Tektronix

TDSJIT3 Jitter 3 Analysis Application and TDSJIT3E Jitter 3 Essentials

Adapted from the *TDSJIT3 Online Help* Version 2.0

PHP020202

Copyright and Version Information

Tektronix, Inc. P.O. Box 500, Beaverton, OR 97077

TEKTRONIX, TEK, and TEKPROBE are registered trademarks of Tektronix, Inc.

TDSJIT3 Jitter Analysis Measurements Online Help, OLH0202, Version 02.00

General Safety Summary

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

Only qualified personnel should perform service procedures.

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

To Avoid Fire or Personal Injury:

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

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

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

Symbols and Terms: The following terms and symbols may appear in the online help.

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

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

Terms on the Product: The following terms may appear on the product:

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

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

CAUTION indicates a hazard to property including the product.

Symbols on the Product: The following symbol may appear in the product:

 CAUTION Refer to Help

Table of Contents

Introduction to TDSJIT3

Welcome to the TDSJIT3 Jitter Analysis Application

TDSJIT3 and TDSJIT3E are Java™-based applications that enhance basic capabilities of some Tektronix Windows-based oscilloscopes. These applications provides jitter analysis measurements that can:

- Display the statistical results of up to six measurements
- Show the results as plots
- Save the measurement results to a data log file
- Save individual data points to a measurement results file
- Save the worst case waveforms to files
- Select and configure multiple measurements on more than one channel

Perform Random and Deterministic jitter analysis including BER estimation.

To return to the Table of Contents, select Help Topics from the Help Top Menu.

Using Online Help

Online help has many advantages over a printed manual because of advanced search capabilities. Selecting Help on the right side of the application's Menu bar brings up the Help file.

The main (opening) Help screen shows a series of book icons and three tabs along the top menu, each of which offers a unique mode of assistance:

- **Table of Contents (TOC) tab -** organizes the Help into book-like sections. Select a book icon to open a section; select any of the topics listed under the book.
- **Index tab** - enables you to scroll a list of alphabetical keywords. Select the topic of interest to bring up the appropriate help page.
- **Find tab -** allows a text-based search. Follow these steps:
  1. Type the word or phrase you wish to find in the search box.
  2. Select some matching words in the next box to narrow your search.

3. Choose a topic in the lower box, and then select the Display button.

- To print a topic, select the Print button from the help topics menu bar.
- Select Options from the menu bar for other commands, such as to annotate a topic, keep the help window on top or to use system colors.
- Select the Back button to return to the previous help window. Sometimes you can jump from one topic to another through a hyperlink. If the Back button is "grayed out" or a jump is not available, choose the "Help Topics" button to return to the originating help folder.
- Browse buttons (Next >> and Previous <<) allow you to move forward and backward through topics in the order of the Table of Contents (TOC).
- Sometimes you will see the bolded word, "**Note**," in topic text. This indicates important information.

Note:

Certain aspects of the online help are unique to applications that run on the oscilloscope.

Green-underlined text indicates a Jump (hyperlink) to another topic. Select the green text to jump to the related topic. For example, select the green text to jump to the topic on Feedback.

You can tell when the cursor is over an active hyperlink (button, jump, or popup), because the cursor "arrow" changes to a small "hand."

Note the "light bulb" and word "Tip" in the graphic above. This graphic indicates additional information to help you function faster or more efficiently.

Related Documentation

In addition to the online help, you can access other information on how to operate the oscilloscope and application through the following related documents.

Refer to the *Optional Applications Software on a Windows-Based Oscilloscope Installation Manual* for the following information:

- Software warranty
- Software license agreement
- List of all available applications, compatible oscilloscopes, and relevant software and firmware version numbers
- How to apply a new label
- Installation procedures

- How to enable an application
- How to download updates from the Tektronix web site

  You can find a PDF (portable document format) file for this document in the Documents directory on the *Optional Applications Software on a Windows-Based Oscilloscope CD-ROM*. The CD booklet only contains information on installing the application from the CD and on how to apply a new label.

  For other information that will help you to use this application, refer to the following documents:
- The user manual for your oscilloscope provides general information on how to operate the oscilloscope
- The online help for your oscilloscope provides details on how to use GPIB commands to control the oscilloscope

Tip You can also download the file with programmer information and examples from the Tektronix web site. Refer to the installation manual for information on how to download the file.

See also

Using Online Help on Page 8

Conventions

Online help uses the following conventions:

- The terms, TDSJIT3 application or "application" refer to both the TDSJIT3 Jitter and Timing Analysis and the TDSJIT3E Jitter and Timing Analysis Essentials Applications.
- The term, "oscilloscope" refers to any product on which this application runs.
- Displays of an oscilloscope are from a TDS7054 model; there may be minor differences in the displays from other types of oscilloscopes.
- When steps require a sequence of selections using the application interface, the ">" delimiter marks each transition between a menu and an option. For example, one of the steps to recall a setup file would appear as File> Recall.

Contacting Tektronix

Phone	1-800-833-9200*
Address	Tektronix, Inc. Department or name (if known) 14200 SW Karl Braun Drive P.O. Box 500 Beaverton, OR 97077

USA	
Web site	http://www.tektronix.com
Sales support	1-800-833-9200, select option 1*
Service support	1-800-833-9200, select option 2*
Technical support	Email: techsupport@tektronix.com
1-800-833-9200, select option 3* 6:00 a.m. - 5:00 p.m. Pacific time	
***This Telephone number is toll free in North America. After office hours, please leave a voice mail message. Outside North America, contact a Tektronix sales office or distributor; See the Tektronix web site for a list of offices.**	

Feedback

Tektronix values your feedback on our products. To help us serve you better, please send us suggestions, ideas, or other comments you may have regarding your oscilloscope.

Direct your feedback to us through email to techsupport@tektronix.com or FAX at (503) 627-5695, and include the following information. Please be as specific as possible.

General information:

- Oscilloscope model number and hardware options, if any
- Probes used
- Your name, company, mailing address, phone number, FAX number
- Please indicate if you would like to be contacted by Tektronix regarding your suggestion or comments

Application specific information:

- Software version number
- Description of the problem such that technical support can duplicate the problem
- If possible, save the oscilloscope waveform file as .wfm file
- If possible, save the oscilloscope and application setup files from the application to obtain both the scope .set file and the application .ini file.

Once you have gathered this information, you can contact technical support by phone or through e-mail. If using e-mail, be sure to enter in the subject line "TDSJIT3 Problem," and attach the .set, .ini, and .wfm files.

To include screen shots, from the oscilloscope menu bar, select File> Export. The Export Dialog box displays. Enter a file name with a .bmp extension and Save. The file is saved in the

C:\TekScope\Images directory. You can then attach the file to your email (depending on the capabilities of your email editor).

Getting Started

Product Description

The TDSJIT3 Jitter and Timing Analysis Application is a Java™-based application that enhances basic capabilities of some Tektronix oscilloscopes.

With this application you can:

- Take jitter analysis measurements from multiple sources
- Display the statistical results of up to six measurements
- Display the results as plots
- Save the results to a data log file
- Save the worst case waveforms to files
- Perform random and deterministic jitter analysis, including BER estimation

Note:

There are no standard accessories for this product.

Differences Between TDSJIT3 and TDSJIT3E

TDSJIT3 provides the following features that are not included in TDSJIT3 Essentials:

- PLL-Based Clock Recovery
- Crossover Voltage Analysis
- Jitter separation (RjDj analysis)
- Bit error rate estimation (BER)
- Bathtub Plots

Note:

The setup files for TDSJIT3 and TDSJIT3E are compatible with each other.

In the remainder of this document, individual feature descriptions that are not applicable to TDSJIT3E will include a note to that effect.

How to Use the TDSJIT3 User Interface

Here are some tips to help you use the TDSJIT3 user interface:

- Select Source before each measurement

- You may select Source and Measurement multiple times to use different configuration options
- Use the Single run button  to obtain a single set of measurements from a single run
- Use the Run/Stop button  (free/run) to acquire measurements from continual runs; press the Run/Stop button again to stop the acquisition
- Hints appear on the bottom status line of some TDSJIT3 menus to help guide your choice of menu options. For example, on the status line of the Measurements Select menu, these directions appear: "Hint: Select a source, then add a measurement to create a definition."

Accessories

There are no standard accessories for this product.

Compatibility

For information on oscilloscope compatibility, refer to the *Optional Application Software on Windows-Based Oscilloscopes Installation Manual.* The manual is available on the *Optional Application Software on Windows-Based Oscilloscopes CD-ROM*.

The setup files for TDSJIT3 and TDSJIT3E are compatible with each other.

The TDSJIT3E application can be run without the associated Option Key if you have a valid TDSJIT2 Option Key. However, it is recommended that you contact a Tektronix representative to obtain a TDSJIT3E Option Key or consider upgrading to TDSJIT3.

Requirements and Restrictions

The Sun Java Run-Time Environment V1.3.1 must be installed on the oscilloscope to operate the TDSJIT3 application. The installation of TDSJIT3 automatically installs the proper version of JRE. If the JRE on your oscilloscope is deleted, install TDSJIT3 again.

Note: Minimum 256MB Windows PC memory is highly recommended.

Installation

Refer to the *Optional Applications Software on a Windows-Based Oscilloscope Installation Manual* for the following information:

- List of applications, compatible oscilloscopes, and relevant software and firmware version numbers
- How to apply a new label
- How to Install the Application
- How to enable an application
- How to download updates from the Tektronix web site

If you need to locate the corresponding Portable Document Format (PDF) file of this document, you can find it in the Documents directory on the *Optional Applications Software on a Windows-Based Oscilloscope CD-ROM*. The CD booklet only contains information on installing the application from the CD and on how to apply a new label.

Connecting to a System Under Test

You can use any compatible probes or cable interface to connect between your SUT (System Under Test) and oscilloscope. One connection is sufficient for most signals.

The Clock-to-Data, the Crossover Voltage (TDSJIT3 only), and the Skew measurements require two input channels or two reference waveforms.

 **Warning**

To avoid electric shock, you must ensure that power is removed from the SUT before attaching probes to it. Do not touch exposed conductors except with the properly rated probe tips. Refer to the probe manual for proper use.

Refer to the General Safety Summary in your oscilloscope manual.

See Also

General Safety Summary (frontpiece)

Deskewing Probes and Channels on page 59

Basic Operations

About Basic Operations

The following topics discuss the basic features and operations of the application. Select a link below to go to the indicated topic.

Application Interface

The application uses a Windows™-based interface.

View Application Interface UI Controls.

Note:

The oscilloscope application shrinks to half size and appears in the top half of the display when the application is running.

See Also

Hiding and Returning to the Application on page 20

Application Interface UI Controls

Item	Description
Menu bar	Located at the top of the application display and contains application menus
Tab	Tabs contain sub-menus
Area	Visual frame that encloses a set of related options
Option button	Button that defines a particular command or task
List box	Box that contains a list of items from which you can select one item
Box	Box that you can use to type in text, or to enter a value with the Keypad or a Multipurpose knob
Scroll bar	Vertical or horizontal bar at the side or bottom of a display area that can be used for moving around in that area
Browse	Displays a window where you can look through a list of directories and files
Command button	Button that initiates an immediate action

File Menu Selections

Options	Function
Default Setup	Recalls the default (startup) values for most TDSJIT3 parameters
*Recall	Browse to select an application setup (.ini) file to recall the setup file. Recall restores the application to the values saved in the setup file (default path: C:\TekApplications\tdsjit3\setup)
*Save	Save the current application settings in a .ini file (default path: C:\TekApplications\tdsjit3\setup)
Recent Files	Select from a list of the four most recently accessed setup files (saved or recalled) and recall that setup.
Minimize	Minimizes the application
Exit	Exit the application and chose to retain the current oscilloscope settings or restore the oscilloscope to settings prior to start of the application.
***Save or Recall also triggers saving or recalling a oscilloscope setup file (.set) if one with a matching name is found**	

How to Enter Numerical Values

The next table lists methods that you can use to enter values in certain menus, such as the Autoset Ref Level menu.

Entry Method	Description
Keypad	Icon appears when you select the box; select and use to enter a value
Multipurpose knob	When you select the multipurpose (MP) knob, a line appears between the knob and the box; turn the knob on the oscilloscope to select a value

Clear button

To reset the statistical results to zero, choose the Clear button on the Measure menu. You do not have to wait for a measurement to complete to clear the results.

Hide/Exit Buttons

To exit the application, choose Exit from the File menu or select the Exit Button,  , in the top right corner. When you exit the application, you can select to keep the oscilloscope setup currently in use with the application or to restore the oscilloscope setup that was present before you started the application.

To Hide the application, choose the Hide button,  .

Saving and Recalling Setups

How to Save and Recall Setups

You can use the File menu to save and recall different configuration setups and recall recently accessed files. Display the File Menu Selections.

Note:

The File> Save function saves application settings in an .ini file and the settings of the oscilloscope application in a .set file with a matching name.

If an oscilloscope .set file with a matching name is found on recall of a setup file, then the oscilloscope settings are recalled also. If the .set file is missing or cannot be opened by the oscilloscope, then TDSJIT3 recalls the application settings and displays a message that the Recall of the .set file failed.

 **Caution:** Do not edit a setup file or recall a file not generated by the application.

See Also

Saving a Setup below

Recalling a Saved Setup below

Recalling the Default Setup on page 19

Saving a Setup

To save the application and oscilloscope settings to a setup file, follow these steps:

1. Select File> Save.
2. From the popup menu, choose the directory in which to save the setup file or use the current directory.
3. Select or enter a new file name. The application appends an ".ini" filename extension to the name of the Java setup file.
4. Choose Save.

Note:

The application also saves the oscilloscope setup to a ".set" file when you save an application setup. Both the application ".ini" file and oscilloscope ".set" file have the same file name.

Recalling a Saved Setup

To recall the application and oscilloscope settings from a saved setup file, follow these steps:

1. Select File> Recall.

Note: You may also select File> Recent Files if the setup file was recently saved or recalled (in this case skip to step 4 below).

2. From the popup menu, select the directory from which to recall the setup file.

3. Select or enter a setup file name, and then choose Open.
4. A Recall Preview pops up, and then choose OK or Cancel.

Note:

The application also recalls the oscilloscope setup from a ".set" file when you recall an application setup. If a matching .set file is not found or if the .set file does not recall correctly to the oscilloscope, then you receive a warning that the oscilloscope recall failed while the Java application recall succeeded.

Recalling the Default Setup

To recall the application settings from the Default setup file, follow these steps:

1. Select File> Default Setup.
2. Choose OK to the Default Preview.

Note: Most of the application selections are recalled to the default state. Some User Interface (UI) measurement source selections are not reset.

Basic Oscilloscope Functions

Using Basic Oscilloscope Functions

You can use the oscilloscope Help menu to access information about the oscilloscope and how to use it. You can also use other oscilloscope functions and easily return to the application.

To display the oscilloscope online help, follow these steps:

1. Choose the Help> Topics from the oscilloscope menu bar.
2. Use the Contents, TOC, or Index tabs to navigate through the help.

See Also

Minimizing and Maximizing the Application below

Hiding and Returning to the Application on page 20

Minimizing and Maximizing the Application

The application remains displayed when you minimize the oscilloscope. To minimize the application, select File> Minimize.

Tip When you minimize the application, the oscilloscope does not fill the screen. If you wish to do this, use the Hide button.

To maximize the application, select TDSJIT3 in the toolbar at the bottom of the screen.

See Also

Hiding and Returning to the Application on page 20

Hiding and Returning to the Application

When you access oscilloscope functions, the oscilloscope fills the display. You can access oscilloscope functions in the following ways:

- Select the Hide button  in the application menu bar
- Choose the Menu-bar or Toolbar mode on the oscilloscope and access menus
- Press front-panel buttons

To return to the application, choose the App button  on the Top Menu Bar of the oscilloscope.

Application Directories and File Names

The application uses several directories to save setup and log files. The application uses extensions appended to file names to identify the file types.

The following table lists default directory names.

Directory	Used for
C:\TekApplications\tdsjit3	Home location
C:\TekApplications\tdsjit3\data	Temporary files used by the application
C:\TekApplications\tdsjit3\log	Statistics log files
C:\TekApplications\tdsjit3\measurements	Log files of data points for each selected measurement
C:\TekApplications\tdsjit3\measurementsSnapshots	Measurement log files from Save Current Measurement
C:\TekApplications\tdsjit3\setup	Setup files
C:\TekApplications\tdsjit3\waveforms	Log worst case waveforms and waveform files supplied for use with the tutorial and application examples
C:\TekApplications\tdsjit3\plotData	Data that is exported from measurement plots.
C:\TekApplications\tdsjit3\plotFigures	Image files that are exported from measurement plots.

See Also

File Name Extensions on page 21`

File Name Extensions

Extensions	Descriptions
.csv	Log file that uses a "comma separated variable" format
.ini	Application setup file
.set	Oscilloscope setup file saved and recalled with an .ini file; both files will have the same name
.wfm	Waveform file that can be recalled into a reference memory

Taking Measurements

About Taking Measurements

If you want to change trigger settings or localize the measurement, you should do so before you take any measurements.

Note:

If you select a reference waveform as the source, you need to recall and display the waveform before the application can take a measurement. Refer to Recalling a Waveform File.

Note:

If an error message displays because there are not enough cycles from which to take a measurement, increase the Horizontal Scale.

See Also

Clearing Measurements on page 23

Selecting Sources and Measurements

Setting Up the Application

You can set up the application to take up to six measurements at the same time. In addition, you can plot the results in five plot types and save the statistical results to a file to review later.

Specifying Input Sources

The application takes measurements from waveforms specified as sources. You may select a live input channel (CH1, CH2, CH3, CH4), a reference waveform, or a math waveform as a source.

Note:

Most measurements require one source. The Setup, Hold, Clock-Out, Skew and Crossover Voltage measurements require two input sources.

You may select the same measurement multiple times using different input sources. Select the source, then select the measurement.

Measurement and Source selections and their configuration values (if applicable) are summarized in Measurements> Summary of Measurements.

Selecting a Math Measurement

TDSJIT3 provides four preset math equations.

To select a Math definition:

1. Go to the Measurements> Select> Select Source panel.
2. Select one of the four preset equations from the drop-down list.

Note:

Select the Scope User button if you wish to measure a user-defined math waveform (defined using the oscilloscope math equation editor).

Selecting a Measurement

To take a measurement, select the type of measurement in the Measurements menu, which is also the default opening screen of the application. To access the Measurements menu, go to the Menu bar and choose Measurements> Select> Type of Measurement (Clock, Data, Clock-Data, General).

Choose and input source and then select a measurement. As you choose measurements, the measurement and source appears in the Measurements/Sources list. You may choose as many as six measurements for analysis.

Note: You can make duplicate source and measurement selections, then choose different measurement configuration parameters.

Clearing Measurements

Choose the Clear All button to remove all the measurements in the list of selected measurements.

To clear an individual measurement from the table:

1. Select the associated number button on the left side of the table.

   (The measurement and source are highlighted.)
2. Select the Clear button to clear the selected measurement.

Selecting Sources and Measurements Menu

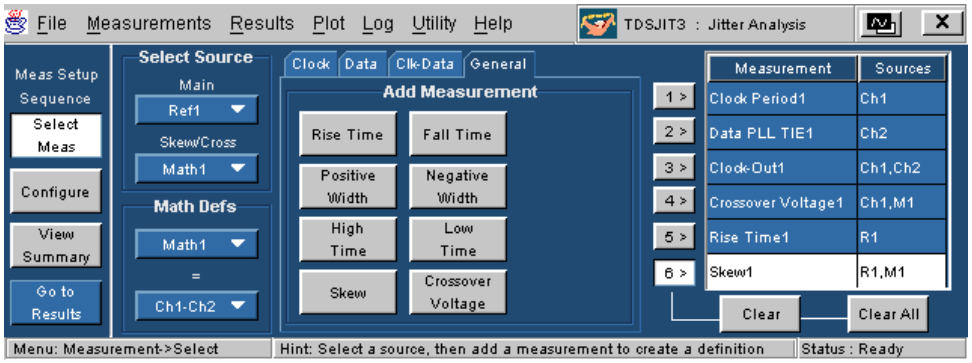

File
Measurements
Results
Plot
Log
Utility
Help
TDSJIT3 : Jitter Analysis
Meas Setup Sequence
Select Meas
Configure
View Summary
Go to Results
Select Source
Main
Ref1
Skew/Cross
Math1
Math Defs
Math1
=
Ch1-Ch2
Clock
Data
Clk-Data
General
Add Measurement
Rise Time
Fall Time
Positive Width
Negative Width
High Time
Low Time
Skew
Crossover Voltage
1 >
2 >
3 >
4 >
5 >
6 >
Measurement
Sources
Clock Period1
Ch1
Data PLL TIE1
Ch2
Clock-Out1
Ch1,Ch2
Crossover Voltage1
Ch1,M1
Rise Time1
R1
Skew1
R1,M1
Clear
Clear All
Menu: Measurement->Select
Hint: Select a source, then add a measurement to create a definition
Status : Ready

Table of Active Measurements Areas and Options

Area	Option	Description
Clock	Period*	Elapsed time between consecutive crossings of the mid reference level by the waveform in the specific direction; see Common Cycle Start Edge.
	Frequency*	Inverse of the period for each clock cycle
	Cycle-Cycle Period*	Difference in period measurements from one cycle to the next.
	N-Cycle Period*	Difference in elapsed time between tow consecutive groups of N-Cycles where N is a configuration object that you can set.
	Positive Cy-Cy Duty	Difference between two consecutive positive widths.
	Negative Cy-Cy Duty	Difference between two consecutive negative widths.
	Positive Duty Cycle*	Ratio of the positive portion of the cycle relative to the period.
	Negative Duty Cycle*	Ratio of the negative portion of the cycle relative to the period.
	TIE*	Difference in time between the designated edge on a sampled clock waveform to the designated edge on a calculated clock waveform with a constant frequency (zero jitter).
	PLL TIE*	Measurement errors relative to a timing reference that is recovered from a data stream by a phase locked loop (PLL). Available only for TDSJIT3.
Data	Data Period	Elapsed time between when a waveform crosses a specific reference voltage level in the same direction twice.
	Data Frequency	Inverse of the period for each data cycle.
	Data TIE*	Difference in time between the data edges on a sampled data waveform to the data edges on a calculated data waveform with a constant rate (zero jitter).
	Data PLL TIE*	Measurement errors relative to a timing reference that is recovered from a data stream by a phase locked loop (PLL). Available only for TDSJIT3.
Clk–Data	Setup Time*	Elapsed time between when a data waveform crosses a voltage reference level followed by the clock signal crossing its own voltage level.
	Hold Time*	Elapsed time between when the clock waveform crosses a voltage reference level followed by a data waveform crossing its won voltage level.
	Clock–Out Time*	Elapsed time between when the clock waveform crosses a voltage reference level followed by an output waveform crossing its own voltage level.

General	Rise Time	Elapsed time from when a rising edge crosses the low reference voltage level and then the high reference voltage level.
	Fall Time	Elapsed time from when a falling edge crosses the high reference voltage level and then the low reference voltage level.
	Positive Width	Amount of time a waveform remains above the mid reference voltage level.
	Negative Width	Amount of time a waveform remains below the mid reference voltage level.
	High Time	Amount of time a waveform remains above the high reference voltage level
	Low Time	Amount of time a waveform remains below the low reference voltage level.
	Skew*	Difference in time between two similar edges on the Main and 2nd Input waveform with the assumption that every edge in the Main waveform has a corresponding edge (either in the same or opposite polarity) in the 2nd waveform; edge locations are referenced to the mid reference voltage level.
	Crossover Voltage*	Edge timing is derived from the (voltage) crossover of differential clock or data measurements. Available only for TDSJIT3.
***Requires Configuration**		

Configuring Measurements

Configuring a Measurement

Many measurements require configuration. To access the Configure Measurements menu, go to the Measurements menu in the menu bar and choose Configure> Meas Params.

See Also

Clock Edge Option on page 26

Data Edge Option on page 27

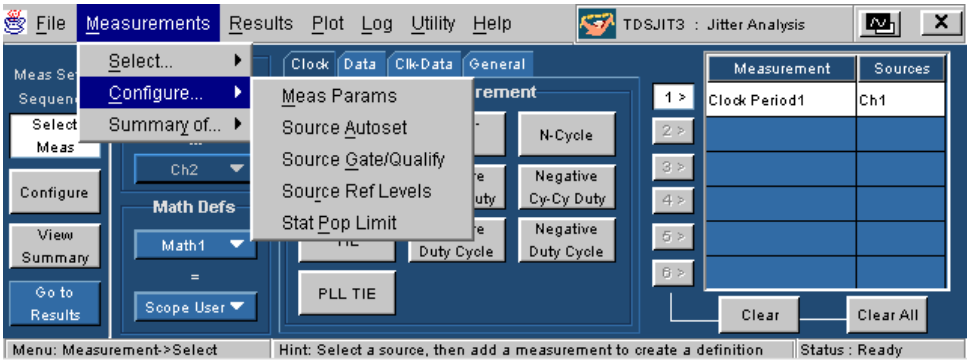
Note:

The following measurements do not have configuration options:

- General area: Rise Time, Fall Time, Positive Width, Negative Width, High Time and Low Time
- Clock area: Positive Cy-Cy Duty, and Negative Cy-Cy Duty
- Data area: Data Frequency and Data Period

In the Measurements: Configure menu, the following message appears on the screen when you select any of the above measurements: "No configuration parameters available for current selection."

