TLA6400 Series Logic Analyzer
Product Specifications & Performance Verification

Technical Reference

This document supports TLA Application Software V6.0 and above.

Warning

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

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General safety summary

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

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

To avoid fire or personal injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

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

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

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

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

Connect the probe reference lead to earth ground only.

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

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

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

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

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

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry.

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

Terms in this manual

These terms may appear in this manual:

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

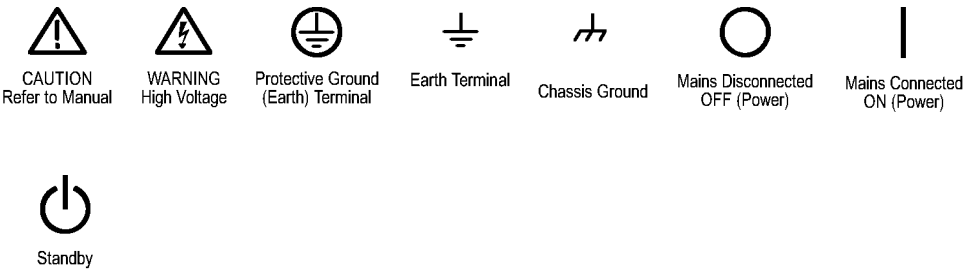
CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Symbols and terms on the product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

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



Service safety summary

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

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

Disconnect power. To avoid electric shock, switch off the instrument power, then disconnect the power cord from the mains power.

Use care when servicing with power on. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Preface

This document lists the characteristics and specifications of the TLA6400 series logic analyzers. It also includes the performance verification procedures. Microprocessor-related products and individual logic analyzer probes have their own documentation for characteristics and specifications.

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

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

Be sure to follow all warnings, cautions, and notes in this manual.

Related documentation

The following list and table provide information on the related documentation available for your Tektronix product. For additional information, refer to the Tektronix Web site (www.tektronix.com/manuals).

Related documentation

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

Specifications

The following tables list the specifications for the TLA6400 series logic analyzers. *Typical* characteristics describe typical or average performance and provide useful reference information.

Specifications that are marked with the ✓ symbol are checked directly (or indirectly) in the *Performance Verification* chapter of this document.

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

- The instrument must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications.
- The instrument must have had a warm-up period of at least 30 minutes.
- The instrument must have been calibrated/adjusted at an ambient temperature between +18 °C and +28 °C.

For optimum performance using an external oscilloscope, please consult the documentation for any external oscilloscopes used with your Tektronix logic analyzer to determine the warm-up period and signal-path compensation requirements.

Atmospheric characteristics

The following table lists the Atmospheric characteristics of components in the TLA6400 series logic analyzers.

Table 1: Atmospheric characteristics

Characteristic	Description
Temperature	*Operating (no media in CD or DVD drive)*
	+5 °C to +40 °C (+41 °F to +101 °F), 15 °C/hr (59 °F/hr) maximum gradient, noncondensing (derated 1 °C (34 °F) per 300 m (984 ft) above 1500 m (4921 ft) altitude)
	Nonoperating (no media in drive)
	-20 °C to +60 °C (-4 °F to +104 °F), 15 °C/hr (59 °F/hr) maximum gradient
Relative Humidity	*Operating (no media in drive)*
	20% to 80% relative humidity, noncondensing
	Nonoperating (no media in drive)
	8% to 80% relative humidity, noncondensing
	Maximum wet bulb temperature
	+29 °C (84.2 °F), derates relative humidity to approximately 22% at 50 °C (122 °F) and 10% at 60 °C (140 °F)
Altitude	*Operating*
	To 3000 m (9843 ft), derated 1 °C (34 °F) per 300 m (984 ft) above 1500 m (4921 ft) altitude.
	Nonoperating
	To 12,000 m (39,370 ft)

System characteristics

Table 2: External signal interface

Characteristic		Description
System Trigger Input		TTL compatible input via rear panel mounted BNC connector
	Input destination	System trigger
	Threshold voltage range (Vth)	Variable from 0.5 V to 1.5 V
	Maximum input voltage	0 V to +5.0 V_{peak}
	Minimum input voltage	Vth ±900 mV
	Input mode	Falling edge sensitive, latched (active low)
	Minimum pulse width	12 ns
	Active period	Accepts system triggers during valid acquisition periods via real-time gating, resets system trigger input latch between valid acquisition periods

Table 2: External signal interface (cont.)

