Tektronix Logic Analyzer Family
Quick Start User Manual

www.tektronix.com
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Tektronix

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Preface

This manual describes the basic operation and concepts of the Tektronix Logic Analyzer series instruments. The TLA5000B Series Logic Analyzers are stand-alone products and the TLA7000 Series Logic Analyzers are configurable modular products. The TLA7000 Series Logic Analyzers can be configured with a variety of logic analyzer modules and serial analyzer modules. All logic analyzers have integrated operation capabilities with Tektronix oscilloscopes. This manual supports the following instruments:

- TLA5000B Series Logic Analyzers (TLA5201B, TLA5202B, TLA5203B, TLA5204B)
- TLA7000 Series Mainframes (TLA7012, TLA7016) and their associated modules

Key Features

The Tektronix Logic Analyzers can help you verify and debug hardware designs, processor and bus designs, and embedded software and hardware integration. Key features include:

- 34/68/102/136 channel logic analyzers
- 500 ps (2 GHz) 256 Mb deep timing analysis
- 125 ps (8 GHz) MagniVu high resolution timing acquisition simultaneous with deep timing or state acquisition to find difficult problems
- Up to 235 MHz state acquisition analysis of synchronous digital circuits, TLA5000B series
- Up to 800 MHz state acquisition analysis of synchronous digital circuits, TLA7Axx series
- Up to 1400 MHz state acquisition analysis of synchronous digital circuits, TLA7Bxx series
- Simultaneous state, high-speed timing and analog analysis through the same logic analyzer probe to pin-point elusive faults without double probing, TLA7ACx series, TLA7Bxx series, and Tektronix oscilloscopes
- Glitch and setup/hold violation triggering finds and displays elusive hardware problems
- Transitional storage extends the signal analysis capture time
- Connectorless probing system with 0.5 pF total capacitive loading eliminates the need for on-board connectors, minimizes intrusion on circuits, and is ideal for differential signal applications

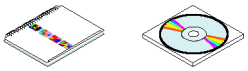
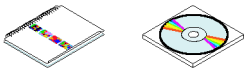
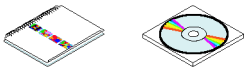
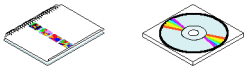
Tektronix also offers the TLA7S08 and TLA7S16 serial analyzer modules for PCI Express validation of silicon, computer systems, and embedded systems. Key features include:

- 8- and 16-channel serial analyzer modules with 32 M 8b/10b symbols memory depth per channel
- 2.5 Gb/s and 5 Gb/s acquisition speeds for PCI Express 1.0 and PCI Express 2.0
- Support for x1, x2, x4, x8, and x16 PCI Express links

Documentation

The following table lists related documentation, available as printed documents or as PDF documents on the TLA Documentation CD and on the Tektronix Web site (www.tektronix.com). Other documentation, such as online help, is available on the instrument.

Related Documentation

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

Version Differences

Some of the illustrations in this document may have different icons than your instrument due to differences in software versions. Refer to the online help for the menu features of your software version.

Basic Setups

Installation Documentation

For installation instructions and descriptions of controls and connectors on your instrument, refer to the installation reference card or installation manual that came with the instrument. (See page iii, *Documentation*.)

Connecting to a Network

The user interface operates under the Microsoft Windows® operating system. Before you connect to a network, Microsoft recommends the following to ensure your instrument is protected:

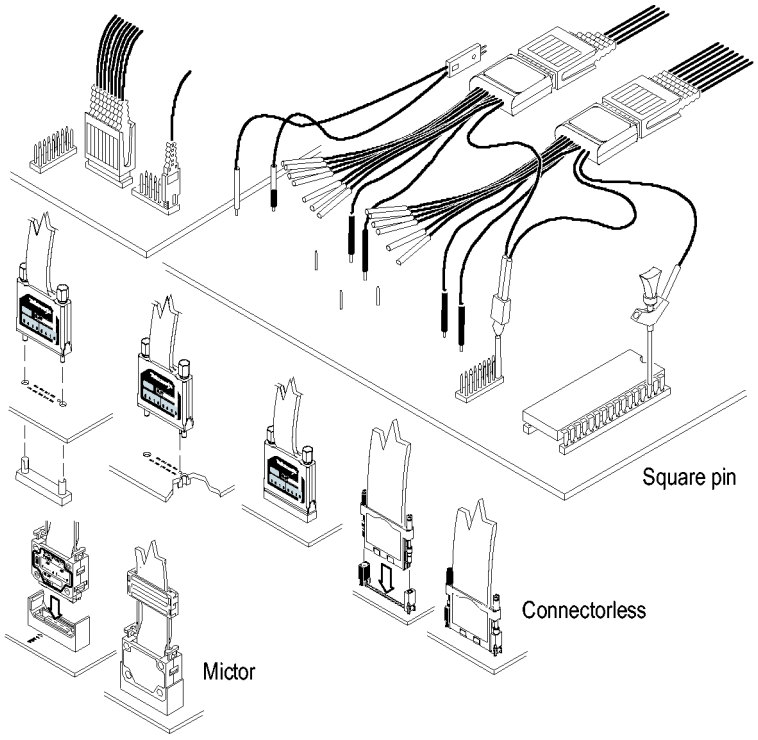
- Use an internet firewall
- Install operating system updates regularly
- Use up-to-date antivirus software

See the installation manual for detailed instructions on connecting to a network.

Connecting Probes to the System Under Test

The logic analyzer has different methods of connecting probes to the system under test. Refer to the illustration and connect your probes to the system under test.

- **Square pin connectors.** Use general-purpose probes to connect to the system under test using square pin connectors or square-pin adapters.
- **Connectorless compression connectors.** Use land pattern probes for applications that connect many channels to connectorless compression contacts on the system under test.
- **Mictor connectors.** Use Mictor connector probes for applications requiring many channels to be quickly connected using Mictor connectors or Mictor adapters.



Connecting to Your Instrument

You can connect to your instrument as Remote Host, Remote Desktop, or Local.

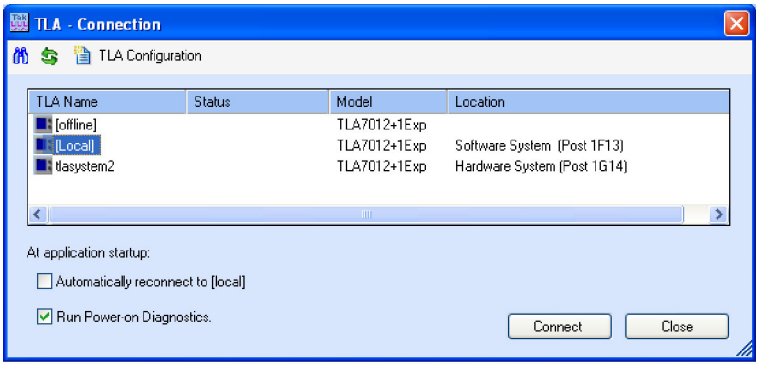
To access the TLA Connection dialog box, start the TLA Application software on the instrument or on your PC.

NOTE. *The TLA Connection dialog box appears when you start the instrument from a PC or when you restart the TLA application without shutting down the instrument.*

Local Connection

Choose a Local connection when you want to work directly on the instrument.

NOTE. *Make sure that you select* ***Local*** *instead of* ***Offline*** *when you want to connect to your local instrument. Selecting Offline does not connect you to an instrument.*

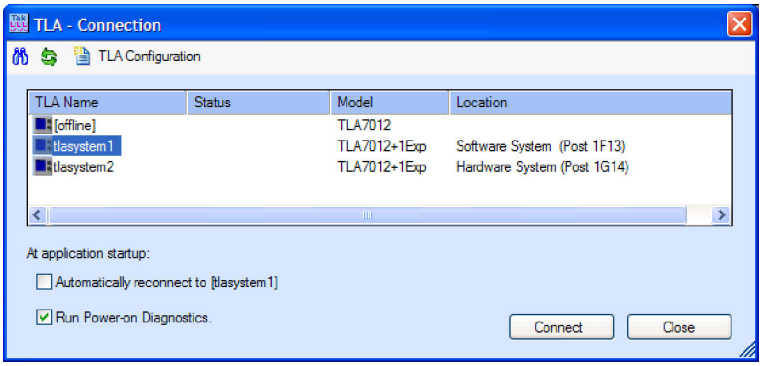


Remote Host Connection

Connect as Remote Host when you want to run the application on your PC to control the instrument remotely, and then store the data locally on your PC.

NOTE. *You must be connected to a LAN to use Remote Host and the TLA Server (TLA7012 and TLA5000B) must be running.*

Refer to Controlling the Logic Analyzer Remotely in the TLA7000 Series Logic Analyzers Installation Manual for more information on configuring your instrument for remote operation.

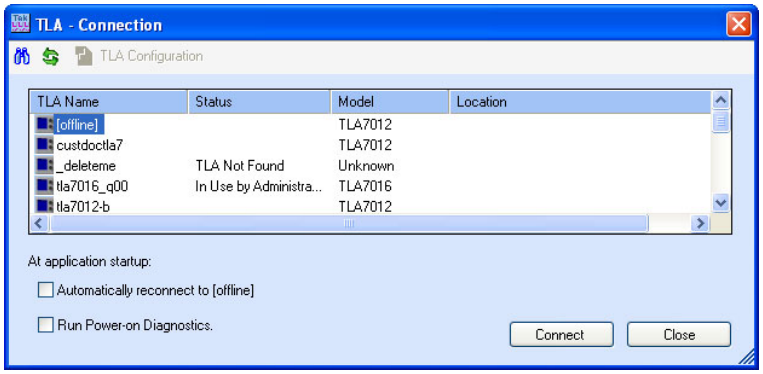


NOTE. *To start the TLA Server on a TLA7012 instrument, right-click the* *(TLA Server) icon in the toolbar at the bottom right side of the screen and select* ***Start TLA Server***

Offline

You can work offline, without connecting to an instrument, to modify setups or view data files that you previously saved.

Click the TLA Application on the desktop and then select Offline.

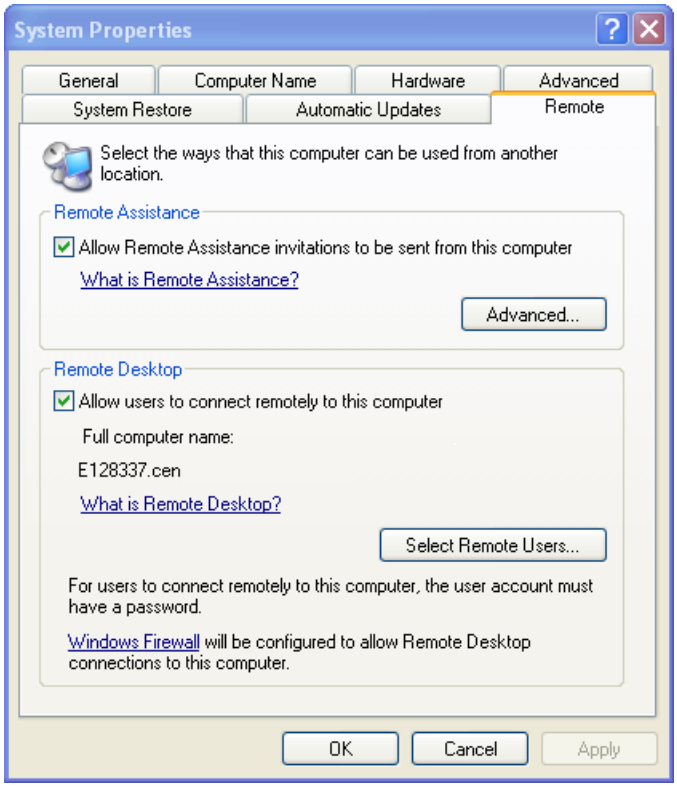


Remote Desktop

Connect as Remote Desktop when you want to run the application on the instrument from your PC and store the data on the instrument.

To enable the Remote Desktop, ensure that the Microsoft Windows System Properties dialog box on the instrument is setup as shown.

See the Microsoft Web site http://www.microsoft.com for more information on working remotely.



Navigating the Logic Analyzer Windows

Tektronix provides several different ways of navigating the logic analyzer windows to accomplish your basic tasks. Choose the one that works best for you.

Toolbar Buttons

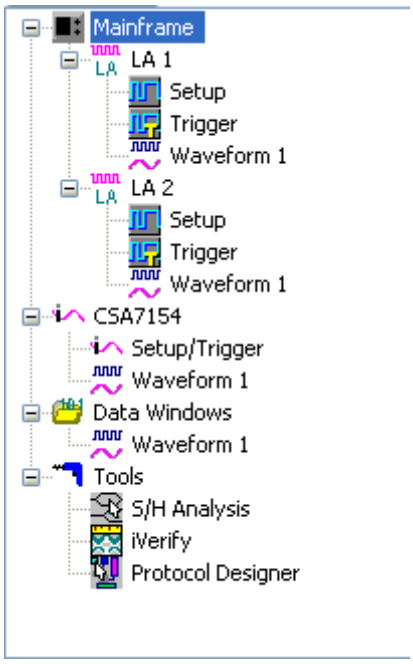
Use the toolbar buttons to quickly navigate between key windows while making the best use of screen space.

Click one of the buttons to quickly access a Setup window, Trigger window, Waveform window, or Listing window.