Configure: Measurement Menus



Clock Edge Option

The Clock Edge option defines which edge of the clock input is used to calculate statistics of the following clock-based measurements:

- Frequency
- Period
- Cycle-Cycle
- Positive Duty Cycle
- Negative Duty Cycle

The following Clock-Data measurements also have a Data Edge option:

- Setup Time
- Hold Time
- Clk-Out

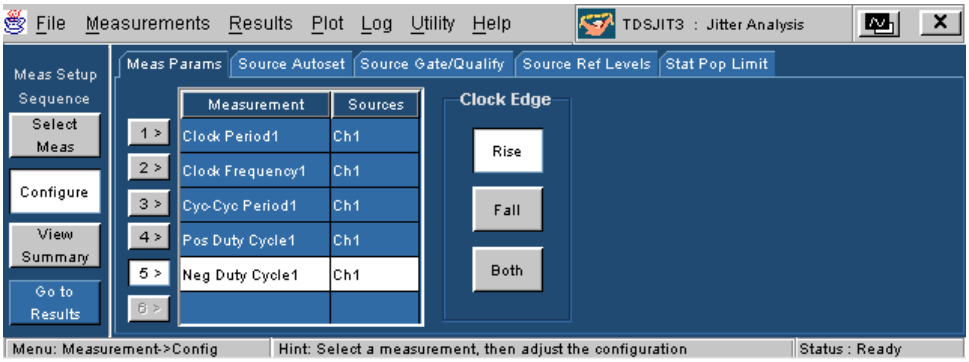
View Example Clock Edge Configuration Menu

See Also

Data Edge Option on page 27

Table of Active Measurements Areas and Options on page 25

Clock Edge Configuration Menu



Data Edge Option

In addition to a Clock Edge, the Clock-Data measurements may also configure a Data Edge. Data Edge defines which edge of the data input is used to calculate statistics on the following clock-data based measurements:

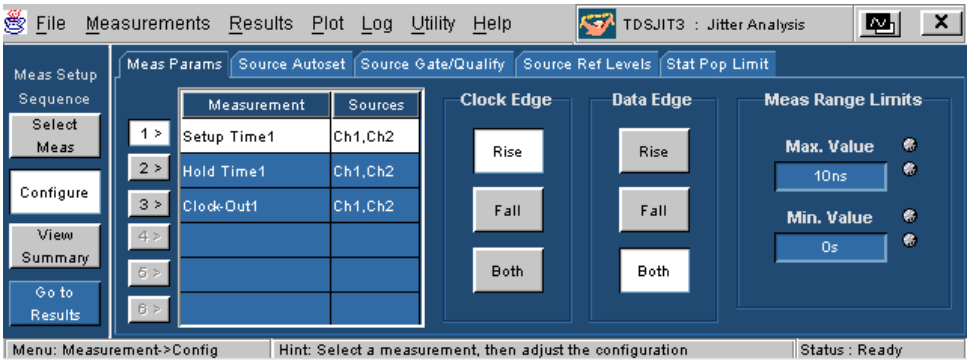
- Setup Time
- Hold Time
- Clock-Out

View Clock and Data Edge Configuration Example below

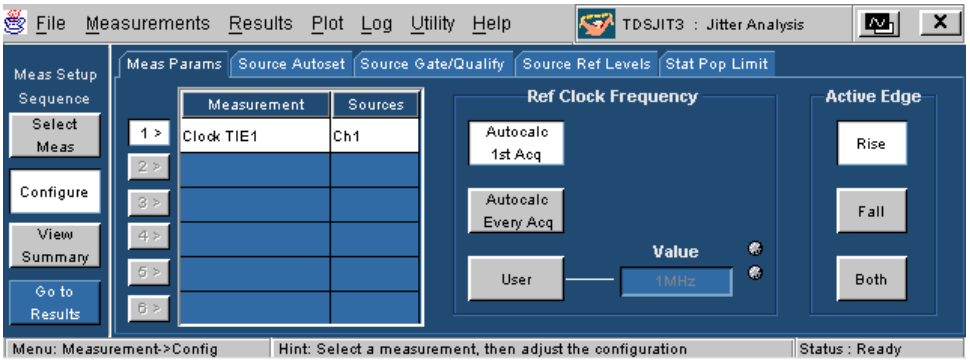
See Also

Clock Edge Option on page 26

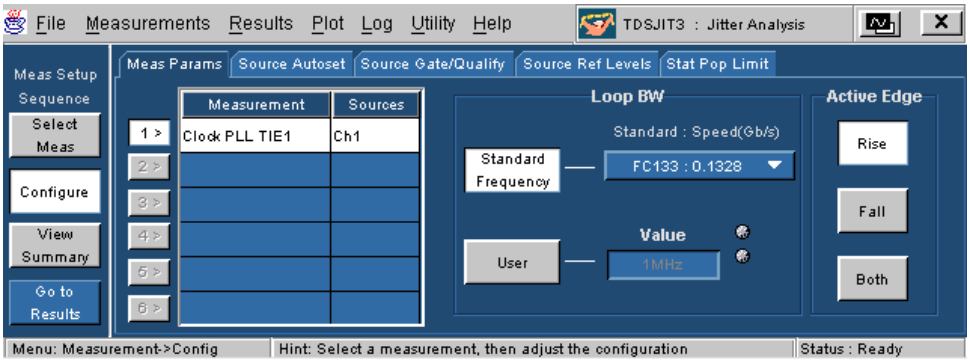
Clock and Data Edge Configuration Example



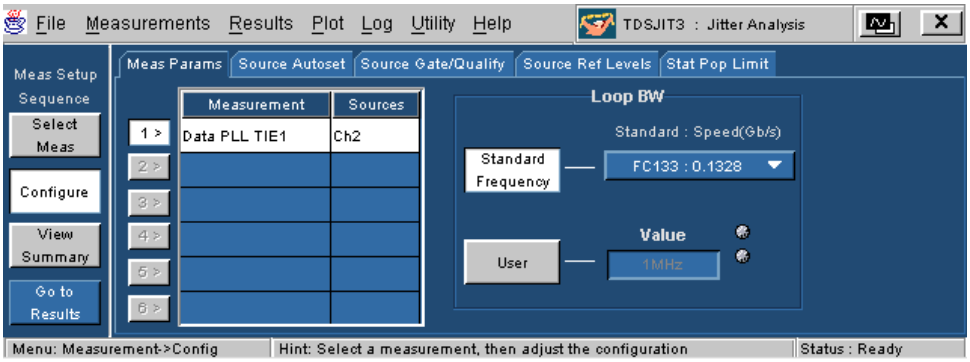
Clock TIE Configuration Menu



Clock PLL TIE Configuration Menu (available only for TDSJIT3)



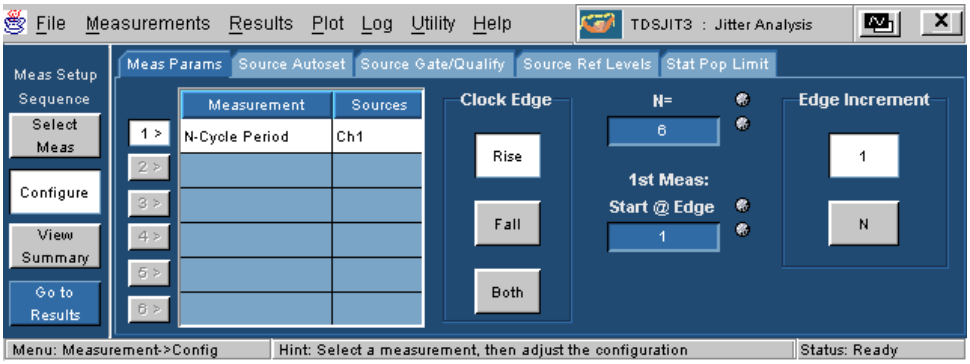
Data PLL TIE Configuration Menu (available only for TDSJIT3)



N-Cycle Configuration Options

Option	Description
Clock Edge	Edge used to calculate statistics
N=	Number of cycles in an N-cycle group
1st Meas: Start @ Edge	Number of cycles skipped prior to starting the measurement
Edge Increment	Specifies whether consecutive measurements (each spanning 2 N-cycles) jump forward one cycle (option 1) or N cycles in the waveform (option N)

N-Cycle Period Configuration Menu



Skew Configuration Options

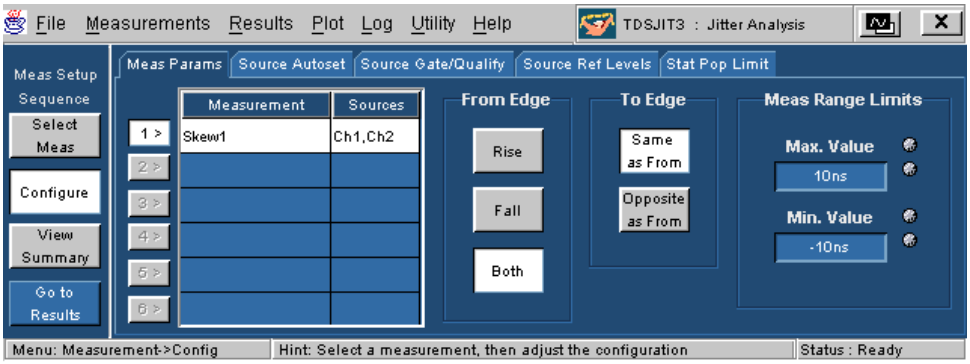
Option	Description
From Edge	Edge on the Main waveform used to take the measurement
To Edge	Edge on 2nd waveform either Same as From Edge or Opposite of From Edge
Meas Range Limits	Minimum and maximum values in nanoseconds

View Skew Configuration menu

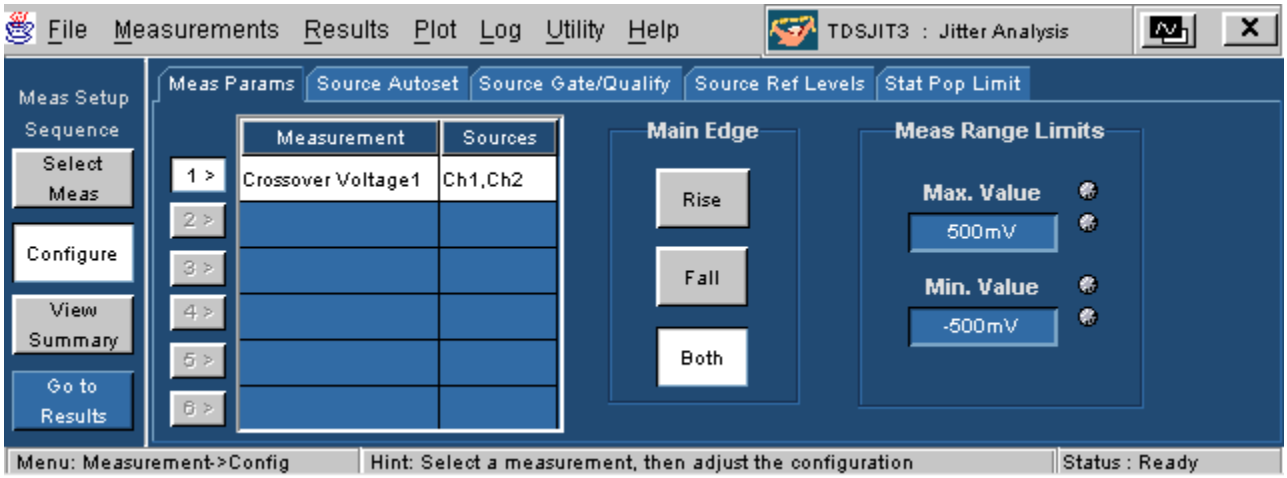
See Also

Configure Measurement Menus on page 26

Skew Configuration Menu



Crossover Voltage Configuration Menu (available only for TDSJIT3)



Gating, Qualifying and Population Control

Source Input Options

Option	Description
Source	A “live” channel, reference, or math waveform used as the signal source; all sources must have the same Horizontal Sample Rate, Record Length, and Position to assure that measurements function properly
Source Autoset	Changes the horizontal resolution and vertical scale and position for Ch1, Ch2, Ch3, and Ch4 waveforms so that they occupy the full vertical space available on the display without any part of the waveform missing (clipped); uses 80% of the Acquisitions ADC range
Source Gate/Qualify	Methods for limiting measurements to specified regions of the source waveforms through gating, such as horizontal and vertical cursors and zoom or qualifying area with logic waveforms by source and active areas
Source Ref Levels	Thresholds are set as a percentage of the voltage levels relative to the minimum and maximum levels of the peak-to-peak values*
Mid	Where to set the middle threshold level on the slope, in volts
Hysteresis	Threshold margin, in volts, relative to the reference level which the voltage must cross to be recognized as changing; the margin is the voltage reference level plus or minus half the hysteresis
High	Where on the slope, in volts, to set the high threshold level
Low	Where on the slope, in volts, to set the low threshold level
Stat Pop Limit	Sets the maximum population used for measurements
*** The base-top method defaults to using either the Min-Max or the Low-High Histogram. You may select a specific Base-Top method by selecting the Autoset Setup button at Measurements> Configure> Source Ref Levels.**	

Configure: Source Autoset

Using Source Autoset

In some cases measurement accuracy can be improved using Source Autoset to optimize the vertical or horizontal settings. Autoset Vertical Scale sets the scale so the Peak-Peak of the selected source is 80% of the ADC full scale. Autoset Horizontal Resolution sets the Sample Rate such that five samples are taken on the fastest rising or falling edge found on any of the waveforms being measured.

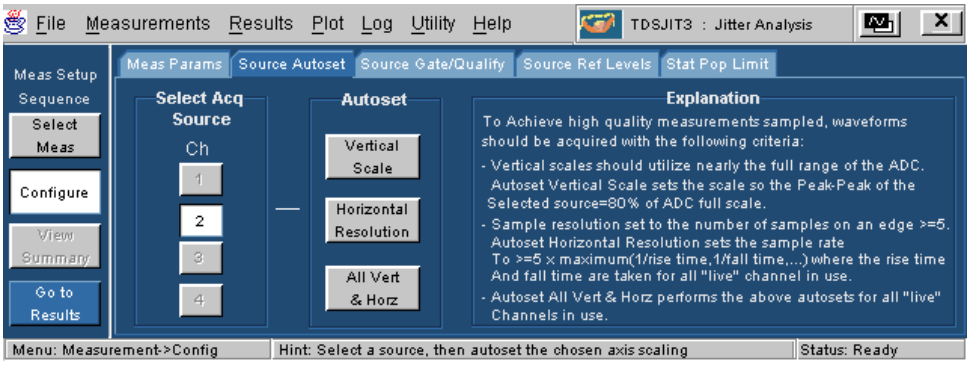
To use Source Autoset:

1. Select Measurements> Configure> Source Autoset.
2. Select the All Vert & Horiz button to Autoset all "live" channels in use or you may individually set live channels by:
   - Selecting the Acq Source channel
   - Selecting Autoset Vertical Scale

- Selecting Autoset Horizontal Resolution

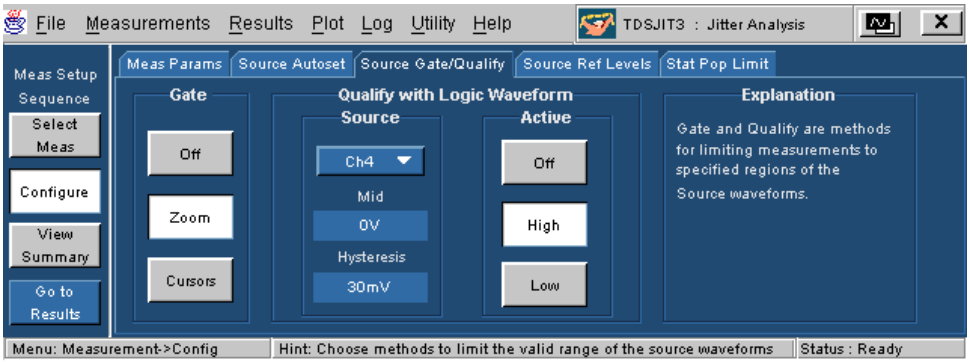
See Source Autoset Menu below

Source Autoset Menu



Configure: Source/Gate/Qualify

Configure: Source Gate/Qualify Menu



Specifying Qualifiers

Qualifiers allow you to focus the application on more narrowly defined conditions before taking measurements. This is one way to filter unnecessary information.

To access the Source Gate/Qualify menu, go to the Configure menu in the menu bar and choose Source Gate/Qualify.

See Also

Configure: Gate/Qualify Menu Options below on page 33

Specifying Gating Options

Gating allows you to focus the application on a specific area of the waveform bound by cursors or by zoom region before taking measurements. This is one way to filter unnecessary information.

To access the Source Gate/Qualify menu, go to the Measurements menu and choose Configure> Source Gate/Qualify.

Configure: Gating Options

Option	Description
Zoom	Zoom to specified region of source waveform and take measurements within the selected area
Cursors	Use oscilloscope cursors to define one specific part of the waveform on which to take measurements

Configure: Source Gate/Qualify Menu Options

Area	Description
Source	A “live” channel, reference, or math waveform used to qualify the signal or clock source; all sources for the measurements and Qualify inputs must have the same Horizontal Sample Rate, Record Length, and Position to assure that measurements function properly
Ref Levels	Select the Mid and Hysteresis Vertical Reference Level for the Qualify channel
Active	Specifies whether the Qualifier option is off or active when High or Low

See Also

Specifying Gating Options on page 32

Configure: Ref Levels

About Voltage Reference Levels

Jitter timing measurements are based on edge times in waveforms. By definition, edges occur when a waveform crosses specified voltage reference levels. The TDSJIT3 application uses three basic reference levels: High, Mid and Low. In addition, a hysteresis value defines a voltage band that prevents a noisy waveform from producing spurious edges.

The reference levels and hysteresis are independently set for each source waveform, and are specified separately for rising versus falling transitions.

See Also

High, Mid and Low reference levels on page 35

Rising Versus Falling thresholds on page 81

Using the Hysteresis Field on page 81

Configuring the Vertical Reference Levels

Separate reference voltages and hysteresis are maintained for each source waveform. Set these levels manually or use the Autoset function. If used, Autoset is applied either to a specific source or to all currently active sources. The Autoset feature is also configured from the Autoset Setup button.

To set the reference levels manually:

1. Go to Measurements> Configure> Source Ref Levels> Select Source and choose a source (channel, reference or math waveform) for which you wish to set the reference levels.

   Note: You cannot select sources that are not currently active. Sources become active when selected for use with a measurement. An inactive source (not currently in use for a selected measurement) appears as a grayed out number on the button. An active source (one currently in use for a measurement) appears as a black number on the button. When you select an active source the button background turns white.
2. Under Set Reference Levels, adjust the six reference levels and the hysteresis value. Repeat these steps for other sources.
3. To set the reference levels automatically for all active sources, choose All Active Sources under Autoset. To autoset a single source, select the source and choose Autoset Selected Source.

View Source Ref Level Menu

See Also

Configuring Ref Level Autoset on page 36

High, Mid and Low Reference Levels on page 35

Source Ref Level Menu Options

Option	Description
Select Source	Identifies the source for the reference levels (Ch, Ref, or Math)
Autoset	
Setup	Accesses a menu that configures how the Reference Level Autoset chooses the thresholds
Selected Source	Causes threshold and hysteresis levels to be automatically chosen for the selected source
All Active Sources	Causes threshold and hysteresis levels to be automatically chosen for all active sources
Set Reference Level	
Mid (Rise) Mid (Fall)	The points at which a waveform crosses its Mid voltage threshold define the waveform's high and low states for most timing measurements. The Mid (Rise) threshold is only active when crossed in a rising direction. The Mid (Fall) threshold is only active when crossed in a falling direction.
Low (Rise) Low (Fall)	The Low threshold defines when a signal is fully in the low state for rise, fall and low time measurements.
High (Rise) High (Fall)	The High threshold defines when a signal is fully in the high state for rise, fall or high time measurements
Hysteresis	For each threshold (High, Mid, Low), the waveform must fully cross a band defined by threshold ± hysteresis to define an edge. The hysteresis never affects the location of the edge, it only affects whether an edge is valid and when the edge-finder is sensitive to subsequent edges

High, Mid and Low Reference Levels

The three reference levels used by TDSJIT3 are High, Mid and Low.

- For many measurements, only the Mid reference level is used. The Mid reference level defines when the waveform transition occurs.
- For Rise Time, Fall Time, High Time, and Low Time measurements, the High and Low reference levels define when the waveform is fully high or low.

See Also

Rising Versus Falling Thresholds on page 81

Using the Hysteresis Field on page 81

Configuring Ref Level Autoset

Autoset sets all six reference thresholds and the hysteresis value to percentages of the base-top voltage amplitude for the waveform. By default the application selects the best base-top method.

To configure the Autoset function manually:

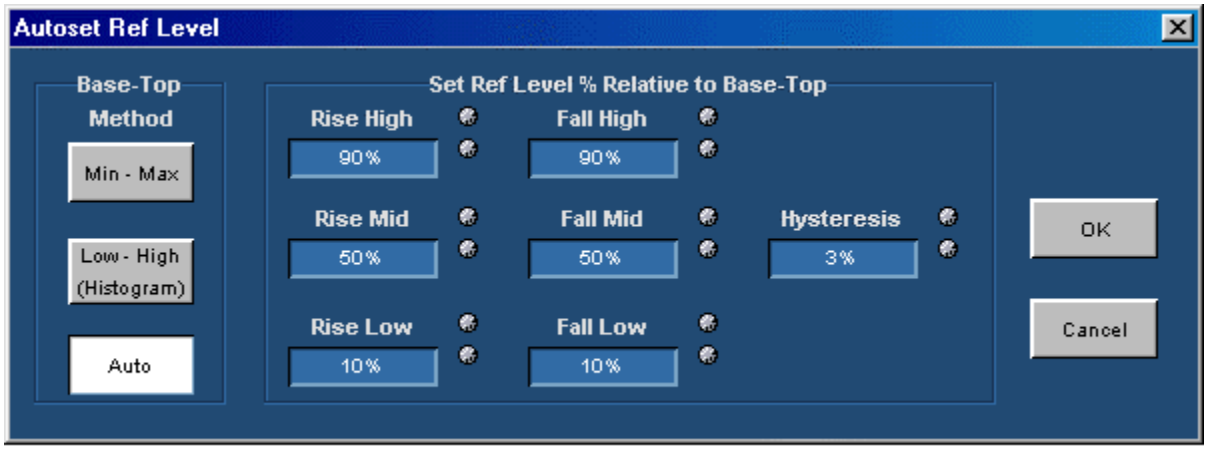
1. Go to Measurements> Configure> Source Ref Levels and choose Setup, under Autoset. The Autoset Ref Level menu appears.
2. Under Base-Top Method
   - Choose Min-Max to use the minimum and maximum values in the waveform to define the base-top amplitude.

   Note: Min-Max works well if the waveform has low noise and is free from excessive overshoot.
   - Choose Low - High (Histogram) to use a histogram-based approach to define the base-top amplitude for your waveform

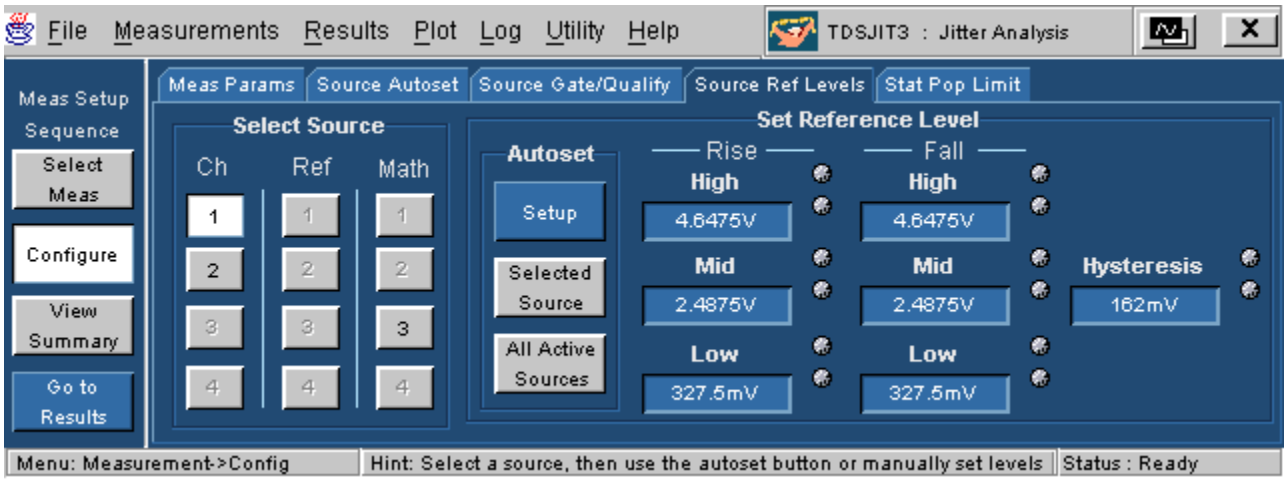
   Note: This method creates a histogram of the amplitudes of the waveform. The histogram should have a peak at the nominal high level, and another peak at the nominal low level. These peaks define the base-top amplitude
   - Choose Auto (the default) to enable the application to choose either the min-max or histogram method automatically
3. You may enter the percentage for any or all values for the Base-Top Method.

See Autoset Ref Level Setup Menu below.

Autoset Ref Level Setup Menu



Autoset Ref Level Menu



Configure: Stat Pop Limit

Stat Pop Limit

Use the Stat Pop Limit to set a limit on the maximum population to obtain for each active measurement.

To define the maximum population for measurements:

1. Go to Measurements> Configure> Stat Pop Limit.
2. Select the On button.
3. Select the Size field and select a population limit from one to one million.

See Stat Pop Limit Menu below

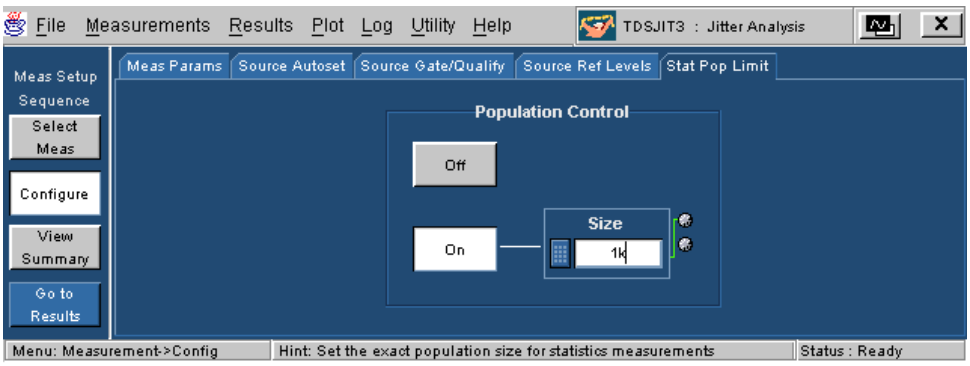
Note:

Statistics individually accumulate for each measurement to the population limit. A Free Run stops when all active measurements reach the population limit.