Characteristic		Description	
System Trigger Output		TTL compatible output via rear panel mounted BNC connector	
	Source selection	System trigger	
	Output levels	50 Ω back terminated TTL-compatible output	
	V_{OH}	≥4 V into open circuit ≥2 V into 50 Ω to ground	
	V_{OL}	≤0.7 V sinking 10 mA	
	Source mode	Active (true) low, falling edge latched	
	Active period	Outputs system trigger state during valid acquisition period, resets system trigger output to false state between valid acquisitions via software	
	Output protection	Short-circuit protected (to ground)	
External Signal Input		TTL compatible input via rear panel mounted BNC connector	
	Input destinations	Signal 1, 2 Signal 3, 4	
	Threshold voltage range (Vth)	Variable from 0.5 V to 1.5 V	
	Maximum input voltage	0 V to +5.0 V_{peak}	
	Minimum input voltage	Vth ±900 mV	
	Input mode	Active (true) low, level sensitive	
	Input bandwidth [1]	*Signal 1, 2*	*Signal 3, 4*
		50 MHz square wave minimum	10 MHz square wave minimum
	Active period	Accepts signals during valid acquisition periods via real-time gating.	
External Signal Output		TTL compatible outputs via rear panel mounted BNC connector	
	Source selection	Signal 1, 2 (high-speed) Signal 3, 4 10 MHz clock	
	Output modes Level sensitive	User definable Active (true) low or active (true) high	
	Output levels	50 Ω back terminated TTL output	
	V_{OH}	≥4 V into open circuit ≥2 V into 50 Ω to ground	
	V_{OL}	≤0.7 V sinking 10 mA	
	Output bandwidth	*Signal 1, 2*	*Signal 3, 4*
		50 MHz square wave minimum	10 MHz square wave minimum
	Active period	Outputs signals during valid acquisition periods. Resets signals to false state between valid acquisitions Outputs 10 MHz clock continuously when selected	
	Output protection	Short-circuit protected (to ground)	

Table 2: External signal interface (cont.)

Characteristic	Description
Chassis ground lug	Lower right side on rear panel
CLK10 accuracy	10 MHz ±50 PPM

1 The input bandwidth specifications only apply to signals to the External Signal input. It does not apply to round-trip signals applied to the External Signal Input and back out of the External Signal Output.

Table 3: PC controller

Characteristic	Description
CPU	Intel Core i3-2120, 3.3 GHz, 3 M cache
DRAM	2 x 2 GB DIMM, 4 GB total DDR3, 1066 MHz, PC3-8500
Hard disk drive	500 GB or greater SATAII, 3.5-inch, 7200 RPM
Optical drive	Optical, CD-RW/DVD-R/RW DVD+R/RW, 16.7 MB/second, 650 M/8.5 GB, SATA
Boot from USB	Instrument is capable of booting from USB
Operating system	Microsoft Windows 7 Ultimate, 64-bit

Table 4: External PC controller interfaces

Characteristic	Description
USB ports	
Front panel	3 USB 2.0
Rear panel	2 USB 2.0 2 USB 3.0
PS2 ports	1 PS2 keyboard 1 PS2 mouse
LAN	2 (10/100/1000 Mbps)

Table 5: Display system

Characteristic		Description		
Dual screen & external display support		Internal + DVI, Internal + VGA, DVI + VGA		
		Resolution (Pixels)	*Colors*	*Refresh Rates*
		2048 x 1536, maximum	256, minimum	75 Hz
Internal display	Size & type	15 in. LCD		
	Resolution	1024 x 768		
Touchscreen	15.3 in. touch panel	Included as an ordering option; available only at time of purchase (no field upgrade available)		
	Type	Resistive, single point		

Table 6: Front-panel interface

Characteristic		Description
Keypad		18 buttons allow user to perform the most common tasks required to operate the instrument
Special function knobs	Multi-function Knob	Various increment, decrement functions dependent on screen/window selected.
	Vertical position	Scrolling and positioning dependent on display type.
	Vertical scale	Scales waveform displays only.
	Horizontal position	Scrolling and positioning dependent on display type.
	Horizontal scale	Scales waveform displays only.

Table 7: AC power source

Characteristic	Description
Mains / input voltage and frequency	100 to 240 VAC ±10%, 50 Hz to 60 Hz ±5%
Power consumption	400 W maximum
On/Sleep indicator	Green/yellow front panel LED located left of the On/Standby switch provides visual feedback when the switch is actuated. When the LED is green, the instrument is powered and the processor is not sleeping. When the LED is yellow, the instrument is powered, but the processor is sleeping.
On/Standby switch and indicator	Front panel On/Standby switch allows users to turn the instrument on. A soft power down is implemented so that users can turn the instrument off without going through the Windows shutdown process; the instrument powers down normally. The power cord provides main power disconnect

Table 8: Probing specifications

Characteristic	Description		
Number of channels			
TLA6401	34		
TLA6402	68		
TLA6403	102		
TLA6404	136		
Probe connector location	Lower right side of the instrument		
Probes user removable	Remove probes by pressing button on the probe connector.		
Analog outputs			
Number of outputs	Any four of the channels can be mapped to the four analog outputs with the appropriate PowerFlex option. All four outputs can be used at the same time. A given input channel cannot be routed to more than one output at the same time.		
Attenuation [1] *(Typical)*	10 x, 5 x		
Bandwidth *(Typical)*	*P5910 General Purpose probe*	*P5934 Mictor probe*	*P5960 DMAX probe*
	2 Ghz (-3dB)	1.5 Ghz (-3dB)	2 Ghz (-3dB)
Accuracy (gain and offset) *(Typical)*	±(80 mV + 2% of signal amplitude)		
Channel-to-channel skew *(Typical)*	±500 ps		
Delay time from probe tip to analog signal out *(Typical)*	11.9 ns		
PowerFlex	Standard:	4 fixed channels	
	Options:	Any input channel to 4 channels	
Input voltage range, dynamic *(Typical)*	-2.5 V to +5 V		
Input voltage range, absolute maximum *(Typical)*	-4.5 V to +13 V		
Threshold range and step size	Can be set from -2.0 V to +4.5 V in 5 mV increments		
✓ Threshold accuracy (Certifiable parameter)	±(50 mV + 1% of the threshold voltage setting)		
Number of thresholds	Each channel has an independent threshold control.		