Toolbar Buttons

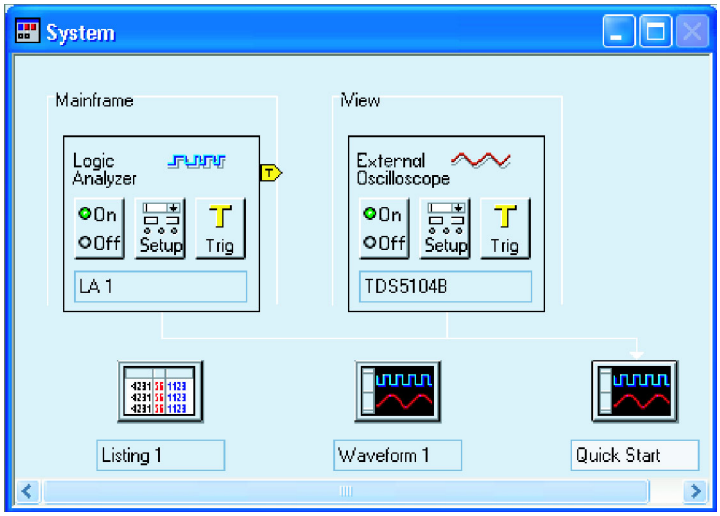
Use the TLA Explorer to quickly access key windows from a tree structure.

The TLA Explorer shows all of the modules in the logic analyzer and their subcomponents.



System Window

The System window shows a block diagram representation of the modules and data windows available with your logic analyzer. Click an icon to open the related window.



Quick Tips

- To open the System window, select System from the Window menu or press function key F9.
- Use the front-panel buttons to navigate between windows on the TLA7012 Portable Mainframe.

Basic Steps for Using a Logic Analyzer

The basic steps for using the logic analyzer are summarized below.

1. Use the Setup window to set up the logic analyzer signals, threshold voltages, clocking, and sampling, and samples per signal
2. Specify triggering in the Trigger window.
3. Configure a Waveform window.
4. Acquire data.
5. Analyze the data in the Waveform or Listing window.

Data Window Overview

Use data windows to display and analyze data acquired by your instrument. The Waveform window is the default data window. Create other data windows using the New Data Window wizard.

NOTE. *To start the New Data Window wizard click* *in the toolbar or select New Data Window from the Window menu.*

Waveform Window

Use Waveform windows to display waveform data from the logic analyzer or from an external oscilloscope. Waveform windows are best used for diagnosing timing problems, measuring hardware timing-related characteristics, and verifying correct hardware operation by comparing recorded results against data sheet timing diagrams.

Listing Window

Use Listing windows to display acquired data in a state table display. Listing windows can be used for state machine debug applications, tracing relative software execution, system optimization, and following data through a system design.

Histogram Window

Use Histogram windows to display acquired data as histograms. Histogram data is useful for evaluating the performance of software, such as determining which routines or functions take most of the time performing certain tasks.

Source Window

Use Source windows with Listing windows to track the execution of source code in software applications.

Graph Window

Use Graph windows to display the results of acquired data in a graph or chart format.

Protocol Window

Use Protocol windows to display and analyze protocol data.

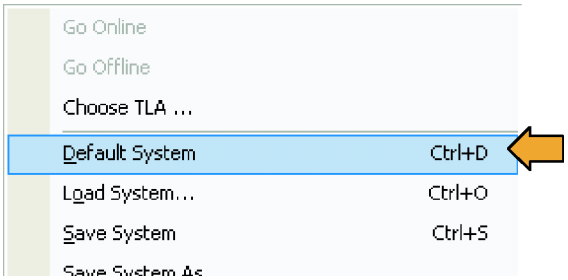
Getting Acquainted with Your Instrument

The following sections show how to set up the logic analyzer and to do timing analysis using data from a simple D-type flip-flop. Flip-flops serve as building blocks in digital systems. Although most flip-flops are buried inside complex ASICS and other devices, they are useful for showing hardware debugging techniques using a logic analyzer. The examples in this document use only a few channels to acquire data. However, you can use the same concepts with hundreds of channels.

Set the Default System

Use the Default System setup to load the factory default settings.

1. Power on the instrument and wait for the instrument to complete the power-on tests.
2. Select **Default System** from the File menu.
3. Click **OK**.

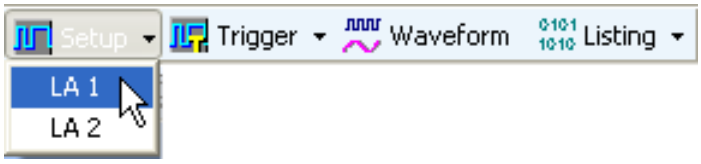


Configure the Setup Window

Use the following procedures to define data signals, to set the clocking, to set the probe threshold voltages, and to use other features of the Setup window.

Open the Setup Window

- Click the Setup button in the TLA toolbar and to select the Setup window for your instrument.



Specify the Sampling Method

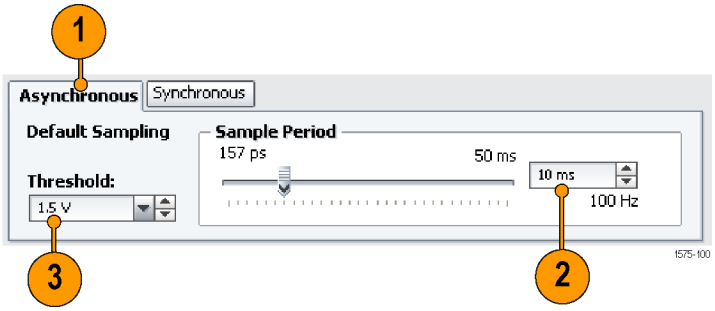
When you select asynchronous sampling, the logic analyzer selects when data is sampled (sample point). Asynchronous sampling is also known as timing acquisition.

When you use synchronous sampling, the system-under-test specifies the sample point by an external clock. Synchronous sampling is also known as state acquisition.

The following example uses asynchronous sampling.

1. Select **Asynchronous**.
2. Set sample period (or use default setting).
3. Select the threshold voltage.

The threshold voltage is applied to all probe channels. You can set threshold voltages for individual channels in the bottom part of the Setup window.

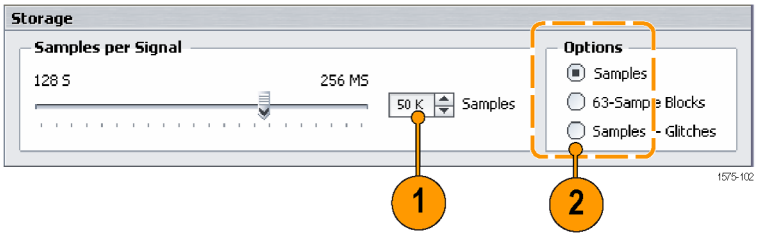


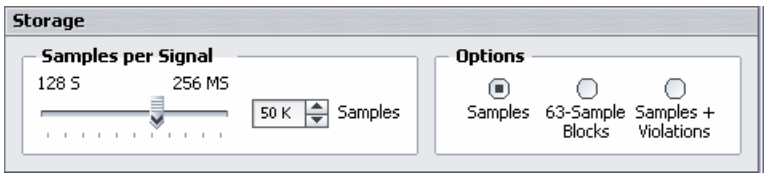
NOTE. *If your logic analyzer has a support package installed, a custom clocking tab is available. The label on the tab is the same as the support package.*

Set the Storage Options

Use Storage to specify the length of each data acquisition and how to store the acquisition.

1. Select the number of samples to store per signal. The selections vary depending on your logic analyzer.
2. Select how to store the acquisition.
   - Select **Samples** to store samples specified by the trigger actions.
   - Select **63-Sample Blocks** to store samples in blocks of 63 bits; this is often recommended for troubleshooting program flow.
   - Select **Samples + Glitches** to store glitch data (Asynchronous sampling only).
   - Select **Samples + Violations** (Setup and hold violations) to store setup and hold violations (Synchronous and Custom sampling only).

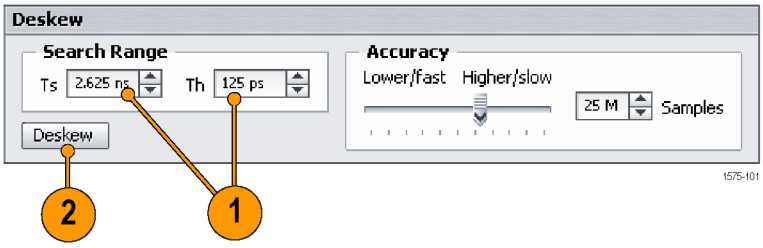




Deskew the Probe Signals

When using Synchronous or Custom sampling, you might want to deskew the signals in your setup.

1. Set the deskew parameters.
2. Click **Deskew** to begin the deskew process.

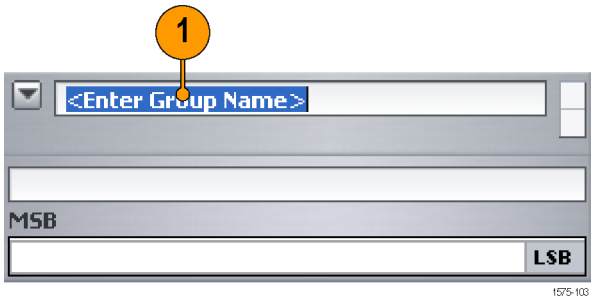


Create Groups

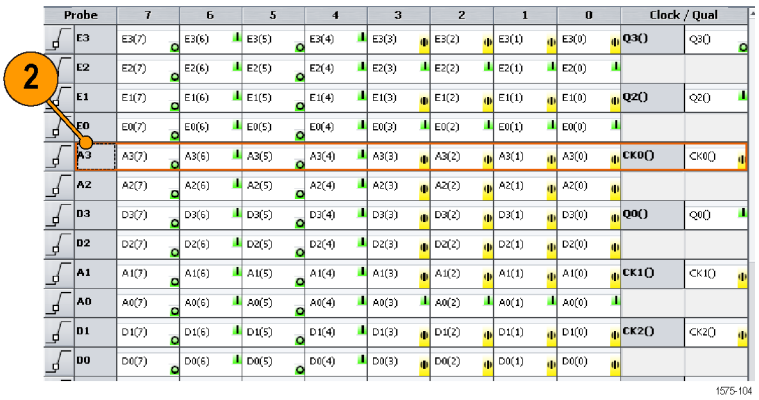
Groups are logical collections of probe signals often related to busses on your system-under-test.

When you enter the Setup window the first time, an empty group card appears on the right side of the Setup window.

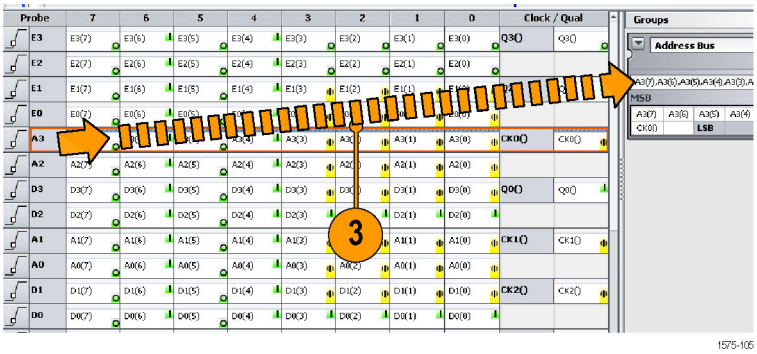
1. Enter a name for the group, for example, Address Bus.



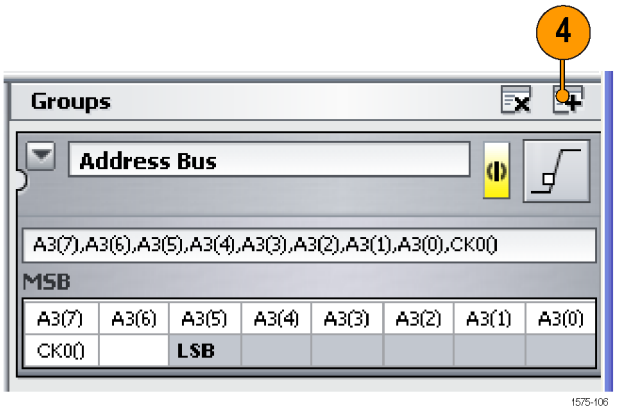
2. Determine the probe section that you want to use. For example, click A3 to select the signals for section A3.



3. Drag selected signals to the group card.



4. To create additional groups, click the plus sign at the right edge of the Groups column.



Check Signal Activity

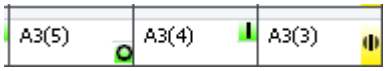
You can easily check for signal activity at the probe tips by looking at the Activity & Threshold indicators in the Setup window. When there is signal activity, the indicators change from a 1 to a 0 with yellow in between. Each data and clock signal has its own indicator.

Note the signals in the example:

The signal connected to A3(5) is low as indicated by the zero (o).

The signal connected to A3(4) is high as indicated by the one (1).

The signal connected to A3(3) is transitioning as indicated in yellow..



NOTE. *If the signals are inverted the zero (O) appears on top and the one (1) is on the bottom.*

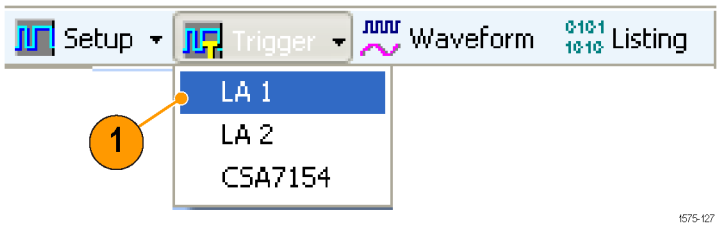
If there is no probe activity, check for the following:

- Check the probe connections.
- Verify that the target system is powered on
- Check the probe threshold voltages. (Click the Activity & Threshold indicators to open a dialog box to adjust the threshold voltages.)