See Also

Stat Pop Limit Menu Parameters on page 83

Stat Pop Limit Menu



View Summaries

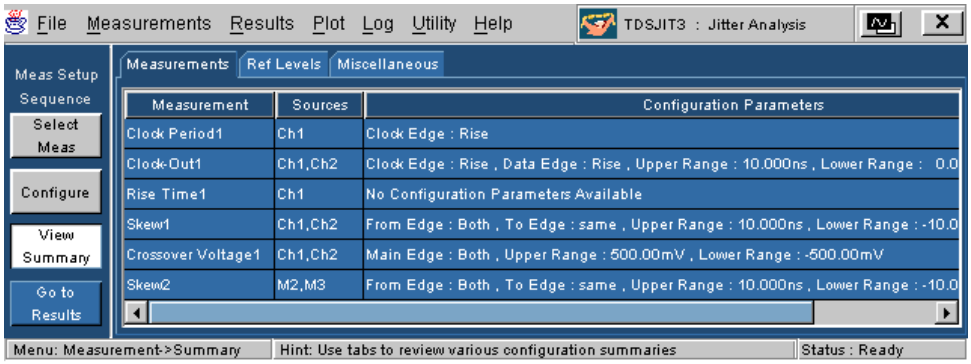
About Viewing Summaries

There are three summaries available.

Select Measurements> Summary of to view summaries of measurements and configuration parameters, ref levels, or miscellaneous configurations (gating, qualifiers, or the stat pop limit).

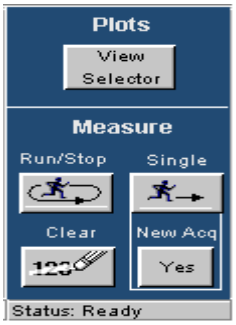
See Summaries Menu below.

View Summaries Menu



Sequencing

Control Panel



Acquiring Data

To acquire data from waveforms:

1. Go to Results> All Statistics.
2. Select the Run/Stop button  on the Control Panel (see above) for a free run continuous acquisitions or the Single button  for measurements on a new or existing acquisition.
3. Stop sequencing by pressing the button a second time.

Note: The status at the bottom of the screen indicates Ready when Sequencing is complete. It may also indicate Stopping prior to indicating Ready.

See Also

New Acq Button on page 39

Localizing Measurements

By specifying the trigger position, the starting point, and the length of the waveform, you can effectively filter out information that is not useful to analyze before taking a measurement.

To focus the application measurement on a part of the waveform, you can use the Configure: Gating/Qualify menu. You can also adjust the Record Length, Scale, or pre-trigger information in the oscilloscope Horizontal menu, or the trigger level and slope in the Trigger menu.

New Acquisition Button

To take more than six measurements on an acquisition:

1. Take the first six measurements using the Single run button.
2. Choose the new acquisition button (New Acq) to change the default setting of Yes to No.
3. Select and configure the next set of measurements and press the Single button again.
   a. When you are ready to acquire new data, select the New Acq button again (to change to Yes).

Analyzing the Results

Analyzing the Results

You can view the results as statistics or graphically in as many as four display plots.

You can also log the data to a ".csv" file for viewing in a spreadsheet, database, text editor or data analysis program.

View example of results as statistics in a .csv file with Wordpad.

View example of how an edited ".csv" file may look in a spreadsheet program.

See Also

Viewing Statistics on page 40

Viewing Plots on pages 40, 46

Viewing Statistics

To view measurement statistics, select All Statistics from the Results menu. The application displays results for up to six measurements for the current acquisition and for all acquisitions.

The All Statistics menu contains statistical values for the following characteristics:

- Population
- Mean
- Standard deviation (StdDev)
- Maximum (Max)
- Minimum (Min)
- Pk-Pk
- Maximum positive deviation
- Maximum negative deviation

The Results menu shows current and all acquisition data for each statistical value:

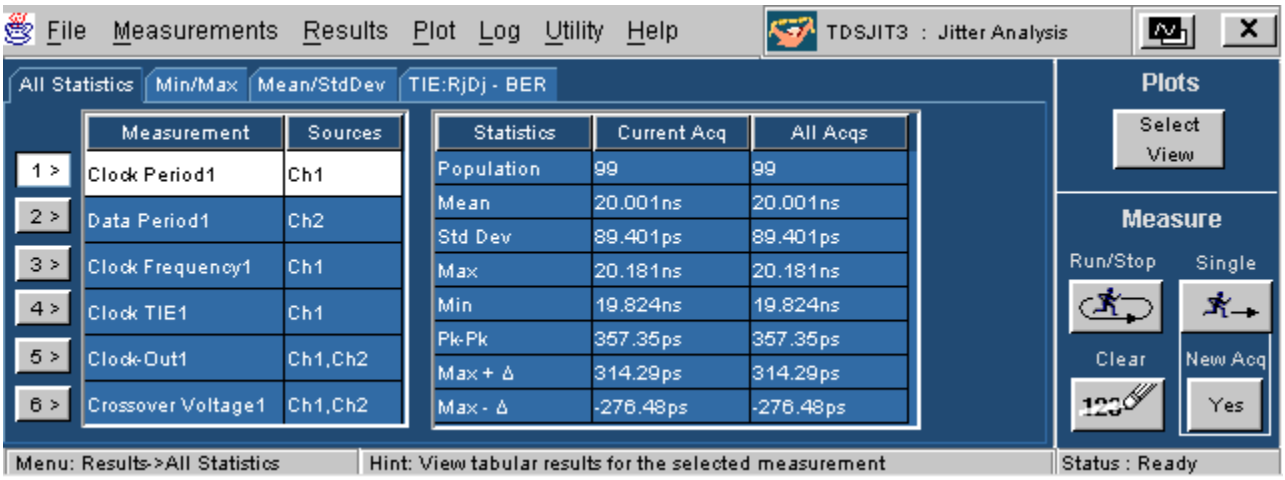
View All Statistics Menu for a tabular listing of statistics for selected measurements.

View Statistics: Min/Max Menu for a summary of all Min/Max and Max positive and negative deviations.

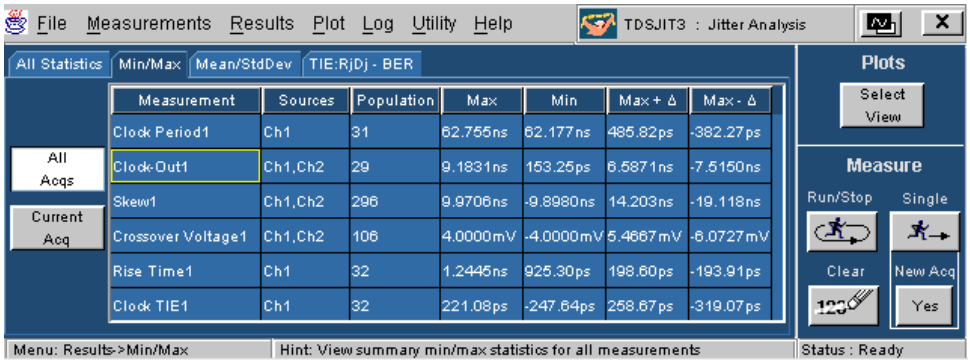
View Statistics: Mean/StdDev Menu for a summary of Mean and Standard Deviations.

View Statistics: TIE RjDj - BER Menu for a summary of Jitter decomposition for selected TIE measurements. (Available only in TDSJIT3)

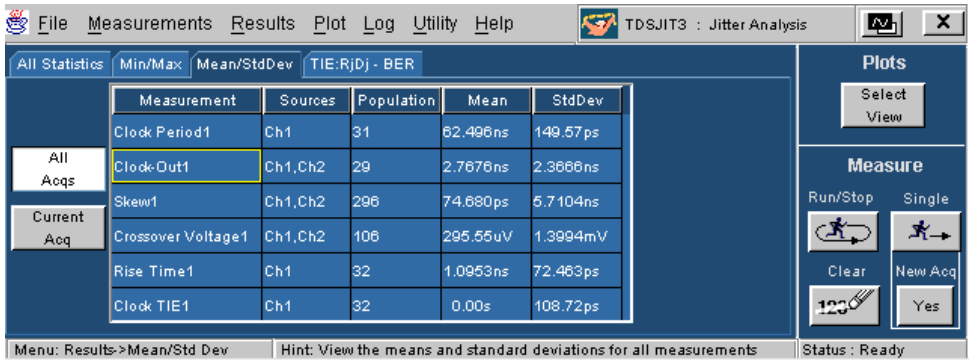
All Statistics Menu



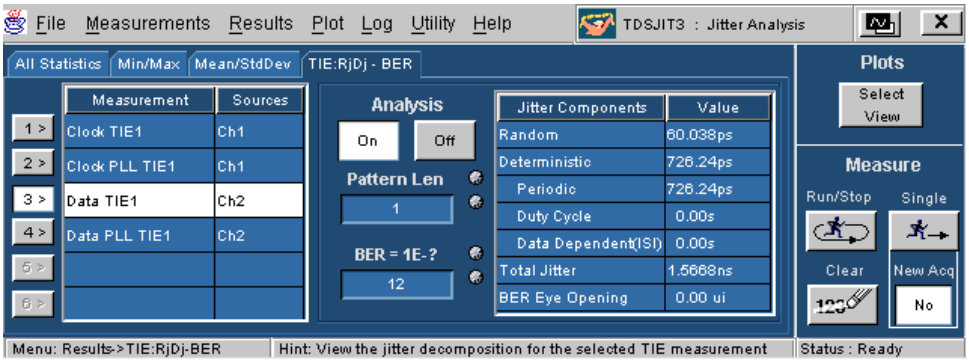
Statistics: Min/Max Menu



Statistics: Mean/StdDev Menu



Statistics: TIE RjDj - BER Analysis Menu (Available only in TDSJIT3)



Saving Results to a File

About Logging Statistics

You can continuously log (save to file) the calculated statistics using TDSJIT3, or you can choose to save a snapshot of the current statistics.

To log statistics go to Log> Statistics:

1. Select measurements that you wish to log or choose "Yes to All" (You can also choose "No to All" if you do not wish to log statistics).
2. To log Statistics continuously, select the On button. This starts a file browser that allows selection of an existing file or a new file to contain the saved statistics.
3. Choose the Off button to stop continuous logging or the Delete button to delete the current statistics file.

To save a snapshot of current statistics (as shown in the Results panes), under Save Current Statistics choose the Save button to save the current statistics to a stats.csv file.

Note: For either type of logging, you may use the Delete button to browse and delete the files.

View Log Statistics Menu

See Also

Log: Statistics Options and Buttons on page 43

About Logging Measurements

You can log (save to file) the actual data points as measurement files. You may either log continuously or save the data points for the current acquisition.

To log measurements go to Log> Measurements> Config:

1. Select measurements and sources that you wish to log or choose "Yes to All" (You can also choose "No to All" if you do not wish to log measurements).
2. Under Log Measurements, select the On button to browse and select a directory name and start continuous measurement logging.
3. Choose the Off button to stop continuous logging.

To save current data points in measurement log files under Save Current Measurements, choose the Save button to browse for a directory and to save the snapshot.

Note:

For either type of logging you may use the Delete button to browse and delete individual measurement files. Using either log measurement feature provides a directory browse to navigate or create new folders.

View Log Measurements Menu

See Also

Log: Measurements Options and Buttons

Log: Statistics Options and Buttons

Option/button	Description
Log Statistics	Enables the application to save continuously the statistical results for all selected measurements
On button	Browse to select or enter a file name and turn logging on
Off button	Turn off continuous logging
Delete button	Browse to select and delete .csv files
Save Current Statistics	Saves a snapshot of the current statistics for the current acquisition and accumulated acquisitions for selected measurements
Save button	Browse to select a file name and save a Snapshot of statistics
Delete	Browse to select and delete .csv files

See Also

Log Statistics Menu Parameters on page 88

Log: Measurements Options and Buttons

Option/button	Description
Log Measurements	Enables the application to save all selected measurements
On button	Browse to select or enter a directory name and turn logging on
Off button	Turn off continuous logging
Delete button	Browse to select and delete .csv files
Save Current Measurements	Saves a snapshot of the current measurements for the current acquisition and accumulated acquisitions for selected measurements
Save button	Save current and accumulated measurements
Delete	Browse to select and delete .csv files

See Also

File Names for Logging Measurement Files on page 44

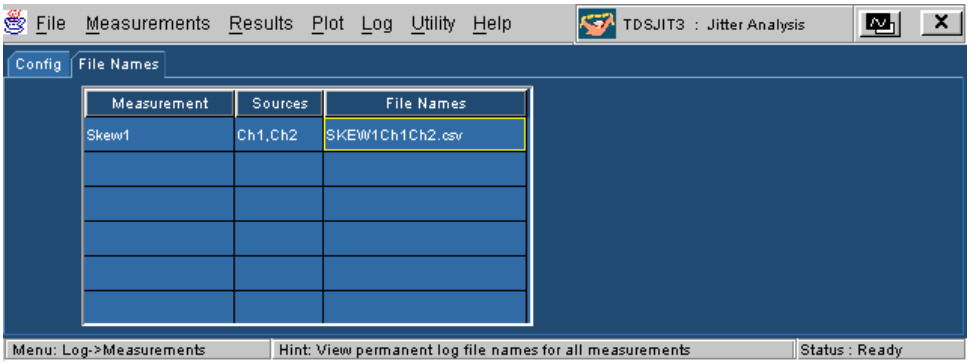
File Names for Logging Measurement Files

You may choose a directory for measurement log files; however, the file names are created by a combination of measurement name and source chosen.

See Also

Logging Measurements on page 64

Log Measurements File Names Menu



Viewing a Data Log File

You can view the measurements and statistics files .csv files (data log files in comma separated variable format) in a spreadsheet, database, text editor or data analysis program for further analysis.

Tip You can use Notepad or Wordpad to quickly view the results in the data log file.

Logging Worst Case Waveforms

Worst Case Waveform logging saves the acquired waveforms whenever a selected measurement exceeds the highest prior value. When enabled, the waveforms are saved to a set of .wfm files.

To log Worst Case waveforms, follow these steps:

1. From the Menu bar, select Log> Worst Case Waveforms> Config.
2. Select measurements and sources that you wish to log or choose "Yes to All."
3. Select On under Log Measurements to browse and select a directory.
4. To turn off logging, select the Off button.

Note: Use the Delete button to browse and delete individual .wfm files.

See Also

Logging Worst Case Waveforms Example on page 64

Plots

Plot Types

You can graphically plot the results for easier analysis. The following table lists the plot types:

Plot	Description
Histogram	This plot type shows measurements sorted according to value. The result is a distribution of measurement values versus the number of times the values occurred. Determine measurement resolution by the span of the histogram and the number of bins in that span.
Cycle Trend	For the most recently processed waveform, plot the measurement values versus the index. For clock measurements, the index is equivalent to the cycle number in the source waveform.
Time Trend	For the most recently processed waveform, plot the measurement values versus the time location of the measurement. A Time Trend spans the same time window as the source waveform. Plot values before the first measurement's means value.
Spectrum	For the most recently processed waveform, plot the FFT of the Time Trend. An analysis window may be applied to the trend data prior to performing the FFT.
Bathtub	For TIE type measurements with RjDj analysis activated, plot the BER versus the horizontal eye opening (i.e. along the time axis). Available only for TDSJIT3.

Note: When taking measurements in the free run mode it is best to stop acquisitions before using the Create Plot menu.

See Also

Selecting and Viewing Plots on page 47

Creating Plots on page 46

About Plot Axes on page 49

Plot Types and Selecting Plots

Creating Plots

To create a new plot, go to Plot in the menu bar and follow these steps:

1. Choose Create.

View the Create Plot menu.

2. Select a measurement from the list of measurements.
3. Select a plot format from the "Add Plot" buttons. The measurement + plot format are added to the table of defined plots. If results are available, the plot is created; otherwise the plot will appear after a measurement sequence is performed.
4. Add another plot format for the current measurement, or select a different measurement and add associated plots.

Note: The Bathtub plot selection (available only for TDSJIT3) is only enabled when a TIE-type measurement is chosen, and

requires that RjDj analysis be enabled in the RjDj results area.
Display RjDj example

See Also

Removing Plots on page 49

Selecting and Viewing Plots on page 47

About Plot Axes on page 49

Selecting and Viewing Plots

To view an existing plot, follow these steps:

1. Choose the Select View button. This button appears on the Control Panel at the right edge of the main TDSJIT3 window and in the toolbar of every plot window. The Active Plot Summary Menu appears listing the currently defined plots.
2. To view the first plot in the Active Plot Summary on the top half of the display, choose the Plot1 button from the column entitled "Top." To view this plot on the bottom, choose Plot1 from the column entitled "Bottom." You may place the other defined plots on the top or bottom of the display by similar steps. Choose Scope to bring the oscilloscope interface to the top of the display. Choose App to bring the TDSJIT3 main window to the bottom.
3. Choose Close or ✕ to dismiss the view selector window. This window is modal, so it must be dismissed before the TDSJIT3 windows will respond to any commands.

Tip If you have a keyboard, the alt-tab Window shortcut may also be used to rapidly select a window for viewing.

Tip If you have a second monitor, position the plot windows on the second monitor by clicking and dragging in the plot window's title bar.

See Also

Plot Types on page 46

Cursor Measurements on page 53

About Using Zoom on page 55

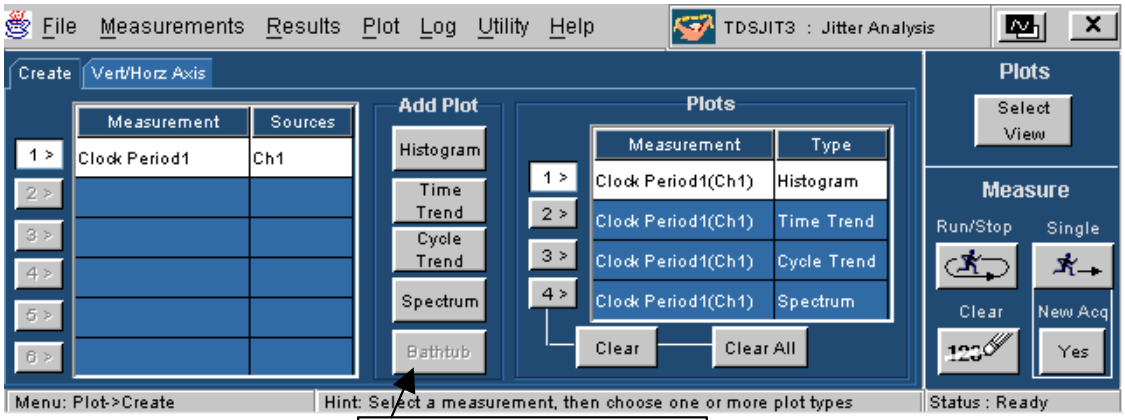
About Plot Axes on page 49

View Create Plot Menu on page 48

View "Locate Window at" Menu (Plots) on page 48

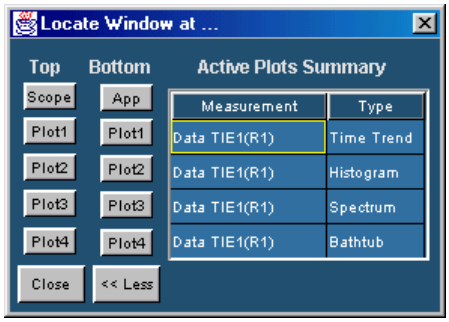
View Plot Window with Controls on page 49

Create Plot Menu

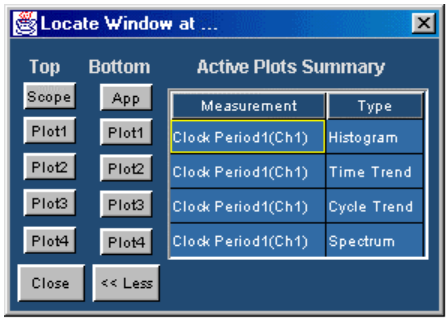


Available only for TDSJIT3

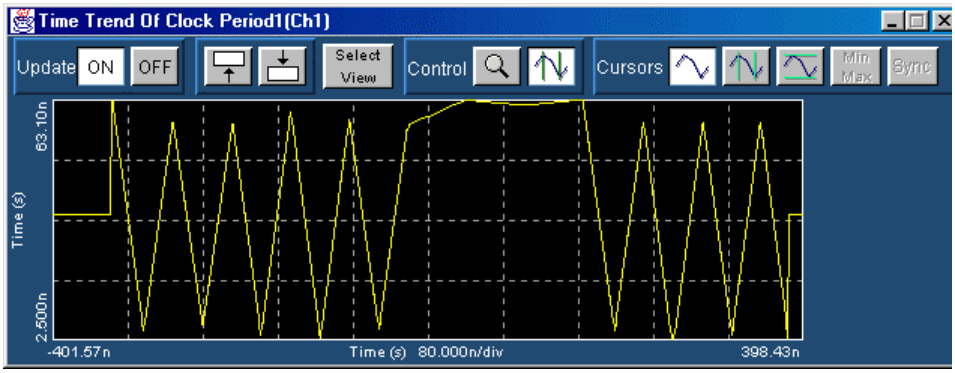
Active Plot Summary Menu



Locate Window at Menu (Plots)



Plot Window with Controls



Removing Plots

To remove an existing plot, follow these steps.

1. Choose Create from the Plot menu.
2. Select a defined plot from the Plots table.
3. Choose Clear to delete the selected plot.

Note: Choose Clear All to delete all defined plots.

See Also

Creating Plots on page 46

Selecting an existing plot for viewing on page 47

About Plot Axes on page 49

Plot Axes: Changing the Appearance of Plots

About Plot Axes

Most of the plot formats allow the appearance of the plot to be modified by adjusting various axis parameters. The vertical and horizontal axis configuration options vary from one plot format to another. Create, and then select the plot to adjust the axis. Each plot window has independent axis controls.

To access the Vertical/Horizontal Axis menu, go to the Plots entry in the menu bar and choose Vert/Horiz Axis.

Note: There are no configuration options for Cycle Trend plots.

Using Histogram Plots

Histogram plots display the results such that the horizontal axis represents the measurement values and the vertical axis represents the number of times that the value occurred. Unlike any other plot, a histogram plot accumulates measurements over multiple acquisitions, up to a total population size of 2.0 billion.

The vertical scaling (log vs. linear) can be changed at any time without losing the accumulated statistics. The number of bins can also be changed at any time, since 500 bins are always used for the actual computation.

Note: Changing any of the horizontal scale controls (Center, Span, Refresh, Autoset) will cause the histogram plot to reset so that only the results from the most recent acquisition are displayed. This is because the bin size must be recalculated.

View the Vert/Horiz Axis Menu for Histogram plots.

See Also

Vert/Horiz Axis Plot Options for Histogram Plots below

Vert/Horiz Axis Plot Options for Time Trend Plots on page 51

Vert/Horiz Axis Plot Options for Spectrum Plots on page 52

Vert/Horiz Axis Plot Options for Bathtub Plots on page 52

Vert/Horiz Axis Plot Options for Histogram Plots

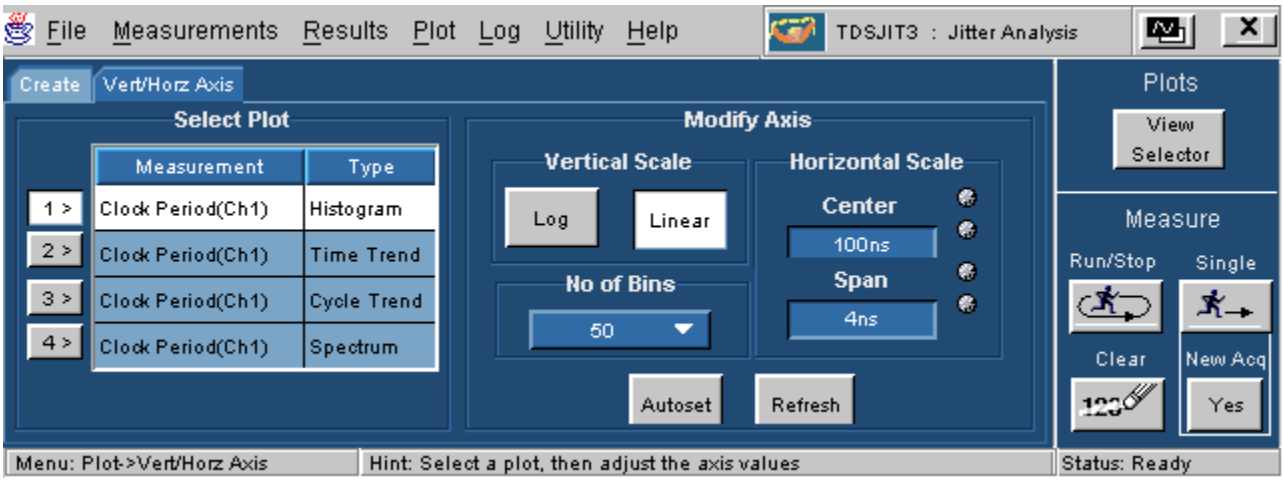
Area/option	Description
Vertical Scale	
Log	Vertical axis in logarithmical scale
Linear	Vertical axis in linear scale (default)
Horizontal Scale	
Center	Numerical value for the horizontal center position of the histogram, after Refresh
Span	Numerical value for the total horizontal range of the histogram, after Refresh
Refresh	Updates the plot with the latest Center and Span values entered
Autoset	Uses the latest results to determine logical values for the Center and Span options if the population of the measurement is three or more, and redraws the plot.
Number of Bins	Resolution, or number of bins into which the Span is divided. Choices are 25, 50, 100, 250, 500.

View the Vert/Horiz Axis Plot menu for Histogram plots on page 51.