Table 8: Probing specifications (cont.)

Characteristic	Description
✓ Channel-to-channel skew (Maximum)	±40 ps instrument only
Channel-to-channel skew (maximum)	
P5910 general purpose probe	Instrument channel-to-channel skew plus ±125 ps
P5960 D-Max probe	Instrument channel-to-channel skew plus ±125 ps
P5934 Mictor probe	Instrument channel-to-channel skew plus ±500 ps
Channel-to-channel skew *(Typical)*	±40 ps instrument only
P5910 general purpose probe	Instrument channel-to-channel skew plus ±40 ps
P5960 D-Max probe	Instrument channel-to-channel skew plus ±40 ps
P5934 Mictor probe	Instrument channel-to-channel skew plus ±250 ps
Hot-pluggable probes	Probes can be added or removed from the instrument while the instrument is turned on.
Minimum probe input voltage	300 mV_{p-p}

1 Characteristics are verified only at the 10 x attenuation

Table 9: Sampling specifications

Characteristic	Description		
MagniVu timing			
Resolution	Data is synchronously sampled and stored every 40 ps in a separate high resolution memory. The storage speed can be changed by software to 80 ps, 160 ps, 320 ps, or 640 ps (with no loss in memory depth) so that the high resolution memory covers more time at a lower resolution.		
Record length	128 k per channel		
Minimum pulse width *(Typical)*	*P5910 General Purpose probe*	*P5934 Mictor probe*	*P5960 DMAX probe*
	250 ps	500 ps	250 ps
Sampling (clocking) modes	Internal, External, Custom		
✓ Internal clocking			
1x mode	1.25 ns (800 MS/s) maximum clocking period on all channels		
2x mode	625 ps (1.6 GS/s) maximum clocking period on all channels		
4x mode	312.5 ps (3.2 GS/s) maximum clocking period on half channels (using 2:1 demultiplex mode)		
	50 ms is the slowest clocking rate. A 1–2–5 sequence is supported, but it starts with 312.5 ps, 625 ps, 1.25 ns, 2.5 ns (PowerFlex), 5 ns, 10 ns, 20 ns, 50 ns, etc. It is possible to use storage control and only store data when it has changed (transitional storage).		
Minimum pulse width *(Typical)*	*P5910 General Purpose probe*	*P5934 Mictor probe*	*P5960 DMAX probe*
	250 ps	500 ps	250 ps

Table 9: Sampling specifications (cont.)

Characteristic	Description
External clocking	
✓ External clock rate	333 MHz, minimum (standard instrument) 667 MHz, maximum, optional via PowerFlex)
✓ External data rate	667 Mbs, minimum (standard instrument) 1333 Mbs, maximum (optional via PowerFlex)
Clocks and qualifiers	
TLA6401	2 clocks
TLA6402	4 clocks
TLA6403	4 clocks, 2 qualifiers. Clocks can be used as qualifiers.
TLA6404	4 clocks, 4 qualifiers. Clocks can be used as qualifiers.
✓ Data valid window (Setup-and-hold window) [1]	
P5910 General Purpose probe, P5960 DMAX probe	300 ps maximum, single channel
P5934 Mictor probe	500 ps, single channel
Data valid window (Setup-and-hold window) [1] *(Typical)*	
P5910 General Purpose probe, P5960 DMAX probe	260 ps, single channel
Mictor probe	500 ps, single channel
Data valid window (Setup-and-hold window) adjustment resolution	20 ps
Data valid window (Setup-and-hold window) adjustment range	+15 ns to -7.5 ns

[1] If the TLA application uses Auto Deskew, add another 20 ps (one over-sampler step size) to the numbers.

Table 10: Triggering specifications

Characteristic	Description
Number of independent trigger states	16
Independent If/Then clauses per state	16 maximum
Events per If/Then clause	8 maximum
Actions per If/Then clause	8 maximum
Trigger events	26 maximum (two counter/timers plus any 24 other resources)
Word recognizers	24
Transition recognizers	24

Table 10: Triggering specifications (cont.)

