panel indicators respond.
4. Use the *Primary Troubleshooting Procedure* chart on page 6–32 to determine how to proceed.

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

5. Use the *Removal and Installation Procedures* that begin on page 6–7 to replace the faulty module.
6. Refer to Table NO TAG on page NO TAG after module replacement to determine if adjustments are required.
7. Complete the procedures found in the *Performance Verification* section.

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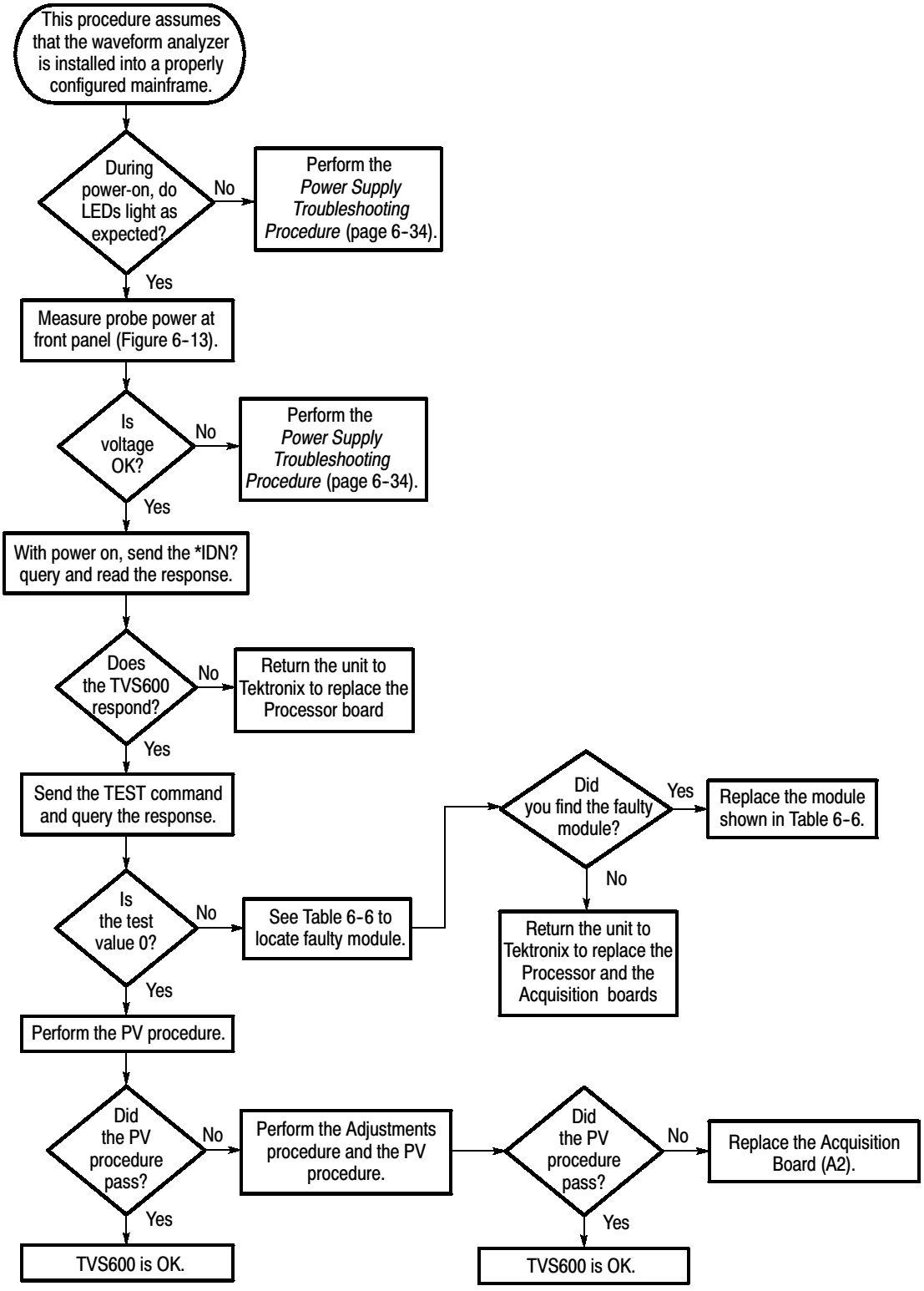
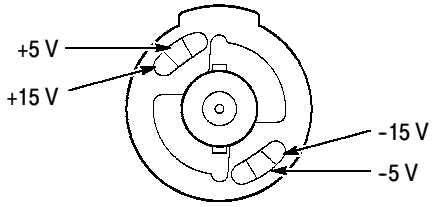


Figure 6-12: Primary troubleshooting procedure

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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

Table 6-6: Primary fault location table

Test code	Faulty module
1100, 1101, 1102, 1103, 1104, 1105, 1200, 1201, 1300, 1301	Processor Board (A1)
1408, 1413, 1416, 1417, 2101, 2201, 2202, 2203, 2204, 2303	Acquisition Board (A2)
All other codes	Cannot identify faulty module