See Also

Plot Create Menu Parameters on page 86

Vert/Horiz Axis Plot menu for Histogram plots



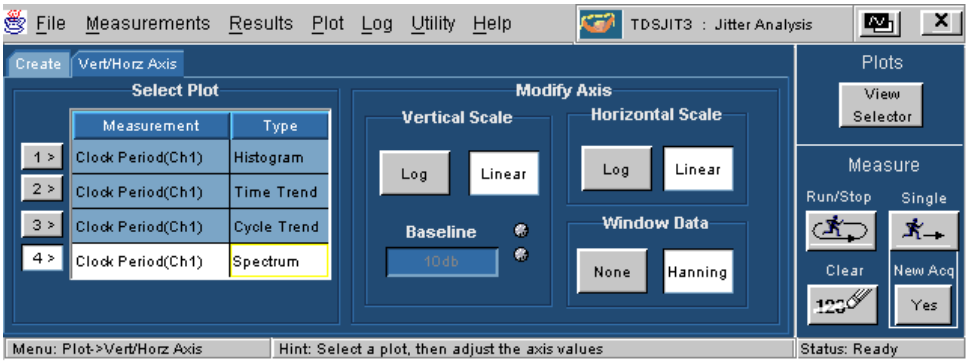
Vert/Horiz Axis Plot Option for Time Trend Plots

Area/option	Description
Mode	
Vector	Measurement points are connected by straight lines (default)
Bar	A vertical bar is placed at the horizontal position of each measurement, with a height (positive or negative) representing the value of that measurement. A horizontal baseline represents the mean value of the time trend.

Vert/Horiz Axis Plot Options for Spectrum Plots

Area/option	Description
Vertical Scale	
Log	Vertical axis in logarithmical scale (default)
Linear	Vertical axis in linear scale
Baseline	Numeric value (expressed as base-10 exponent) at bottom of logarithmic vertical scale
Window	
None	No processing window is applied to the Time Trend prior to fourier transform
Hanning	A Hanning (raised cosine) window is applied to the Time Trend prior to fourier transform, to reduce spectral leakage. (default)

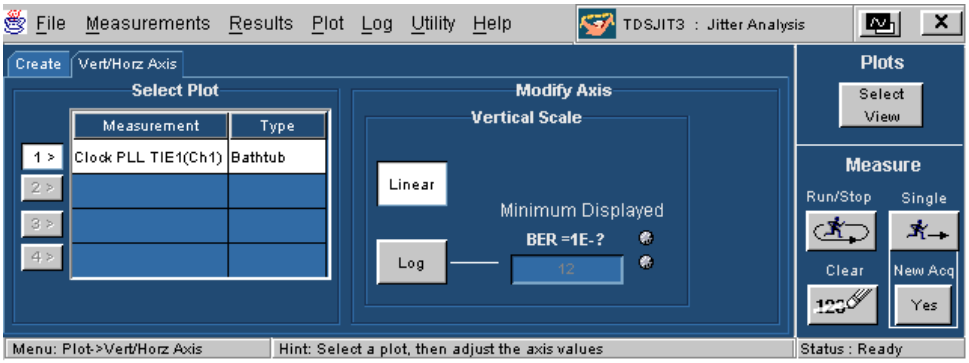
Vert/Horiz Axis Plot Menu for Spectrum Plots



Vert/Horiz Axis Plot Options for Bathtub Plots (Available only for TDSJIT3)

Area/option	Description
Vertical Scale	
Log	Vertical axis in logarithmical scale (default)
Linear	Vertical axis in linear scale
Minimum Displayed	Numeric value (expressed as negative of base-10 exponent) at bottom of logarithmic vertical scale. (default = 12, representing 10^{-12})

Vert/Horiz Axis Plot Menu for Bathtub Plots (Available only for TDSJIT3)



Exporting Plot Information

About Exporting Plots

There are two ways you can export plot information from TDSJIT3 for use in other applications:

- You can export the mathematical data that is represented in the plot figure. This may be useful if you wish to perform additional processing on the data.
- You can create an image file that captures the current plot view. This may be a useful way to document your results.

In support of these tasks, you will find the following export tool panel in the top left corner of each plot window:

Note: Both export buttons are disabled whenever the application is actively sequencing.

See Also

Exporting raw plot data

Exporting plot images

Exporting Raw Plot Data

The waveform image in each plot is typically only 500 by 160 pixels, but the data that it represents may be several million samples of double-precision floating-point information. Exporting this data allows you to perform addition processing or derive custom measurements. Please note that the file sizes can be very large.

To export the mathematical data that was used to create a plot, follow these steps:

1. Select Data on the Export tool panel in the upper left corner of the plot window. A file chooser window will appear. By default, the chooser will provide a filename derived from the current date and time, and will offer to place the data in a folder called “plotData”, in the TDSJIT3 file area. The default data type will be ascii text.

2. Use the controls at the top of the file chooser to select the directory where you would like to save the data.

3. If ascii text is not the desired data format, use the drop-down list labeled “Files of type:” to select another file type. The choices are:

    - Ascii Text (.txt) – Ascii text that is readable by an editor such as Wordpad
    - Comma Separated Values (.csv) – Ascii text that can be loaded into a spreadsheet
    - MATLAB (.mat) – Binary data in the native MATLAB 5.0 format

4. If you have a keyboard, you can change the filename if you wish.

5. Choose Save to save the data.

Note: Files with .txt and .csv extensions are identical except for the extension.

Binary files will typically use only about 40% as much disk space as text files.

See Also

Exporting plot images

Exporting Plot Images

You can save the exact waveform that you see in the plot window, including any cursors. This may be convenient for reports, engineering records, or sharing interesting results with your peers.

To create an image file from your plot, follow these steps:

1. Adjust the zoom and/or cursors to get the view you wish to save.

2. Select **Fig** on the Export tool panel in the upper left corner of the plot window. A file chooser window will appear. By default, the chooser will provide a filename derived from the current date and time, and will offer to place the image file in a folder called “plotFigure”, in the TDSJIT3 file area. The default image format will be Portable Network Graphics (.png).

3. Use the controls at the top of the file chooser to select the directory where you would like to save the image.

4. If PNG is not the desired image format, use the drop-down list labeled “Files of type:” to select another format. The choices are:

   - Windows Bitmap (.bmp) – This is an uncompressed pixel map in the standard Windows format
   - JPEG File Interchange Format (.jpg) – This is a lossy, compressed format
   - Portable Network Graphics (.png) – A lossless, compressed format that offers good portability

5. If you have a keyboard, you can change the filename if you wish.

6. Select Save to save the image file.

See Also

Exporting raw plot data

Using Cursors and Zoom with Selected Measurements

Using Horizontal and Vertical Cursors

Cursor Measurements

Cursor Measurements (Cursor Meas) enable you to determine numerical values associated with a plot based on cursor locations. There are two cursors and two modes of using them, horizontal and vertical-paired.

Note: You can only use one mode at a time; horizontal or vertical-paired but not both.

See Also

Using Horizontal Cursors on page 53

Using Vertical Cursors on page 53

Vertical Cursor Example on page 54

Using Horizontal Cursors

Horizontal cursors appear as two cursor lines in the plot window. They enable you to read the vertical coordinate where each line

touches the plot and also view the difference (delta) between the two cursors.

To use horizontal cursors while viewing a plot in the Plot Window:

In the Control portion of the toolbar, select the cursors button:

In the Cursors portion of the toolbar, select Horizontal Cursors:

Click and drag either cursor line to move the cursor to the part of the plot desired.

Notes on using Horizontal Cursors

Use the 

button to place the Horizontal cursors at the levels corresponding to the minimum and maximum values of the visible portion of the plot.

Activate the Touch Screen on the oscilloscope if you prefer to adjust the cursors in the Plot Window screen with your fingers.

See Also

Using Vertical Cursors

Using Vertical Cursors

Vertical cursors appear as two vertical lines in the plot window. They enable you to read the horizontal coordinates where each line touches the plot and also view the horizontal difference (delta) between the two placements.

In addition, a red cross appears where each cursor intersects the plotted waveform. The vertical value at each of these crosses (as well as the vertical delta) is shown in the Plot Window.

To use vertical cursors while viewing a plot in the Plot Window:

In the Control portion of the toolbar, select the cursors button:

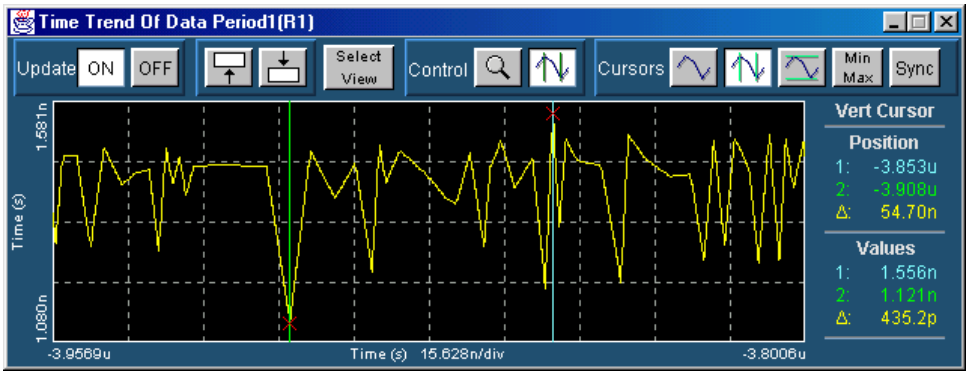
In the Cursors portion of the toolbar, select Vertical Cursors:

Click and drag either cursor line to move the cursor to the part of the plot desired.

See Also

Additional Ways of Using Vertical Cursors on page 53

Vertical Cursors Example



Additional Ways of Using Vertical Cursors

You can use the Vertical Cursors in the following ways:

- Use the Min Max button to place the two cursors at the positions corresponding to the minimum and maximum vertical values within the plot. If the plot display has been zoomed, the minimum and maximum values within the current horizontal limits of the zoom are used.
- For Time Trend only, you can use the Sync button to synchronize the oscilloscope cursors with the plot cursors' positions.
- Min/Max is most useful for Trend Plots. The max (half of the feature) is useful for Spectrum plots.

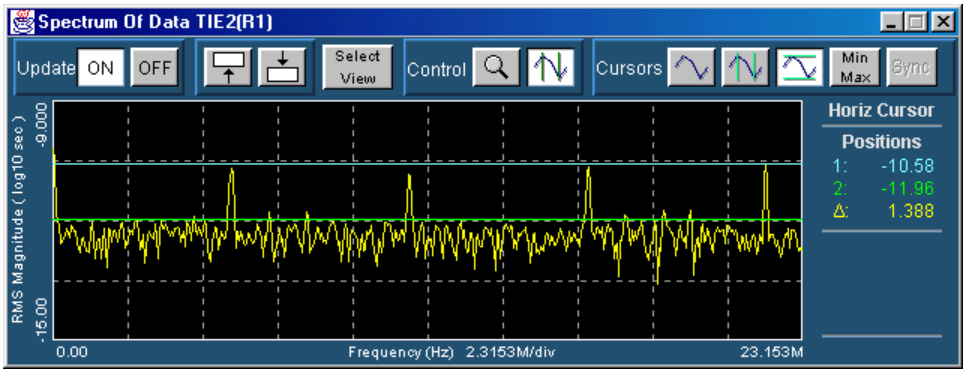
See Also

Using Plot Cursor Controls Example on page 71

Using Horizontal Cursors on page 53

Using Vertical Cursors on page 53

Horizontal Cursors Example



Using Zoom

About Using Zoom

Once you have created a plot, the Zoom buttons enable you to examine a waveform at various scales. You can use the buttons in the Zoom toolbar to accomplish the following tasks:

- Zoom in to examine a small portion of a waveform in greater detail.
- Zoom out to see the entire available waveform.
- Synchronize the scope's zoom window with the TDSJIT3 zoom. (Time Trend only)

Note: Activate the Touch Screen on the oscilloscope if you prefer to adjust the zoom in the Plot Window screen with your fingers.

Zooming In

To examine a portion of a plotted waveform in greater detail:

In the Control portion of the toolbar, select the Zoom button (magnifying glass icon): 

This step is not necessary if the Zoom toolbar is already visible.

1. In the Zoom toolbar, select Zoom In: 
2. To zoom the horizontal scale by a factor of two without affecting the vertical scale, click-and-release on a point of interest in the waveform.
3. To zoom in by an arbitrary amount both horizontally and vertically, use a click-drag-release action with the mouse. After you click and begin dragging, a bounding box will appear to show what part of the waveform will be expanded upon release.

The two zoom methods may be repeated in any order until the maximum zoom is reached.

Zooming Out

To reduce the scale of a plotted waveform so that more of the waveform can be seen:

1. In the Control portion of the toolbar, select the zoom button: 

This step is not necessary if the Zoom toolbar is already visible.
2. To zoom out partially, select  and then click anywhere on the waveform. The view is restored to the zoom values

that existed before the most recent zoom-in. Clicking multiple times will restore successively earlier views.

3. To zoom out completely, select 100%. The view will be restored to its initial zoom settings, in which the entire waveform can be seen.

Using Zoom Sync (Time Trend Only)

By using the Zoom Sync function, you can synchronize the oscilloscope's zoom window with the current horizontal axis limits of a Time Trend plot:

1. Use the TDSJIT3 Zoom-in or Zoom-out buttons until the desired portion of the Time Trend waveform is visible.
2. Select Sync in the Zoom toolbar. This turns on the oscilloscope's zoom mode and adjust the scope's horizontal zoom scale and position to correspond closely with those of the Time Trend plot.

Notes:

- Pressing the Sync button will not bring the oscilloscope's user interface to the foreground if it was obscured by a TDSJIT3 plot window. To make the scope's user interface visible, use the Select View button or the Windows alt-tab shortcut. See Selecting and Viewing Plots.
- Since the oscilloscope's zoom window has a limited number of valid scale factors, the time scale synchronization is not necessarily an exact match.

Min/Max Button

The Min/Max button is available with cursors and sets the cursors to the maximum and minimum values in both horizontal or vertical plots.

Utilities

Warning Messages

Warning Messages

The application displays and saves warning messages if the input conditions do not support accurate measurements. You can view the accumulated messages in the Warnings menu. To access the Warnings menu, go to the Utility menu in the menu bar and choose Warnings.

Note:

To remove all of the messages, select Clear in the Warnings History.

View Warning History Menu below

See Also

Warning History Example on page 59

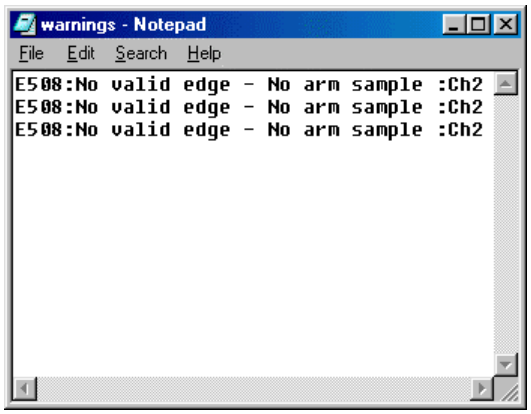
Warning History Menu

See Also

Warning History Example below

Warning Messages pages 19, 58

Warning History Example



Acquisition Timeout

Acq Timeout

The Acq Timeout sets the delay (in seconds) the software allows between an acquisition start and when a waveform is expected.

- Selecting Auto allows the software to adjust the delay according to the record length and measurement complexity.
- Selecting User allows you to set the appropriate delay value (30 s to 86000 s in 30 s increments).

Deskew

Deskewing Probes and Channels

To ensure accurate results for two-channel measurements, it is important to first deskew the probes and oscilloscope channels before you take measurements from your system under test (SUT).

The application includes an automated deskew utility that you can use to deskew any pair of oscilloscope channels. Go to Steps to Deskew Probes and Channels.

Note:

To produce good deskew results; you should connect the probes to the fastest signal in your SUT.

Steps to Deskew Probes and Channels

To deskew a pair of probes and oscilloscope channels, follow these steps:

1. Refer to the topic, Connecting to a System Under Test, before starting the deskew process.

Note: In the following procedures, channel 1 (and the probe connected to it) is the reference point used to deskew channel 2.

2. Connect the probes to the fastest signal in your SUT (System Under Test).
3. Set up the oscilloscope as follows:
   a. Use the Horizontal Scale knob to set the oscilloscope to an acquisition rate so that there are two or more samples on the deskew edge.
   b. Use the Vertical Scale and Position knobs to adjust the signals to fill the display (view the full amplitude) without missing any part of the signals.
   c. Set the Record Length so that there are more than 100 edges in the acquisition.
4. Start the application.
5. Select Utilities> Deskew> and set the Source to Ch 1. The Source waveform is the reference point used to deskew the remaining channels.

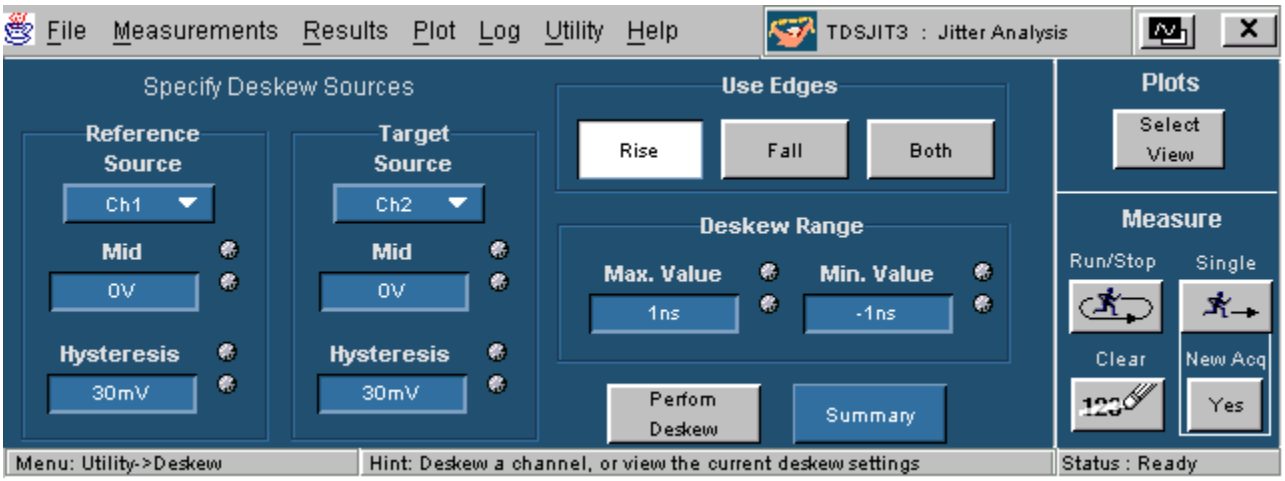
   View the Deskew Menu

   6. Select Target Source on the Deskew Menu and set the Source to Ch2, the channel to deskew.
   7. Select appropriate values for Mid and Hysteresis for both channels.
   8. To start the deskew utility, select the Perform Deskew button from the Deskew Menu and answer Yes to the question in the box that pops up to continue the operation.

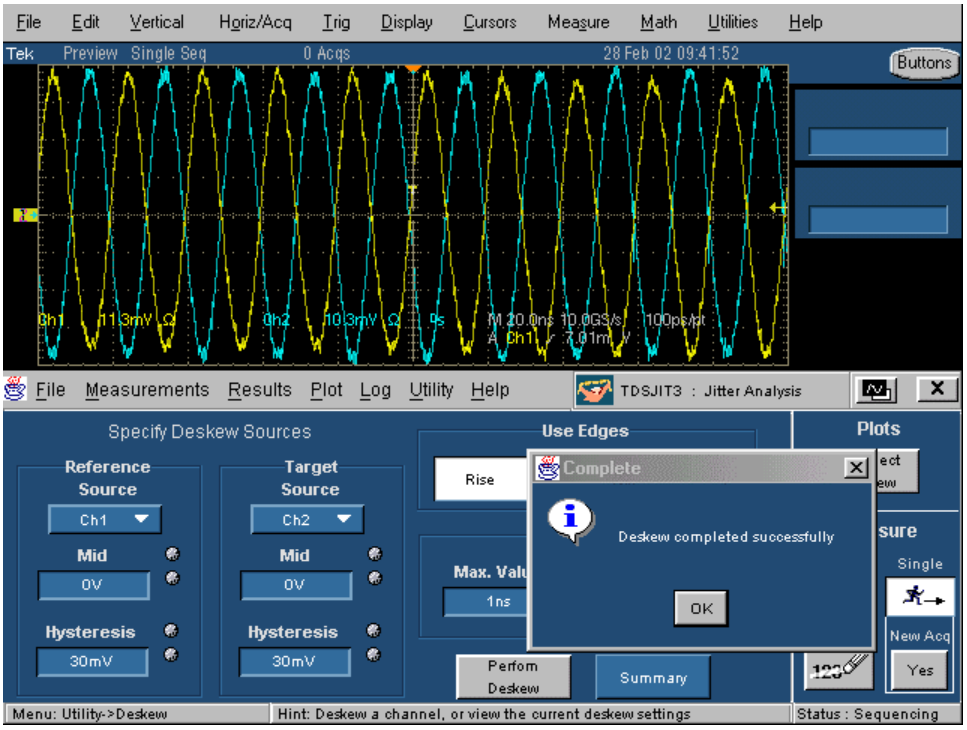
9. Do not change the Reference Source and deskew the remaining channels.

   Display a sample screen produced by the Deskew utility when it finishes.

Deskew Menu



Deskew Complete Example



Tutorial

Introduction to the Tutorial

This tutorial teaches you how to set up the application, take two types of measurements, and view the results.
Before you begin the tutorial, you must do the following tasks:

- Set up the oscilloscope
- Start the application
- Recall the tutorial waveforms

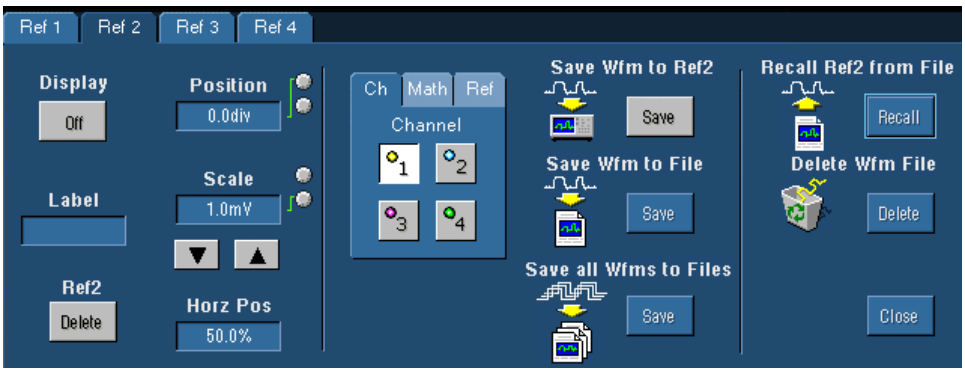
Note: Displays of an oscilloscope are from a TDS7054 model; there may be minor differences in the displays from other types of oscilloscopes.

Setting Up the Oscilloscope

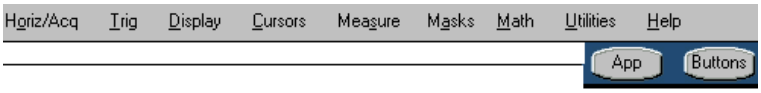
To set up the oscilloscope, follow these steps:

1. Go to the File menu in the oscilloscope menu bar and select Recall Default Setup to set the oscilloscope to the default factory settings.
2. Press the individual CH1, CH2, CH3, and CH4 buttons as needed to remove active waveforms from the display.

Oscilloscope Reference Memory Setup Menu



Oscilloscope Top Menu Bar



Starting the Application

To start the application, go to the File menu on the menu bar and select Run Application> Jitter Analysis 3. The application starts up and displays the Select Active Measurements menu.

View the Measurements Select menu on page 24.

Recalling a Waveform File

To recall waveform files, follow these steps:

1. Go to the File menu in the oscilloscope menu bar and access Reference Waveforms> Reference Setup.
2. Select the Ref1 tab.
3. Select the Recall button for Recall Ref1 from File.
4. Choose the c:\TekApplications\tdsjit3\waveforms directory.
5. Select jit3_clk.wfm file and Recall.
6. Select the Ref2 tab and the Recall button for Recall Ref2 from File.
7. Select the jit3_data.wfm file and Recall.
8. To return to the application, choose the App button in the Menu bar.

View the Oscilloscope Reference Memory setup on previous page.

See Also

Waveform Files below

Waveform Files

The application includes waveform files for use with this tutorial. The following table shows the types of signals that these waveforms represent.

Waveform name	Signal type
jit3_clk.wfm	A clock signal
jit3_data.wfm	A data signal

See Also

Recalling a Waveform File on pages 22, 57

Taking a Clock Period Measurement - Part 1

In this example, you will learn how to use the application to take a Clock Period measurement, how to view the results as statistics, and how to view the results in the various plot formats. To perform these lessons, the application must be installed and enabled on the oscilloscope. See Installation.

To take a Clock Period measurement, follow these steps:

1. To set the application to default values, select File> Default Setup.
2. Choose Measurements Select> Clock.
3. Select Clock Source Ref1 and select Clock Period measurement.
4. Select Measurements> Configure> Source Ref Levels. Select Ref1 button and Autoset> Selected Source button. View the Autoset Ref Level Menu.
5. Select View Summary button. Note the Summary shows the Ref Level values for Ref1.
6. Choose Go to Results button.
7. Press the Single Run command button to start the acquisition and display the statistical results.

Go to Taking a Clock Period Measurement - Part 2.

Taking a Clock Period Measurement - Part 2

1. To view the results as a Histogram plot, select Plot> Create> Histogram (button).
2. To view the results as a Time Trend plot, select the Time Trend button.
3. To view the results as a Cycle Trend plot, select the Cycle Trend button.
4. To view the results as a Spectrum plot, select the Spectrum button.
5. To turn off Plots, select Clear All

View Statistics Display Results on page 60

Taking a Clock-to-Output Time Measurement

In this example, you will learn how to take two measurements at the same time: Clock-to-Output Time and Clock Period. You will need two waveforms to take a Clock-Out measurement.