Characteristic	Description
Range recognizers	8 maximum There are 24 word/channel-to-channel compare recognizers. Word recognizers can be traded off to form full-width, double-bounded range recognizers. The following selections are available: 24 word, 0 range 21 word, 1 range 18 word, 2 range 15 word, 3 range 12 word, 4 range 9 word, 5 range 6 word, 6 range 3 word, 7 range 0 word, 8 range
Counter/timers	2
Trigger event types	Word, Group, Channel, Transition, Range, Anything, Counter Value, Timer Value, Signal, Glitch, Setup-and-Hold Violation, Snapshot
Trigger action types	Trigger, Trigger All, Trigger Main, Trigger MagniVu, Store, Don't Store, Start Store, Stop Store, Increment Counter, Decrement Counter, Reset Counter, Start Timer, Stop Timer, Reset Timer, Snapshot Current Sample, Go to State, Set/Clear Signal, Do Nothing
✓ Maximum triggerable data rate	The system can trigger and track at the maximum acquisition rate.
Trigger state machine (TSM) sequence rate	DC to 800 MHz (1.25 ns) For data rates of 800 Mb/s or less, the TSM evaluates one data sample per TSM clock. For data rates greater than 800 Mb/s, the TSM evaluates multiple data samples per TSM clock up to the maximum acquired data rate.
✓ Counter/timer range	2 fast (no latency) counter/timers. Maximum count is 2^{48-1} (including bit sign) Maximum time is approximately 3.5 × 105 seconds, approximately four days Counter commands are reset, do nothing, increment, or decrement. Timer command are reset, no change, start, or stop
✓ Timer clock rate	800 MHz (1.25 ns)
✓ Counter/timer test latency	Fast counter/timer latency is Zero clock TC latency
✓ Range recognizers	Double-bounded (136-channels maximum). Can be as wide as any group, but must be grouped according to specified order of significance.
Range recognizer channel order	From most-significant probe group to least-significant probe group: CK3 Q1 C3 C2 C1 C0 Q3 Q2 E3 E2 E1 E0 CK0 Q0 A3 A2 D3 D2 CK1 CK2 A1 A0 D1 D0 Missing channels for instruments with fewer than 136 channels are omitted.
Setup-and-Hold violation recognizer — Setup/Hold time range	From 7.5 ns before to 7.5 ns after the clock edge in 20 ps increments. This range can be shifted towards the positive region by 0 ns, 2.5 ns, 5 ns, or 7.5 ns.
Trigger position	The main trigger position is programmable to any data sample (1.25 ns boundaries)

Table 10: Triggering specifications (cont.)

Characteristic	Description
MagniVu trigger position	The high resolution trigger position is programmable within 1.25 ns boundaries and separate from the main acquisition memory trigger position. The MagniVu position can be set from 0% to 60% centered around the MagniVu trigger.
Storage Control (data qualification)	All global (conditional), by state (start/stop), block, by trigger action, or transitional. Also force main prefill selection is available.

Table 11: Record length specifications

Characteristic	Description
Maximum record length	64 Mb
Record length options	
Standard	2 Mb
Options	4 Mb, 8 Mb, 16 Mb,32 Mb, 64 Mb
Data vs. Time stamp vs. Violation storage	Enabling violation storage in either glitch (external) or Ts/Th (internal) does not impact record length
Time stamp bits and resolution (duration)	51 bits @ 20 ps (3.25 days)

Table 12: Symbolic support

Characteristic	Description
Number of symbols or ranges	Unlimited (limited by the amount of virtual memory available)
Object file formats supported	IEEE695, OMF 51, OMF 86, OMF 166, OMF 286, OMF 386, COFF, Elf/Dwarf 1 and 2, Elf/Stabs, TSF [1]

[1] If the software development tools do not generate outputs in one of the listed formats, use TSF (Tektronix symbol file format)

Table 13: iView support

Characteristic	Description
TLA-to-TDS connections for iView	USB-to-USB, Trigger In, Trigger Out, Clock Out
Number of external oscilloscopes connected to the logic analyzer	1
Number of external oscilloscopes supported	>100, please check the Tektronix Web site at www.tek.com/iview

Table 14: Mechanical

Characteristic		Description
Overall dimensions *(Typical)*		Dimensions are without front feet extended, front cover attached, pouch attached, nor power cord attached.
	Height (with feet)	29.7 cm (11.7 in)
	Width	43.7 cm (17.2 in)
	Depth	38.7 cm (15.2 in)
Weight *(Typical)*		Includes instrument with front cover and empty accessory pouch
	TLA6401	13.52 kg (29 lbs 13 oz)
	TLA6402	13.88 kg (30 lbs 10 oz)
	TLA6403	14.29 kg (31 lbs 8 oz)
	TLA6404	14.65 kg (32 lbs 5 oz)
	Shipping	21.90 kg (48 lbs 4 oz)

Performance verification procedures

This chapter contains procedures for functional verification, certification, and performance verification procedures for the TLA6400 series logic analyzers. Generally, you should perform these procedures once per year or following repairs that affect certification.

Summary verification

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

Performance verification procedures confirm that a product meets or exceeds the performance requirements for the published specifications documented in the *Specifications* chapter of this manual. The performance verification procedures certify the accuracy of an instrument and provide a traceability path to national standards.

Certification procedures certify the accuracy of an instrument and provide a traceability path to national standards. Certification data is recorded on calibration data reports provided with this manual. The calibration data reports are intended to be copied and used for calibration/certification procedures.