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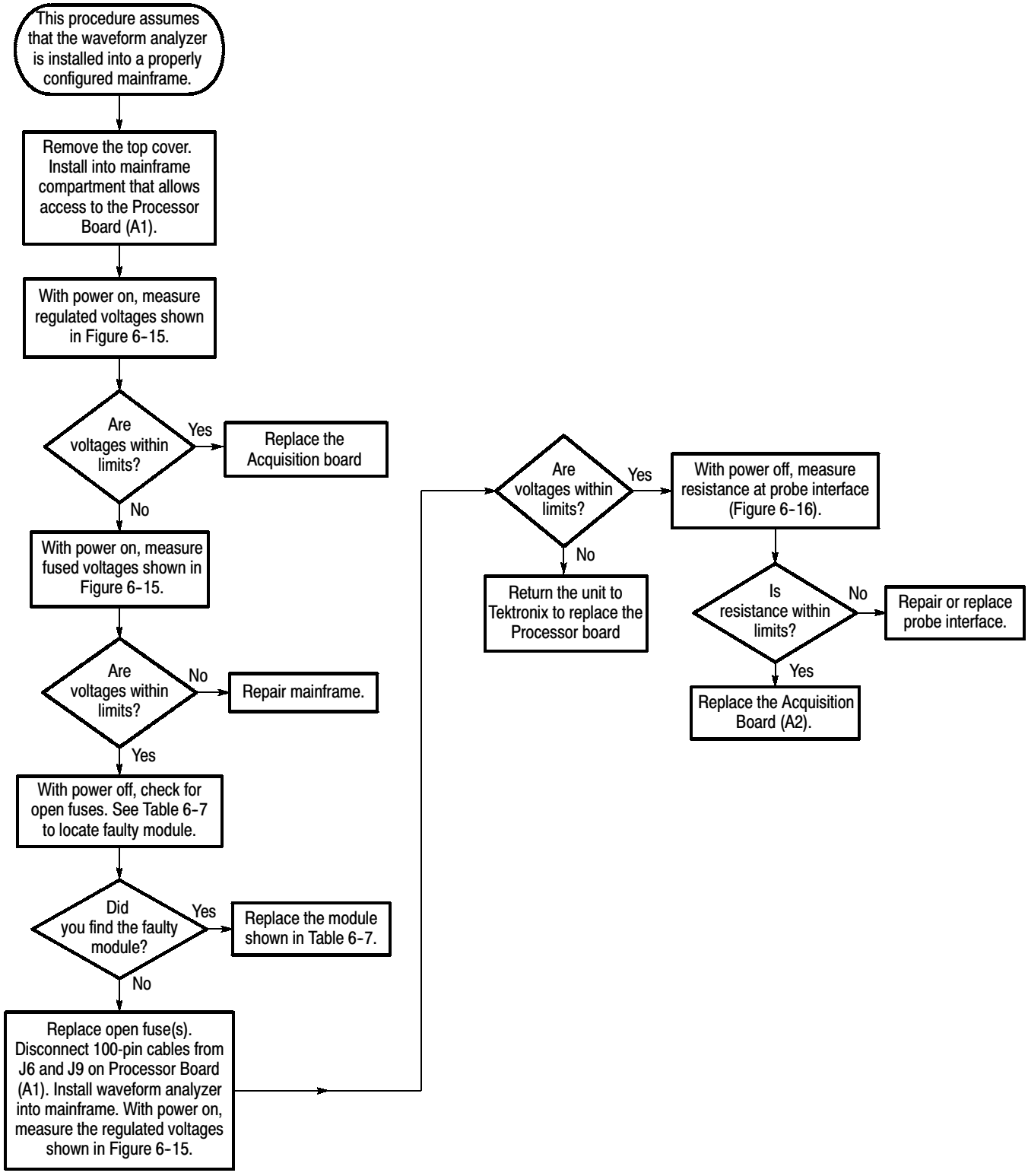
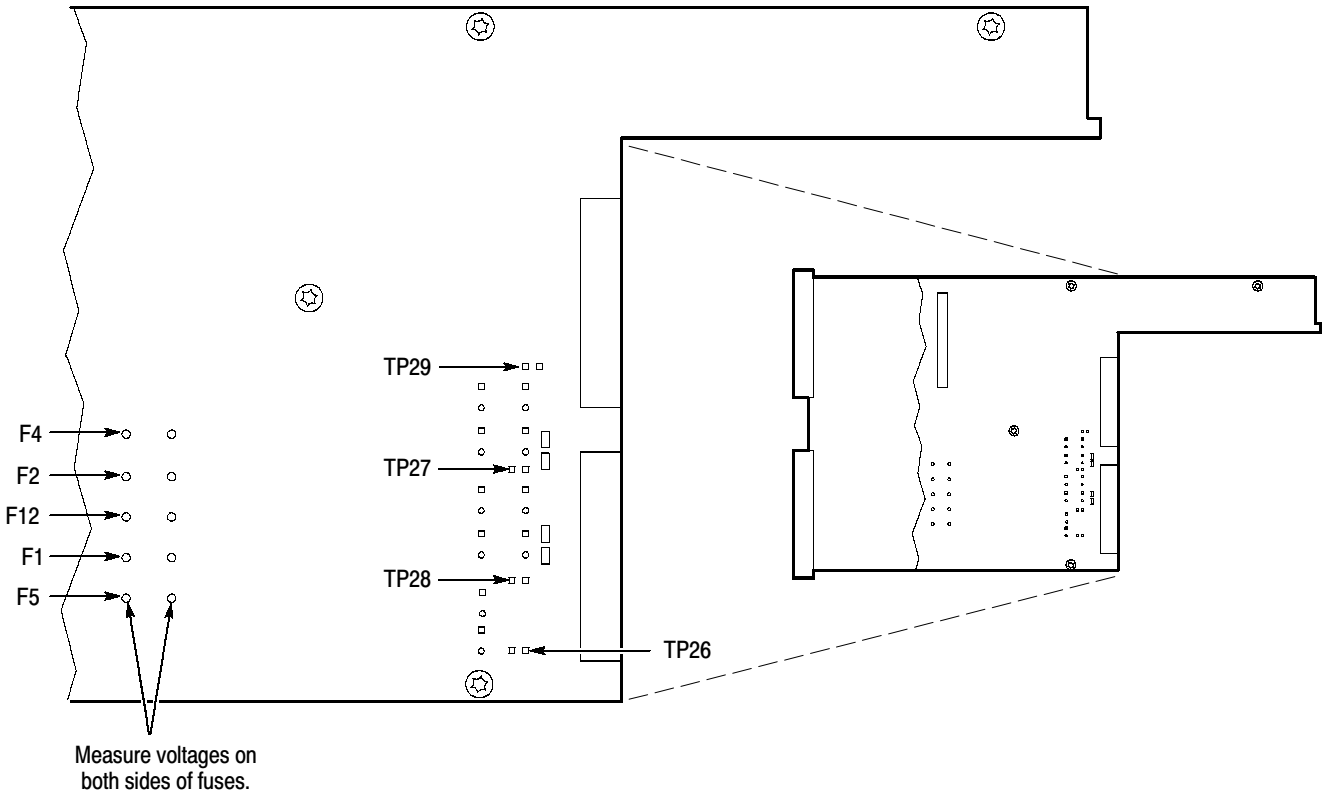


