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User Manual



TDSJIT1V2 Jitter Analysis Measurements Application 071-0875-00

This document supports software version 1.2.0
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General Safety Summary

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

Only qualified personnel should perform service procedures.

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

To Avoid Fire or Personal Injury

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

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

Terms in this Manual. These terms may appear in this manual:



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



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

Terms on the Product. These terms may appear on the product:

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

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

CAUTION indicates a hazard to property including the product.

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



CAUTION Refer to Manual

Preface

This manual contains operating information for the TDSJIT1V2 Jitter Analysis Application. The manual consists of the following chapters:

- The *Getting Started* chapter briefly describes the TDSJIT1V2 Jitter Analysis Application, lists oscilloscope compatibility, and provides installation instructions.
- The *Operating Basics* chapter covers basic operating principles of the application and includes a tutorial that teaches you how to set up the application to acquire a waveform, take measurements, and view the results.

To show you how to operate the application using GPIB commands, this chapter includes a simple GPIB program.

- The *Reference* chapter includes a diagram of the menu structure and descriptions of parameters.
- The *Measurement Algorithms* appendix contains information on measurement guidelines and on how the application takes the measurements.
- The *GPIB Command Syntax* appendix contains a list of arguments and values that you can use with the GPIB commands and their associated parameters.
- The *Error Codes* appendix contains a list of error codes, descriptions of the errors, and possible solutions to correct the problem.
- The *Example Program to Copy Large Files* appendix contains an example of a GPIB program you can use to transfer large files to a personal computer.

Related Documentation

The user manual for your oscilloscope provides general information on how to operate the oscilloscope.

Programmer information in the online help for your oscilloscope provides details on how to use GPIB commands to control the oscilloscope. You can also download the `tds6prog.zip` file (online help) with examples from the Tektronix web site. The file can be used for all supported oscilloscopes. Refer to *Updates Through the Web Site* on page 1–2 for information on how to download the file.

Conventions

This manual uses the following conventions:

- This manual refers to the TDSJIT1V2 Jitter Analysis Application as the TDSJIT1V2 application or as the application.
- When steps require that you make a sequence of selections using front-panel controls and menu buttons, an arrow (→) marks each transition between a front-panel button and a menu, or between menus. Names that are for a main menu or side menu item are clearly indicated: Press VERTICAL MENU → Coupling (main) → DC (side) → Bandwidth (main) → 250 MHz (side).

Contacting Tektronix

Phone	1-800-833-9200*
Address	Tektronix, Inc. Department or name (if known) 14200 SW Karl Braun Drive P.O. Box 500 Beaverton, OR 97077 USA
Web site	www.tektronix.com
Sales support	1-800-833-9200, select option 1*
Service support	1-800-833-9200, select option 2*
Technical support	Email: techsupport@tektronix.com 1-800-833-9200, select option 3* 1-503-627-2400 6:00 a.m. – 5:00 p.m. Pacific time

* This phone number is toll free in North America. After office hours, please leave a voice mail message.
Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.



Getting Started

Product Description

The TDSJIT1V2 Jitter Analysis Application is a Java™-based application that enhances basic capabilities of some Tektronix oscilloscopes.

The application provides jitter analysis measurements, can display the statistical results of up to six measurements, can display the results as plots, can save the results to a data log file, and can save the worst case waveforms to files.

Figure 1–1 shows an example of a Clock Period measurement displayed as a Histogram plot.

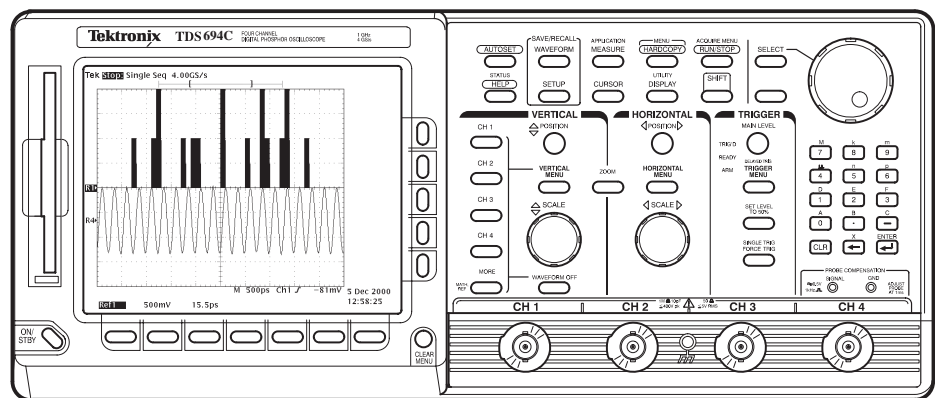


Figure 1–1: TDSJIT1V2 Jitter Analysis Application

Compatibility

The Jitter Analysis Application V 1.2.0 and above is compatible with the TDS694C oscilloscope with firmware version 6.2 and above, and with TDS784D and TDS794D oscilloscopes with firmware version 6.6e and above, or 7.2e and above depending on the acquisition board in the oscilloscope.