As you complete the performance verification procedures, fill out a calibration data report to keep on file with your instrument. A blank copy of the calibration data report is provided with this manual. The calibration data report is intended to be copied and used to record the results of the calibration/certification procedures.

Test equipment

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

Table 15: Test equipment

Item number and description	Minimum requirements	Example
Logic analyzer	TLA6401, TLA6402, TLA6403, or TLA6404	-
Logic analyzer probe	One required	P5910 [1]
Precision voltage reference or a DC signal generator and precision digital voltmeter	(accurate to within ±5 mV)	-
Data Timing Generator	Tektronix DTG 524 with a DTGM30 Output Module	-
Frequency counter	Frequency accuracy: <0.0025% Frequency range: 1 kHz to 100 MHz	Hewlett Packard 5314A
Test fixture, Threshold Accuracy	One required	Refer to Threshold Accuracy Test Fixture. (See page 25.)
Test fixture, Setup and Hold	Minimum of two test fixtures required	Refer to Setup and Hold Test Fixture. (See page 26.)
Cable, precision 50 Ω coaxial	50 Ω , 36 in, male-to-male BNC connectors	Tektronix part number 012-0482-XX

[1] In addition to the P5910 probe, you will also need the ground extender accessory to connect the ground input to the test fixture.

Functional verification

The following list describes the functional verification procedures for the TLA6400 series logic analyzer.

- Power-on and fan operation
- Power-on diagnostics
- Extended diagnostics

Power-On and fan operation

Complete the following steps to check the power-on and fan operation of the logic analyzer:

1. Power on the instrument and observe that the On/Standby switch illuminates.
2. Check that the fans spin without undue noise.

3. If everything is properly connected and operational, you should see the modules in the System window of the logic analyzer application.
4. If there are no failures indicated in the System window, the power-on diagnostics pass when you power on the instrument.

Extended diagnostics

Do the following steps to run the extended diagnostics:

NOTE. *Running the extended diagnostics will invalidate any acquired data. If you want to save any of the acquired data, do so before running the extended diagnostics.*

Prerequisites Warm-up time: 30 minutes

Perform the following tests to complete the functional verification procedure:

1. If you have not already done so, power on the instrument and start the logic analyzer application if it did not start by itself.
2. Go to the System menu and select Calibration and Diagnostics.
3. Verify that all power-on diagnostics pass.
4. Click the Extended Diagnostics tab.
5. Select All Modules, All Tests, and then click the Run button on the property sheet.

   All tests that displayed an "Unknown" status will change to a Pass or Fail status depending on the outcome of the tests.
6. Scroll through the tests and verify that all tests pass.

Certification

The system clock is checked for accuracy, and the input probe channels are checked for threshold accuracy and setup and hold accuracy. The instrument is certifiable if these parameters meet specifications. Complete the performance verification procedures and record the certifiable parameters in a copy of the Calibration Data Report at the end of this chapter.

Performance verification procedures

This section contains procedures to verify that the instrument performs as warranted. Verify instrument performance whenever the accuracy or function of your instrument is in question.

Tests performed

Do the following tests to verify the performance of the instrument. You will need test equipment to complete the performance verification procedures. (See Table 15 on page 14.) If you substitute equipment, always choose instruments that meet or exceed the minimum requirements specified.

Table 16: Parameters checked by verification procedures

Parameter	Verification method
System clock (CLK10) accuracy [1]	Verified by the 10 MHz system clock test
Threshold accuracy [1]	Verified by the threshold accuracy test. Certified by running the certification procedure.
Channel-to-channel skew	Verified indirectly by the setup and hold procedure
Internal sampling period (Internal clocking)	Verified indirectly by the 10 MHz system clock test
Synchronous clock rate, minimum and maximum (External clock rate)	Diagnostics verify the clock detection/sampling circuitry. Bandwidth is verified indirectly by the at-speed diagnostics, the setup and hold test, and the clock test.
Synchronous data rate, minimum and maximum (External data rate)	Diagnostics verify the clock detection/sampling circuitry. Bandwidth is verified indirectly by the at-speed diagnostics, the setup and hold test, and the clock test.
Setup and hold window size (data and qualifiers)	Verified directly by setup and hold procedure
Counters and timers	Verified by diagnostics

Table 16: Parameters checked by verification procedures (cont.)

Parameter	Verification method
Maximum triggerable data rate	Verified indirectly by at-speed diagnostics and internal sampling period
Trigger state machine (TSM) sequence rate	Verified indirectly by at-speed diagnostics

1 Certifiable parameter

Checking the 10 MHz system clock (CLK10)

The following procedure checks the accuracy of the 10 MHz system clock:

Equipment required	Frequency counter Precision BNC cable
Prerequisites	Warm-up time: 30 minutes

1. Verify that all of the prerequisites above are met for the procedure.
2. Connect the frequency counter to the External Signal Out BNC connector on the instrument.
3. Go to the System window and select System Configuration from the System menu.
4. In the System Configuration dialog box, select 10 MHz Clock from the list of routable signals in the External Signal Out selection box and click OK.
5. Verify that the output frequency at the External Signal Out connector is 10 MHz ±500 Hz. Record the measurement on a copy of the calibration data report and disconnect the frequency counter.
6. In the System Configuration dialog box, reset the External Signal Out signal to None.