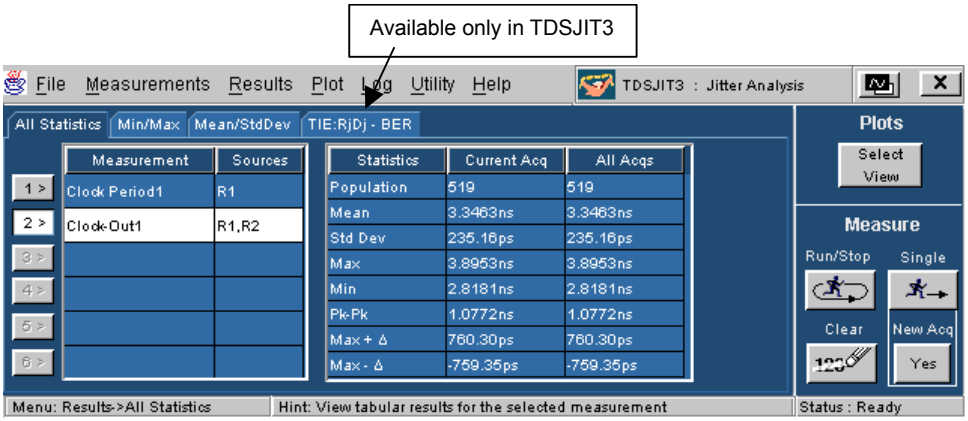
Retain the clock signal in Ref1 and the data signal in Ref2 from the previous lesson. You use these waveforms in both measurements.

To set up the application to take a Clock-Out measurement, follow these steps:

1. Select Measurements> Select> Clock-Data
2. Select data source Ref2 and Clock-Out
3. Clock should be Ref1 from previous lesson.
4. Select Measurements> Configure> Ref Levels> Autoset> All Active Sources button
5. Choose View Summary to check the Ref levels for both Ref1 and Ref2.
6. Select Go to Results. Choose the Single Run button to start the acquisition. The statistical results will appear on screen. View sample statistical results.

Tip To view the statistical results as plots, follow the steps outlined in Taking a Clock Period Measurement - Part 2.

Clock to Output Statistical Results



Viewing a Data Log File in a Text Editor

To view the data log file in a text editing application, such as WordPad or Excel, follow these steps:

1. From the Windows tool bar, select Start icon> Programs> Accessories> WordPad (or Excel if available).
2. Select File> Open.
3. Locate the C:\TekApplications\tdsjit3\log or measurements or measurements snapshot directory.
4. Select All Documents (*.*) for the Files of Type.

5. Select the results.csv file and Open.
   View an example of the Statistics.csv file on the next page.

Statistical Display Results

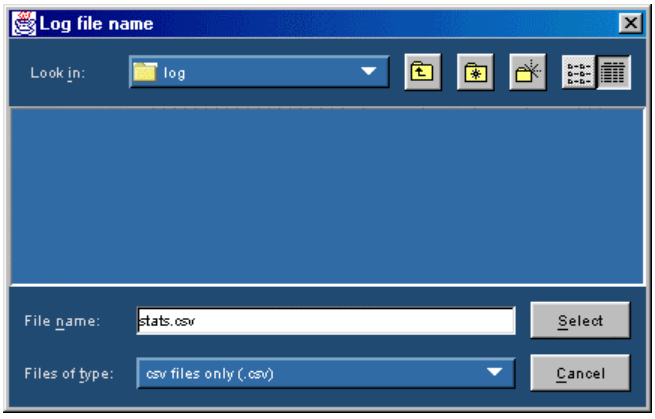
Below is a sample statistical result viewed in WordPad:

```
TDSJIT3,Version V 1.0,Fri Apr 12 17:53:21 PST 2002,,,,,,,,,

Measurements -,,,,,,,,,,,

Measurement#,Measurement,Sources,Configuration Parameters,,,,,,,,
1,Clock Period,R2,Clock Edge : Rise,,,,,,,,
2,Clock-Out,R2 - R3,Clock Edge : Rise , Data Edge : Rise , Upper Range :

Source Ref Levels -,,,,,,,,,,,

Ref Levels,Ch1,Ch2,Ch3,Ch4,Ref1,Ref2,Ref3,Ref4,Math1,Math2,Math3,Math4
Rise High,1V,1V,1V,1V,1V,780.6mV,811.8mV,1V,1V,1V,1V,1V
Rise Mid,0V,0V,0V,0V,0V,-21mV,-9mV,0V,0V,0V,0V,0V
Rise Low,-1V,-1V,-1V,-1V,-1V,-822.6mV,-829.8mV,-1V,-1V,-1V,-1V,-1V
Hysteresis,0V,0V,0V,0V,0V,60mV,62mV,0V,0V,0V,0V,0V
Fall High,1V,1V,1V,1V,1V,780.6mV,811.8mV,1V,1V,1V,1V,1V,,,,,,,
Fall Mid,0V,0V,0V,0V,0V,-21mV,-9mV,0V,0V,0V,0V,0V,,,,,,,
Fall Low,-1V,-1V,-1V,-1V,-1V,-822.6mV,-829.8mV,-1V,-1V,-1V,-1V,-1V,,,,,,

Miscellaneous -,,,,,,,,,,,,,,,,,,

,Gating,Source Qualify,Pop Limit,,,,,,,,,,,,,,,
State,Off,Off,Off,,,,,,,,,,,,,,,
Source,-,Ch4,-,,,,,,,,,,,,,,,
Size,-,-,1000,,,,,,,,,,,,,,,

Statistics -,,,,,,,,,,,,,,,,,,

,,,CP(s),,,,,,,,,TCO(s),,,,,,,
Acq#,Time,,Population,Mean,Std Dev,Max,Min,Pk-Pk,Max + ″,Max - ″,,Popula
1,17:53:23,,998,2.00E-08,2.42E-10,2.06E-08,1.93E-08,1.26E-09,1.09E-09,-1
Total,17:53:23,,998,2.00E-08,2.42E-10,2.06E-08,1.93E-08,1.26E-09,1.09E-0
```

Stats.csv File: Spreadsheet Example

TDSJIT3	Version V 1.0	Fri Apr 12 17:53:21 PST 2002				
Measurements -						
Measurement#	Measurement	Sources	Configuration Parameters			
1	Clock Period	R2	Clock Edge : Rise			
2	Clock-Out	R2 - R3	Clock Edge : Rise	Data Edge : Rise	Upper Range : 10.000	L
Source Ref Levels -						
Ref Levels	Ch1	Ch2	Ch3	Ch4	Ref1	R
Rise High	1V	1V	1V	1V	1V	78
Rise Mid	0V	0V	0V	0V	0V	-2
Rise Low	-1V	-1V	-1V	-1V	-1V	-8
Hysteresis	0V	0V	0V	0V	0V	60
Fall High	1V	1V	1V	1V	1V	78
Fall Mid	0V	0V	0V	0V	0V	-2
Fall Low	-1V	-1V	-1V	-1V	-1V	-8
Miscellaneous -						
	Gating	Source Qualify	Pop Limit			
State	Off	Off	Off			
Source	-	Ch4	-			
Size	-	-	1000			
Statistics -						
			CP(s)			
Acq#	Time		Population	Mean	Std Dev	M
1	17:53:23		998	2.0000E-08	2.4160E-10	
Total	17:53:23		998	2.0000E-08	2.4160E-10	

Log File with Default File Name



Stopping the Tutorial

If you need more than one session to complete the tutorial lessons, you can stop the tutorial and return to it another time.

To save the application setup and stop your session, refer to Saving a Setup and to Exiting the Application.

Returning to the Tutorial

To return to the tutorial setup, you can start the application and then recall the saved setup. To recall the application setup, refer to Recalling a Saved Setup on pages 18, 19, and 62

Application Examples

About Application Examples

This section presents simplified application examples that highlight the application measurements and give you ideas on how to use the application to solve your own test problems.

To use these examples, you must have the TDSJIT3 application installed and enabled on the oscilloscope. For information, see Installation and Starting the application.

Three application examples are presented:

- Logging
- RjDj Separation (available only for TDSJIT3)
- Creating and Using Plots

Logging

Logging

The following application examples show how to save the results of your measurements, either using Logs or Snapshots.

With Logs, you configure the application before you run your tests, so that information of interest is automatically saved to a log file as it is produced. For example, you can obtain a detailed record of the measurements that result from an overnight test run.

Snapshots provide a way for you to save the information that is currently displayed in the User Interface. For example, this is useful if from testing you find that a particular test run yields results that you would like to analyze further or archive.

All of the following examples assume that the application is configured as described in Taking a Clock-to-Output Time Measurement.

See Also

Logging Statistics

Logging Measurement

Logging Worst-Case Waveforms

Snapshot of Current Statistics

Snapshot of Current Measurements

Logging Statistics

The contents of a Statistics log file include a header with the time and date and all the measurement configurations and reference levels. This is followed by the information from the Results > All Statistics panel. There is one file for all measurements selected in the Log Statistics panel.

In this example, you configure a statistics log file, run a series of measurements, and then look at the statistics log file that is produced. To set up and enable a statistics log file, follow these steps:

1. Select Log> Statistics.
2. Set Log Statistics to On. A filename selection dialog pops up.
3. For the filename, type "stats1.csv".
4. Choose the Select button.

   Note: At this point statistics logging is enabled.
5. Select Results > All Statistics.
6. Select Single run button,  , to start the measurements. The application performs the measurements and then and statistics are displayed in the Results panel.
7. Go to Log> Statistics and select the Off button under Log Statistics.

   The statistics log file "stats1.csv" now exists in the directory C:\TekApplications\TDSJIT3\log.

View a Statistics Spreadsheet Example on page 61.

View Statistical Display Results on page 60.

Logging Measurements

The contents of each Measurement log file include a header with the time, date, measurement configuration and reference levels for a specific measurement. This is followed by rows of measurements, where each row contains all the instances of the measured parameter for one acquisition. There is one measurement log file for each selected measurement in the Log Measurements panel.

In this example, you configure a measurements log file, run a series of measurements, and then look at the log file that was produced. To set up and enable a measurements log file, follow these steps:

1. Select Log > Measurements > Config.

2. Set Log Measurements to On. A directory selection dialog will pop up.
3. Click the OK button to accept the default director of c:\TekApplications\TDSJIT3\measurements.

Note: At this point measurement logging is enabled. Select the File Names tab to view the file names to be used in this example: CPR2.csv for the Clock Period on R2; TCOR2R3.csv for the Clock-Out time from R2 to R3. If a file with the assigned name already exists in the target directory, the new file is appended to it.

4. Select Results > All Statistics.
5. Select the Single run button,  , to start the measurements. The application performs the measurements and displays statistics results.
6. Go to Log> Measurements and select the Off button under Log Measurements

The log files CPR2.csv and TCOR2R3.csv now exist in the directory C:\TekApplications\TDSJIT3\measurements.

Logging Worst Case Waveforms Example

When you enable logging of worst-case waveforms, the TDSJIT3 application saves all the waveforms that contributed to the worst-case maximum value for each enabled measurement, and all the waveforms that contributed to the worst-case minimum value for each measurement.

When a new worst-case waveform is found, all the associated waveforms are overwritten. The file format is the binary .wfm format used for waveform storage by Tektronix oscilloscopes.

In this example, you enable logging of worst-case waveforms for two measurements, run a series of measurements, and then look at the log directory to see what files were created.

To enable logging of worst-case waveforms, follow these steps:

1. Select Log > Worst Case Waveforms > Config.
2. Select the On button under Log Worst Case Waveforms. A dialog to help you choose a directory pops up.
3. Click the OK button to accept the default directory of c:\TekApplications\TDSJIT3\waveforms.

Note: At this point waveform logging is enabled. The names of the individual waveform files are not user-configurable. Select the File Names tab to view the file names that will be used in this case: CPR2Max1.wfm and CPR2Min1.wfm for the Clock Period measurement, and TCOR2R3Max1.wfm, TCOR2R3Min1.wfm,

TCOR2R3Max2.wfm and TCOR2R3Min2.wfm for the Clock-Out measurement.

4. Select Results > All Statistics.
5. Select  to start the measurements. The application performs the measurements and displays statistics.
6. Select Log > Worst Case Waveforms > Config and choose the Off button under Log Worst Case Waveforms.

The waveform files mentioned above now exist in the directory C:\TekApplications\TDSJIT3\waveforms. See Recalling a Waveform File.

Snapshot of Current Statistics

A statistics snapshot is useful when you want to save the visible results.

To save the results in the Results > Statistics UI panel, follow these steps:

1. Select Log > Statistics.
2. Select the No to All Button and select Clock-Out.
3. Under Save Current Statistics, select Save. A filename selection dialog pops up.
4. Type snapshot1.csv for the file name.
5. Choose the Select button to save the current statistics for Clock-Out in c:\TekApplications\TDSJIT3\log\snapshot1.csv.

Snapshot of Current Measurement

Follow these steps to save the actual measurement results from the most recent acquisition:

1. Select Log > Measurements > Config.
2. Under Save Current Measurements, select Save. A directory selection dialog pops up.

To save the measurement file for Clock-Out (as used in this and the other Logging Examples), select the OK button to accept the default directory of c:\TekApplications\TDSJIT3\measurementSnapshot.

RjDj Separation

Note

The RjDj separation feature is not available in TDSJIT3E. However, all of Part I and the first two steps in Part II can be performed in TDSJIT3E to display the statistical results of a Data TIE measurement.

RjDj Separation Part 1

In this example, you will learn how to use the application to take measurements on the random jitter and deterministic jitter components of the TIE jitter. Also, you will learn how to obtain a bathtub curve plot.

Requirements:

- TDS5000/6000/7000 Oscilloscope
- TDSJIT3 Jitter and Timing Analysis Software
- Reference waveform j3dat1.wfm (in C:\TekApplicaitons\TDSJIT3\waveforms\)

Recalling Waveform:

First, you must recall the proper Oscilloscope Reference Waveform. To recall j3dat1.wfm file to Ref1 on the oscilloscope, follow these steps:

1. On the oscilloscope go to File> Reference Waveforms> Reference Setup menu> Ref1 tab.
2. Choose the c:\tekApplication\tdsjit3\waveforms directory.
3. Select the j3dat1.wfm file and recall.

At this point you should see a waveform on the oscilloscope.

View RjDj Reference Waveform Example.

Starting the Application:

Go to File> Run Application on the oscilloscope and choose TDSJIT3.

1. Go to Measurements> Select and select the Data TIE measurement.
2. Go to Select Resource and select Ref1 as data resource by using the pull-down menu.
3. Press the TIE button to select the TIE measurement.

To configure the measurement, follow these steps:

1. Press the Configure button. The Configure Measurement Parameters panel opens.
2. Select the Source Ref Levels tab.
3. Press the Autsoset All Selected Sources button. Source reference levels are automatically set.

View Source Ref Levels menu.

See Also

RjDj Separation Part 2 below

RjDj Reference Waveform Example on page 68

RjDj Separation Part 2

To continue the Data TIE measurement, follow these steps:

1. Press the Go to Results button. Select the All Statistics tab.
2. Press the application Measure Single sequence button.

This starts the measurement process: the reference waveform in oscilloscope is transferred to the application, the application performs timing analysis, and statistics are calculated; measurement results are displayed.

Display Data TIE Measurement Results.

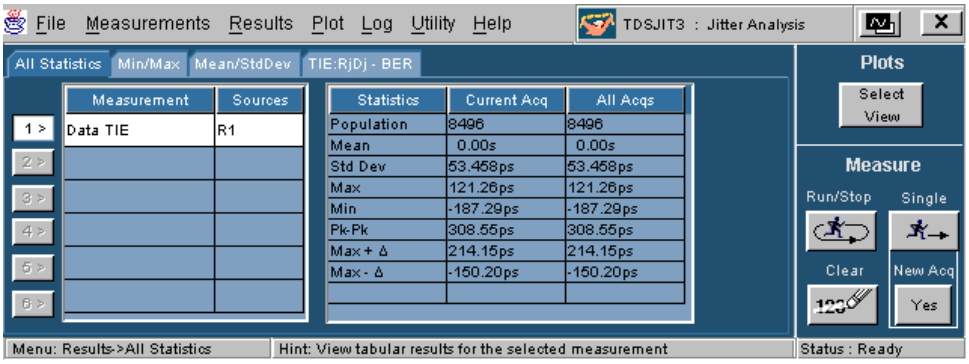
To perform RjDj separation, follow these steps:

1. Select the TIE:RjDj-BER tab.
2. Set the Pattern Length to 40.
3. Press the analysis ON button.

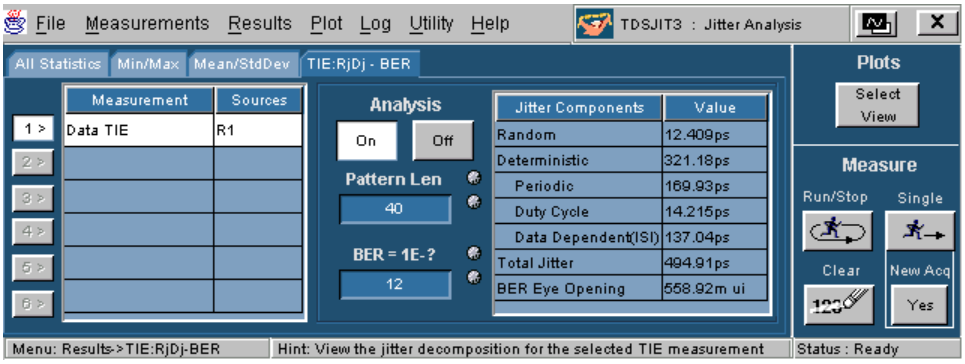
The application performs RjDj separation and displays the results.

Display RjDj Separation Results.

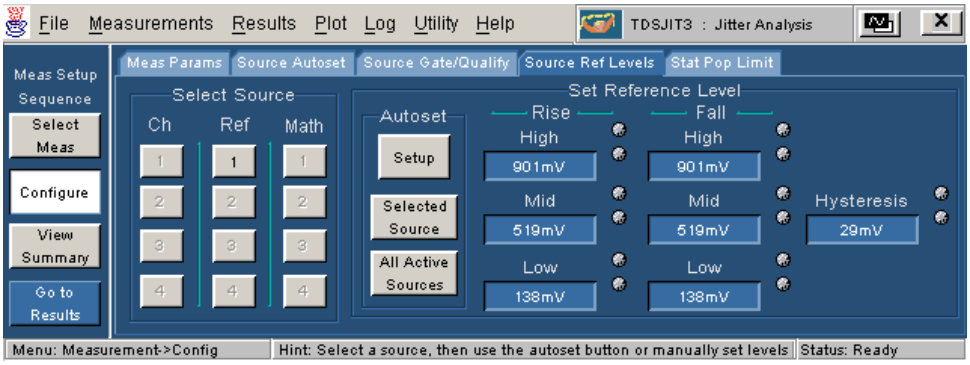
Data TIE Measurement Results



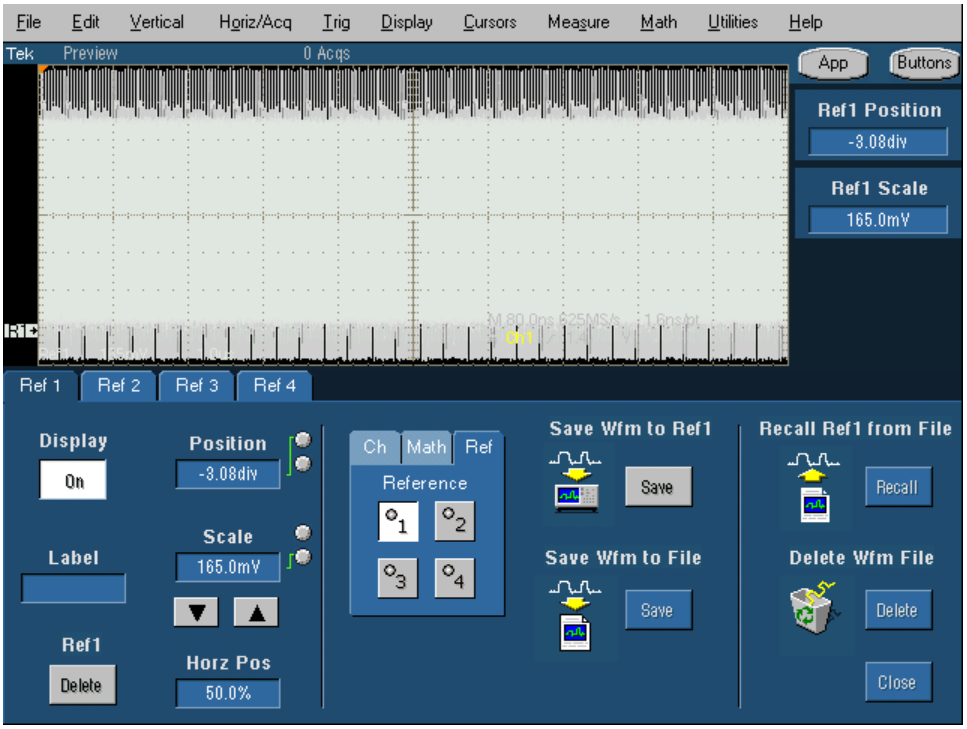
RjDj Separation Results (Available only in TDSJIT3)



Source Ref Levels Menu



RjDj Reference Waveform Example



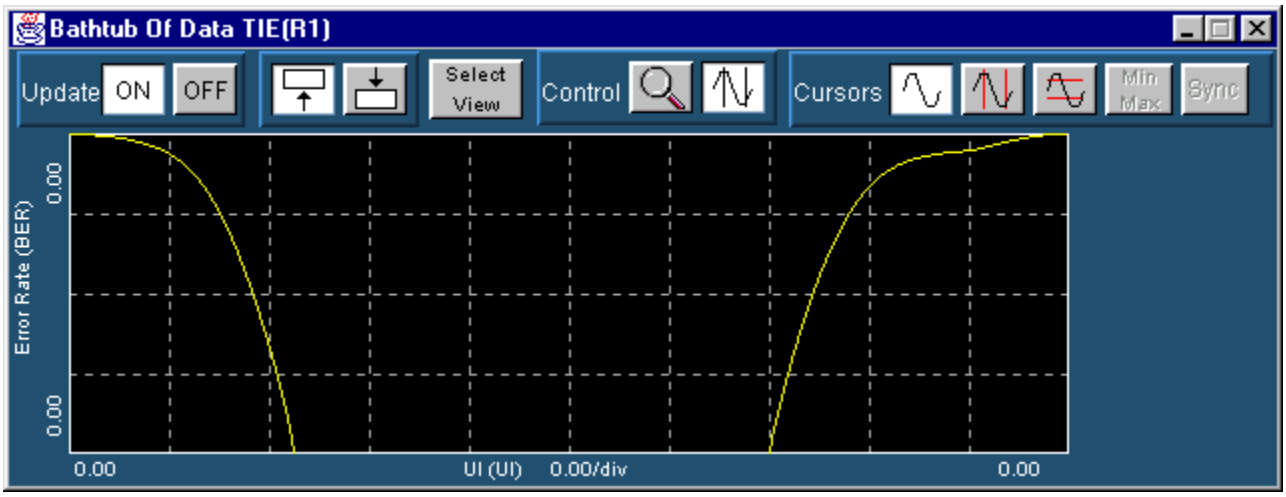
Plotting the Bathtub Curve (Available only for TDSJIT3)

To plot the bathtub curve, follow these steps:

1. Using the Plot/Create menu to bring up the plot panel.
2. On the Plor panel, select Data TIE of R1.
3. Select bathtub curve plot by pressing the Bathtub button from the Add Plot list. The application will place Bathtub plot on Data TIE of Ref1 on the plots list. The bathtub plot is displayed.
4. Set the Vertical Scale to Log or Linear by using the Plot/Vert/Horz Axis menu.

See example Bathtub Curve below.

Bathtub Curve



Plotting

Creating and Using Plots

(Some features in these examples are not supported in TDSJIT3E.)

In these examples, you learn how to create and control plots that graphically show the results of your measurements. To prepare for these examples, first perform the steps in the RjDj Separation application example.

The examples assume that you are using a mouse to control the plots, but the same actions may be performed with a finger or

stylus on the touch-sensitive display if Touch Screen is activated on the oscilloscope.

To create a Time Trend plot of the Data TIE, follow these steps:

1. Select Plot > Create.
2. In the table on the left, identify the measurement to plot by selecting Data TIE R1.
3. In the Add Plot panel, choose Time Trend.

The selected measurement is added to the table of defined plots on the right. A new window appears on the upper half of the screen, containing a plot of the Data TIE versus time for REF1.

Using Plot Zoom Controls

When the Time Trend plot was created in the prior step, it automatically scaled both axes to hold the entire measurement from the latest acquisition (in this case, a stored waveform). In this example you will adjust the axis scaling so that fine details of the waveform can be clearly seen.

1. In the Time Trend plot window toolbar, select the zoom button  if it is not already highlighted.
2. In the Zoom area of the toolbar, select the zoom-in button  if it is not already highlighted.
3. Click once with the mouse near the center of the waveform display area. The display zooms in (enlarges) horizontally by a factor of two, centered on the point that was selected. The vertical scaling remains fixed.
4. Click and hold the mouse near the upper left corner of the waveform display area, and drag down and to the right. A rectangle appears, showing how much area is currently selected. Release the mouse when the rectangle encloses the area you would like to see in greater detail. The display zooms in both horizontally and vertically.
5. In the Zoom area of the toolbar, select the zoom-out button  . Click and release the mouse anywhere in the waveform display area. The waveform display returns to the zoom settings that were in effect before the most recent zoom-in operation.
6. In the Zoom area of the toolbar, select the 100% button. The waveform display area returns to the original, "unzoomed" scale, which shows the entire available waveform.
7. Select the Move Downward button  in the toolbar. The Time Trend plot window moves to the bottom of the overall display, revealing the oscilloscope display of voltage-vs-time on the upper half.

8. On the Time Trend plot, select the zoom-in button and then use the mouse to click twice within the waveform display area. Select the sync button. In the oscilloscope display on the upper half of the screen, a zoomed waveform window appears with horizontal endpoints that closely match those in the Time Trend plot.
9. Use the Front Panel Zoom button to turn off the oscilloscope zoom display.

Using Plot Cursor Controls

In this example you will use cursors to determine numerical values represented by a waveform.