For information on how to get the current firmware, contact your local Tektronix distributor or sales office.

For a current list of compatible oscilloscopes, see the Software and Drivers category in the Tektronix, Inc. web site (www.tektronix.com).

Requirements and Restrictions

The TDS Run-Time Environment V1.2.0 or above must be installed on the oscilloscope to operate the TDSJIT1V2 application and use GPIB commands.

Updates Through the Web Site

You can find information about this and other applications at the Tektronix, Inc. web site. Check this site for application updates and for other free applications.

To install an application update, you will need to download it from the web site to a hard disk, copy it to a blank DOS-formatted floppy disk, and then install it on your oscilloscope.

NOTE. *More information about changes to the application or installation is in a Readme.txt file on the web site. You should read it before you continue.*

To copy an application from the web site, follow these steps:

1. Access www.tektronix.com/Measurement/Support/Scopes.
2. Scroll through the files to the application that you want, select the file, and download it to your hard disk drive. If necessary, unzip the file.

NOTE. *To ensure that the files were downloaded successfully, always unzip the files on a hard disk before copying them to a floppy disk.*

3. Copy the application from the hard disk to a blank, DOS-formatted floppy disk. Only copy one application on to one floppy disk.
4. Follow the *Installing the Application* procedure on page 1–3.

Accessories

There are no standard accessories for this product other than this manual.

Installation

This section contains information on the following tasks:

- Installing the application
- Deskewing probes and channels
- Connecting to a system under test

Installing the Application

The TDSJIT1V2 floppy disk contains the TDSJIT1V2 Jitter Analysis Application. You can download updates, if any, from the Tektronix ftp site through a web browser.

NOTE. To operate the TDSJIT1V2 application, the TDS Run-Time Environment V1.2.0 or above must be installed on the oscilloscope.

To install the application from the floppy disk to your oscilloscope, follow these steps:

1. Power off the oscilloscope.

NOTE. Additional information about the application or installation is located in a Readme.txt file on the floppy disk. You should insert the floppy disk into a DOS-based personal computer and read the Readme.txt file before you continue.

If you are updating the application, the Readme.txt file on the Tektronix ftp site supersedes the Readme.txt file on the TDSJIT1V2 floppy disk.

2. Insert the disk in the floppy disk drive, and power on the oscilloscope.

NOTE. To verify that the TDS Run-Time Environment V1.2.0 or above is installed, watch for the abbreviated name, RTE, and version number to appear at the top of the display when you power on the oscilloscope. If they do not appear, contact your local Tektronix sales office.

After performing the power-on selftest, the oscilloscope automatically begins the installation procedure.

As the application loads from the disk, the oscilloscope displays a clock icon to indicate that it is busy. Also, the floppy disk drive LED is on, indicating activity. If the clock icon continues to display after the floppy disk LED has gone out, a problem has occurred with the installation. Repeat the above procedure. If the problem persists, contact your Tektronix representative.

When the installation is complete, an Installation Complete message displays.

3. Remove the floppy disk, and cycle the power to the oscilloscope.

Deskewing the 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). Deskewing is where the oscilloscope adjusts the relative delay between signals to accurately time correlate the displayed waveforms.

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

The application includes an automated deskew utility that you can use to deskew any pair of oscilloscope channels. The following procedure describes how to deskew two channels. Channel 1 (and the probe connected to it) is the reference point used to deskew channel 2. The steps to deskew the third and fourth channels are the same.



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.*

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

1. Connect similar probes to CH 1 and CH 2 on the oscilloscope.
2. Connect the probes to the fastest signal in your SUT.
3. To set up the oscilloscope, press the AUTOSET front-panel button.

Figure 1–2 shows an example of signal path skew found in similar probes.