Figure 6-14: Power supply troubleshooting procedure

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Fused voltages from VXIbus mainframe

Test point	Power supply	Limits
F4	-5.2 V	-4.85 V to -5.46 V
F2	+5 VD	4.65 V to +5.25 V
F12	+5 V	+4.65 V to +5.25 V
F1	+12 V	+10.8 V to +13.2 V
F5	-12 V	-10.8 V to -13.2 V

Regulated voltages from Processor Board (A1)

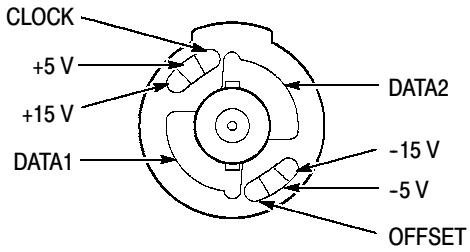
Test point	Power supply	Limits
TP29	-5 V	-4.9 V to -5.25 V
TP27	+5 V	+4.9 V to +5.25 V
TP28	+15 V	+14.85 V to +15.3 V
TP26	-15 V	-14.85 V to -15.3 V

Figure 6-15: DC voltages for troubleshooting

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Table 6-7: Power supply fault location table

Open fuse	Faulty module
No open fuses	Cannot identify faulty module
F1 (+12 V power supply)	Cannot identify faulty module
F2 (+5 VD power supply)	Processor Board (A1)
F4 (–5.2 V power supply)	Cannot identify faulty module
F5 (–12 V power supply)	Cannot identify faulty module
F12 (+5 V power supply)	Acquisition Board (A2)



Signal	Approximate resistance to ground
Clock	1 kΩ
+5 V	20 Ω
+15 V	590 Ω
Data1	950 Ω
Data2	950 Ω
–15 V	150 Ω
–5 V	30 Ω
Offset	870 Ω

Values shown are typical when using a Tektronix VX4101 DMM/Counter 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 6–8 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 TVS600A system can't find a unit, the problem may be a Processor Board or a ribbon card failure.*

Table 6-8: Diagnostic tests

Group & Test	Most likely cause	Power on	Extended
Kernel			
Power-On Kernel	MPU	✓	✓
MPU Static RAM	MPU		✓
Nonvolatile RAM	MPU		✓

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Table 6-8: Diagnostic tests (cont.)

Group & Test	Most likely cause	Power on	Extended
DSP Shared RAM	MPU		✓
VXI Shared RAM	MPU		✓
Calibration Checksums	MPU; ACQ	✓	✓
Factory Calibration Status	Recalibrate with CATS; ACQ	✓	✓
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	✓	✓

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Overview of Procedures

Table 6–9 provides a brief overview of the troubleshooting, adjustment, verification, and calibration procedures.

Table 6–9: Troubleshooting overview

Procedure	Recommended interval	Purpose	Documented
Incoming test	When you initially receive the unit and open the packing box	Verifies functional operation of the unit	*Incoming Inspection Procedure*, page NO TAG
Self calibration	When there is a significant temperature change	Optimizes signal path compensation	*Diagnostics,* page 2–13
Performance verification	Annually or after board replacement	Verifies advertised performance specifications	*Using the Software*, page NO TAG
Field adjustment	If the unit fails the Performance Verification procedure	To correct a condition not within the specification	*Using the Software*, page NO TAG
Diagnostics and Troubleshooting	When self-calibration fails or Performance Verification and adjustment fails	To isolate and correct a nonconforming specification	*TVS600A Diagnostics*, page 6–29

Adjustment After Repair

After the removal and replacement of a circuit board or assembly due to electrical failure, locate the board removed in Table 6–10 and perform the indicated procedures.