Define the Trigger Window

Use triggers to tell the logic analyzer when to acquire data and display the results in a data window.

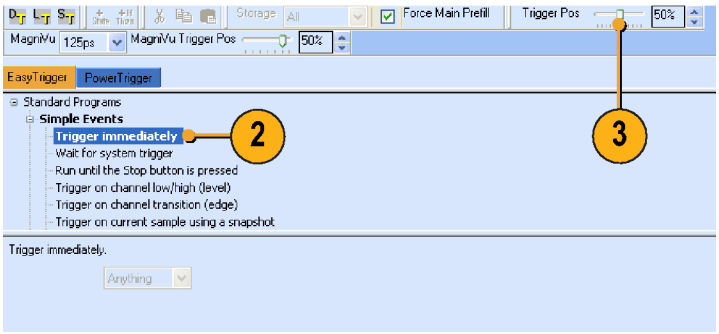
1. Click the Trigger button in the TLA toolbar and select the Trigger window for your instrument.



2. In the Easy Trigger tab, select a trigger program from the list. For example, select **Trigger immediately** to trigger the instrument on any data.

   Use the area below the trigger program list to enter more details for the trigger programs, if needed.

3. Click and drag the **Trigger Pos** indicator to the point in memory where you want the instrument to trigger. The default selection is 50%.



Quick Tips

- After you have acquired data, use the Tabbed Trigger window to define simple trigger programs without having to close the Waveform or Listing window.
- Use EasyTrigger to define the trigger program for most applications; use PowerTrigger to customize the trigger program for specific needs.

Define the Waveform Window

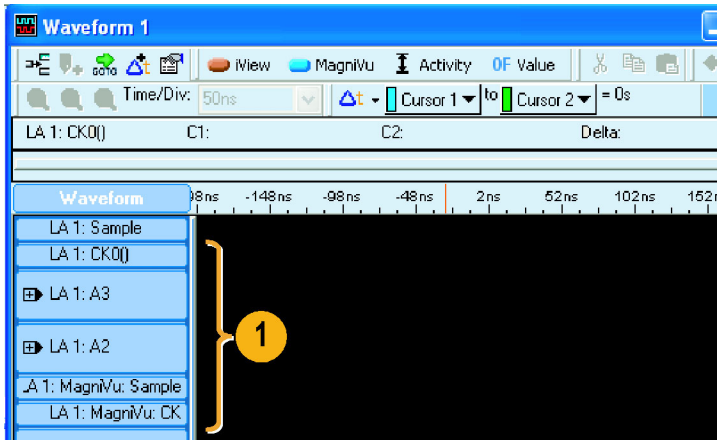
For most applications, you will define the data windows for your needs. For this example, you will use the Waveform window.

Open the Waveform Window

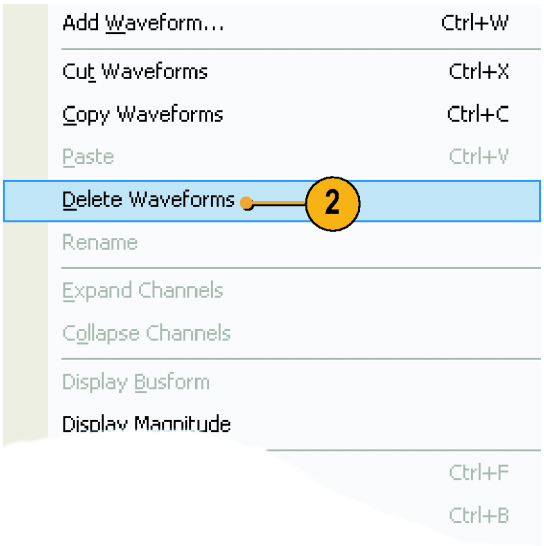
- Click the Waveform button to open the Waveform window.

Delete the Default Waveforms

1. Press the **CTRL** key and select each waveform name that you want to delete.



2. Right-click and select **Delete Waveforms**.



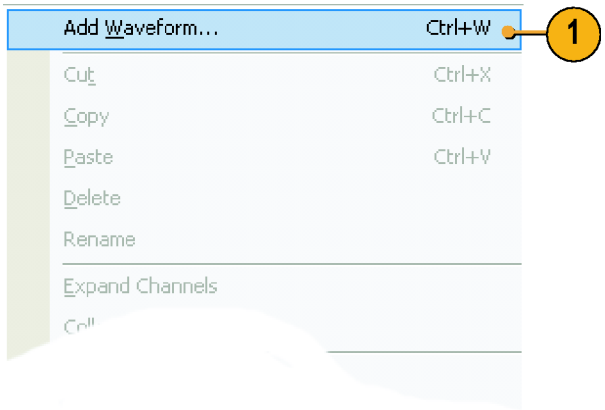
Quick Tip

- Use the delete key on the keyboard to delete highlighted waveforms.

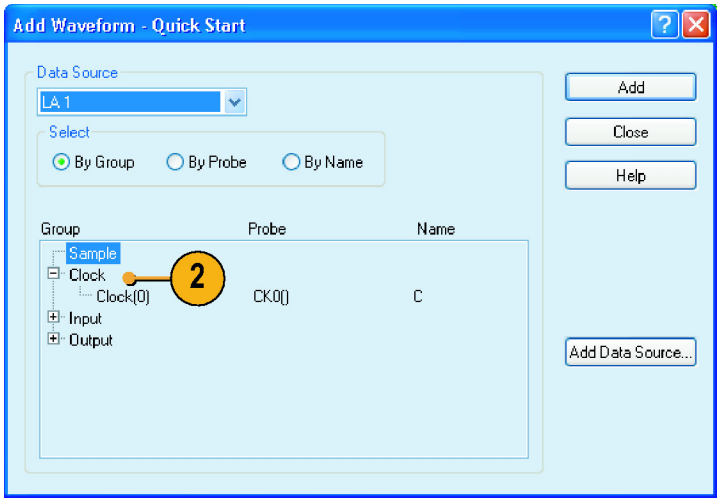
Add Waveforms

Use the following steps to add the waveforms that you defined in the Setup window. (See page 11, *Create Groups*.)

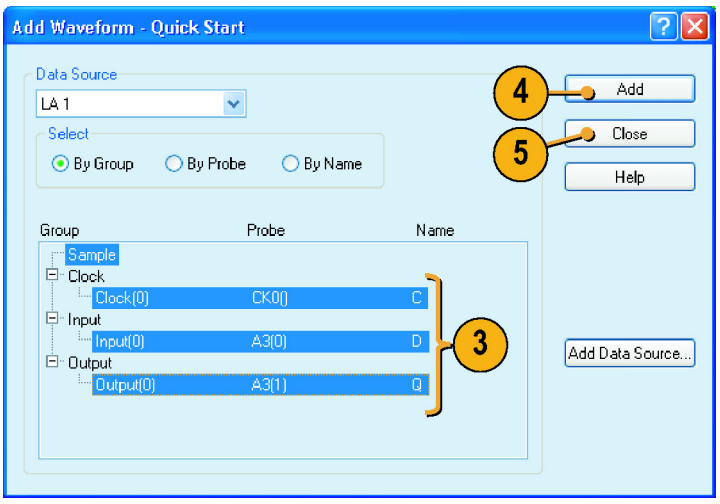
1. Right-click in the waveform label area and select **Add Waveform**.



2. Expand each group.



3. Press the **Ctrl** key while selecting each signal that you want to add to the Waveform window.
4. Click **Add**.
5. Click **Close**.



Quick Tip

- Select **By Name** to add the probe signals to the Waveform window by their channel names. This is useful for groups that have only one channel.

Acquire Data

After you have defined all of the setups and connected the probes to the target system, you are ready to acquire data. You can acquire a single sequence of data, or you can continuously acquire data.

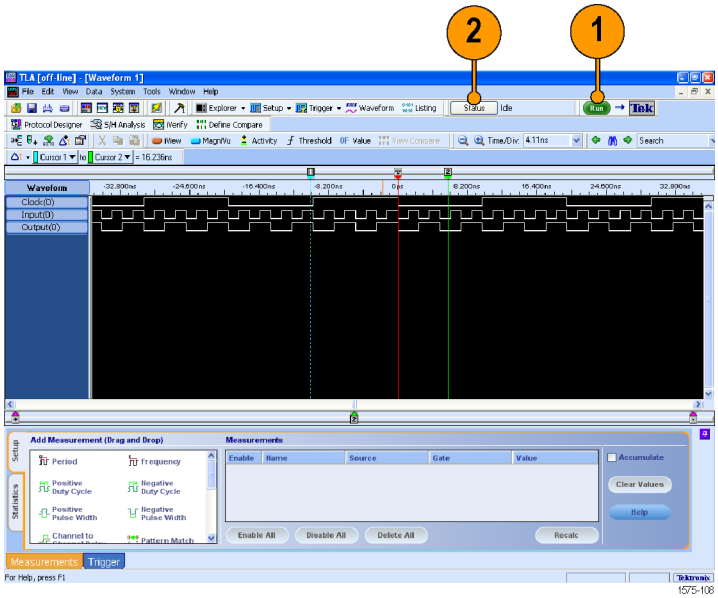
Making a Single Acquisition

1. Click **Run**.

   The Run button changes to Stop until the instrument has met the trigger conditions and has acquired the data. The button changes back to Run after data has been acquired.

2. If the instrument does not trigger, click **Status**. Use the information in the dialog box to see if the logic analyzer is waiting for the trigger or if it has triggered and is filling its acquisition memory.

   When a trigger occurs, the instrument displays the flip-flop Clock, Input, and Output data in the Waveform window. The trigger point is represented by the red trigger marker (T).



Quick Tip

- To verify that the instrument is acquiring data during long periods of inactivity on the screen, check that the Tek icon in the upper right corner of the screen is animated.

Making Repetitive Acquisitions

1. Click the Repetitive Run button to acquire data repetitively. The icon changes from an arrow to a loop.

2. Click **Run**. The instrument will acquire data until you click Stop or until you click the Repetitive Run button again to change back to single run mode.

Using the Tabbed Trigger Window

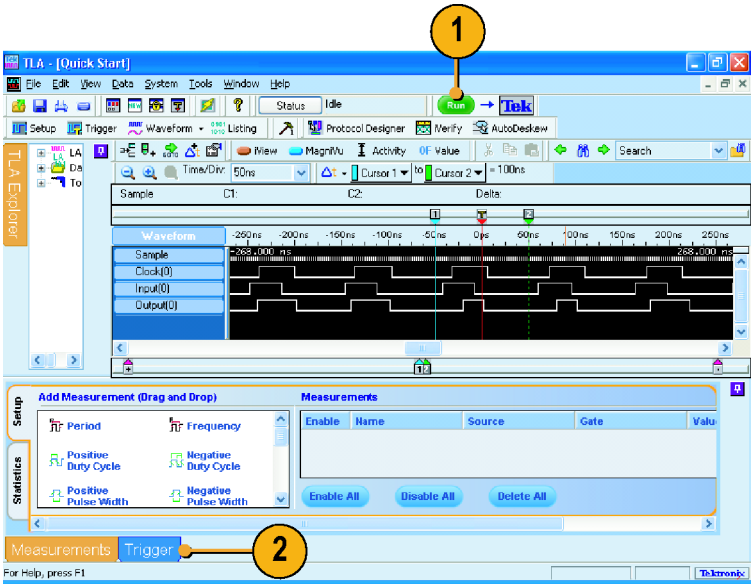
You can define a trigger program using the Tabbed Trigger window without closing the Waveform or Listing window. The following example shows how to set up the instrument to trigger on a channel edge.

You can also use this procedure to quickly define other trigger programs. To acquire complex data, you can still use the Power Trigger window.

1. Click **Run**.

Data must be present before you can use the Tabbed Trigger window.

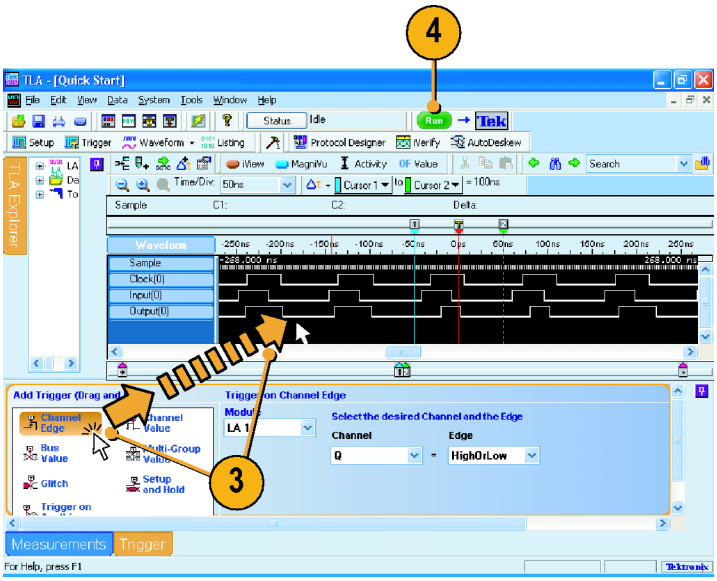
2. Click **Trigger** in the tabbed window.