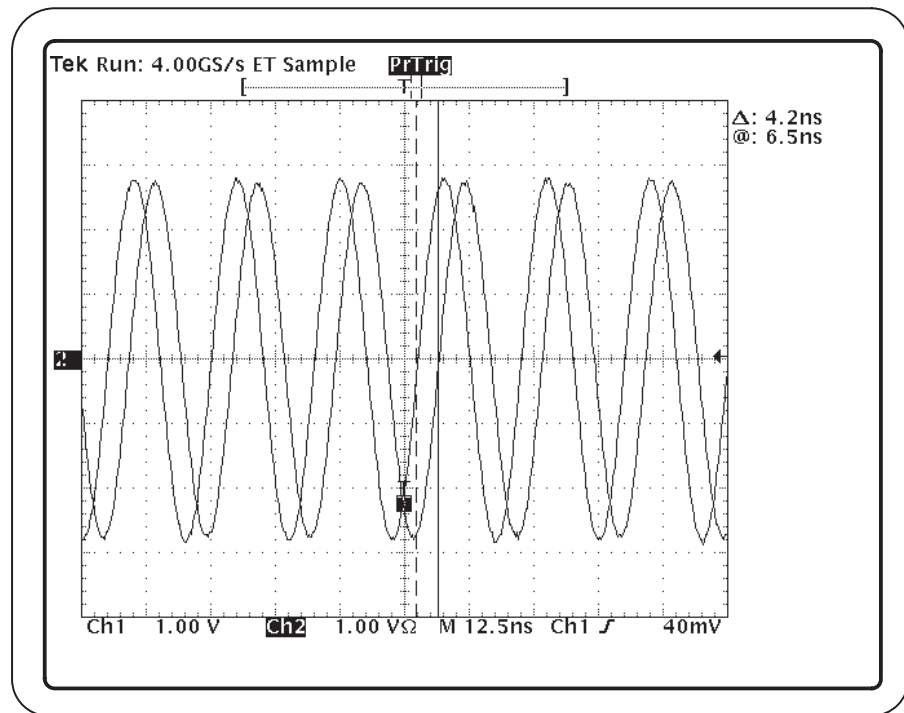


Figure 1-2: Typical signal path skew

4. Start the application as described on page 2–30.
5. Press Inputs (main) → Main (side) → Source (side) and select Ch1. The waveform displayed as the source for the Main Input is the reference point to which the remaining channels are deskewed.
6. Press Vertical Autoset (side). Figure 1–3 shows the results of a the Vertical Austoset.

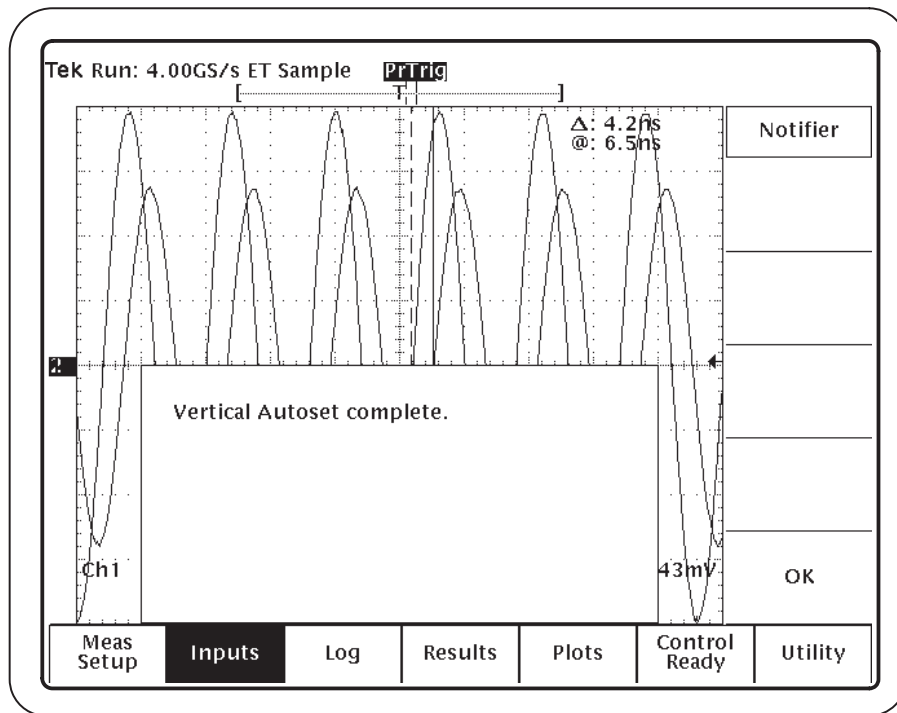


Figure 1-3: Vertical Autoset complete

7. Press OK (side).
8. Press Done (side).
9. Press 2nd (side) → Source (side) and select Ch2. The waveform displayed as the source for the 2nd Input is the channel to be deskewed.
10. Press Vertical Autoset (side) and then OK (side).
11. Press – more – 1 of 2 (side) → Deskew ... (side). Figure 1-4 shows how to access the Deskew menu. Figure 1-5 shows the Deskew menu.