Table 6–10: Requirements after replacement

Module replaced	Adjustments required
A1 Processor Board (not customer servicable)	Self cal
A2 Acquisition Board	Full Sequence

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Repackaging Instructions

This section contains the information needed to repackage the waveform analyzer 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 waveform analyzer 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)

See Table 1–8 on page 1–11 for a complete listing of the environmental charactertistics.

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Options

This chapter describes the accessories and options that are available for the waveform analyzer.

Tektronix offers service options that cover calibration and repair services. Contact your local Tektronix representative for details.

Standard Accessories

The following accessories are shipped with the waveform analyzer:

- *TVS600 and TVS600A Waveform Analyzers User Manual* (Tektronix part number 070-9916-XX)
- *TVS600 and TVS600A Waveform Analyzers Command Reference* (Tektronix part number 070-9917-XX)
- *TVS600 and TVS600A Waveform Analyzers Reference Manual* (Tektronix part number 070-9918-XX)
- *TVS600 and TVS600A Series VXIplug&play Instrument Drivers* (part of Tektronix part number 070-9916-XX)

Optional Accessories

The*TVS600 and TVS600A Waveform Analyzers Service Manual* (Tektronix part number 070-9915-XX), which includes Field Adjust/PV software, can be ordered for use with the waveform analyzer:

Options

Tektronix Service Options are listed on the *Tektronix Service Options* page on the back of the warranty page of this manual.

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Electrical Parts List

Refer to the *Mechanical Parts List* section for a complete listing and description of replaceable parts for the waveform analyzer.

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Diagrams

This chapter contains the block diagram and the interconnection diagram for the waveform analyzer.

Symbols

Graphic symbols and class designation letters are based on ANSI Standard Y32.2–1975. Abbreviations are based on ANSI Y1.1–1972.

Logic symbology (when used) is based on ANSI/IEEE Std 91-1984 in terms of positive logic. Logic symbols depict the logic function performed and can differ from the manufacturer's data.

Other standards used in the preparation of diagrams by Tektronix. Inc are:

- Tektronix Standard 062–2476 Symbols and Practices for Schematic Drafting
- ANSI Y14.159–1971 Interconnection Diagrams
- ANSI Y32.16–1975 Reference Designations for Electronic Equipment
- MIL–HDBK–63038–1A Military Standard Technical Manual Writing Handbook

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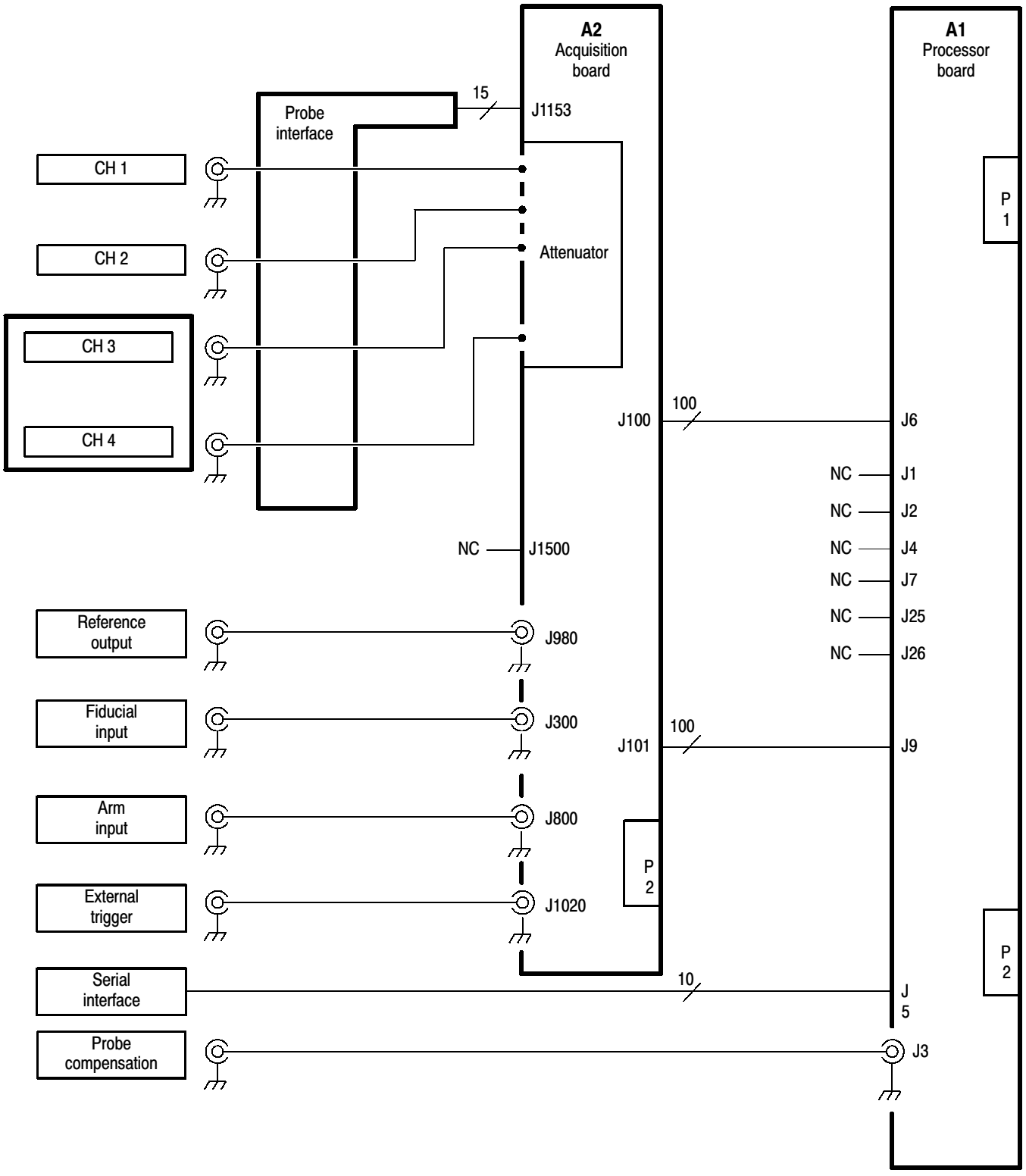