Threshold accuracy test

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

Equipment required	Precision voltage reference or a DC signal generator and precision digital voltmeter (accurate to within ±5 mV) Threshold Accuracy test fixture P5910 Logic analyzer probe
Prerequisites	Warm-up time: 30 minutes
	Ambient temperature must be 23 °C ±5 °C (73 °F ±9 °F)

Test equipment setup

Connect a P5910 probe from the logic analyzer to the voltage source, using the Threshold Accuracy test fixture. If the voltage source does not have the required output accuracy, use a multimeter with the required accuracy to verify the voltage output levels specified in the procedure.

TLA6400 setup

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

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

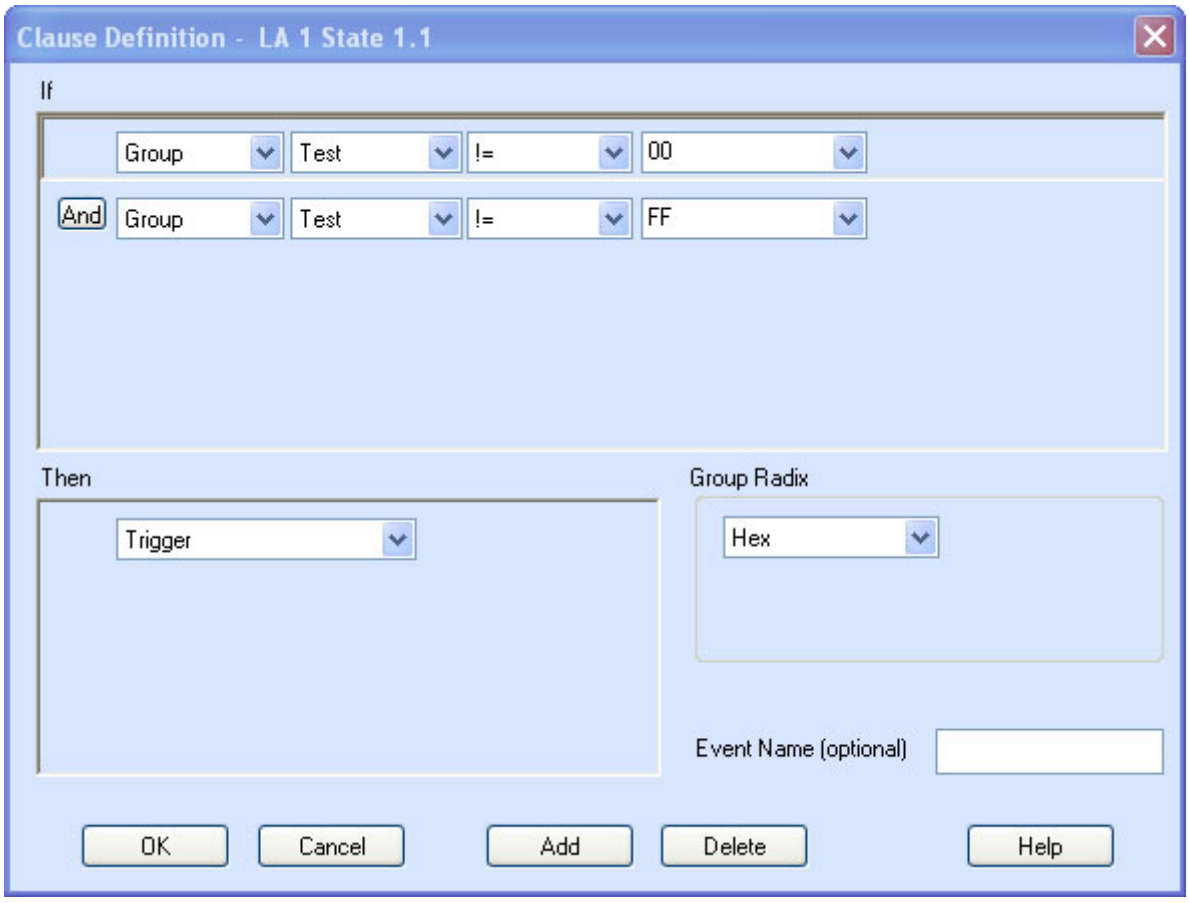


Figure 1: Setting trigger parameters

Verification procedure

Complete the following steps to complete this procedure. Record the results on the copy of the Calibration Data Sheet.