3. Click and drag the **Channel Edge** icon from the Tabbed Trigger window to the Output waveform.

   The instrument will display the details of the program in the Trigger Details area. The details are similar to those in the Power Trigger window. You can edit any of the details.

4. Click **Run** to acquire data and trigger the instrument based on the new trigger program.



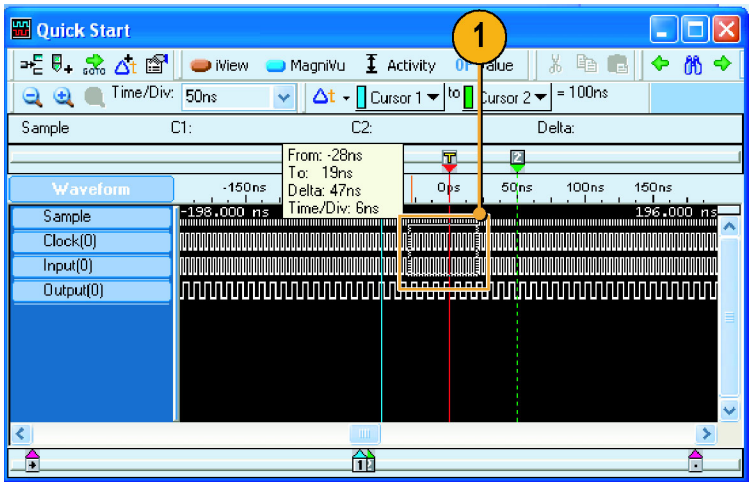
Analyzing Data

Your instrument has several tools for analyzing data, such as zooming data, measuring data, and viewing data with MagniVu high-resolution timing. This section provides concepts and procedures for analyzing data in the Waveform window. Some of these features also apply to the Listing window; refer to the online help for more details.

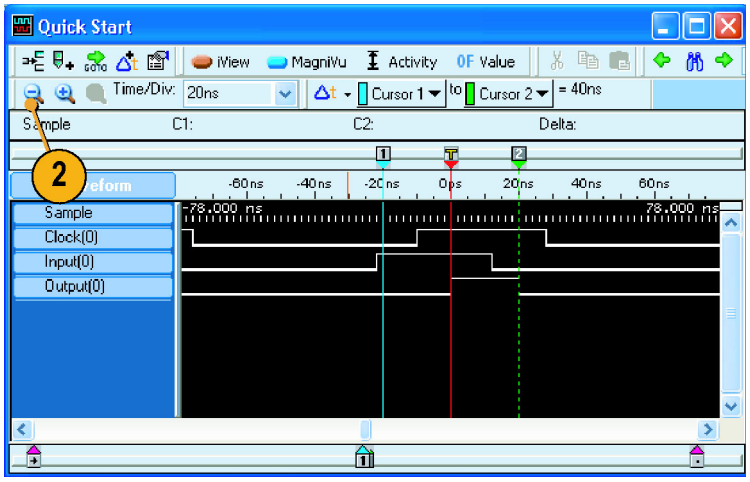
Zooming Data

To zoom data in the Waveform window:

1. Click and drag from left to right over the area you want to zoom.



2. Click the Zoom In button a few times to zoom the timing data samples.



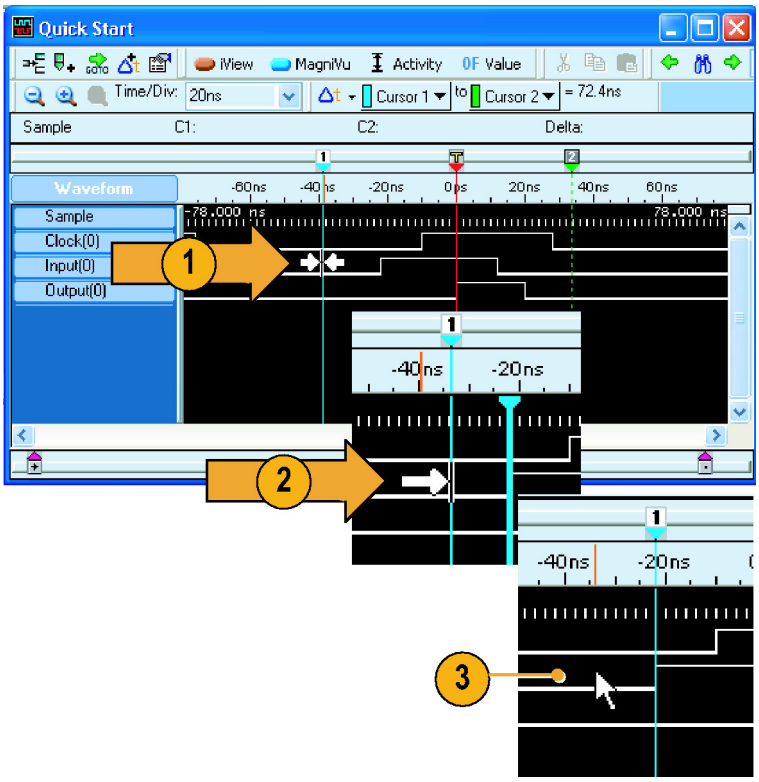
Quick Tips

- Click and drag from the right to the left to zoom to the previous selection.
- Use the Zoom In and the Zoom Out buttons in the toolbar as an alternative method of zooming data.
- Rearrange the toolbars, as needed, to access command buttons, if the command buttons appear off-screen.

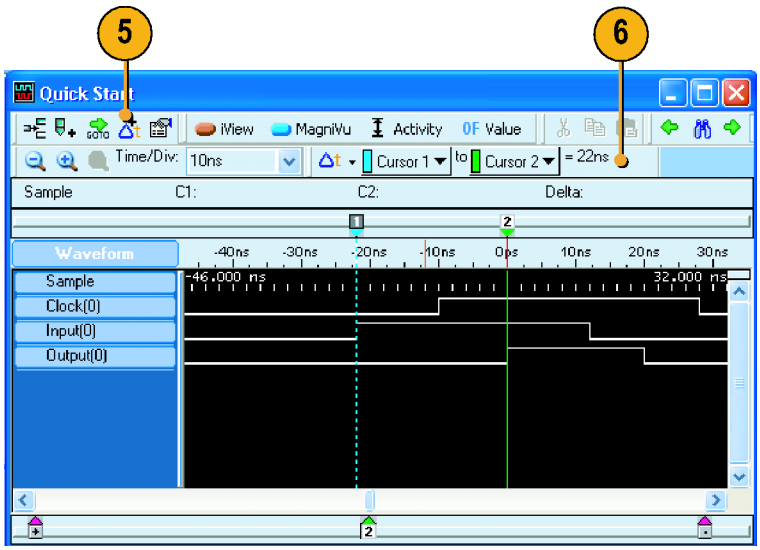
Measure Waveform Data using Cursors

Use the Snap to Edge feature with cursors in the Waveform window to measure the time between waveforms.

1. Point the mouse at Cursor 1 over the waveform that you want to measure.
2. Click and drag Cursor 1 toward a leading or trailing edge of the waveform.
3. Release the mouse to snap the cursor to the next waveform edge.
4. Repeat for Cursor 2.



5. If the Delta-time toolbar is turned off, click .
6. Read the time difference between the two cursors.



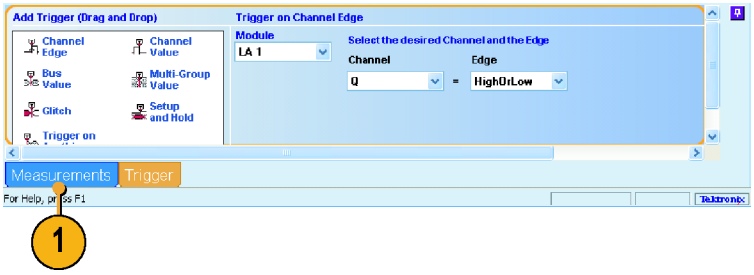
Quick Tips

- If the cursors do not appear in the Waveform window, use the right-click menu to move the cursors on screen (select **Move Cursor 1 Here**).
- You can use the Snap to Edge feature with any of the user marks.
- You can click to add multiple Delta-Time toolbars in the same Waveform window.
- You can use the Delta-Time toolbar to measure time between any two marks. Select the marks from the drop-down lists in the toolbar.

Using the Data Measurement Window

Use the Data Measurement window to quickly take measurements in the Waveform or Listing window.

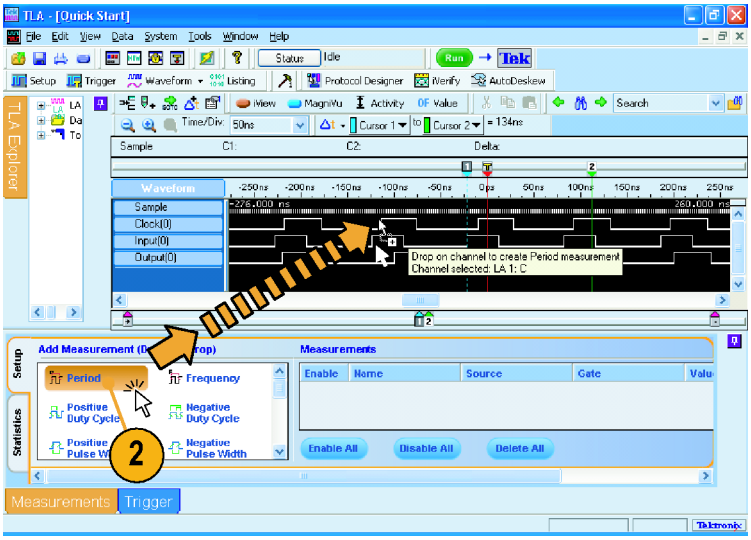
1. Click **Measurements**.



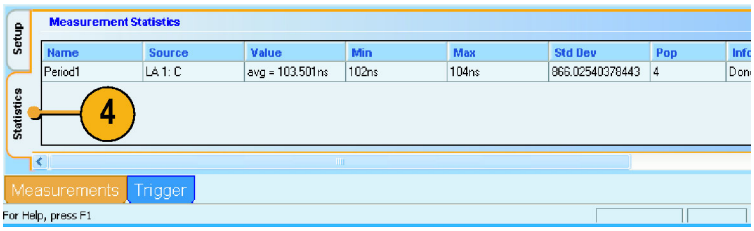
2. Click and drag the **Period** icon to the Clock waveform, and release.

   The selected measurement will be added to the Data Measurement window at the bottom of the display.

3. Repeat for any other measurements.



4. Click the **Statistics** tab in the Data Measurement window to display the results of the measurement along with other statistics. Measurements are taken on the existing data without having to acquire new data.



Quick Tips

- To take a measurement on new data, click **Run**.
- To save the measurement data to a file, click the Export button in the Statistics tab of the Data Measurement window.
- To select a measurement in the Waveform window, select the waveform label, right-click the waveform, select **Add LA Data Measurement**, and then select a measurement from the list.

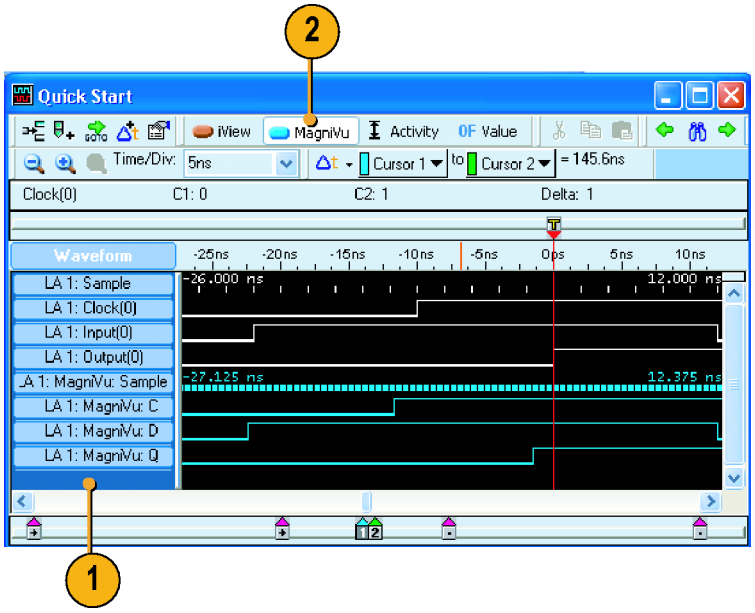
View Acquired Data with MagniVu High-Resolution Timing

MagniVu high-resolution timing provides 125 ps sampling (500 ps sampling on TLA7N4 modules) on all waveforms to analyze details that you may not see using Deep timing. It is like having two logic analyzers in one. Using a single probe you can view Deep timing data for long time spans and MagniVu high-resolution timing data for greater resolution at the area of interest.

The MagniVu high-resolution data is automatically acquired with each acquisition. However, the waveforms may not be visible. To add MagniVu timing waveforms:

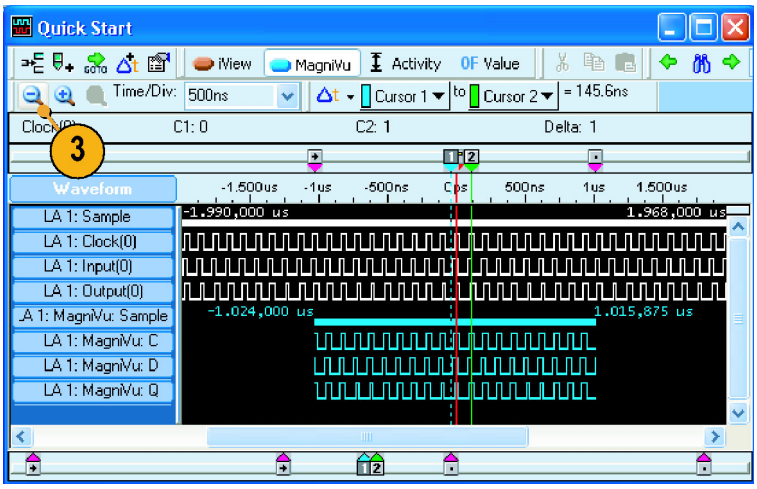
1. Click below the waveform labels to deselect all waveforms.
2. Click **MagniVu** to add the MagniVu data to the Waveform window.