Figure 9-1: Interconnections

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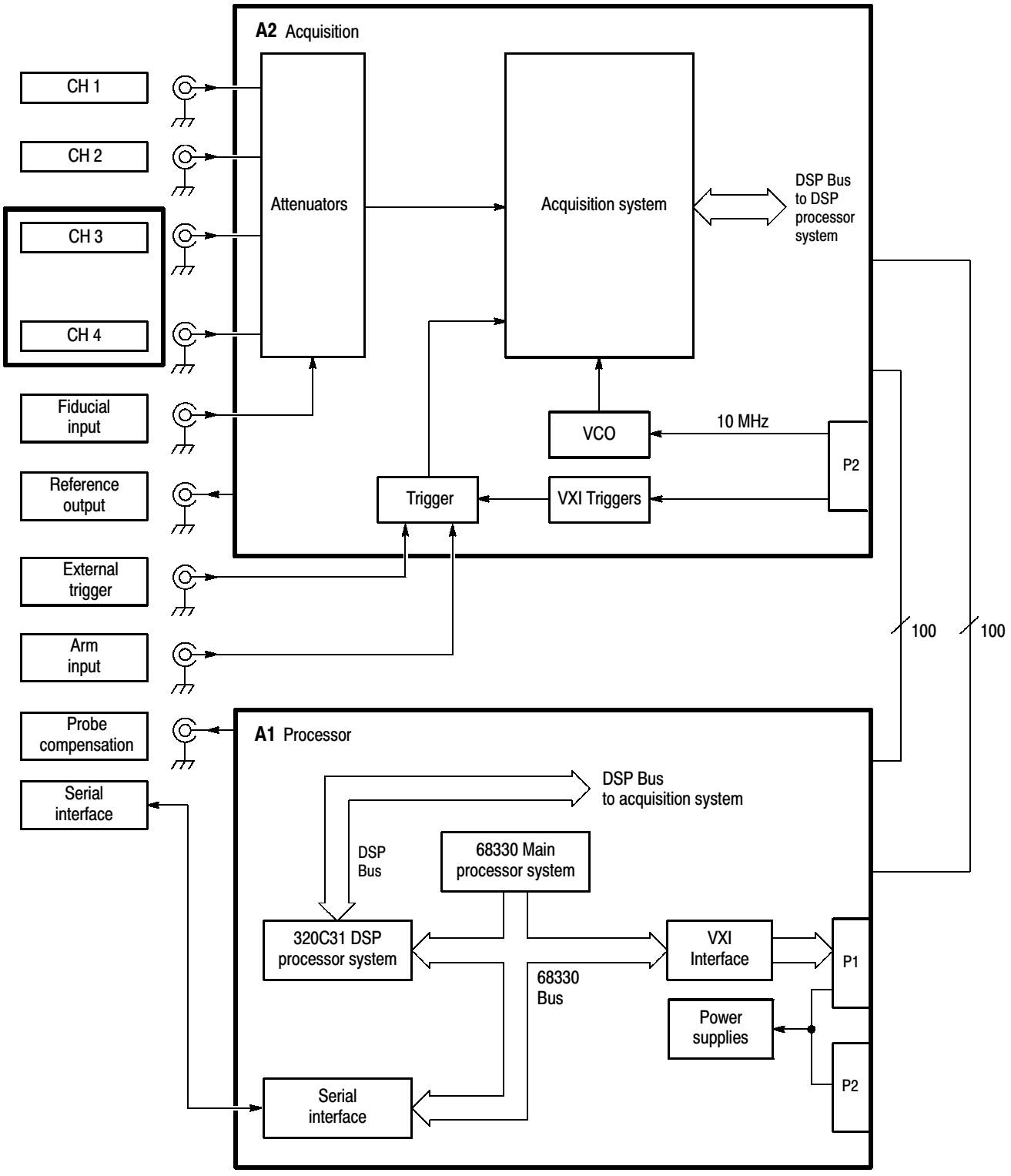


Figure 9-2: Block diagram

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Mechanical Parts List

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

Parts Ordering Information

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

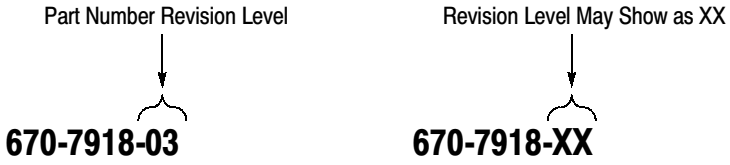
Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- 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.

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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 waveform analyzer. 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.