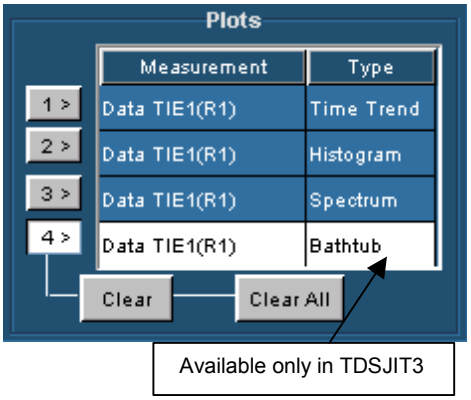
1. In the Time Trend plot window from the prior example, select the 100% button to restore the default zoom scale.
2. In the Control area of the toolbar, select the cursors button  to switch from zoom mode to cursor mode.
3. In the Cursors area of the toolbar, select the vertical cursors button  . Two vertical bars appear in the waveform display area. Red crosses appear at the points where the bars cross the Time Trend waveform. The panel at the right edge of the plot window displays the horizontal positions of the two cursors, together with the vertical values of the red crosses.
4. Use the mouse to click on one of the cursor bars. Without releasing the mouse, drag to the left or right to move the cursor. Release the mouse when the cursor is placed where you wish.
5. Select the Min/Max button in the toolbar. One of the cursors snaps to the maximum value currently displayed in the plot window, and the other snaps to the minimum value.
6. If the Time Trend plot window is currently on the upper half of the display screen, select the "move downward" button  in the toolbar. The Time Trend plot window moves to the bottom of the overall display, revealing the oscilloscope display of voltage-vs-time on the upper half.
7. Select the Sync button in the Cursors area of the toolbar. On the oscilloscope display, the oscilloscope's cursors are now positioned at the times that correspond to the cursors on the Time Trend plot.

Navigating Between Plot Windows

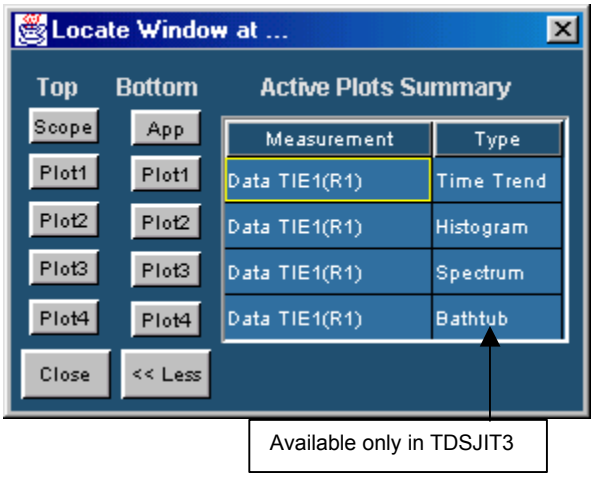
This example shows you several ways to navigate between the scope, the TDSJIT3 main window, and up to four plot windows.

To navigate using the view selector window:

1. If the main TDSJIT3 application window is obscured by a plot window, minimize the plot window using the icon in the upper right corner.
2. Select Plot > Create. The Time Trend plot that you created in a prior step will already be listed in the table of defined plots. In the Add Plot panel, choose Histogram to add a histogram plot of the Data TIE measurement.
3. Similarly, choose Spectrum and Bathtub to create two more plots. The plot definition panel should now look like this:



4. Press the Select View button. Note that this button appears in the upper right corner of the TDSJIT3 main window and in the upper central part of each plot window. Any of these buttons will cause the following window to appear:



5. To bring the histogram plot to the foreground, select one of the Plot2 buttons to the left of the histogram entry in the Active Plot Summary. Choose the button from the "Top" column to display the histogram on the upper half of the display. Choose the button from the "Bottom" column for display on the lower half.
6. Close button to close the view selector window. Since the view selector is modal, you must close it before the controls on any other TDSJIT3 window will be active.

Note:

If you have a keyboard, use the Windows alt-tab shortcut to rapidly select plot windows. Hold down the alt key and press the tab key one or more times, until the desired plot window icon is highlighted in the selector. Release the alt key to bring the selected window to the foreground.

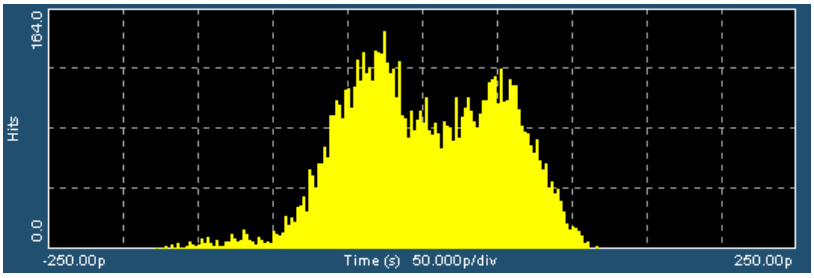
Tip You can also move the TDSJIT3 plot windows by dragging their title bars. If your oscilloscope is configured with a second monitor, it may be convenient to place the plot windows on the second display.

Modifying the Plot Axis

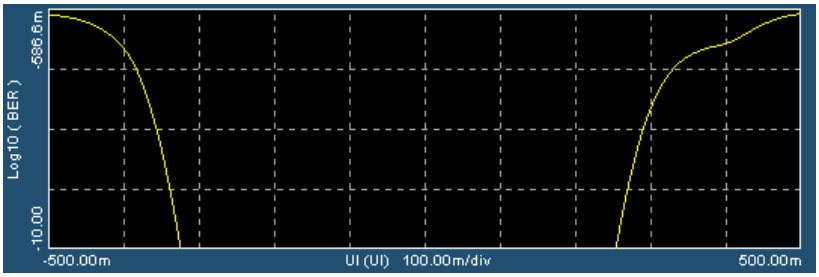
In this example you will use the Axis controls to modify the way that plots are displayed. This example assumes that you have created four plots as described in the RjDj application example and the prior sections of the Plotting example.

To use the axis controls:

1. Use the view selector or the alt-tab shortcut to place the histogram plot on the top half of the display and the TDSJIT3 main window on the bottom half.
2. Choose Plot > Vert/Horiz Axis. On the left portion of the display, select the Data TIE Histogram entry from the "Select Plot" table, so that this entry is highlighted.
3. Under "Modify Axis", use the drop-down menu titled "No of Bins" to choose 250 bins.
4. Choose the "Span" control and use either the pop-up keypad or the multipurpose knob to adjust the span to 500ps. Choose "Refresh" to apply this setting to the display. The graticule portion of the histogram plot should now look like this:



5. Use the view selector to place the bathtub plot on the upper half of the display. In the "Select Plot" portion of the TDSJIT3 main window, select Bathtub. In the right half of the main window, the Modify Axis panel offers a choice of Linear or Log for the vertical scale, and allows the minimum displayed BER to be changed. Use either the pop-up keypad or the multipurpose knob to adjust the minimum displayed value to 10 (corresponding to BER of 1e-10). The graticule portion of the bathtub plot should now look like this:



6. Choose other plot types from the "Select Plot" menu under Vert/Horiz Axis. Each of the plot types except Cycle Trend allows various axis parameters to be varied.

Reference

Parameters

About Application Parameters

This section describes the TDSJIT3 application parameters, and includes the menu default settings. You should refer to the user manual for your oscilloscope for operating details of other controls, such as front-panel buttons.

The parameters for the menus and options list the selections or range of values available for each and also includes the default values.

Refer to the GPIB Programming section of this Help file for a complete list of the GPIB Command Syntax. This entry includes a complete list of the GPIB commands along with the arguments, variables, and variable values that correspond to the TDSJIT3 parameters.

Note: Incremental unit values shown are valid when the FINE button is enabled on the oscilloscope.

Measurements Menus

Measurements: Select Menu Options

Options available on the Select Active Measurements menu by area are as follows:

- Clock area: Period, Cycle-Cycle, N-Cycle, Frequency, Positive Cy-Cy Duty Cycle, Negative Cy-Cy Duty Cycle, Positive Duty Cycle, Negative Duty Cycle, TIE, PLL TIE[1]
- Data area: Period, Frequency, Data TIE and Data PLL TIE[1]
- Clk-data area: Setup, Hold, and Clock-Out
- General area: Rise Time, Fall Time, Positive Width, Negative Width, High Time and Low Time, Skew and Crossover Voltage[1]

[1] These measurements are available only in TDSJIT3.

Configuration Menu

Configuration Menus

Measurements menus:

- Meas Params
- Source Autoset
- Source Gate/Qualify
- Source Ref Levels
- Stat Pop Limit

Measurement Parameters

Configure Menu

You may configure the following measurements:

- Clock: Period, Frequency, Cycle-Cycle, N-Cycle, Positive Duty Cycle, Negative Duty Cycle, TIE, PLL TIE[1]
- Data: Data TIE and Data PLL TIE[1]
- Clk-Data (all): Setup Time, Hold Time and Clock-Out Time
- General: Skew and Crossover Voltage[1]

There is no configuration for the following measurements:

- General: Rise Time, Fall Time, Positive Width, Negative Width, High Time and Low Time
- Clock area: Positive Cy-Cy Duty and Negative Cy-Cy Duty
- Data: Data Frequency and Data Period

Display the parameters for the Configure Measurements menu and the selections or range of values for each.

[1] These measurements are available only in TDSJIT3.

Configure: Measurement Parameters (Meas Param)

Parameter	Selections	Default setting
Clock Edge	Rise, Fall, Both	Rise
N-cycle		
Active edge	Rise, Fall, Both	Rise
N=	1 to 1k in 1 units	6
1st Meas:Start @ Edge	1 to 1k in 1 units	1
Clock edge increment	1 or N	1
Clock TIE		
Active Edge	Rise, Fall, Both	Rise
Ref Clock Frequency	Autocalc 1st Acq, Autocalc every Acq, User	Autocalc 1st Acq
Value (User ref clock)	1 Hz to 5 GHz in 1 Hz units	100 MHz
Data TIE		
Ref Clock Frequency	Autocalc 1st Acq. Autocalc Every Acq, User	Autocalc 1st Acq
Value (User ref clock)	1 Hz to 5 GHz in 1 Hz units	100 MHz
Data PLL TIE (Available only for TDSJIT3)		
Ref Clock Frequency	Autocalc 1st Acq, Autocalc every Acq, User	Autocalc 1st Acq
Value (User ref clock)	• 1 Hz to 5 GHz in 1 Hz units	100 MHz
Clock PLL TIE (Available only for TDSJIT3)		
Active Edge	Rise Fall, Both	Rise
Loop Bandwidth	Standard Frequency, User	Standard Freq
Standard Speed (Gs/s)	FC133:0.1328, FC266:0.2656, FC531:1.0625, FC1063:11.063,: FC2125:2.125, IB2500:2.5, SerATAG1:1.5, SerATAG2:3, SerATAG3:6, USB_FS:0.12, USB_HS:0.48, 1394b_S400b:0.4915, 1394b_S800b:0.983, 1394b_S1600b:1.966, GB_Ethernet:1.25, 100BaseT:0.125, OC1:0.0518, OC3:0.155, OC12:0.622, OC48:2.488	FC133:0.1328
Value (User only)	1 Hz to 50 MHz in 1 Hz units	1 MHz

Data PLL TIE (Available only for TDSJIT3)		
Loop Bandwidth	Standard Frequency, User	Standard Frequency
Standard Speed (Gs/s	FC133:0.1328, FC266:0.2656, FC531:1.0625, FC1063:11.063,: FC2125:2.125, IB2500:2.5, SerATAG1:1.5, SerATAG2:3, SerATAG3:6, USB_FS:0.12, USB_HS:0.48, 1394b_S400b:0.4915, 1394b_S800b:0.983, 1394b_S1600b:1.966, GB_Ethernet:1.25, 100BaseT:0.125, OC1:0.0518, OC3:0.155, OC12:0.622, OC48:2.488	FC133:0.1328
Value	1 Hz to 50 MHz in 1 Hz units	1 MHz
Setup Time, Hold Time, Clock-Out		
Clock edge	Rise Fall, Both	Rise
Data Edge	Rise Fall, Both	Both
Meas Range Limits: Max Value Min Value	-500 ms to 500 ms in 10 ps units	 10 ns 0 ns

Crossover Voltage	Available only for TDSJIT3	
Main Edge	Rise, Fall, Both	Both
Meas Range Limits: Max Value	-10 V to 10 V in 10 mV units	500 mV
Meas Range Limits: Min Value	-10 V to 10 V in 10 mV units	-500 mV
Skew		
From Edge	Rise, Fall, Both	Both
To Edge	Same as From, Opposite as From	Same as From
Meas Range Limits: Max Value	-500 ms to 500 ms in 10 ps units	10 ns
Meas Range Limits: Min Value	-500 ms to 500 ms in 10 ps units	-10 ns
Note: All incremental values are with the Fine button on		

N-Cycle Configuration Parameters

Parameters	Selections	Default Setting
Clock Edge		Rise
N=	1 to 100,000 in increments of 1 edge	1
1st Meas: Start @ Edge	1 to 1000 in increments of 1 edge	1

Clk-Data Area Parameters

Selection	Parameters	Default Setting
Clock Edge	Rise, Fall, Both	Rise
Data Edge	Rise, Fall, Both	Both
Meas Range Limits	Max Value -500 ns to 500 ns in increments of 10 ps Min Value -500 ns to 500 ns in increments of 10 ps	Max Value 10 ns Min Value 0 ps

Clock and Data Tie Measurement Parameters

Option	Selection	Default Setting
Active Edge	Rise, Fall, Both	Rise
Ref Clock Frequency	Autocalc 1st Acq, Autocalc Every Acq, User	Autocalc 1st Acq
Value	1Hz to 5GHz in units of 1 Hz	100MHz*
***Value only applies to User**		

Clock PLL TIE Measurement Parameters (available only for TDSJIT3)

Parameter	Selection	Default Setting
Active Edge	Rise, Fall, Both	Rise
Loop Bandwidth	Standard Frequency, User	Standard Frequency
Standard Frequency: Standard Speed(Gs/s)	FC133:0.1328, FC266:0.2656, FC531:1.0625, FC1063:11.063,: FC2125: 2.125, IB2500:2.5, SerATAG1:1.5, SerATAG2:3, SerATAG3:6, USB_FS:0.12, USB_HS:0.48, 1394b_S400b:0.4915, 1394b_S800b:0.983, 1394b_S1600b:1.966, GB_Ethernet:1.25, 100BaseT:0.125, OC1:0.0518, OC3:0.155, OC12:0.622, OC48:2.488	FC133:0.1328
User Value	1Hz to 50 MHz in units of 1Hz	1MHz

View Clock PLL TIE Configuration Menu on page 28.

Data PLLTIE Measurement Parameters (Available only for TDSJIT3)

Parameter	Selection	Default Setting
Loop Bandwidth	Standard Frequency, User	Standard Frequency
Standard Frequency Standard Speed(Gs/s)	FC133:0.1328, FC266:0.2656, FC531:1.0625, FC1063:11.063,: FC2125: 2.125, IB2500:2.5, SerATAG1:1.5, SerATAG2:3, SerATAG3:6, USB_FS:0.12, USB_HS:0.48, 1394b_S400b:0.4915, 1394b_S800b:0.983, 1394b_S1600b:1.966, GB_Ethernet:1.25, 100BaseT:0.125, OC1:0.0518, OC3:0.155, OC12:0.622, OC48:2.488	FC133:0.1328
User Value	1 Hz to 50 MHz in increments of 1 Hz	1MHz

View Data PLL TIE Configuration Menu on page 29.

Skew Configuration Parameters

Parameters	Selections	Default Setting
From Edge	Rise, Fall, Both	Both
To Edge	Same as From, Opposite to From	Same as From
Meas Range Limits Max Min	 -500 to 500 ns in increments of of 10ps -500 ns to 500 ns in increments of 10 ps	10 ns

Crossover Voltage Configuration Parameters (Available only for TDSJIT3)

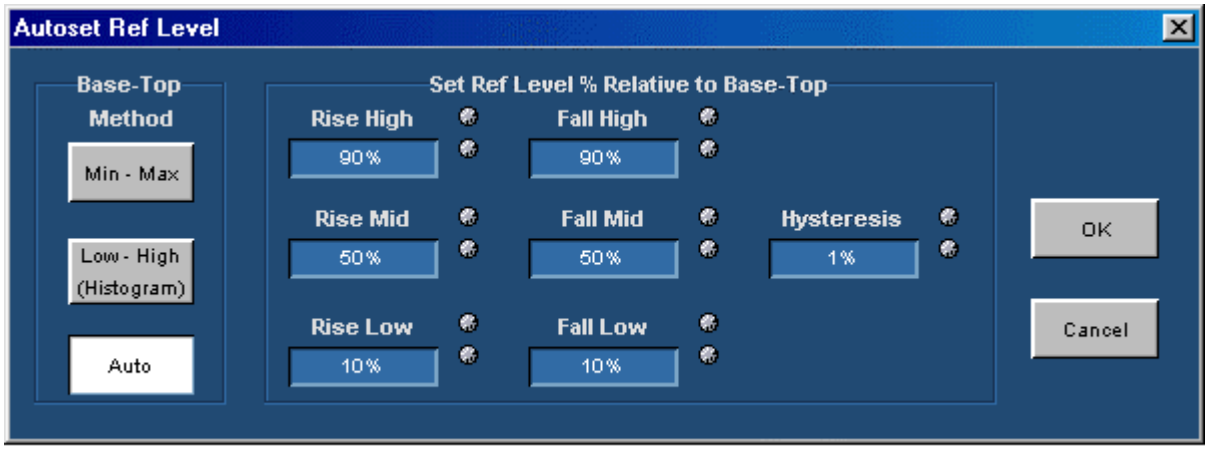
Parameter	Selection	Default Setting
Main Edge	Rise, Fall, Both	Both
Meas Range Limits: Max Value	-10V to 10V in units of10mV	500mV
Meas Range Limits: Min Value	-10V to 10V in units of 10mV	-500mV

Source Autoset Menu

Autoset Ref Level Setup Parameters

Parameter	Selections	Default setting
Base Top method	Min-Max, Low-High (Histogram), Auto	Auto (Selects best choice of Min/Max or Low-High
Rise/Fall High	2% to 99% in 1% units	90%
Rise/Fall Low	1% to 98% in 1% units	10%
Rise/Fall Mid	1% to 99% in 1% units	50%
Hysteresis	0% to 50% in 1% units	3%

Autoset Ref Level Setup Menu



Source Gate/Qualify Menu

Source Gating Menu Parameters

Parameter	Selections	Default setting
Gate	Off/Zoom/Cursors	Off

See Also

Configure: Gate/Qualify Menu on page 32

Qualify Menu Parameters

Parameter	Selections	Default setting
Source	Ch 1-4, Math 1-4, or Ref 1-4	Ch4
Active	Off/High/Low	Off

View Configure: Gating/Qualify Menu on page 32.

Rising Versus Falling Thresholds

Specify two decision thresholds to configure each of the three reference levels (High, Mid, and Low).

- A rising event occurs when the waveform rises through the Rise threshold.
- A falling event occurs when the waveform falls through the all threshold.
- For a given reference level, rising and falling events alternate as time progresses.

Note: In many cases the rising and falling thresholds for a given reference level are set to the same value. In this case, a hysteresis value helps prevent spurious edges produced by small amounts of noise in a waveform.

Tip Setting the rising threshold higher than the falling threshold and setting the hysteresis to zero can model the classic behavior of a Schmitt Trigger circuit.

Using the Hysteresis Field

Using the hysteresis field prevents small amounts of noise in a waveform from producing multiple threshold crossings. Use hysteresis when the rising and falling thresholds for a given reference level are set to the same value.

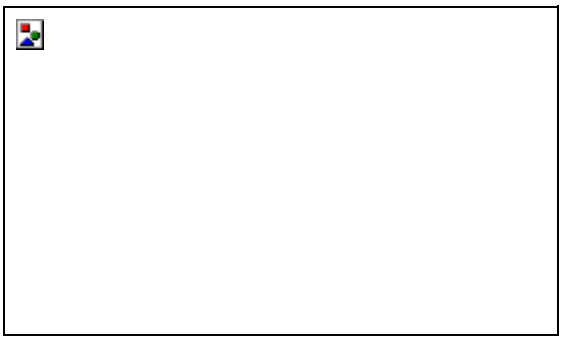
The reference level ± hysteresis value defines a voltage range that must be fully crossed by the waveform for an edge event to occur. If the decision threshold is crossed more than once before the waveform exits the hysteresis band, the mean value of the first and last crossing are used as the edge event time.

For example, if the waveform rises through (Threshold - Hysteresis), then rises through Threshold, then falls through Threshold, then rises through both Threshold and (Threshold + Hysteresis), a single edge event occurs at the mean value of the two rising crossings.

See Also

Example of Hysteresis on a Noisy Waveform below

Example of Hysteresis on a Noisy Waveform



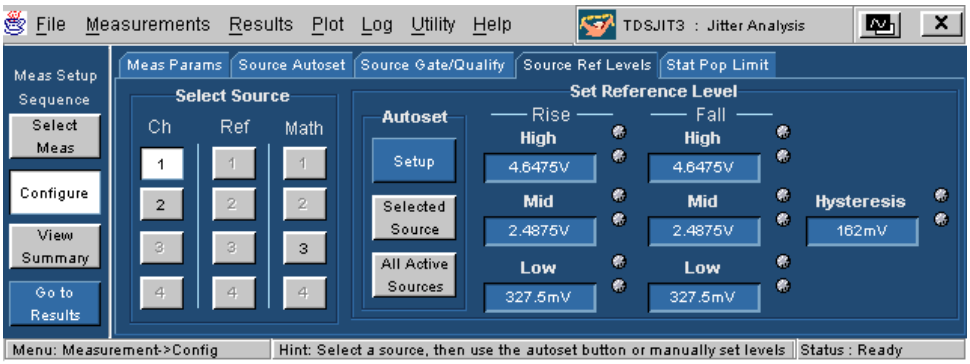
Source Ref Level Menu

Source Ref Level Menu Parameters

Parameter	Selections	Default setting
Rise/Fall High	-20V to 20V in 1µV units	1V
Rise/Fall Low	-20V to 20V in 1µV units	-1V
Rise/Fall Mid	-20V to 20V in 1µV units	0V
Hysteresis	0V to 10V in 1µV units	30 mV

View Ref Level Menu on page 83.

Ref Level Menu



Stat Pop Limit Menu

Stat Pop Limit Menu Parameters

Parameter	Selections	Default setting
Population Control	Off, On	Off
Size	1 to 1M in units of 1	1k

The Stat Pop Limit applies to all active measurements.

- As each active measurement reaches the population limit, TDSJIT3 stops calculating statistics
- For measurements that have not reached the population limit, acquisitions and calculation of statistics continue until all measurements have reached the population limits
- When all measurements reach the limit, then a Free Run stops
- In a Single Run, multiple Single runs are sometimes needed to reach the limit.

View Stat Pop Limit Menu on page 37.

Control Panel

Control Panel Parameters

Parameter	Selections	Default setting
Single	Run/Stop	Stop
Free Run	Run/Stop	Stop
New Acq (Single run)	Yes, No	Yes
Clear	None	None
Status at bottom of screen shows if sequencing, calc RjDj, stopping, or ready		

Results Menus

Results Menus

The application includes the following Results menu parameters:

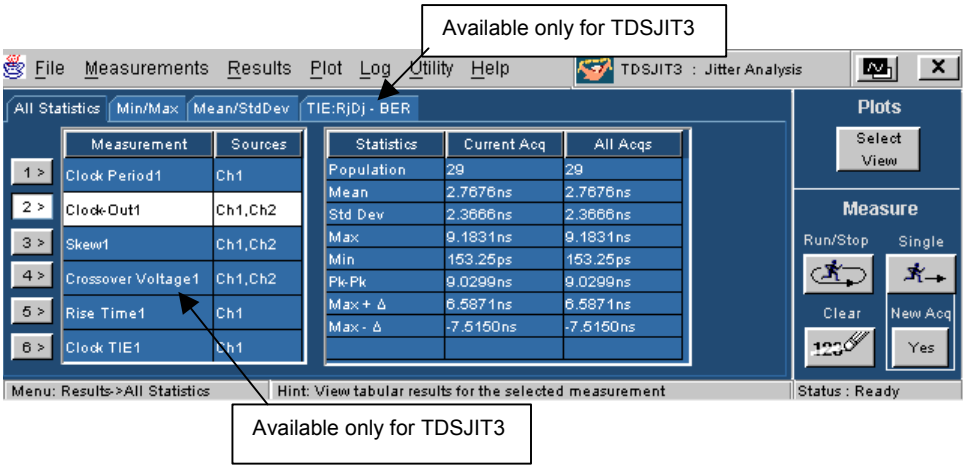
- All Statistics
- Min/Max
- Mean/Std Dev
- TIE: RjDj - BER

Results: All Stats Menu Parameters

Selecting a measurement tab displays all calculated statistics for that measurement for the current acquisition and for all acquisitions.