1. Go to the Setup window of the logic analyzer and set the probe threshold voltages to 2.5 V.
2. Set the voltage source to 2.300 V.
3. Start the logic analyzer and verify that it does not trigger.
4. Increase the voltage in 10 mV steps, waiting at least 3 seconds between steps to make sure that the logic analyzer continues to run without triggering. Continue until the logic analyzer triggers and then record the voltage.
5. Set the voltage source to 2.700 V.
6. Start the logic analyzer and verify that it does not trigger.
7. Decrease the voltage in 10 mV steps, waiting at least 3 seconds between steps to make sure that the logic analyzer continues to run without triggering. Continue until the logic analyzer triggers and then record the voltage.
8. Add the two voltage values and divide by two. Verify that the result is 2.50 V ±75 mV. Record the voltage on the Calibration Data Sheet.
9. Go to the Setup window and set the logic analyzer threshold voltages to –2.0 V.
10. Repeat steps 3 through 8 for -2.200 V and -1.800 V.
11. Add the two voltage values and divide by two. Verify that the result is -2.00 V ±70 mV. Record the voltage on the Calibration Data Sheet.
12. Repeat the procedure for each probe channel group that you want to verify.

Setup and hold

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

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

Digital timing generator setup

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

   To test other TLA data channels simultaneously and your DTG has additional outputs available, set up those DTG channels like the first data channel, and connect them to the other logic analyzer channels that you want to test. (The channels must be in the same probe, and you will need another test fixture for each additional channel pair.) Otherwise, repeat the procedure for each new pair of logic analyzer channels.
8. Set the termination to open on each DTG channel.
9. Set the DTG output voltage levels to 2.0 V High and 0.0 V Low, with no offset.

TLA6400 setup

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

      With the 50 Ω external termination attached at the SMA fixture end, this sets the logic analyzer threshold voltage levels to one-half the resulting termination voltage, which should be about 500 mV (not 1 V).
4. In the Acquisition Options box, select the following:
   a. Acquisition Length: 1K or greater
   b. Storage Options: Normal
5. Create a new group: right click in the Group Name column.
6. Select Add Group from the pop-up window. Rename the new group Test.
7. In the Probe Channels column, enter the names of the two adjacent data channels that will be used to connect to CH2 of the DTG.

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

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

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

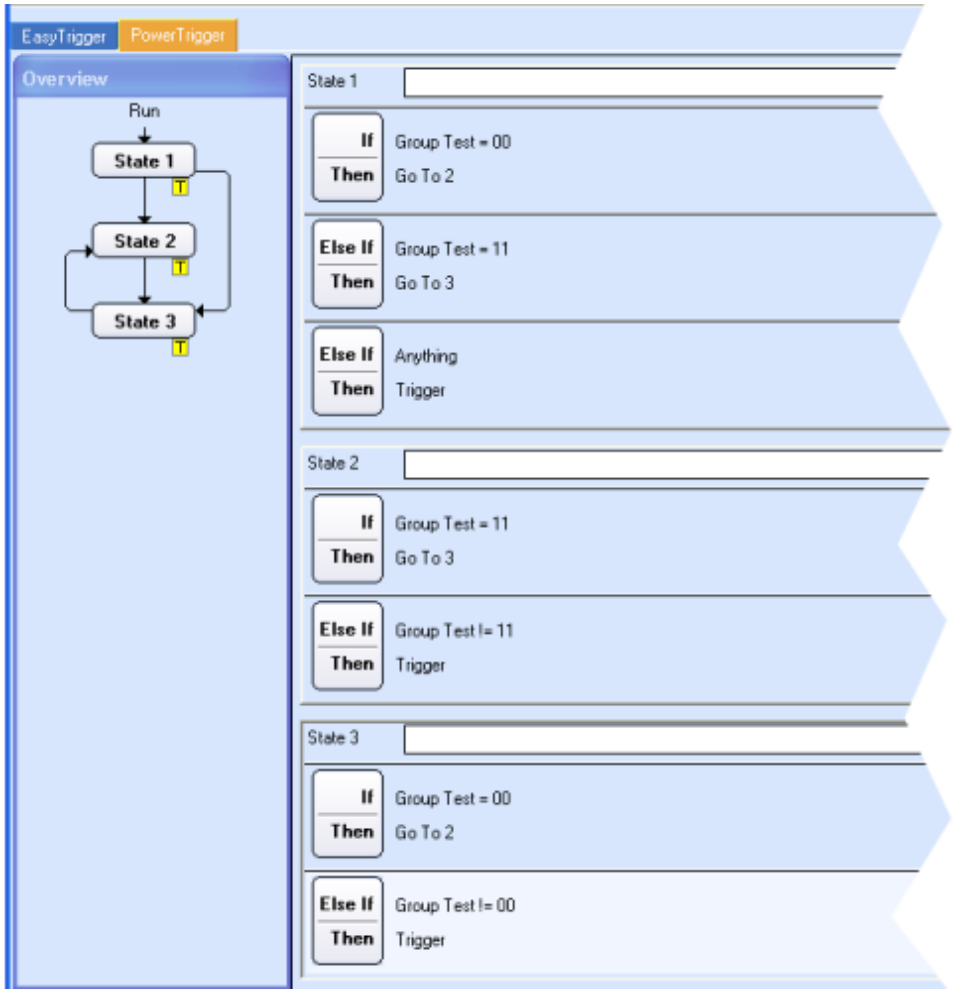


Figure 2: Set the trigger states

Verification procedure

Complete the following steps to complete this procedure. Record the results on the Calibration Data Sheet.