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Manufacturers cross index

Mfr. code	Manufacturer	Address	City, state, zip code
00779	AMP INC.	CUSTOMER SERVICE DEPT PO BOX 3608	HARRISBURG, PA 17105-3608
06090	RAYCHEM CORP	300 CONSTITUTION DR	MENLO PARK, CA 94025-1111
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
24931	SPECIALTY CONNECTOR CO	2100 EARLYWOOD DR P O BOX 547	FRANKLIN, IN 46131
30817	INSTRUMENT SPECIALTIES CO INC	EXIT 53, RT 80 BOX A	DELAWARE WATER GAP, PA 18327
75915	LITTELFUSE INC	800 E NORTHWEST HWY	DES PLAINES, IL 60016-3049
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077-0001
86928	SEASTROM MFG CO INC	456 SEASTROM STREET	TWIN FALLS, ID 83301
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK HWY SUITE 2	VANCOUVER, WA 98661
TK2597	MERIX CORP	1521 POPLAR LANE	FOREST GROVE, OR 97116
TK2647	INSTRUMENT SPECIALITIES INC	C/O TEMCO NW 1336 SE 51ST STREET	HILLSBORO, OR 97123

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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	200-4242-00			1	COVER,VXI:VXI APPLICATION,TWO-WIDE,COVER	80009	200-4242-00
-2	211-0409-00			6	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL,CDPL,T-10	0KB01	211-0408-00
-3	348-1434-00			4	GASKET,EMI:2.912 L,CLIP ON,BE CU EMI GASKET,TIN PLD	30817	97-613-17-029
-4	211-0409-00			6	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL,ZINC,T-10	0KB01	211-0408-00
-5	671-3233-XX			1	CIRCUIT BD ASSY:PROCESSOR (NOT ORDERABLE, REPLACEMENT AVAILABLE AT TEKTRONIX SERVICE CENTER); ALL TVS600 & TVS600A MODELS (A1)	80009	671-3233-XX
	159-5009-00			1	FUSE:1.5A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT (F13)	75915	45101.5
	159-5014-00			2	FUSE:2.0A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT (F1, F5)	75915	R451 002
	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)	75915	R451 010
	159-5018-00			1	FUSE:3.0A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT,T&R (F2)	75915	R451 003
-6	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	80009	129-1474-00
-7	671-4116-XX			1	CIRCUIT BD ASSY:ACQUISITION, TVS645A (A2)	80009	671-3232-XX
	159-5009-00			3	FUSE:1.5A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT (F300, F980, F1020)	75915	45101.5
	159-5019-00			4	FUSE,THRM:SELF RESETTING FUSE,1.10A HOLD,2.20A TRIP,15V MAX,SMD100-2018-2,T&R (F1806, F1807, F1808, F1809)	06090	SMD100-2018-2
	159-5020-00			4	FUSE:SELF RESETTING FUSE,2.5A HOLD,5.0A TRIP,15V MAX,SMD250,T&R (F110)	06090	SMD250-2
-7	671-4115-XX			1	CKT BD ASSY:ACQUISITION, TVS641A (A2)	80009	671-3569-XX
	159-5009-00			3	FUSE:1.5A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT (F300, F980, F1020)	75915	45101.5
	159-5019-00			4	FUSE,THRM:SELF RESETTING FUSE,1.10A HOLD,2.20A TRIP,15V MAX,SMD100-2018-2,T&R (F1806, F1807, F1808, F1809)	06090	SMD100-2018-2
	159-5020-00			4	FUSE:SELF RESETTING FUSE,2.5A HOLD,5.0A TRIP,15V MAX,SMD250,T&R (F110)	06090	SMD250-2

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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
-7	671-4114-XX			1	CKT BD ASSY:ACQUISITION, TVS625A (A2)	80009	671-3570-XX
	159-5009-00			3	FUSE:1.5A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT (F300, F980, F1020)	75915	45101.5
	159-5019-00			4	FUSE,THRM:SELF RESETTING FUSE,1.10A HOLD,2.20A TRIP,15V MAX,SMD100-2018-2,T&R (F1806, F1807, F1808, F1809)	06090	SMD100-2018-2
	159-5020-00			4	FUSE:SELF RESETTING FUSE,2.5A HOLD,5.0A TRIP,15V MAX,SMD250,T&R (F110)	06090	SMD250-2
-7	671-4113-XX			1	CKT BD ASSY:ACQUISITION, TVS621A (A2)	80009	671-3571-XX
	159-5009-00			3	FUSE:1.5A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT (F300, F980, F1020)	75915	45101.5
	159-5019-00			4	FUSE,THRM:SELF RESETTING FUSE,1.10A HOLD,2.20A TRIP,15V MAX,SMD100-2018-2,T&R (F1806, F1807, F1808, F1809)	06090	SMD100-2018-2
	159-5020-00			4	FUSE:SELF RESETTING FUSE,2.5A HOLD,5.0A TRIP,15V MAX,SMD250,T&R (F110)	06090	SMD250-2
-7	671-3232-XX			1	CIRCUIT BD ASSY:ACQUISITION, TVS645 (A2)	80009	671-3232-XX
	159-5009-00			3	FUSE:1.5A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT (F300, F980, F1020)	75915	45101.5
	159-5019-00			4	FUSE,THRM:SELF RESETTING FUSE,1.10A HOLD,2.20A TRIP,15V MAX,SMD100-2018-2,T&R (F1806, F1807, F1808, F1809)	06090	SMD100-2018-2
	159-5020-00			4	FUSE:SELF RESETTING FUSE,2.5A HOLD,5.0A TRIP,15V MAX,SMD250,T&R (F110)	06090	SMD250-2
-7	671-3569-XX			1	CKT BD ASSY:ACQUISITION, TVS641 (A2)	80009	671-3569-XX
	159-5009-00			3	FUSE:1.5A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT (F300, F980, F1020)	75915	45101.5
	159-5019-00			4	FUSE,THRM:SELF RESETTING FUSE,1.10A HOLD,2.20A TRIP,15V MAX,SMD100-2018-2,T&R (F1806, F1807, F1808, F1809)	06090	SMD100-2018-2
	159-5020-00			4	FUSE:SELF RESETTING FUSE,2.5A HOLD,5.0A TRIP,15V MAX,SMD250,T&R (F110)	06090	SMD250-2