   The MagniVu timing waveforms are added to the window in a different color.

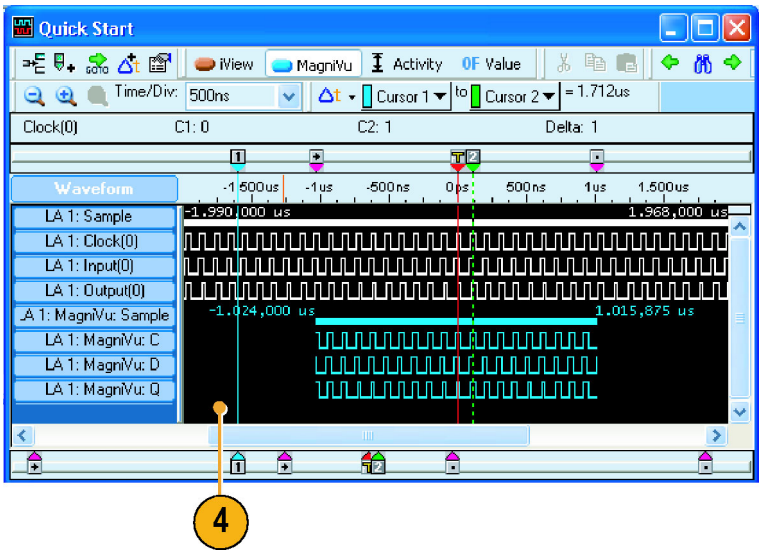


3. Click the Zoom Out button until you see the entire MagniVu timing waveforms.

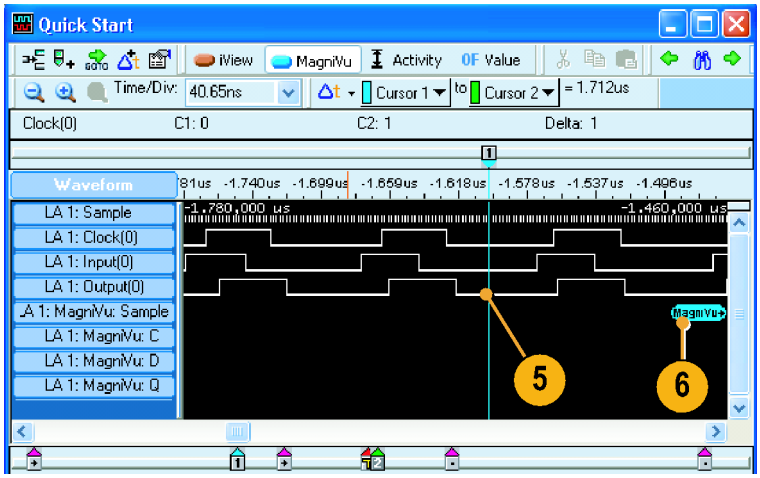
   Note that the MagniVu timing data is 16 K bits long as compared to the Deep timing data. Deep timing lets you acquire a large amount of data; MagniVu timing lets you focus on the details of the data.



4. Move Cursor 1 to an area in the Waveform window outside the range of the MagniVu data.



5. Zoom on Cursor 1. The MagniVu button indicates the MagniVu waveforms are off screen.
6. Click the MagniVu button to center the MagniVu data on-screen.



Quick Tip

- Click the MagniVu button in the Listing or Waveform window to turn the MagniVu display on and off.

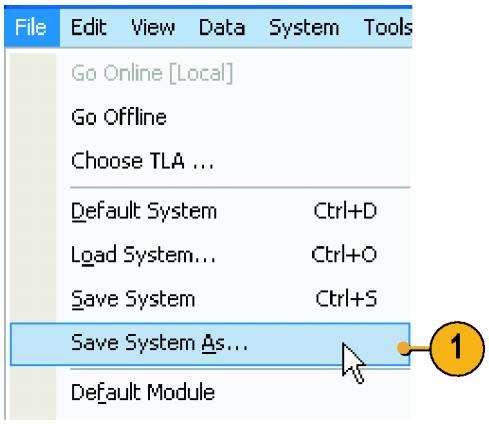
Managing Data

This section contains procedures for managing data, such as saving setups and loading saved setups.

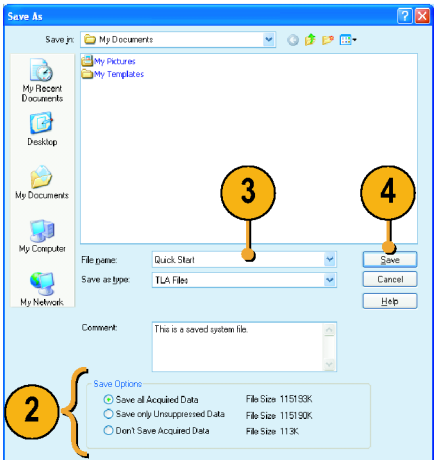
Saving Setups

After defining your setup, you can save it for future use.

1. Select **Save System As**.



2. Select one of the following save options:
   - **Save all Acquired Data**
   - **Save only Unsuppressed Data**
   - **Don't Save Acquired Data**
3. Enter a file name.
4. Click **Save**.



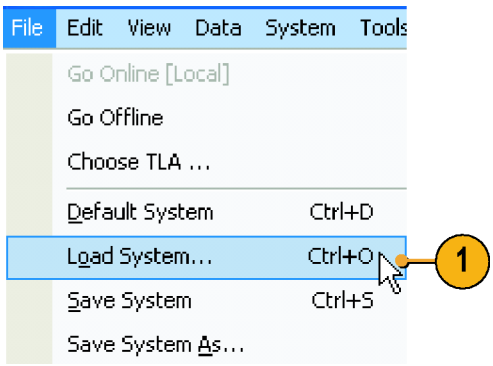
Quick Tips

- Save often to avoid losing critical setups and data.
- See the online help for details on saving setups.

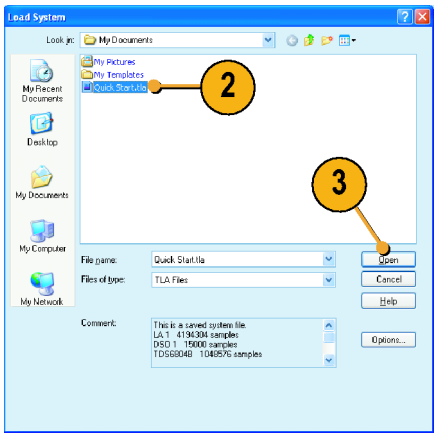
Loading Setups

Use the following steps to load the setup that you saved under *Getting Acquainted with Your Instrument*. (See page 8.)

1. Select **Load System**.



2. Select the file name.
3. Click **Open**.
4. Click **Yes** when you are prompted to confirm your actions.



iView Integrated Measurements

You can use the iView feature to connect an external Tektronix oscilloscope to the logic analyzer, acquire data from both instruments, and display the results on the logic analyzer. This is useful for displaying the analog components of a signal in the same data window as the digital components.

In the following examples the logic analyzer and the oscilloscope will acquire the same data. The logic analyzer captures the digital components and the oscilloscope captures the analog components.

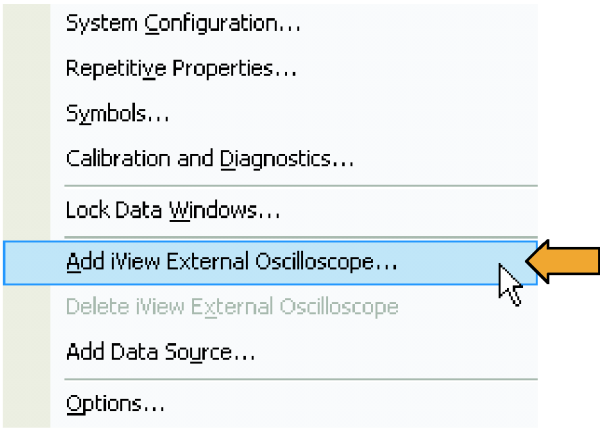
Use the following steps to set up the oscilloscope for these examples. Refer to the documentation that came with your oscilloscope for operating instructions.

1. Connect the oscilloscope probe to the same signal source as the logic analyzer (for this example, connect to the Q output of the flip-flop).
2. Power on the oscilloscope.
3. Press the **Default Setup** button on the oscilloscope, and then press the **Autoset** button. You should have a signal on the oscilloscope screen.

Connecting the Logic Analyzer and the Oscilloscope

After completing the oscilloscope and logic analyzer setups, use the iView wizard to connect the two instruments together.

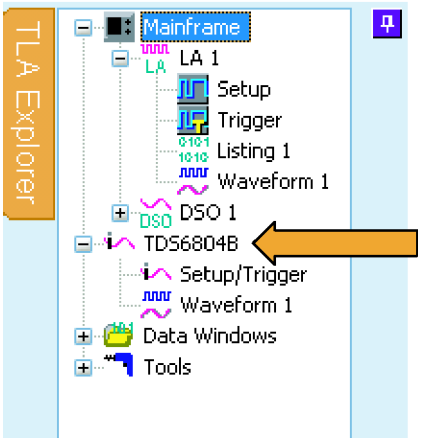
1. From the logic analyzer System menu, select **Add iView External Oscilloscope . . . .**
2. Follow the instructions on each page of the iView wizard to do the following steps:
   - Select the oscilloscope.
   - Connect the iView cable to the logic analyzer.
   - Connect the iView cable to the oscilloscope.
   - Verify the GPIB address of the oscilloscope.
   - Identify where to display the oscilloscope data.
   - Specify the triggering.
   - Verify the connections and setups.
3. Click **Finish** on the last page of the wizard.



Quick Tips

- Start the iView wizard by clicking the iView icon in the Listing window or Waveform window. If you have a TLA7012 Portable Mainframe, start the iView wizard by pressing the front-panel iView button.
- If the oscilloscope is properly connected to the logic analyzer when you start the iView wizard, the wizard will bypass the connection instructions. Follow the on-screen instructions to finish the installation or to return to the start page of the wizard.

The oscilloscope is added to the TLA Explorer and to the System window.



Acquiring the iView Data

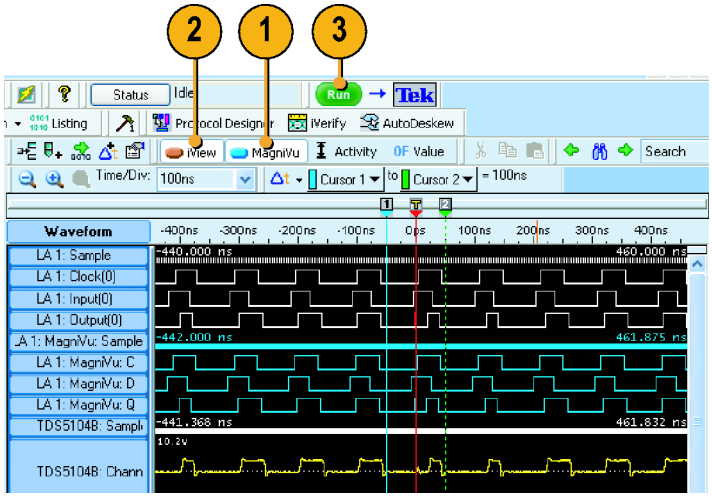
The next steps consist of acquiring the initial data, and then adjusting the data to properly view and analyze the data.

Acquire the Initial Data

1. Click **MagniView** to turn on the MagniVu waveforms.
2. Click **iView** to turn on the iView waveforms.

   If desired, delete any of the unused oscilloscope waveforms.
3. Click **Run** to acquire and display waveform data from both instruments.

   Depending on the oscilloscope and your Waveform window settings, you may not see any waveform data from the oscilloscope. If necessary, click the iView button in the Waveform window to bring the waveform on screen.