View Results: All Stats Menu

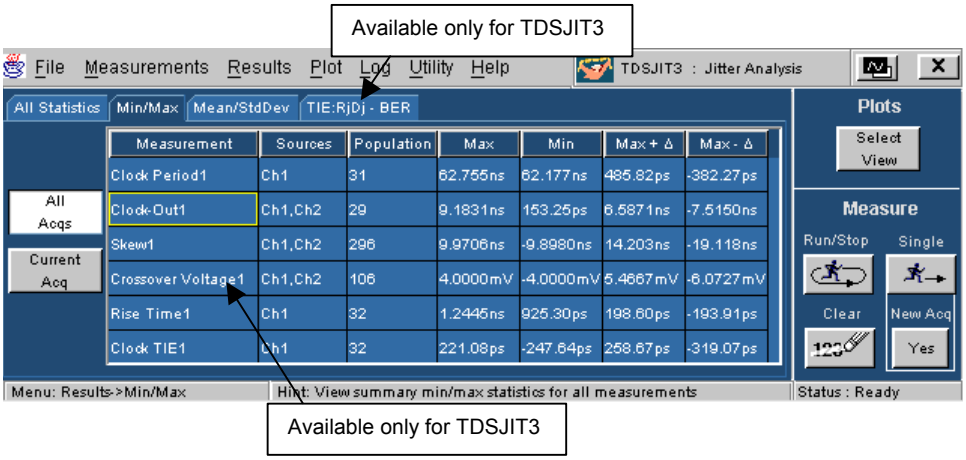
Results: All Stats Menu



Results: Min/Max Menu Parameters

Parameter	Selections	Default Setting
Selection of Acquisition type	All Acqs, Current Acqs	All Acqs

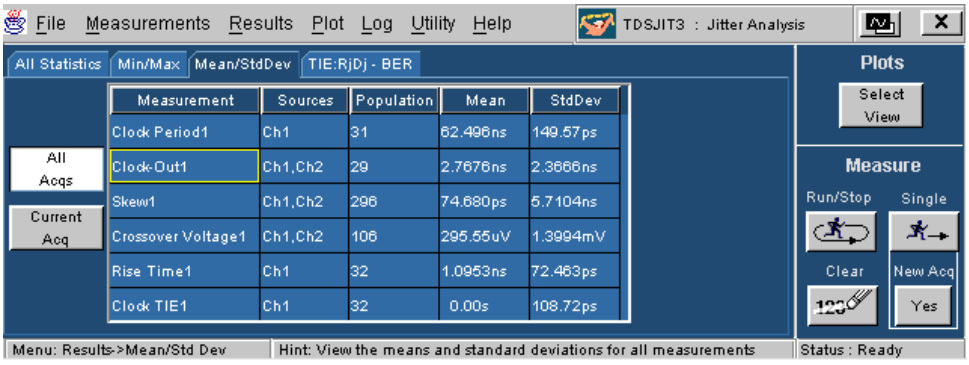
Results: Min/Max Menu



Results: Mean/Std Dev Menu Parameters

Parameter	Selections	Default Setting
Selection of Acquisition type	All Acqs, Current Acqs	All Acqs

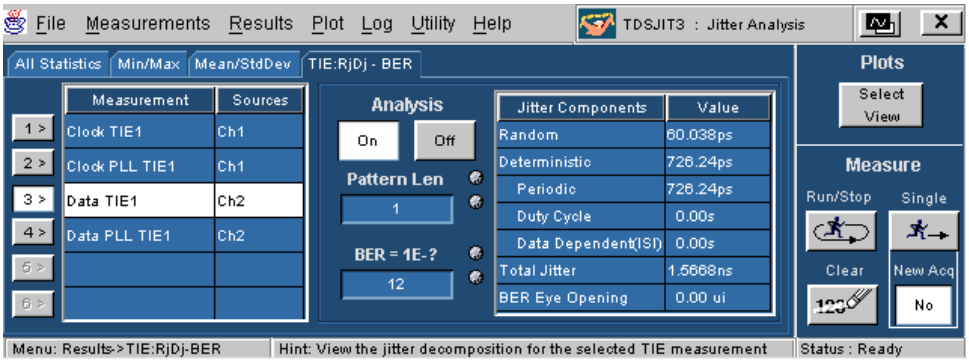
Results: Mean/Std Dev Menu



Results TIE: RjDj - BER Menu Parameters (Available only for TDSJIT3)

Parameter	Selections	Default setting
RjDj results are only available for Clock TIE, Clock PLL TIE, Data TIE, Data PLL TIE		
RjDj Analysis	Off, On	Off
Pattern Length	1 to 5000 in units of 1	1
Target BER:1.E-N	2 to 15 in units of 1	12

Results: TIE RjDj-BER Menu (Available only for TDSJIT3)



Plot Menus

Plot Create Menu Parameters

The Plot Create menu contains the following parameters:

- List of Active Measurements. (Select a measurement and select a plot type.)
- Add Plot type options: Histogram, Time Trend, Cycle Trend, Spectrum, and Bathtub[1]

Note: Bathtub plot only applies to TIE and PLL TIE type measurements.[1]

[1] Bathtub plots are available only for TDSJIT3.

Plot Vert/Horiz Axis Parameters

Parameter	Selections	Default Setting
Histogram		
Vertical Scale	Log Linear	Linear
No of Bins	25, 50, 100, 250, 500	50
Horizontal Scale		
Center: Positive Time Only	1 ps to 1 s in 1 ps units	100 ns
Center: Pos/Neg Time	-500 ns to 500 ns in 1 ps units	0 s
Center: Frequency	1 Hz to 10 GHz in 1 Hz units	5 GHz
Center: Duty Cycle	0% to 100% in 5M% units	50%
Center: Pos/Neg Volts	-1 V to 1 V in 1 mV units	0 V
Span: Positive Time Only	1 ps to 1 s in 1 ps units	4 ns
Span: Pos/Neg Time	1 ps to 1 s in 1 ps units	4 ns
Span: Frequency	1 Hz to 10 GHz in 1 Hz units	5 GHz
Span: Duty Cycle	0% to 100% in 5M% units	50%
Span: Pos/Neg volts	0 V to 1 V in 1 mV units	10 mV
Time Trend		
Mode	Vector, Bar	Vector
Spectrum		
Vertical Scale	Log, Linear	Log
Baseline	-20 dB to 15 dB in 0.5 dB units	Autoset
Window Data	None, Hanning	Hanning
Bathtub (Available only for TDSJIT3)		
Vertical Scale	Log, Linear	Log
Minimum Displayed BER=1.0e-? (for Log only)	2 to 15 in 1 units	12

Log Menu

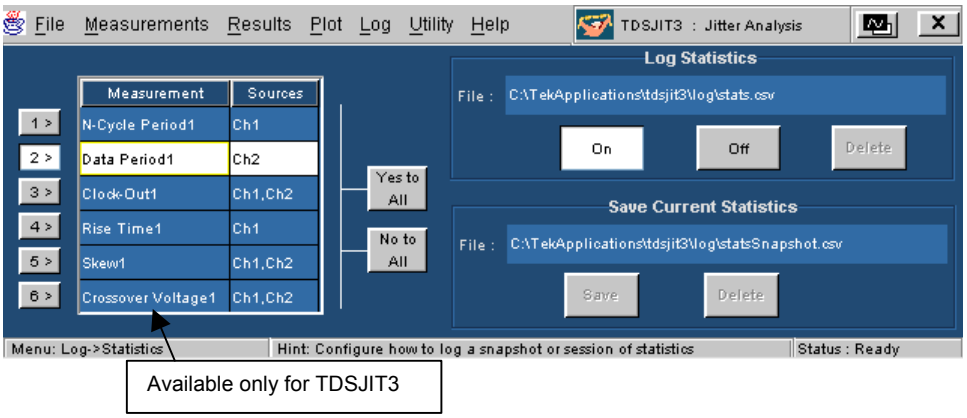
Log: Measurements Menu Parameters

Parameter	Selections	Default setting
Log Measurements		
Directory Path		C:\TekApplications\tdsjit3\measurements
On/Off button	On,Off	Off
Save Current Measurements		
Directory Path	Save button	C:\TekApplications\tdsjit3\measurements Snapshot

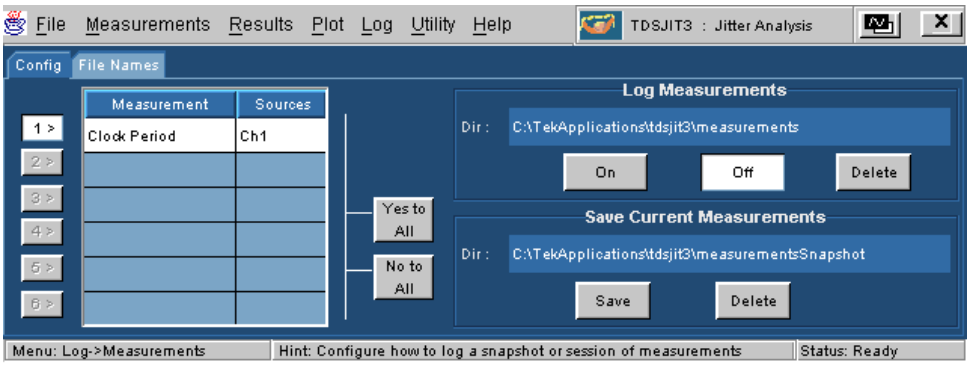
Log Statistics Menu Parameters

Parameter	Selections	Default setting
Log Statistics		
File: path and name	Any	C:\TekApplications\tdsjit3\log\stats.csv
On/Off Button*	On, Off, Delete	Off
Save Current Statistics		
File: path and name	Any	C:\TekApplications\tdsjit3\log\rStatsSnapshot.csv
Save button	Save	None
Delete button	Browse to delete individual .csv files	None
***On saves statistics continuously until turned off**		

Log: Statistics Menu



Log Measurements Menu



Log Worst Case Waveforms Menu Parameters

Parameter	Selections	Default setting
On/Off		Off
Select Directory: Browse	Any directory	C:\TekApplications\tdsjit3\waveforms
Delete	Browse to delete individual .wfm files	None

Utility Menu

Utility Deskew Menu Parameters

Parameter	Selections	Default setting
Specify Deskew Sources	Reference Source (Ch1-Ch4)	Mid=-20µV to 20mV in units of 1µV
		Hysteresis=1µV to 30µV in units of 1 µV
	Target Source (Ch1-Ch4)	Mid=0V Hysteresis=10mV
Use Edges	Rise Fall Both	Rise
Deskew Range		
Max Value	-24.9ns to 25.0ns in units of 1ns	1µs to - 1µs in units of 1µs
Min Value	-25ns to 23.9 ns in 100 ps units	-1ns
Summary	Popup of source and resultant deskew value	None

Utility Acq Timeout Menu Parameters

Parameter	Selections	Default setting
Acquisition Timeout *	30 s to 24hrs in 30s units	Auto 30s
***In user mode TDSJIT3 waits until the Acq Timeout value for a signal before stopping a Single or Free Run with an error of failed to acquire signal.**		

Utility Warnings Menu Parameters

Parameter	Selections	Default setting
Warning History	View* Clear	None
***View allows you to view messages in Notepad. To save the file from Notepad.**		

Help Menu

Help Menu

There are no parameters for the Help Menu.

Measurement Algorithms

About Measurement Algorithms

The TDSJIT3 application can take timing measurements from one or two waveforms. The number of waveforms used by the application depends on the type of measurement being taken. Thus, there are Types of Single Waveform Measurements and Types of Dual Waveform Measurements.

See Also

Oscilloscope Setup Guidelines

Test Methodology

Edge-Timing Measurements

Oscilloscope Setup Guidelines

For all measurements, use the following guidelines to set up the oscilloscope:

1. The signal is any channel, reference, or math waveform.
2. The vertical scale for the waveform must be set so that the waveform does not exceed the vertical range of the oscilloscope.
3. The sample rate must be set small enough to capture sufficient waveform detail and avoid "aliasing."
4. Longer record lengths increase measurement accuracy (though at the same time decreasing measurement speed).

Test Methodology

The application performs the measurement according to the following steps:

1. Imports the current waveform.
2. Checks that the reference voltage level plus or minus half the hysteresis are within the 2.5% to 97.5% range of the peak-to-peak waveform values.
3. Checks that there are a minimum number of edges in the waveform to calculate the measurement as follows:
   - Single edge: Rise Time, Fall Time

- One edge pair: Pulse Width, High Time, Low Time
- Two cycle-start edges: Period, Frequency, Duty Cycle
- Three cycle-start edges: Cycle-to-Cycle, TIE, PLL TIE
- Clock TIE and PLL TIE measurements require 500 edges for RjDj analysis[1]
- Data TIE and PLL TIE measurements require 100 Pattern Length edges[1]
- 2N + 1 cycle-start edges: N-Cycle
- Two edges on each of two waveforms: Skew, Crossover[1]

4. Performs the measurement.
5. Displays the results as statistics, or saves the results to a data log file.

Edge-Timing Measurements

All timing measurements are based on the time locations of edges within each acquisition. Edge conditions are defined in the setup menu of each timing measurement. Tn represents the acquisition edge times where *n* is an index between 1 and the number of edges in the acquisition.

The "i" and "j" represent dissimilar acquisition indices. Dissimilar acquisition indices occur when the correlation between clock edges and a data transitions are not one-to-one.

RjDj Measurement (available only for TDSJIT3)

The Rj/Dj measurement calculates the deterministic and random components of a jitter. The jitter is obtained from the TIE measurements. Rj is the random jitter. It is assumed to be Gaussian and has a flat spectrum. The Rj measurement calculates the standard deviation of the random jitter. Dj is the deterministic jitter. It is predictable and can be generated consistently given known circumstances. Dj has a spectrum of impulses when data signal has repeating pattern. The Dj measurement calculates the peak-to-peak value of the deterministic jitter. Tj is the total jitter, which is composed of Dj and Rj. The Tj measurement calculates the peak-to-peak value of the total jitter at the specified BER.

To obtain measurements of Dj and Rj, the application distinguishes the impulse bins from noise floor bins in the spectrum of total jitter.

The application calculates Rj measurement using the following equation:

Rj=Standard deviation(noise floor of jitter spectrum)

The application calculates Dj measurement using the following equation:

[1] These measurements are available only in TDSJIT3.

$$Dj = Max(Dj^{Time}) - Min(Dj^{Time})$$

Where: Dj is the deterministic jitter.

Dj^{Time} is the time domain record of Dj obtained by performing an inverse FFT on Dj spectrum which is composed of impulses.

- Dj is composed of ISI, DCD and Pj: [ISI is Inter-Symbol Interference. It is also called DDj (Data Dependent Jitter). The ISI measurement calculates the peak-to-peak value of the ISI.]
- [DCD is Duty Cycle Distortion.] It is the difference in the mean pulse width of positive pulse width compared to the mean pulse width of negative pulse width. The DCD measurement calculates the peak-to-peak value of the DCD. Pj is periodic jitter.
- The Pj measurement calculates the peak-to-peak value of the Pj.

For a data signal with a repetitive data pattern, Dj has a spectrum of impulses. All impulses due to ISI+DCD components must appear at multiples of 0.5/N where N is the data pattern length. Any remaining impulses are due to Pj.

The application distinguishes the impulses appear due to ISI+DCD and impulses due to Pj.

The application calculates Pj measurement using the following equation:

$$Pj = Max(Pj^{Time}) - Min(Pj^{Time})$$

Where: Pj is the deterministic jitter.

Pj^{Time} is the time domain record of Pj obtained by performing an inverse FFT on Pj spectrum.

The application calculates the time domain histogram of ISI+DCD for the rising edges and for the falling edges respectively.

The application calculates ISI measurement using the following equation:

$$ISI = \left(Max(H^{Rise}) - Min(H^{Rise}) + Max(H^{Fall}) - Min(H^{Fall})\right) / 2$$

$$DCD = \left| Mean(H^{Rise}) - Mean(H^{Fall}) \right|$$

Where: ISI is the inter-symbol interference.

DCD is the duty cycle distortion.

H^{Rise} is the time domain histogram of ISI+DCD for the rising edges.

H^{Fall} is the time domain histogram of ISI+DCD for the falling edges.

See BER and Tj Estimation below on page 93.

BER and Tj Estimation (available only for TDSJIT3)

The BER Estimation calculates the bit error rate curve and the eye open for given bit error rate. After the Rj/Dj separation, the recovered histogram of the total jitter can be computed. The recovered Tj histogram, when properly normalized, can be interpreted as the probability density function (PDF) of the Tj.

Integration of the PDF yields the CDF, which can then be used to create the bit error rate curve (bathtub curve). Based on the bathtub curve, the eye opening can be estimated for a given bit error rate.

The application calculates to recovered total jitter histogram using the following equation:

$$H^{Tj} = H^{Dj} \otimes H^{Rj}$$

Where: H^{Tj} is the recovered histogram of total jitter.

H^{Tj} is the histogram of Dj and is computed from the time record of Dj after the RjDj separation.

H^{Rj} is the histogram of Rj and is synthesized based on its Gaussian model after the RjDj separation.

The application calculates the Tj at the specified BER using the following equation:

Tj = (1-eye opening) * UI

Where UI is the unit interval in seconds.

See Also

RjDj Measurement

Single Waveform Measurements

About Single Waveform Measurements

Conditions are defined for one waveform.

See Also

Oscilloscope Setup Guidelines on pages 90, 93

Test Methodology on pages 90, 93

Edge-Timing Measurements on pages 90, 92, and 93

Single Waveform Measurements

Rise Time	Clock Period	Positive Duty Cycle
Fall Time	Clock Frequency	Negative Duty Cycle
Positive Width	Cycle–Cycle	Clock TIE, PLL TIE
Negative Width	N–Cycle	Data Period
High Time	Positive Cycle–Cycle Duty	Data Frequency
Low Time	Negative Cycle–Cycle Duty	Data TIE, Data PLL TIE

Note

PLL TIE is available only for TDSJIT3.

Rise Time Measurement

The Rise Time measurement is the time difference between when the VRefHi reference level is crossed and the VRefLo reference level is crossed on the rising edge of the waveform. The Rise Time algorithm uses the VRef values as the reference voltage level. Each edge is defined by the slope, voltage reference level (threshold), and hysteresis.

The application calculates this measurement using the following equation:

$$T_n^{Rise} = T_n^{Hi+} - T_n^{Lo+}$$

Where: T^{Rise} is the rise time.

T^{Hi+} is the VRefHi crossing on the rising edge.

T^{Lo+} is the VRefLo crossing on the rising edge.

Fall Time Measurement

The Fall Time measurement is the time difference between when the VRefLo reference level is crossed and the VRefHi reference level is crossed on the falling edge of the waveform. The Fall Time algorithm uses the VRef values as the reference voltage level. Each edge is defined by the slope, voltage reference level (threshold), and hysteresis.

The application calculates this measurement using the following equation:

$$T_n^{Fall} = T_n^{Lo-} - T_n^{Hi-}$$

Where: T^{Fall} is the fall time.

T^{Lo-} is the VRefLo crossing on the falling edge.

T^{Hi-} is the VRefHi crossing on the falling edge.

Positive and Negative Width Measurements

The Positive Width and the Negative Width measurements are the difference in time (positive or negative) between the leading edge and trailing edge of a pulse. The trailing edge is the opposite polarity (direction) of the leading edge.

The application calculates these measurements using the following equations:

$$W^{+}_{n} = T^{-}_{n} - T^{+}_{n}$$

$$W^{-}_{n} = T^{+}_{n} - T^{-}_{n}$$

Where: W^{+} is the positive pulse width.

W^{-} is the negative pulse width.

T^{-} is the VRefMid crossing on the falling edge.

T^{+} is the VRefMid crossing on the rising edge.

High Time Measurement

The High Time Measurement is the amount of time that a waveform cycle is above the VRefHi voltage reference level.

The application calculates the measurement using the following equation:

$$T^{Hi}_{n} = T^{Hi-}_{n} - T^{Hi+}_{n}$$

Where: T^{Hi} is the high time.

T^{Hi-} is the VRefHi crossing on the falling edge.

T^{Hi+} is the VRefHi crossing on the rising edge.

Low Time Measurement

The Low Time measurement is the amount of time that a waveform cycle is below the VRefLo voltage reference level.

The application calculates this measurement using the following equation:

$$T^{Low}_{n} = T^{Lo+}_{n} - T^{Lo-}_{n}$$

Where: T^{Low} is the low time.

T^{Lo+} is the VRefLo crossing on the rising edge.

T^{Lo-} is the VRefLo crossing on the falling edge.

Clock Frequency Measurement

The Clock Frequency measurement calculates the inverse of the clock period for each cycle.

The application calculates this measurement using the following equation:

$$F_n^{Clock} = 1/P_n^{Clock}$$

Where: F^{Clock} is the clock frequency.

P^{Clock} is the period.

Clock Period Measurement

The Clock Period measurement calculates the duration of a cycle as defined by a start and a stop edge. Edges are defined by slope, threshold, and hysteresis.

The application calculates this measurement using the following equation:

$$P_n^{Clock} = T_{n+1} - T_n$$

Where: P^{Clock} is the clock period.

T is the VRefMid crossing time in the Common Cycle Start Edge direction.

Clock Cycle-to-Cycle Measurement

The Clock Cycle–to–Cycle measurement calculates the difference in period measurements from one cycle to the next.

The application calculates this measurement using the following equation:

$$\Delta P_n = P_{n+1}^{Clock} - P_n^{Clock}$$

Where: ΔP is the difference between adjacent periods.

P^{Clock} is the period.

Clock N-Cycle Measurement

The N-Cycle measurement calculates the difference in clock period measurements from cycles that are a defined number of cycles apart.

The application calculates this measurement using the following equation:

$$\Delta NP_n = \left(T_{n+2N}^{+} - T_{n+N}^{+}\right) - \left(T_{n+N}^{+} - T_n^{+}\right)$$

Where: ΔNP is the difference between adjacent N–cycle periods.

T^+ is the VRefMid crossing time in the Common Cycle Start Edge direction.

Clock Positive and Negative Cycle to Cycle Duty Measurements

The Positive Cycle-to-Cycle Duty and Negative Cycle-to-Cycle Duty measurements calculate the ratio of the positive (or negative) portion of the cycle relative to the period from one cycle to the next.

The application calculates these measurements using the following equations:

$$\Delta W_n^+ = W_n^+ - W_{n-1}^+$$

$$\Delta W_n^- = W_n^- - W_{n-1}^-$$

Where: ΔW^+ is the positive cycle-to-cycle duty.

ΔW^- is the negative cycle-to-cycle duty.

W^+ is the positive pulse width.

W^- is the negative pulse width.

Clock Positive and Negative Duty Cycle Measurements

The Positive Duty Cycle and Negative Duty Cycle measurements calculate the ratio of the positive (or negative) portion of the cycle relative to the period.

$$D_n^+ = W_n^+ / P_n^{Clock}$$

$$D_n^- = W_n^- / P_n^{Clock}$$

The application calculates these measurements using the following equations:

Where: D^+ is the positive duty cycle.

D^- is the negative duty cycle.

W^+ is the positive pulse width.

W^- is the negative pulse width.

P^{Clock} is the period.

Clock TIE Measurement

The Clock TIE measurement calculates the difference in time between the designated edge on a sampled clock waveform to the designated edge on a calculated clock waveform with a constant frequency (zero jitter).

The application calculates this measurement using the following equation:

$$TIE_n^{Clock} = T_n - T_n'$$

Where: TIE^{Clock} is the clock time interval error.

Tn is the specified clock edge.

T ′n is the calculated ideal clock edge.

Clock PLL TIE Measurement (available only for TDSJIT3)

The Clock PLL TIE measurement calculates the difference in time between the designated edge on a sampled clock waveform to the designated edge on a clock waveform calculated by means of a PLL. Low frequency TIE components that are within the loop bandwidth of the PLL are tracked by the PLL and thereby removed.

The application calculates this measurement using the following equation:

$$TIE_n^{Clock} = T_n - T_n'$$

Where: TIE^{Clock} is the clock time interval error.

T_n is the specified clock edge.

T'_n is the recovered clock edge by means of a PLL.

Data Frequency Measurement

The Date Frequency measurement calculates the inverse of the data period for each cycle.

The application calculates this measurement using the following equation:

$$F_n^{Data} = 1/P_n^{Data}$$

Where: F^{Data} is the data frequency.

P is the period.

Data Period Measurement

The Date Period measurement calculates the duration of a cycle as defined by a start and a stop edge. Edges are defined by slope, threshold, and hysteresis.

The application calculates this measurement using the following equation:

$$P^{Data} = \left(T_n^{Data} - T_{n-1}^{Data}\right) / \left(C_n - C_{n-1}\right)$$

Where: P^{Data} is the data period.

T^{Data} is the VRefMid crossing time in either direction.

C_n is the calculated clock cycle location of T^{Data}_n.

Data TIE Measurement

The Data TIE measurement calculates the difference in time between the designated edge on a sampled data waveform to the designated edge on a calculated data waveform with a constant frequency (zero jitter).

The application calculates this measurement using the following equation:

$$TIE_n^{Data} = T_n^{Data} - T_n^{Data'}$$

Where: TIE^{Data} is the data time interval error.

T^{Data} is the data edge, the VRefMid crossing time in either direction.

T^{Data} is the calculated ideal data edge time.

Data PLLTIE Measurement (available only for TDSJIT3)

The Data PLL TIE measurement calculates the difference in time between the designated edge on a sampled data waveform to the designated edge on a data waveform calculated by means of a PLL. Low frequency TIE components that are within the loop bandwidth of the PLL are tracked by the PLL and thereby removed.

The application calculates this measurement using the following equation:

$$TIE_n^{Data} = T_n^{Data} - T_n^{Data'}$$

Where: TIE^{Data} is the data time interval error.

T^{Data} is the data edge, the VRefMid crossing time in either direction.

T^{Data} is the recovered data edge by means of a PLL.

Dual Waveform Measurements

About Dual Waveform Measurements

Edge conditions are defined for two waveforms. These algorithms use the VRef values as the reference voltage level. Each edge is defined by the slope, voltage reference level (threshold), and hysteresis.

See Also

Oscilloscope Setup Guidelines on pages 90, 93

Test Methodology on pages 90, 93

Edge-Timing Measurements on pages 90, 92, and 93

Dual Waveform Measurements

Setup Time
Hold Time
Clock-Out
Skew
Crossover Voltage

Setup Time Measurement

The Setup Time measurement is the elapsed time between the designated edge of a data waveform and when the clock waveform crosses its own voltage reference level. The closest data edge to the clock edge that falls within the range limits is used.

The application calculates this measurement using the following equation:

$$T_n^{Setup} = T_i - T_n^{Data}$$

Where: T^{Setup} is the setup time.

T is the Main input (clock) $VRefMid_{Main}$ crossing time in the specified direction.

T^{Data} is the 2nd input (data) $VRefMid_{2nd}$ crossing time in the specified direction.

Hold Time Measurement

The Hold Time measurement is the elapsed time between when the clock waveform crosses its own voltage reference level and the designated edge of a data waveform. The closest data edge to the clock edge that falls within the range limits is used.

The application calculates this measurement using the following equation:

$$T_n^{Hold} = T_n^{Data} - T_i$$

Where: T^{Hold} is the hold time.

T is the Main input (clock) $VRefMid_{Main}$ crossing time in the specified direction.

T^{Data} is the 2nd input (data) $VRefMid_{2nd}$ crossing time in the specified direction.

Clock-Out Measurement

The Clock–to–Output Time measurement is the elapsed time between when the clock waveform crosses its own voltage reference level and the designated edge of a data waveform. The closest data edge to the clock edge that falls within the range limits is used.