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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
-7	671-3570-XX			1	CKT BD ASSY:ACQUISITION, TVS625 (A2)	80009	671-3570-XX
	159-5009-00			3	FUSE:1.5A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT (F300, F980, F1020)	75915	45101.5
	159-5019-00			4	FUSE,THRM:SELF RESETTING FUSE,1.10A HOLD,2.20A TRIP,15V MAX,SMD100-2018-2,T&R (F1806, F1807, F1808, F1809)	06090	SMD100-2018-2
	159-5020-00			4	FUSE:SELF RESETTING FUSE,2.5A HOLD,5.0A TRIP,15V MAX,SMD250,T&R (F110)	06090	SMD250-2
-7	671-3571-XX			1	CKT BD ASSY:ACQUISITION, TVS621 (A2)	80009	671-3571-XX
	159-5009-00			3	FUSE:1.5A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT (F300, F980, F1020)	75915	45101.5
	159-5019-00			4	FUSE,THRM:SELF RESETTING FUSE,1.10A HOLD,2.20A TRIP,15V MAX,SMD100-2018-2,T&R (F1806, F1807, F1808, F1809)	06090	SMD100-2018-2
	159-5020-00			4	FUSE:SELF RESETTING FUSE,2.5A HOLD,5.0A TRIP,15V MAX,SMD250,T&R (F110)	06090	SMD250-2
-8	211-0408-00			1	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL,ZINC,T-10	0KB01	211-0408-00
-9	210-0870-00			1	WASHER,FLAT:0.141 ID X 0.312 OD X 0.05,STL CD PL	86928	ORDER BY DESCR
-11	386-6868-00			1	PANEL,VXI:TWO-WIDE,BACK PANEL	80009	386-6868-00
-10	441-2080-00			1	CHASSIS,VXI:TWO-WIDE,BOTTOM CHASSISW/SUB FRONT PANEL ATTACHED, /	80009	441-2080-00
	441-2081-00			1	CHASSIS:VXI TWO-WIDE, BOTTOM CHASSISW/SUB FRONT PANEL ATTACHED,/	80009	441-2081-00
-12	211-0408-00			2	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL,ZINC,T-10	0KB01	211-0408-00
-13	211-0911-00			4	SCREW,MACHINE:M2.5, PITCH 0.45MM, LENGTH 11MM, HEAD DIA 5MM, HEAD HEIGHT 2MM, BRIGHT NICKEL FI	80009	211-0911-00
-14	211-0730-00			3	SCR,ASSEM WSHR:6-32 X 0.375,PNH,STL,CDPL,T-15	0KB01	ORDER BY DESCR
-15	367-0410-00			1	HANDLE,EJECTOR:BOTTOM,SINGLE WIDE MODULE	80009	367-0410-00
-16	334-7519-00			1	MARKER,IDENT:MKD VXIBUS HANDLE,EJECTOR	0KB05	334-7519-00
-17	131-0890-01			2	CONN,HARDWARE:DSUB,JACK SCREW,4-40 X 0.312 L HEX HD,STL CD PL	00779	205818-2
-18	210-0870-00			1	WASHER,FLAT:0.141 ID X 0.312 OD X 0.05,STL CD PL	86928	ORDER BY DESCR
-19	211-0408-00			1	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL,ZINC,T-10	0KB01	211-0408-00
-20	354-0654-01			4/2	RING,CONN:BNC (TVS641, TVS641A, TVS645 & TVS645A use 4, TVS621, TVS621A, TVS625 & TVS625A use 2)	0JR05	ORDER BY DESCR
-21	131-1315-01			5	CONN,RF JACK:BNC/PNL,50 OHM,FEMALE,STR	24931	28JR306-1
-22	367-0411-00			1	HANDLE,EJECTOR:TOP,SINGLE WIDE	80009	367-0411-00
-23	334-9022-00			1	MARKER IDENT:VXI EJECTOR LABEL,TVS645	80009	334-9022-00

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Replaceable parts list (cont.)