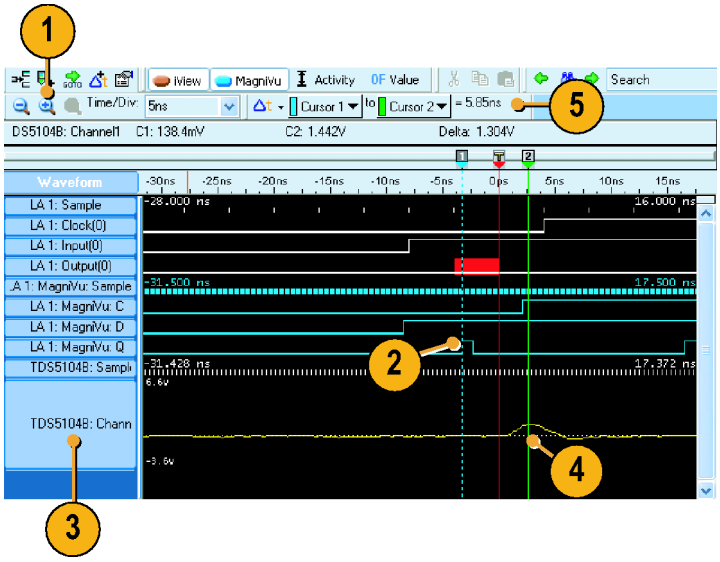


Aligning the Oscilloscope Data with the Logic Analzyer Data

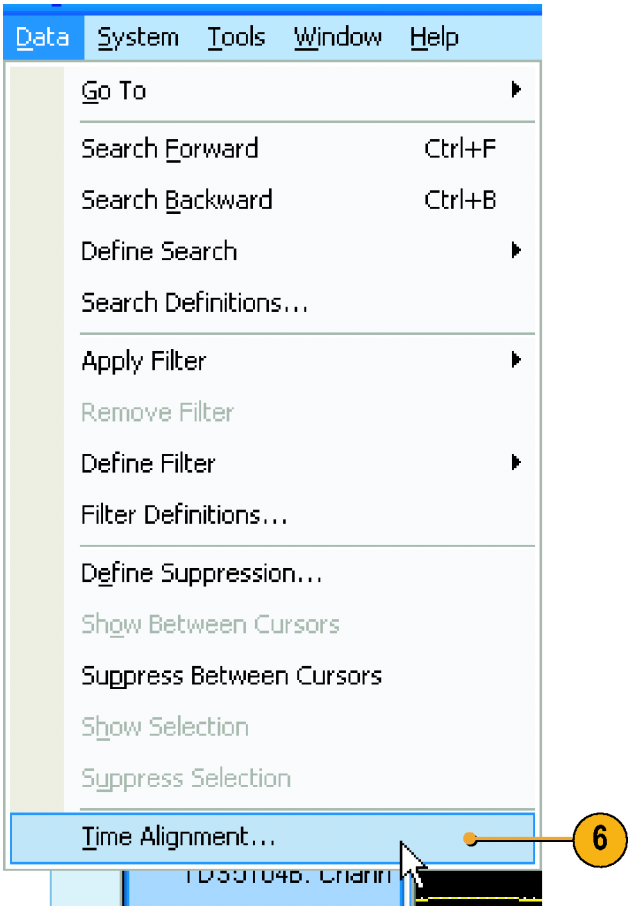
Complete the following steps to fine-tune the data alignment.

1. Zoom the display to measure the time difference between the glitch in the MagniVu waveform and in the oscilloscope waveform:
2. Move Cursor 1 to the leading edge of the glitch in the MagniVu waveform.
3. Click the oscilloscope waveform label to allow you to read the voltage measurements.

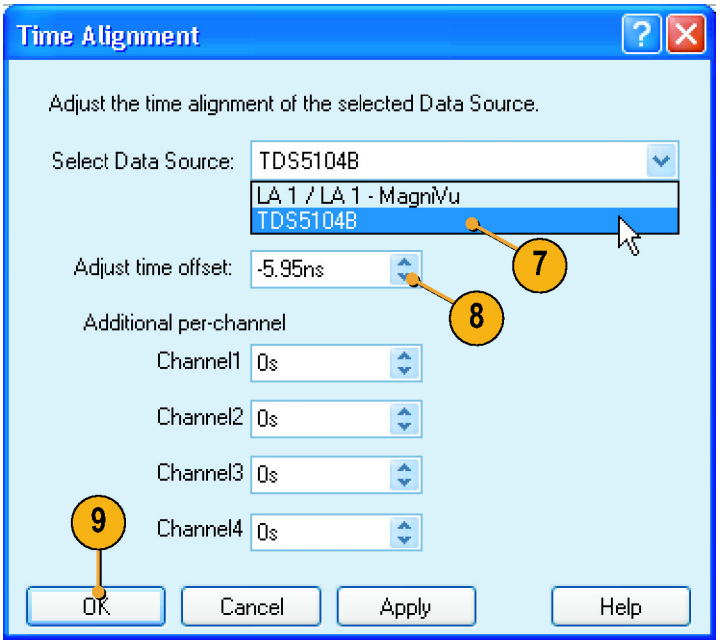
   If the highlighted waveform is too bright, click the area below the waveform labels to turn the highlighting off (you may need to resize the Waveform window to show the label area with no labels).
4. Move Cursor 2 to the point on the glitch where the waveform crosses the threshold voltage as indicated by the measurement readout.
5. Note the Delta Time value.



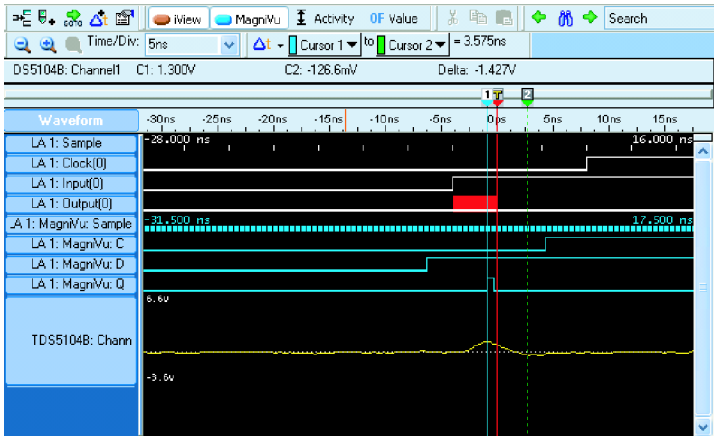
6. Select **Time Alignment . . .** from the Data menu.



7. Select the oscilloscope as the data source.
8. Enter the offset value (Delta Time value) into the Adjust time offset box.
9. Click **OK**.



The oscilloscope data is now time-aligned with the logic analyzer data.



Quick Tips

- A positive Adjust Time offset value will move the oscilloscope waveform in the display to the right with respect to the logic analyzer data. A negative offset value will move the oscilloscope waveform to the left.
- Click the iView button in the Waveform window or press iView button on the TLA7012 front panel to turn the iView signals on and off.

Application Examples

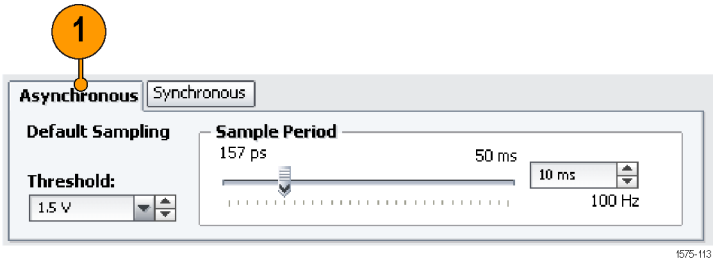
The examples in this section show how to use your instrument to do common logic analyzer tasks. These examples use the basic setups with the flip-flop examples developed earlier in this document. (See page 8, *Getting Acquainted with Your Instrument*.) Refer to the setups as needed to step through the application examples.

Triggering on a Glitch

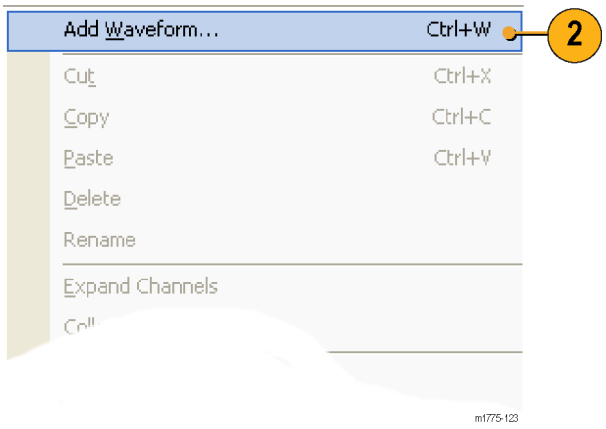
Logic analyzers are useful for debugging elusive, intermittent problems, such as glitches. Use the following procedures to set up the logic analyzer to trigger on a glitch.

Set up the Glitch Trigger

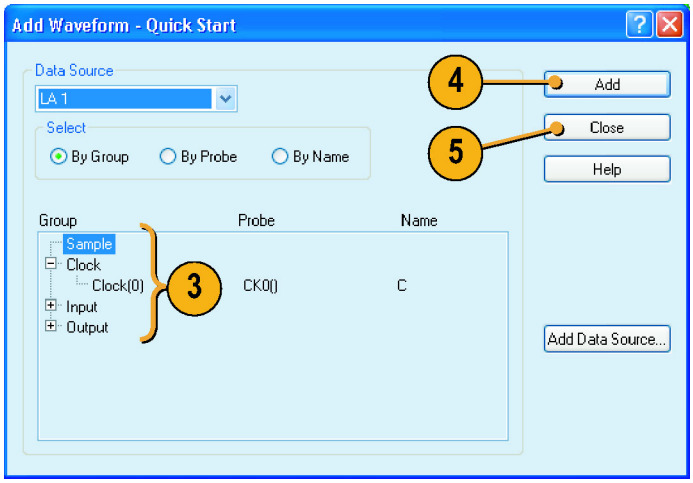
1. Configure the Setup window and ensure that **Asynchronous** is selected. (See page 8, *Configure the Setup Window*.)



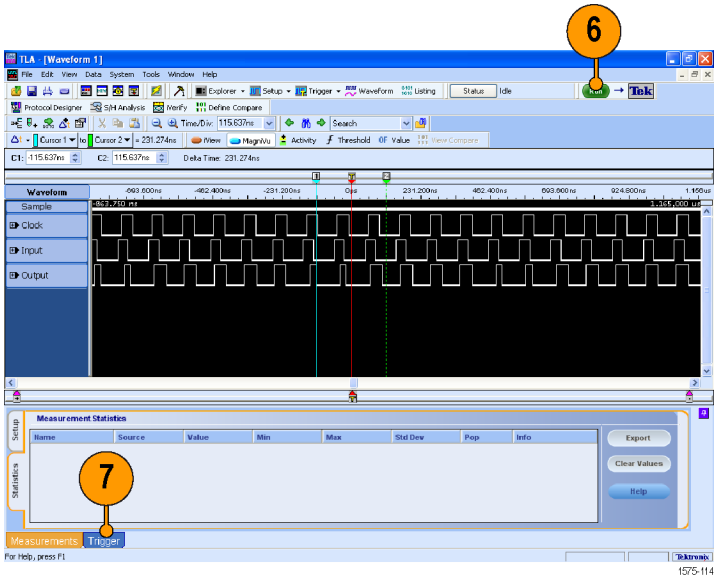
2. Open the Waveform window, right-click in the waveform label area, and select **Add Waveform . . ..**



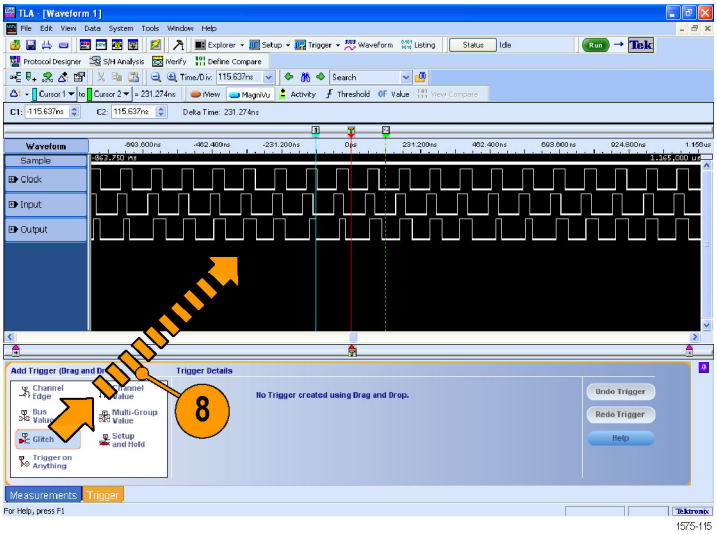
3. Select the groups (Clock, Input, and Output for this example).
4. Click **Add**.
5. Click **Close**.



6. Click **Run**.
7. Click **Trigger**.

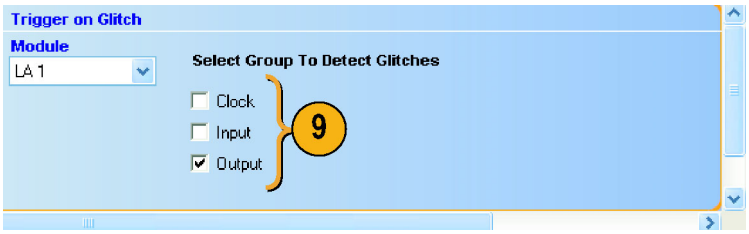


8. Click and drag the **Glitch** icon from the Tabbed Trigger window to the Output group waveform.



9. Select the groups that you want the logic analyzer to trigger on. Clear any other signals.

   The signal where you dropped the Glitch icon is selected by default. You can select the groups you want and avoid triggering on signals that may contain glitches that you do not care about.