The application calculates this measurement using the following equation:

$$T_n^{ClkOut} = T_n^{do} - T_i$$

Where: T^{ClkOut} is the clock-to-output time.

T is the Main input (clock) $VRefMid_{Main}$ crossing time in the specified direction.

T^{do} is the 2nd input (data) $VRefMid_{2nd}$ crossing time in the specified direction.

Skew Measurement

The Skew measurement calculates the difference in time between the designated edge on a principle waveform to the designated edge on another waveform. The closest data edge to the clock edge that falls within the range limits is used.

The application calculates this measurement using the following equation:

$$T_n^{Skew} = T_n - T_n^S$$

Where: S is the period.

T is the Main input $VRefMid_{Main}$ crossing time in the specified direction.

T^s is the 2nd input $VRefMid_{2nd}$ crossing time in the specified direction.

Crossover Voltage Measurement (available only for TDSJIT3)

The Skew measurement calculates the voltage level at the crossover voltage of a differential signal pair. If there is timing jitter on one of the pair of signal lines relative to the other, the crossover point will be modulated by the jitter. Crossover times are determined from the math waveform (main-cross) for a reference level of 0V.

The application calculates this measurement using the following equation:

$$V_n^{Crossover} = V^{Main}(T_n^{Crossover})$$

Where: $V^{Crossover}$ is the crossover voltage.

V^{Main} is the voltage of the Main input.

$T^{Crossove}$ is the crossover time. It is the time when two waveforms crossover in the specified direction.

Calculating Statistics

Maximum Value

The application calculates this statistic using the following equation:

$$Max\ (X) = \text{Highest value of X}$$

Minimum Value

The application calculates this statistic using the following equation:

$$Min\ (X) = \text{Lowest value of X}$$

Mean Value

The application calculates this statistic using the following equation:

$$Mean\ (X) = \overline{X} = \frac{1}{N}\sum_{n=1}^{N} X_n$$

Standard Deviation Value

It may seem odd that the equation for the estimate of the Standard Deviation contains a 1/(N-1) scaling factor. If you knew the true mean of X and used in place of the estimated mean $\overline{X}$, then you would, in fact, scale by1/N. But, $\overline{X}$ is an estimate and is likely to be in error (or bias), causing the estimate of the Standard Deviation to be too small I scaled by 1/N. This is the reason for the scaling shown in the equation. (Refer to Chapter 9.2 in A. Papoulis, *Probability, Random Variables, and Stochastic Processes*, McGraw Hill, 1991.)

The application calculates this statistic using the following equation:

$$Standard\ Deviation\ (X) = \sigma_x = \sqrt{\frac{1}{(N-1)}\sum_{n=1}^{N}(X_n - \overline{X})^2}$$

Max Positive and Negative Difference Values

The application calculates the Max Positive Difference Value using the following equation:

$$Max\ (X_{CC}) = \text{Highest value of } X_{CC}$$

The application calculates Max Negative Difference Value using the following equation:

$$Max\ (-X_{CC}) = -\text{Lowest value of } X_{CC}$$

The Cycle-Cycle Value below is not displayed, but is used in calculations for Max Positive and Max Neg calculations.

$$X_{CC_n} = X_n - X_{n-1}$$

Population Value

The application calculates this statistic using the following equation:

$$Population\ (X) = N$$

GPIB Programming

GPIB Command Syntax

Introduction to GPIB Command Syntax

With knowledge of the GPIB command syntax, you can design a GPIB program to do the following tasks:

- Start the TDSJIT3 application
- Recognize an active application with GPIB protocol

- Program and read application setup parameters
- Sequence measurements
- Read measurement results

See Also

GPIB Reference Materials below

Variable:Value Jitter3 Command on page 104

Variable Value Jitter3 Command Arguments and Queries beginning on page 105

Measurements Results Queries on page 108

GPIB Reference Materials

To use GPIB commands with your oscilloscope, you can use the following reference materials:

- The tdsjit3ctrl.c file on the oscilloscope hard drive (located in the C:\Program Files\TekApplications\tdsjit3 directory) and optional applications compact disc for an example of a GPIB program that can execute the application
- The GPIB Program Example section for guidelines to use while designing a GPIB program
- The Parameters Reference section for incremental units and default values of TDSJIT3 parameters
- The programmer information in the online help of your oscilloscope

See Also

Variable:Value TDS Command on page 108

Starting and Setting Up the Application Using GPIB

To start the TDSJIT3 application, you must send the oscilloscope the following GPIB command:

```
application:activate "Jitter Analysis 3"
```

The application uses the GPIB VARIABLE:VALUE command with arguments to execute some features. The set of GPIB commands does not include the variable names and variable values necessary to select and configure the measurements in the GPIB program.

You must manually set up the application and oscilloscope, selecting and configuring the measurements that you want to use with your GPIB program, and save them in a setup file. To save a setup file, refer to the topic, How to Save and Recall Setups. Use the name of the saved setup file as the value for the "recallName" variables in your GPIB program.

See Also

Variable: Value Jitter3 Command below

Variable:Value TDS Command Arguments and Queries beginning on page 105

Variable: Value Jitter3 Command

Description

This command accepts string arguments for a control or data variable and a value to which to set the argument.

Syntax

VARIABLE:VALUE "<variable name>","<variable value>"

Note:

The arguments <variable name> and <variable value> are required in the order indicated.

VARIABLE:VALUE? <variable name> for query.

 **CAUTION.** Commands are case and space sensitive. Your program will not operate correctly if you do not follow the capitalization and spacing precisely.

See Also

Variable Value Jitter3 Command Arguments and Queries beginning on page 105

Measurements Results Queries on page 108

Variable:Value Jitter3 Command Arguments and Queries - Part 1

Name	Value	Function	Query form returns
application	{exit}	Terminates the active application	Name of the currently active application
Sequencer			
sequencerMode	{MeasureOnly, FreeRun, Single}	Sets the sequencer mode	Sequencer mode
sequencerState	{Stop, Sequencing}	Send Measurement Sequencing command	{Most recent set, Ready} *Ready indicates sequencing has stopped
reset	{Results}	Clears the active measurement results and the plot displays	{Most recent set, Read} *Ready indicates results have been cleared
Save/Recall			
Setup*	{Default, Recall}	Performs the Recall of default or Recall of setup in Recall name	{Most recent setting, Ready} Read indicates both application .ini and oscilloscope .set files were recalled May return an error message
recallName *	Any string from 1 to 40 characters from A to Z and/or 0 to 9 or Special characters like "."	Sets the recalled setup file name. Filename extension .ini is optional. The directory location of the file is the default (\TekApplications\TDSJIT 3\setup) if the app has been started via GPIB or in the most recent recall directory accessed from the GUI	recall setup file name (without extension)
recallDirectory	Query only	Confirms the location of recalled setup files directory. The directory location of the recall file is either the default (\TekApplications\TDSJIT 3 \setup) if the app has been started via GPIB or in the most recent recalled directory selected from the GUI	Recalled setup files directory path. String limit is 40 characters. The middle of a longer string will be shortened to "…" to bring the string length to 40
***All queries that return Ready may return error text instead if an error is encountered**			

Variable: Value Jitter3 Command Arguments and Queries - Part 2

Name	Value	Function	Query form returns
logStatsDirectory	*Query only*	Confirms the location of log directory.	Log directory path. String limit is 40 characters. The middle of a longer string will be shortened to "…" to bring the string length to 40.
logStatsState	{On, Off}	Sets the state of the statistics log; when on, the statistics from the current acquisition are logged	Current value
logCurrentMeasurements	{Now}	Saves measurements into associated files	{*Most recent set*, Ready} Ready indicates measurement logging completed
logCurrentMeasurementsDirectory	*Query only*	Confirms the location of save measurements "now" directory. The directory location of the log file is either the default (\TekApplications\TDSJIT3 \measurementSnapshot) if the app has been started via GPIB or in the most recent log directory selected from the GUI.	Save measurements now directory path. String limit is 40 characters. The middle of a longer string will be shortened to "…" to bring the string length to 40.
logMeasurementsState	{On, Off}	Sets the state of the measurements log; when on, the measurements from the current acquisition are logged	Current value
logWorstcaseState	{On, Off}	Sets the state of the Worstcase log; when on, the Worstcase from the current acquisition are logged	Current value
logWorstcaseDirectory	*Query only*	Confirms the location of log worst case waveforms directory. The directory location of the log file is either the default (\TekApplications\TDSJIT3 \measurementSnapshot) if the app has been started via GPIB or in the most recent log directory selected.	Log worst case waveforms directory path. String limit is 40 characters. The middle of a longer string will be shortened to "…" to bring the string length to 40.

Variable: Value Jitter3 Command Arguments and Queries - Part 3

Name	Value	Function	Query from t
Result Variables			
ResultFor*	{Meas1, Meas2, Meas3, Meas4, Meas5, Meas6}	Specifies the measurement for which results are requested	Returns the selected measurement for the queries associated with resultFor**
resultAcq	{Current, All}	Specifies desired measure set: either the current acquisition or all (accumulated) acquisition.	Current value
TIE RjDj/BER***	Applies to the measurement selected by the resultFor command if it is a TIE measurement		
RjDjBER***	{On, Off}	Force the RjDj BER results to be updated.	Current value
RjDjBERTarget***	{range: 2…15, by 1}	Set the exponent component of the BER (i.e., $10^{-?}$)	Current value
*After sequencing, send the resultFor command prior to querying results. **If there are fewer than six measurements, then resultFor returns the previous setting when a Meas# is set that does not exist ***These commands are valid only for TDSJIT3.			

Variable: Value Jitter3 Command Arguments and Queries - Part 4

Variable Name	Value	Function	Query Form Returns
sourceScaleSelect	{C1, C2, C3, C4}	Selects the source to be autoscaled.	Current value
sourceScaleAutoset	{Vert, Horiz, All}	Starts autoset sequence	{Most recent set, Ready} Ready indicates that scale Autoset is complete
Source Ref Levels			
refLevelSelect	{C1, C2, C3, C4, R1, R2, R3, R4, M1, M2, M3, M4}	Selects the source ref level autoset.	Current value
refLevelAutoset	{Selected, All}	Starts autoset sequence. Selected autosets source specified by refLevelSelect and All operates on all active sources.	{Most recent set, Ready} Ready indicates Ref Level Autoset is complete
Logging Results			
logCurrentStats	{Now}	Updates the current statistics log file	{Most recent set, Ready} Ready stats logging is complete
LogCurrentStatsDestination	Any string from 1 to 40 characters from A to Z and/or 0 to 9 or Special characters like "."	Sets the current statistics log file name. Filename extension .csv is optional. The directory location of the file is the default (\TekApplications\TDSJIT3\log	Current file name. (without extension)
logCurrentStatsDirectory	Query only	Confirms the location of log directory. The directory location of the log file is either the default (\TekApplications\TDSJIT3 \log) if the app has been started via GPIB or in the most recent log directory selected	Log directory path. String limit is 40 characters. The middle of a longer string will be shortened to "…" to bring the string length to 40
LogStatsDestination	Any string from 1 to 40 characters from A to Z and/or 0 to 9 or Special characters like "."	Sets the statistics log file name. Filename extension .csv is optional. The directory location of the file is the default (\TekApplications\TDSJIT3\log	Current name name. (without extension)

logStatsDirectory	Querry only	Confirms the location of log directory.	Log directory path. String limit is 40 characters. The middle of a longer string will be shortened to "…" to bring the string length to 40.
logStatsState	{On, Off}	Sets the state of the statistics log; when on, the statistics from the current acquisition are logged	Current value
logCurrentMeasurements**	{Now}	Saves Measurements into associated files	{Most recent set, Ready} Ready indicates value has been processed.
logCurrentMeasurementsDirectory	Querry only	Confirms the location of save measurements "now" directory. The directory location of the log file is either the default (\TekApplications\TDSJIT3 \measurementSnapshot) if the app has been started via GPIB or in the most recent log directory selected from the GUI.	Save measurements now directory path. String limit is 40 characters. The middle of a longer string will be shortened to "…" to bring the string length to 40.
logMeasurementsState	{On, Off}	Sets the state of the measurements log; when on, the measurements from the current acquisition are logged	Current value
logWorstcaseState	{On, Off}	Sets the state of the Worstcase log; when on, the Worstcase from the current acquisition are logged	Current value
logWorstcaseDirectory	Querry only	Confirms the location of log worst case waveforms directory. The directory location of the log file is either the default (\TekApplications\TDSJIT3 \measurementSnapshot) if the app has been started via GPIB or in the most recent log directory selected from the GUI.	Log worst case waveforms directory path. String limit is 40 characters. The middle of a longer string will be shortened to "…" to bring the string length to 40.
Result Variables			

ResultAcq	{Current, All}	Specifies desired measure set: either the current acquisition or all (accumulated) acquisition.	Current value
TIE RjDj/BER	"Applies to the measurement selected by the resultFor command."		
rjDjBER	{On, Off}	Force the RjDj BER results to be updated.	Current value
rjDjBERTarget	{range: 2…15, by 1}	Set the exponent component of the BER (i.e., $10^{-?}$)	Current value

Measurements Results Queries

 Caution: Prior to doing measurement queries, insert a delay of a second after the resultFor and the resultAcq commands to allow the statistics variables to be refreshed.

You need to use the VARIABLE:VALUE? form to enter measurement results queries in your GPIB program. Before you can do this, you must first set the measurement with the resultFor command. You can select the Current or all acquisition statistics with the resultAcq command.

The Table below lists the measurement results queries for the measurement selected in the resultFor variable.

Variable name	For the measurement selected in the resultFor variable the query Returns the ….
measurement	"key,source(s)" pair. The key as an abbreviation for the selected measurement (e.g., "CP" for Clock Period. Source(s) is an abbreviation for the source or sources associated with the measurement (e.g., "C1" for Channel 1 or C1C2 for a measurement that requires both Channel 1 and Channel 2.
Statistics Results	Basic statistics applicable for all measurements.
measUnits	Return a units string for the measurement (e.g., "s" for seconds for Period).
max	Maximum measurement value
maxPosDev	Magnitude of the largest positive change of the measurement
maxNegDev	Magnitude of the largest negative change of the measurement
mean	Mean value of the result
min	Minimum measurement value
pkpk	Peak-to-peak measurement value (max - min)
population	Population (number of) measurements used to the current statistics
stdDev	Standard deviation measurement set
RjDj results	Applies to TIE type measurements only. For non-TIE measurements an empty string will be returned. For TIE measurements with RjDj turned off a null string is returned.
dataDependent	Data dependent jitter component of the TIE Jitter
dutyCycle	Duty cycle jitter component of the TIE Jitter
deterministic	Determinstic jitter component of the TIE Jitter
periodic	Periodic jitter component of the TIE Jitter
random	Estimated random jitter component of the TIE Jitter
totalJitter	Estimated total jitter component at the designated BER of the TIE Jitter
eyeOpening	Estimated eye opening at the designated BER of the TIE Jitter
Messages	String that returns if App has problems
error	General error.
measError	Measurement specific errors.
rjDjError	RjDj analysis related error.
warning	Warning, if any, from the last measurement taken

GPIB Program Example

About the GPIB Program

An example of a GPIB program that can execute the TDSJIT3 is included with the application. The oscilloscope hard disk and optional applications compact disc both contain the file, tdsjit3ctrl.c. On the hard drivethe file resides in the C:\Program Files\TekApplications\tdsjit3 directory.

This example shows how a GPIB program executes the application to do the following tasks:

- Start the application
- Recall a setup
- Enable logging
- Take a measurement
- Check for an error
- Exit the application

Guidelines to GPIB Programming

Your GPIB program should comply with the following guidelines:

- The application startup must complete before sending additional GPIB commands to the application (see example)
- The measurements cycle must complete before data is queried (see example).
- The error variable should be checked to ensure that an error has not occurred because of a measurement command problem
- GPIB event queue needs to be monitored. Make sure the event queue is clear before sending the next GPIB command to prevent event queue overflow

Display the Program Example**.**

See Also

Introduction to GPIB Command Syntax

GPIB Reference Materials

Variable:Value TDS Command

Variable:Value TDS Command Arguments and Queries

Measurements Results Queries

About the GPIB Program

Program Example

The reference program illustrates how to communicate to TDSJIT3 using Remote GPIB facilities.

The program includes the following steps:

1. Start up the application
2. Recall a setup
3. Take a measurement
4. Display results or errors
5. Exit the application

For the current program, we will recall a setup file named as (setup). You can save setup files according to your own needs using the GUI-based interface of the application.

```
*/


#ifdef __cplusplus
extern "C"{
```

```
#endif
#include <windows.h>
#include <stdio.h>
#include <stdlib.h>
#include "decl-32.h"
#ifdef __cplusplus
}
#endif

/* Forward Declarations */
int start_application(int scope);
int exit_application(int scope);
int do_single_test (int scope);
int recall_setup( int scope, char
*filename);
void display_results(int scope);

/* parameters needed to access the device
driver handler */
#define BDINDEX 0                    //
Board Index
#define PRIMARY_ADDR_OF_DMM 1    // Primary
address of device
#define NO_SECONDARY_ADDR 0      //
Secondary address of device
#define TIMEOUT T10s             // Timeout
value = 10 seconds
#define EOTMODE 1                    //
Enable the END message
#define EOSMODE 0                    //
Disable the EOS mode
char    ErrorMnemonic[21][5] =   {"EDVR",
"ECIC", "ENOL", "EADR", "EARG",

     "ESAC", "EABO", "ENEB", "EDMA", "",

     "EOIP", "ECAP", "EFSO", "", "EBUS",

     "ESTB", "ESRQ", "", "", "", "ETAB"};

/*
* After each GPIB call, the application
checks whether the call
* succeeded. If an NI-488.2 call fails, the
GPIB driver sets the
* corresponding bit in the global status
variable. If the call
* failed, this procedure prints an error
message, takes
```

```
* the device offline and exits.
*/

void GPIBCleanup(int ud, char* ErrorMsg)
{
      printf("Error : %s\nibsta = 0x%x iberr
= %d (%s)\n",
                  ErrorMsg, ibsta, iberr,
ErrorMnemonic[iberr]);
      if (ud != -1)
      {
            printf("Cleanup: Taking device
offline\n");
            ibonl(ud, 0);
      }
      exit(0);
}


int start_application( int scope ) {
      char write_buffer[100];
      char read_buffer[100];
      char app_name[] = "\"TDSJIT3\"\n";
      int status, timer;

      /* Start the Jitter Analysis
application */
      sprintf(write_buffer, "%s",
"Application:activate \"Jitter Analysis
3\"");
      status = ibwrt(scope, write_buffer,
strlen(write_buffer));
      if (ibsta & ERR){
            GPIBCleanup(scope, "Unable to
start the application");
            return 0;
      }

      timer = 1;
      while (1) {
      /* Check whether application has
started */
            sprintf(write_buffer, "%s",
"Variable:value? \"application\"");
            status = ibwrt(scope,
write_buffer, strlen(write_buffer));
            status = ibrd(scope,
read_buffer, sizeof(read_buffer));
            read_buffer[ibcnt] = '\0';
```

```
            if (strcmp(app_name,
read_buffer) == 0) {
                  return 1;
            }
            timer++;
            if (timer > 60) {
                  return 0;
            }
            Sleep(1000);
      }
      return 1;
}


int exit_application(int scope) {
      char write_buffer[100];
      printf("Exit Application ...\n");
      sprintf(write_buffer, "%s",
"Variable:value \"application\",\"exit\"");
      ibwrt(scope, write_buffer,
strlen(write_buffer));
      return 1;
}


int recall_setup(int scope, char* filename)
{
      char write_buffer[100];
      char readBuffer[100];
      int status;
      int timer;

      /* Set Recall file directory */
      sprintf(write_buffer, "%s",
"Variable:value
\"setupDirectory\",\"Default\"");
      status = ibwrt(scope, write_buffer,
strlen(write_buffer));
      if (ibsta & ERR){
            GPIBCleanup(scope, "Unable to
communicate with Scope");
            return 0;
      }

      Sleep(1000);

      /* Set Recall file name */
```

```
      sprintf(write_buffer, "%s%s%s",
"Variable:value \"recallName\",\"",
filename, "\"");
      status = ibwrt(scope, write_buffer,
strlen(write_buffer));
      if (ibsta & ERR){
            GPIBCleanup(scope, "Unable to
communicate with Scope");
            return 0;
      }

      Sleep(1000);

      /* Recall setup */
      sprintf(write_buffer, "%s",
"Variable:value \"setup\",\"Recall\"");
      status = ibwrt(scope, write_buffer,
strlen(write_buffer));
      if (ibsta & ERR){
            GPIBCleanup(scope, "Unable to
communicate with Scope");
      return 0;
      }

      /* Check whether recall is complete or
not...If recall is complete
      variable setup value will change to a
"Ready" string */
      timer = 1;
      while (1) {
            timer++;
            if (timer > 60) {
                  return 0;
            }
            Sleep(1000);
            sprintf(write_buffer, "%s",
"Variable:value? \"setup\"");
            ibwrt(scope, write_buffer,
strlen(write_buffer));
            ibrd(scope, readBuffer, 99);
            if (ibsta & ERR) {
                  GPIBCleanup(scope, "Unable
to write to device");
            }
            readBuffer[ibcnt] = '\0';
            if
(strcmp(readBuffer,"\"Ready\"\n") == 0) {
                  printf("Recall Complete
...\n");
```

```
                    return 1;
               }
               Sleep(1000);
          }
          return 1;
}


int do_single_test (int scope){
          char write_buffer[100];
          char read_buffer[100];
          int timer;
          sprintf(write_buffer, "%s",
"Variable:value
\"sequencerState\",\"Sequencing\"");
          ibwrt(scope, write_buffer,
strlen(write_buffer));
          printf("Executing Test...\n");
          Sleep(100);

          /* Wait for application to come to
Ready State */
          timer = 1;
          while (1) {
               timer++;
               if (timer > 90) {
                    printf("******Test Time Out
******\n");
                    return 0;
               }
               sprintf(write_buffer, "%s",
"Variable:value? \"sequencerState\"");
               ibwrt(scope, write_buffer,
strlen(write_buffer));
               ibrd(scope, read_buffer, 99);
               if (ibsta & ERR) {
                    GPIBCleanup(scope, "Unable
to write to device");
               }
               read_buffer[ibcnt] = '\0';
               if
(strcmp(read_buffer,"\"Ready\"\n") == 0) {
                    printf("Test Complete
...\n");
               return 1;
               }
               Sleep(1000);
          }
```

```
}


void display_results(int scope) {

     char write_buffer[100];
     char read_buffer[100];

     /* Check for errors */
     sprintf(write_buffer, "%s",
"Variable:value? \"error\"");
     ibwrt(scope, write_buffer,
strlen(write_buffer));
     ibrd(scope, read_buffer, 99);
     if (ibsta & ERR) {
          GPIBCleanup(scope, "Unable to
write to device");
     }
     read_buffer[ibcnt] = '\0';
     if (strcmp(read_buffer,"\"\"\n") != 0)
{
          printf("Error has Occured.
Error: %s\n",read_buffer);
     return;
     }

     /* If no error, check for results */
     sprintf(write_buffer, "%s",
"Variable:value \"resultFor\",\"Meas1\"");
     ibwrt(scope, write_buffer,
strlen(write_buffer));
     Sleep(2000);
     printf("\tFirst Measurement
Result\n");

     /*  Mean  */
     sprintf(write_buffer, "%s",
"Variable:value? \"mean\"");
     ibwrt(scope, write_buffer,
strlen(write_buffer));
     ibrd(scope, read_buffer, 99);
     read_buffer[ibcnt] = '\0';
     printf("mean:%s\n", read_buffer);

     /*  Max  */
     sprintf(write_buffer, "%s",
"Variable:value? \"max\"");
     ibwrt(scope, write_buffer,
strlen(write_buffer));
```

```
      ibrd(scope, read_buffer, 99);
      read_buffer[ibcnt] = '\0';
      printf("max:%s\n", read_buffer);

      /*  Min  */
      sprintf(write_buffer, "%s",
"Variable:value? \"min\"");
      ibwrt(scope, write_buffer,
strlen(write_buffer));
      ibrd(scope, read_buffer, 99);
      read_buffer[ibcnt] = '\0';
      printf("min:%s\n", read_buffer);

      /*  PkPk  */
      sprintf(write_buffer, "%s",
"Variable:value? \"pkpk\"");
      ibwrt(scope, write_buffer,
strlen(write_buffer));
      ibrd(scope, read_buffer, 99);
      read_buffer[ibcnt] = '\0';
      printf("pkpk:%s\n", read_buffer);

      /*  stdDev  */
      sprintf(write_buffer, "%s",
"Variable:value? \"stdDev\"");
      ibwrt(scope, write_buffer,
strlen(write_buffer));
      ibrd(scope, read_buffer, 99);
      read_buffer[ibcnt] = '\0';
      printf("stdDe:v%s\n", read_buffer);

      /*  population  */
      sprintf(write_buffer, "%s",
"Variable:value? \"population\"");
      ibwrt(scope, write_buffer,
strlen(write_buffer));
      ibrd(scope, read_buffer, 99);
      read_buffer[ibcnt] = '\0';
      printf("population:%s\n",
read_buffer);
}


int main(){

      int Dev;
      char write_buffer[100];
      int status;
```

```
      Dev = ibdev (BDINDEX,
PRIMARY_ADDR_OF_DMM, NO_SECONDARY_ADDR,
      TIMEOUT, EOTMODE, EOSMODE);
      if (ibsta & ERR){
            GPIBCleanup(Dev, "Unable to open
device");
      } else {
            printf("My device id - %i",
Dev);
      }
      sprintf(write_buffer, "%s", "header
off");
      status = ibwrt(Dev, write_buffer,
strlen(write_buffer));
      if (start_application(Dev)) {
            printf("\nApplication
started....\n");
      }
      Sleep(2000);
      recall_setup(Dev, "setup");
      Sleep(2000);
      do_single_test(Dev);
      /* Print the results */
      display_results(Dev);
      exit_application(Dev);
      /* leave the device back elegantly */
      printf("Cleanup: Taking device
offline\n");
      ibonl(Dev, 0);
```

Index

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

Z