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
	334-9023-00			1	MARKER IDENT:VXI EJECTOR LABEL,TVS641	80009	334-9023-00
	334-9024-00			1	MARKER IDENT:VXI EJECTOR LABEL,TVS625	80009	334-9024-00
	334-9025-00			1	MARKER IDENT:VXI EJECTOR LABEL,TVS621	80009	334-9025-00
-24	174-2693-00			1	CA ASSY,SP,ELEC:RIBBON,IDC,9 COND,28 AWG,8.0 L,MALE DB9 X 2X5	TK2469	174-2693-00
-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	259-0101-01			1	FLEX CIRCUIT:TEK PROBE INTERFACE	TK2597	259010101
-27	196-3417-00			1	CA ASSY,SP:COAXIAL,RFP,5,50 OHM,2,10.25 L,3,15.25 L	TK2469	196-3417-00
-28	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
-29	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
-30	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
-31	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
-32	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
-33	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
-34	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
-35	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
-36	348-1365-01			1	SHLD GSKT,ELEC:SYMETRICAL SLOTTED FINGER, 0.350 W X 7.5 L	TK2647	348-1365-01
					STANDARD ACCESSORIES		
	070-9916-XX			1	MANUAL,TECH:VXI BUS USER MANUAL	80009	070-9916-XX
	070-9917-XX			1	MANUAL,TECH:VXI COMMAND REFERENCE MANUAL	80009	070-9917-XX
	070-9918-XX			1	MANUAL,TECH:VXI QUICK REFERENCE MANUAL	80009	070-9918-XX
	063-2874-00			1	SOFTWARE PKG SLOT ZERO EMBEDDED CONTROLLER PV & ADJUST SOFTWARE;3.5	80009	063-2874-00
	063-2886-00			1	SOFTWARE PKG MXI SLOT ZERO VXI/MXI CONTROLLER PV & ADJUST SOFTWARE;3.5 DISK	80009	063-2886-00
					OPTIONAL ACCESSORIES		
	070-9915-XX			1	MANUAL,TECH:VXI BUS SERVICE MANAUL	80009	070-9915-XX

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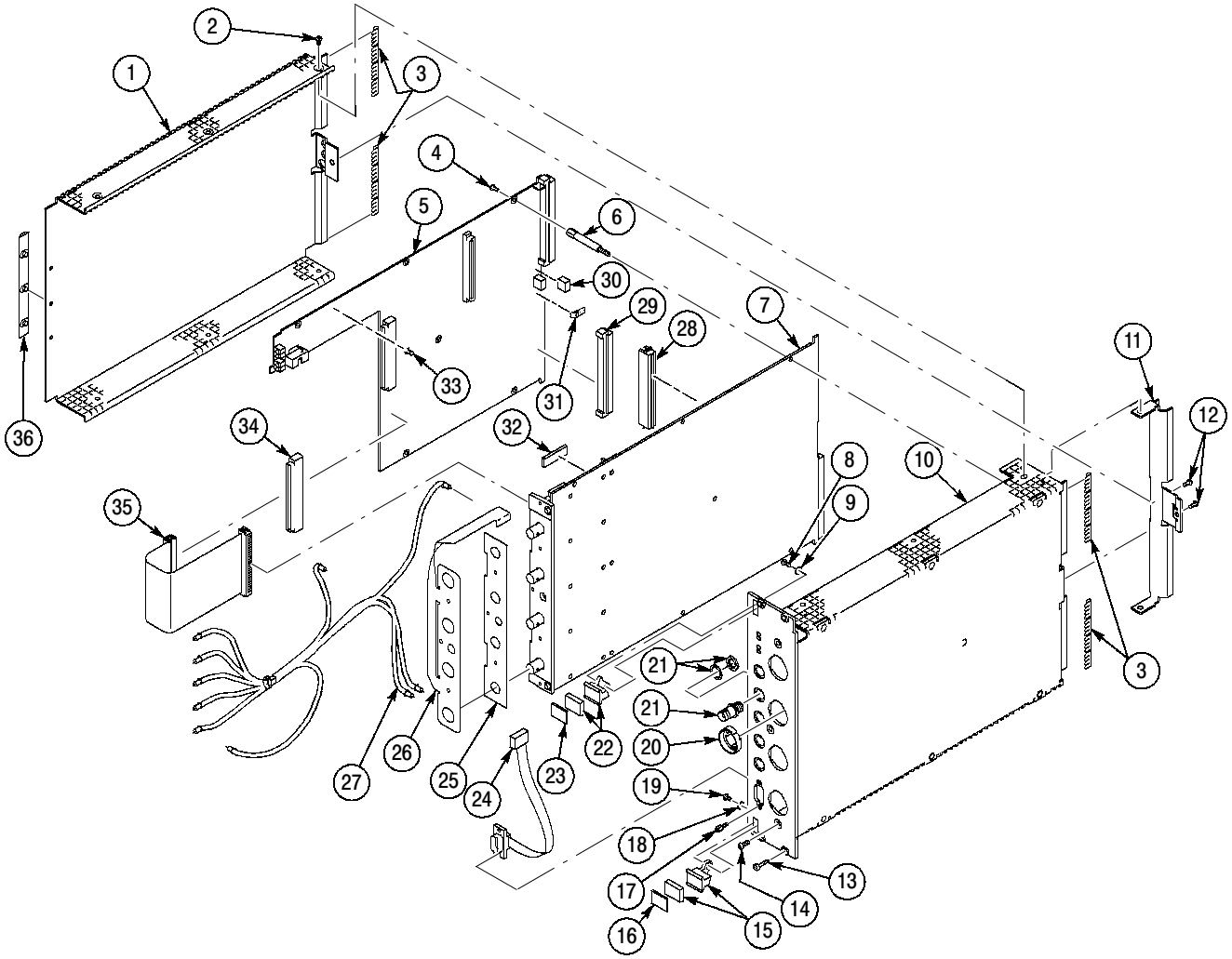


Figure 10-1: Waveform analyzer exploded view

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