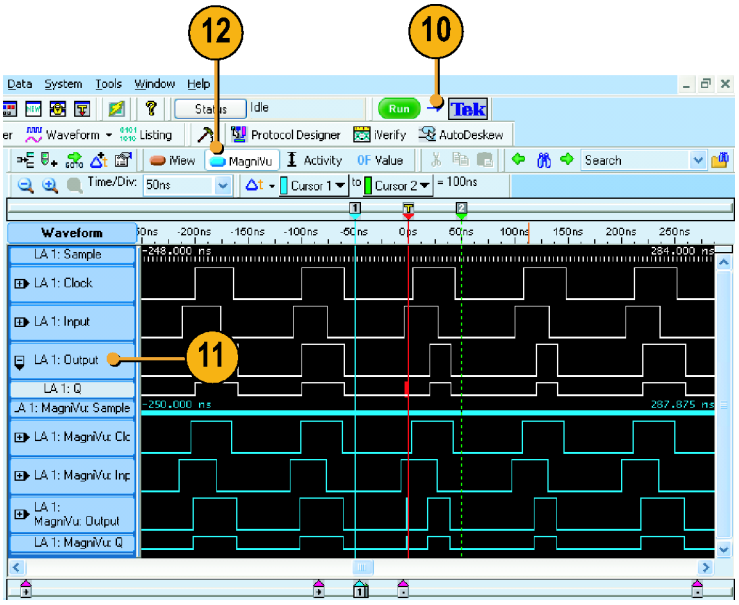


10. Click **Run**.

11. Expand the Output group to see the highlighted glitch on the Q waveform.

12. Click **MagniVu**.

    The glitch data is highlighted in red at every sample point for each signal in the Deep timing waveforms. The MagniVu timing waveforms show the high-resolution glitch data.



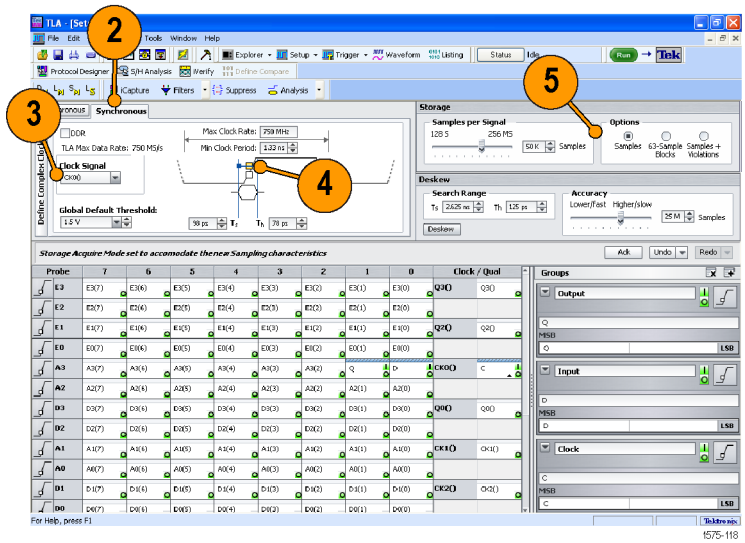
State Acquisition

You can use the logic analyzer for state data analysis; you can view the data in tabular form in the Listing window.

Define the Setup Window

State acquisition uses an external clock from the target system to tell the logic analyzer when to sample data.

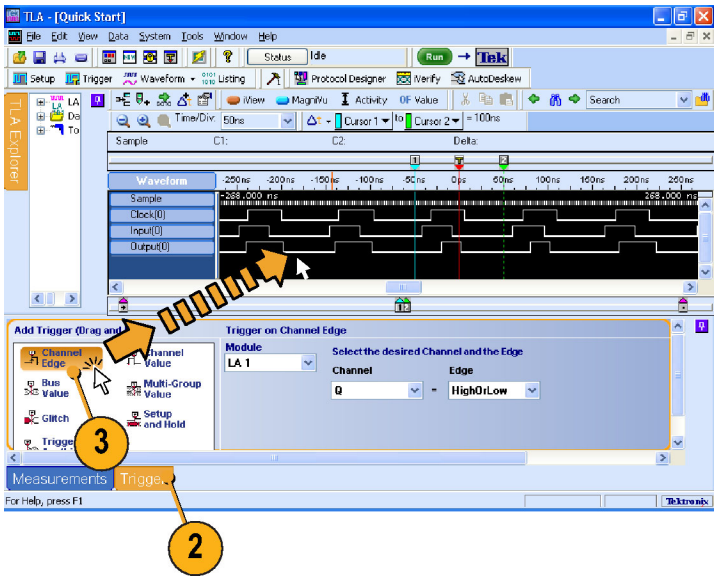
1. Configure the signals in the Setup window. (See page 8, *Configure the Setup Window*.)
2. Select **Synchronous**.
3. Select the Single Clock source. For this example, select **CK0()**.
4. Select the rising edge of the clock.
5. Select **Samples**.



Configure the Trigger

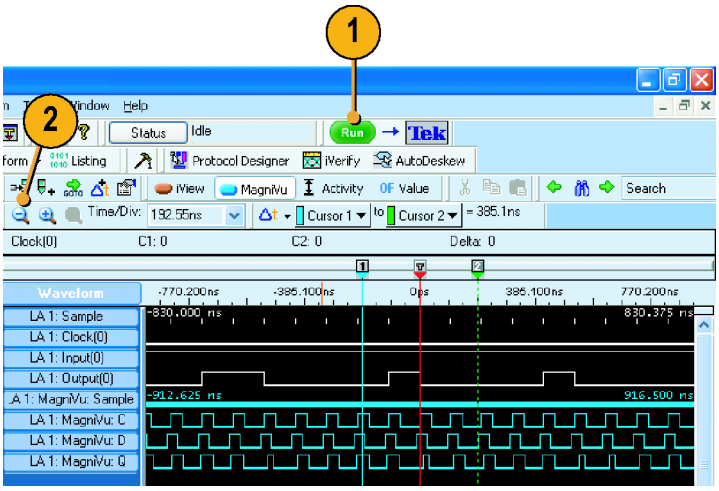
1. Define the setups for the Waveform window. (See page 15, *Define the Waveform Window*.)

   You will use the Waveform window setups to help define the trigger.
2. Click **Trigger** in the tabbed window.
3. Click and drag the **Channel Edge** icon from the Tabbed Trigger window to the Output waveform.



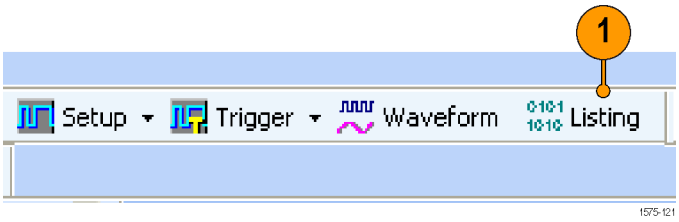
Acquire Data

1. Click **Run**.
2. Zoom the data as necessary to view the acquired data.
   - The LA1: Clock(0) waveform data shows no changes because the data is sampled on each rising clock edge. Each tic mark of the Sample clock waveform represents a clock edge.
   - The MagniVu high-resolution data still displays timing data.

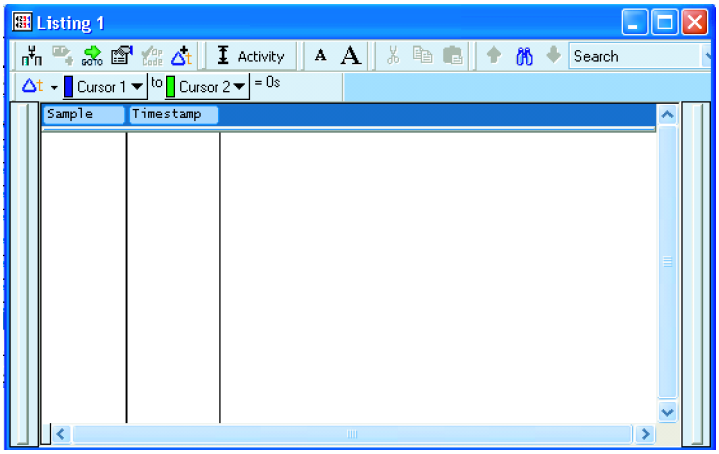


Configure the Listing Window

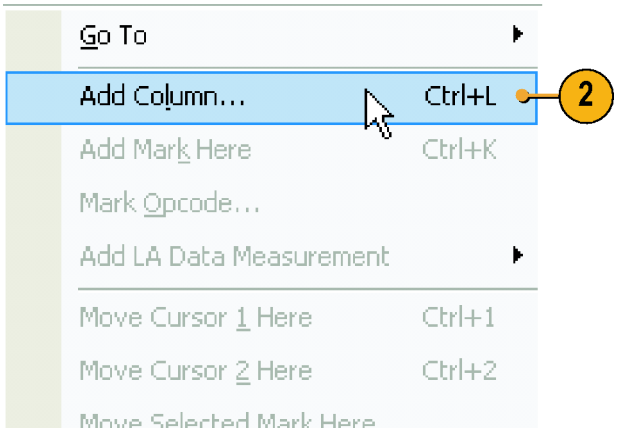
1. Click the Listing window button for your instrument in the TLA toolbar.



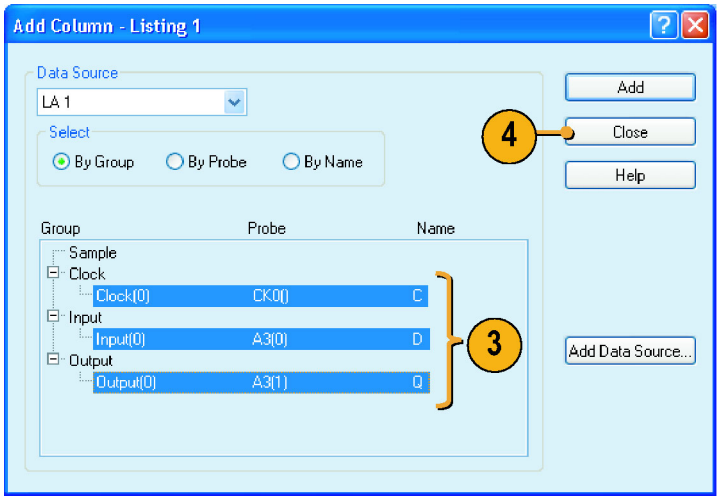
The listing window has no data in it. You need to add the data columns to the window to see the data.



2. Right-click in the data area and select **Add Column**.



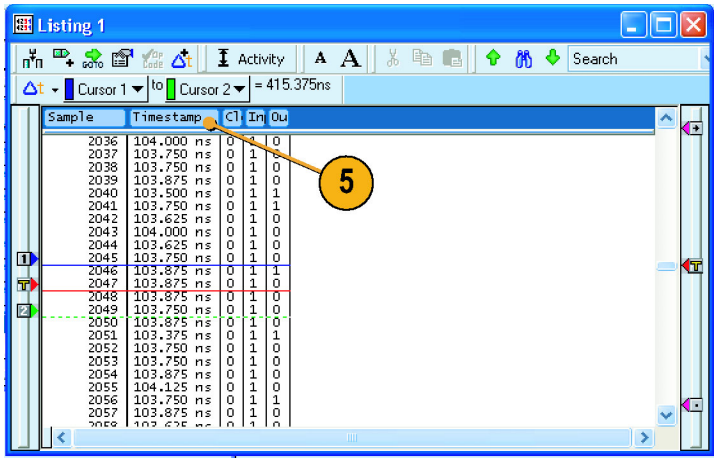
3. Expand the groups, press the **Ctrl** key while selecting each column, and click **Add** to add the columns to the Listing window.
4. Click **Close**.



5. Click and drag the Timestamp column to the right of the last column. Timestamps may be easier to read in this position.

Note the data in the Listing window.

- The clock data appears as zeros because the data is sampled on the rising edge of the clock.
- The Input and Output data appear as ones and zeros.
- The Timestamp column lists the time between data samples.
- The trigger point is halfway through the data because the Trigger position was set to 50%.

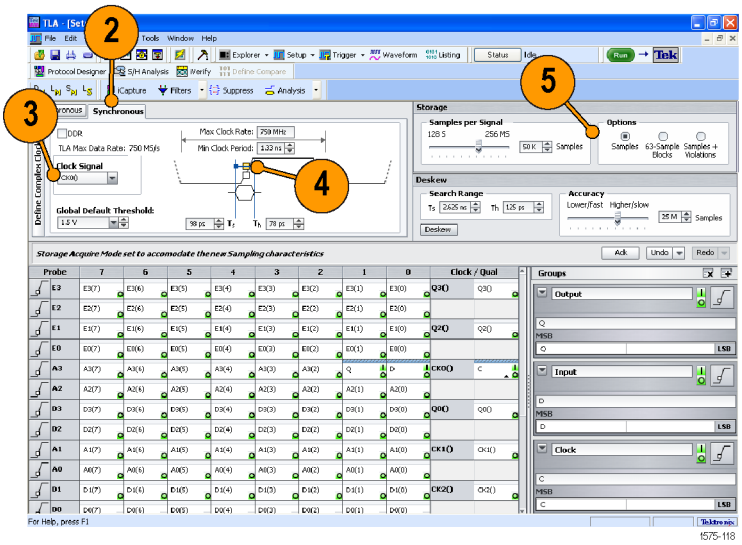


Triggering on a Setup & Hold Violation

Use the Setup & Hold triggering to capture setup and hold violations. This example uses the same setups for the Setup window as the previous example. (See page 37, *State Acquisition*.)