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

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

   As an alternative, you may want to run the logic analyzer in continuous loop mode if the DTG causes a false trigger on the logic analyzer each time you change the delay. Then observe if the data is correct in the waveform window and ignore any false triggers. Continue increasing the clock delay until the waveform window displays data that was not acquired correctly. Record this delay.
4. Add 300 ps to the delay value that you recorded in step 3 and increase the DTG clock delay to match this cumulative value. (For example, if you measured 600 ps, increase the delay to 900 ps.)
5. Press Run and wait a few seconds to verify that it does not trigger. This verifies that the setup and hold window is less than 300 ps, which is the guaranteed specification for a single channel.

   To measure the actual setup and hold window size for your application, slowly decrease the clock delay in steps (waiting a few seconds between steps to verify that it does not trigger), until the logic analyzer triggers. Record this second value. The difference between this second value and the value that you measured in step 3 is the measured setup and hold window size.

Test fixtures

This section includes information and procedures for building the test fixtures used in the performance verification tests.

Threshold accuracy test fixture

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

Equipment required

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

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

Build procedure

Use the following procedure to build the test fixture.

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

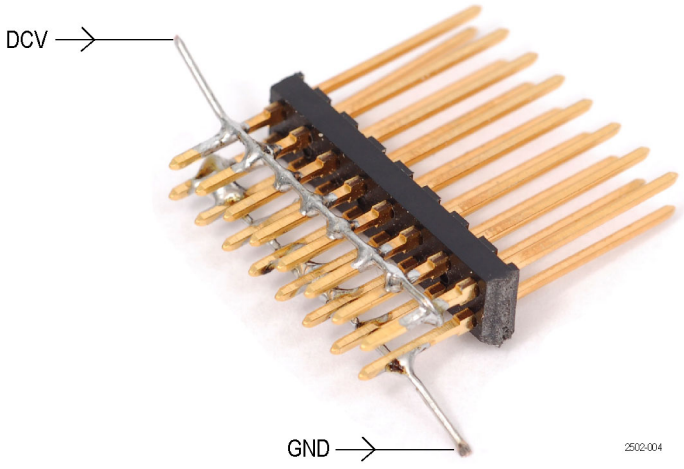


Figure 3: Threshold accuracy test fixture

Setup and hold test fixture

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

Equipment required

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

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

Build procedure

Use the following procedure to build the test fixture.

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

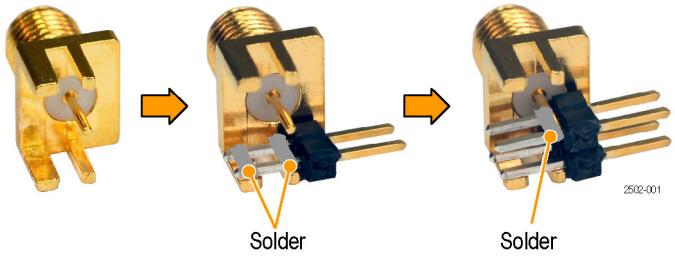


Figure 4: Solder square pins to the SMA connector

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

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

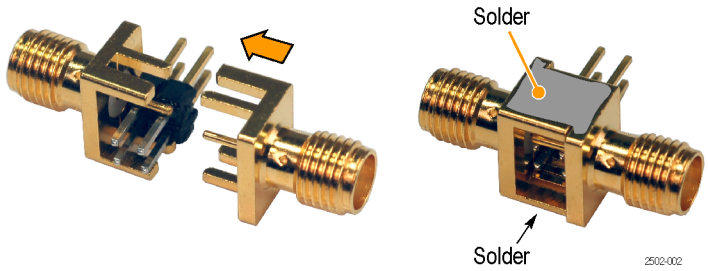


Figure 5: Solder the SMA connectors together

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

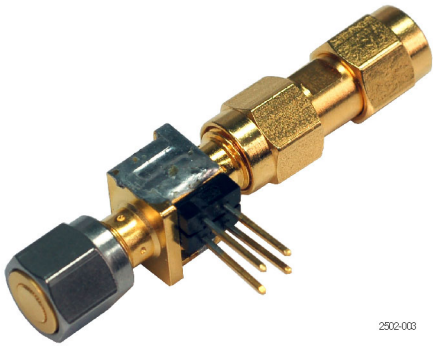


Figure 6: Completed fixture with termination and coupler

Calibration data report

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

TLA6400 test record

Instrument model number:
Serial number:
Certificate number:
Verification performed by:
Verification date:

Test data

Characteristic	Specification	Tolerance	Incoming data	Outgoing data
Clock frequency	10 MHz	±500 Hz (9.9995 MHz-10.0005 MHz)		
Threshold accuracy	+2.5 V	±75 mV (2.425 V to 2.575 V)		
	-2 V	±70 mV (-1.930 V to –2.070 V)		
Setup and hold window:				
single channel	≤300 ps	none		