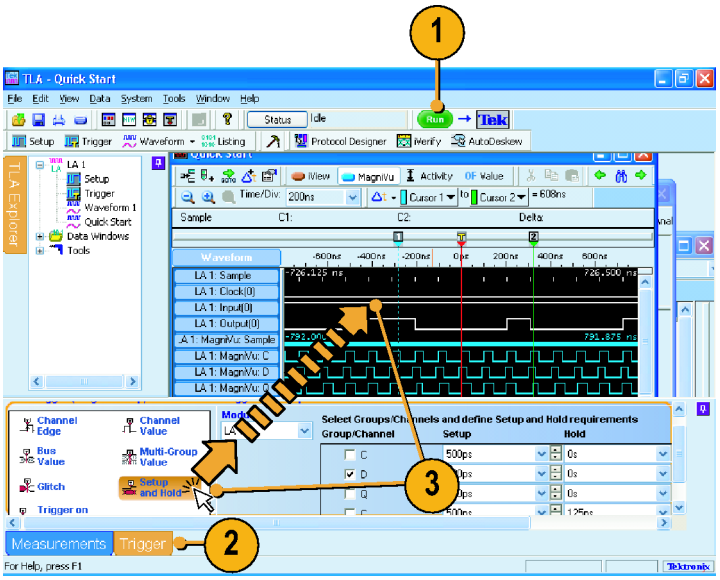
Define the Setup Window

1. Configure the signals in the Setup window. (See page 8, *Configure the Setup Window*.)
2. Select **Synchronous**.
3. Select the Single Clock source. For this example, select **CK0()**.
4. Select the rising edge of the clock.
5. Select **Samples**.

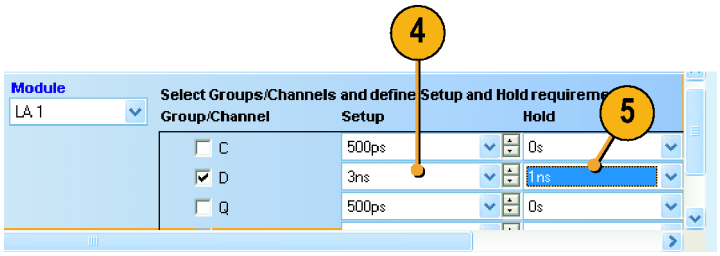


Configure the Trigger

1. Click **Run**.
2. Click **Trigger**.
3. Click and drag the **Setup and Hold** icon from the Tabbed Trigger window to the Input waveform.



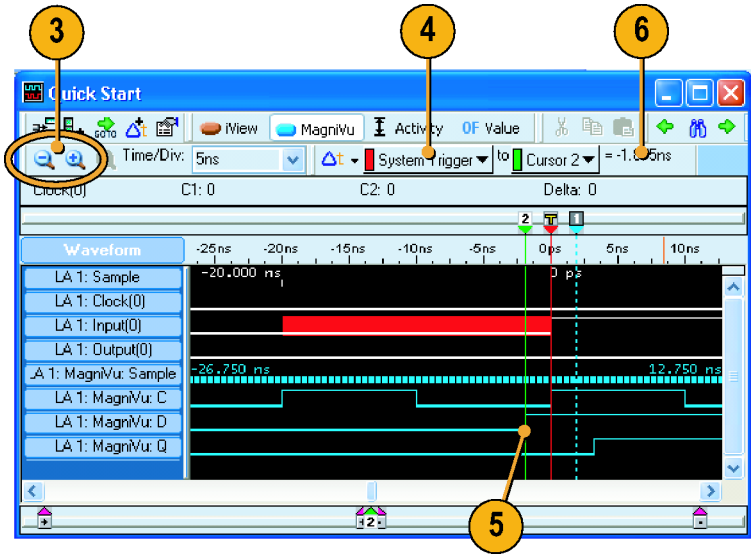
4. Select the desired value for the Input group/signal setup time.
5. Select the desired hold time.



Acquire and Measure the MagniVu High-Resolution Timing Data

1. Click **Run**.
2. View the data in the Waveform window.

   The instrument triggers on the rising edge of the clock signal at the violation. The setup and hold violation area is highlighted in red for each setup and hold violation on the Deep timing waveform. Use the MagniVu timing to view and measure the actual details.
3. Zoom the data as necessary to see the MagniVu waveforms.
4. Select System Trigger in the Measurement toolbar.
5. Move Cursor 2 to the data input transition.
6. Read the setup time from the Delta-Time readout.



Specifications

This section provides the warranted and mechanical specifications for the TLA5000B Series Logic Analyzers, TLA7000 Series Logic Analyzers, TLA7Bxx, TLA7ACx, and TLA7N4 Series Logic Analyzer. All specifications (marked with the ✓ symbol) are guaranteed and can be checked directly or indirectly at your nearest Tektronix location or by following the procedures described in individual service manuals or performance verification documents. Typical specifications are provided for your convenience but are not guaranteed.

The performance limits in these specifications are valid under the following conditions:

- The instrument must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications.
- Logic analyzer modules must be installed in a logic analyzer mainframe.
- The instrument must have had a warm-up period of at least 30 minutes.
- The instrument must have been calibrated and adjusted at an ambient temperature between +20 °C and +30 °C.

Atmospheric characteristics

Characteristic	Description
Temperature: Operating and nonoperating	Operating (no media in floppy disk drive or DVD drive): +5 °C to +50 °C, 15 °C/hr maximum gradient, noncondensing (derated 1 °C per 305 m (1000 ft) above 1524 m (5000 ft) altitude) [1] [2] Nonoperating (no media in floppy disk drive or DVD drive): –20 °C to +60 °C, 15 °C/hr maximum gradient, noncondensing
Relative Humidity: Operating and nonoperating	Operating (no media in floppy disk drive or DVD drive): 20% to 80% relative humidity, noncondensing. Maximum wet bulb temperature: +29 °C (derates relative humidity to approximately 22% at +50 °C) [3] [4] Nonoperating (no media in floppy disk drive or DVD drive): 8% to 80% relative humidity, noncondensing. Maximum wet bulb temperature: +29 °C (derates relative humidity to approximately 22% at +50 °C) [5]
Altitude: Operating and nonoperating	Operating: To 3000 m (9843 ft), (derated 1 °C per 305 m (1000 ft) above 1524 m (5000 ft) altitude Nonoperating: 12190 m (40,000 ft)

1 TLA7Bxx and TLA7ACx series module operating temperature is +40 °C maximum.

2 TLA7012 operating temperature is 45 °C maximum due to the CD-RW DVD drive.

3 TLA7Bxx series module relative humidity derates to approximately 57% at +40 °C.

4 TLA7Bxx and TLA7ACx series module operating humidity is 5% to 90% up to +30 °C, 75% from +30 to +40 °C, noncondensing. Maximum wet-bulb temperature is +29.4 °C.

5 TLA7Bxx and TLA7ACx series module nonoperating humidity is 5% to 90% limited by a wet bulb temperature of +40 °C.

Product Features

Characteristic	Description
✓ CLK10 Frequency (mainframes)	10 MHz ±100 PPM
TLA7012 mainframe slots	4
TLA7016 mainframe slots	13
MagniVu memory depth (samples per channel)	2048 for TLA7N4 modules 16,000 for TLA7ACx modules and TLA5000B instruments 128,000 for TLA7Bxx modules
MagniVu sampling period	125 ps for TLA7ACx modules and TLA5000B instruments 500 ps for TLA7N4 modules 20 ps for TLA7Bxx modules Data is asynchronously sampled and stored in a separate high-resolution memory. The storage speed may be changed (by software) to 250 ps, 500 ps, or 1000 ps, so that the MagniVu memory covers more time at a lower resolution.
Number of channels	
TLA5201B	32 data and 2 clock
TLA5202B, TLA7AC2, TLA7BB2	64 data and 4 clock
TLA5203B	96 data, 4 clock, and 2 qualifier
TLA5204B, TLA7N4	128 data, 4 clock, and 4 qualifier
TLA7AC3, TLA7BB3	96 data and 6 clock/qualifier
TLA7AC4, TLA7BB4, TLA7BC4	128 data and 8 clock/qualifier
Acquisition memory depth	
TLA5000B	2 M or optionally 8 M or 32 M samples (PowerFlex options)
TLA7ACx, TLA7Bxx	64 M per channel, maximum
TLA7N4	64 K or 256 K or 1 M or 4 M samples (PowerFlex options)

Warranted Specifications

Characteristic	Description
Input parameters with probes	
✓ Threshold Accuracy	
TLA5000B, TLA7N4	±100 mV
TLA7ACx, TLA7Bxx	±(35 mV + 1% of the threshold voltage setting)
✓ Channel-to-channel skew	
TLA7N4	≤ 1.6 ns maximum (When merged, add 0.5 ns for the slave module.)
TLA5000B	≤ ±150 ps maximum ≤ 75 ps (Typical)
TLA7ACx	≤400 ps maximum When merged, add the following for slave modules: 0.0 ns when data is acquired on the slave modules through local clocks 125 ps when data is acquired on the slave modules by the master modules' clock and merge deskew has been performed. 375 ps when data is acquired on the slave modules by the master module's clock and merge deskew has *NOT* been performed.
TLA7Bxx	±40 ps maximum, module only (for P6800 and P6900 series probes, add ±60 ps) ±20 ps (Typical), module only
Asynchronous sampling	
✓ Sampling period [1]	The fastest sampling rate for each logic analyzer goes to 50 ms in a 1–2–5 sequence
TLA7N4	4 ns, 250 MS, all channels 2 ns, 500 MS half channels
TLA7ACx, TLA5000B	2 ns, 500 MS, all channels 1 ns, 1000 MS, half channels 500 ps 2000 MS, quarter channels
TLA7Bxx	1.25 ns, 800 MS, all channels 625 ps, 1600 MS, all channels 313 ps, 3200 MS, half channels 157 ps, 6400 MS, quarter channels
✓ Minimum recognizable word [2] (across all channels)	Channel-to-channel skew + sample uncertainty Example for a P6860 Probe and a 1.25 ns sample period: 160 ps + 1.25 ns = 1.45 ns
Synchronous sampling	
✓ Setup and hold window size (data and qualifiers)	
TLA7N4	Maximum window size = Maximum channel-to-channel skew + (2 x sample uncertainty) + 4 ns. Maximum setup time = User interface setup time + 0.8 ns. Maximum hold time = User interface hold time + 2 ns Maximum setup time for slave module of a merged pair = User interface setup time + 0.8 ns Maximum hold time for slave module of a merged pair = User interface hold time + 0.7 ns

Warranted Specifications (cont.)

Characteristic	Description
TLA5000B	Maximum window size = Maximum channel-to-channel skew + (2 x sample uncertainty) + system variation + 100 ps
TLA7ACx (single module)	Maximum window size = Maximum channel-to-channel skew + (2 x sample uncertainty) + 100 ps Maximum setup time = User interface setup time + 75 ps Maximum hold time = User interface hold time + 50 ps
TLA7Bxx	220 ps maximum (180 ps Typical) single channel on single module 240 ps maximum (200 ps Typical) single channel on merged module
✓ Maximum synchronous clock rate	
TLA7N4	200 MHz in full-speed mode (5 ns minimum between active clock edges) [3] 100 MHz in half-speed mode (10 ns minimum between active clock edges) [3]
TLA5000B	235 MHz in full speed mode (4.25 ns minimum between active clock edges)
TLA7ACx	120 MHz in quarter-speed mode (8.3 ns minimum between active clock edges) [3] 235 MHz in half-speed mode (4.25 ns minimum between active clock edges) [3] 450 MHz in full-speed mode (2.2 ns minimum between active clock edges) 800 MHz on half channels [4] Software controls the selection between full-speed and half-speed modes.
TLA7Bxx	750 MHz, one sample point per clock, all channels 750 MHz, four samples points per clock, half channels 1400 MHz, one sample point per clock, all channels 1400 MHz, two sample points per clock, half channels
Trigger System	
✓ Trigger State sequence rate	Same rate as valid data samples received; 500 MHz maximum (TLA7Bxx, 800 MHz maximum)

1 It is possible to use storage control and only store data when it has changed (transitional storage).

2 Applies to asynchronous sampling only. Setup and hold window specification applies to synchronous sampling only.

3 Software controls the selection between full-speed, half-speed, and quarter-speed modes.

4 This is a special mode and has some limitations such as the clocking state machine and trigger state machine only running at 500 MHz.

Mechanical characteristics

Characteristic	Description
TLA5000B dimensions	
Height	284.44 mm (11.200 in)
Width	288.29 mm (11.350 in)
Length	444.5 mm (17.500 in)
TLA7012 dimensions	
Height (with feet)	29.46 cm (11.6 in)
Width	45.08 cm (17.75 in)
Depth	45.97 cm (18.1 in)
TLA7016 dimensions	
Height (with feet)	34.67 cm (13.7 in)
Width	42.42 cm (16.7 in)
Depth	67.31 cm (26.5 in)
TLA7Bxx, TLA7ACx, and TLA7N4 dimensions	
Height	262 mm (10.32 in)
Width	61 mm (2.39 in) with merge connector in the recessed position Width increases by 10.41 mm (0.41 in) with merge connector in the extended position.
Length	373 mm (14.7 in)
Weight (TLA5000B and mainframes include empty accessory pouch, slot covers, and front cover)	
TLA715	13.9 kg (30 lbs 12 oz)
TLA721 and TLA7XM	26.7 kg (58 lbs 11 oz), with benchtop controller
TLA7012	18.45 kg (40 lbs 12 oz)
TLA7016	24 kg (52 lbs 14 oz)
TLA5201B	11.8 kg (25 lb 15 oz)
TLA5202B	11.85 kg (26 lb 2 oz)
TLA5203B	11.9 kg (26 lb 4 oz)
TLA5204B	12 kg (26 lb 7 oz)
TLA7AC2, TLA7BB2	2.282 kg (5 lb 0.5 oz)
TLA7AC3, TLA7BB3	2.381 kg (5 lb 4 oz)
TLA7AC4, TLA7BB4, TLA7BC4	2.438 kg (5 lb 6 oz)
TLA7N4	2.55 kg (5 lbs 10 oz)

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