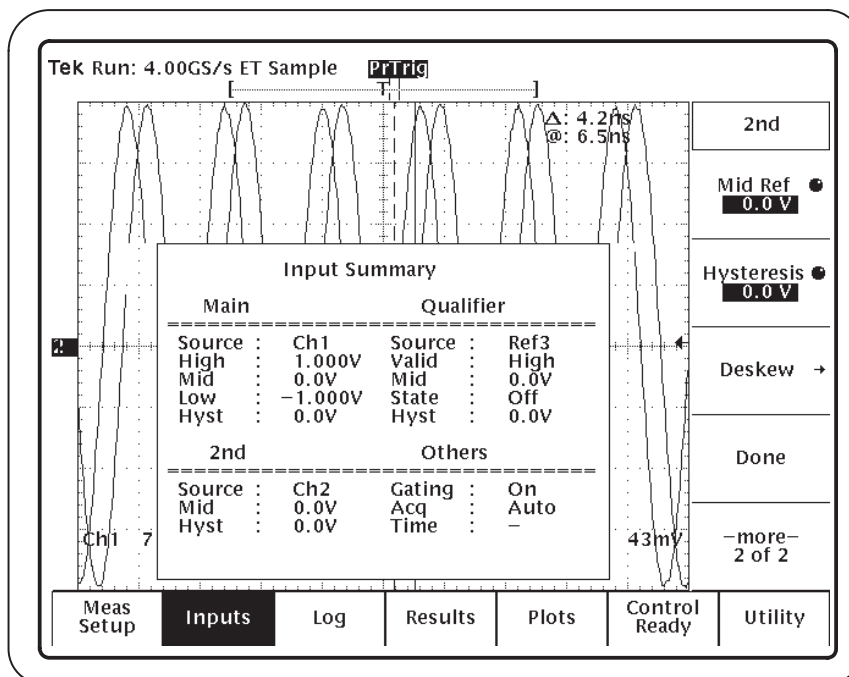


Figure 1-4: Accessing the Deskew utility

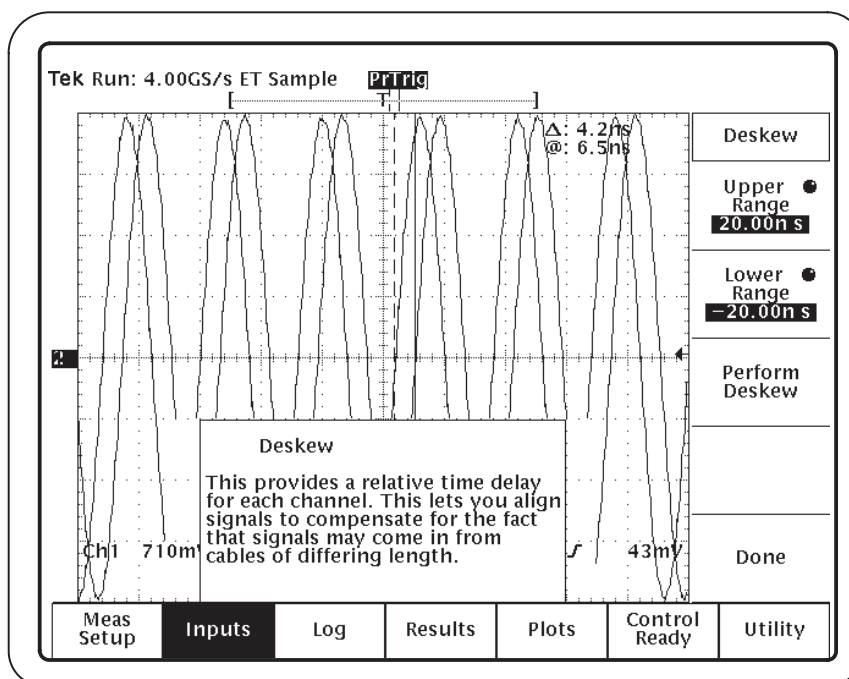


Figure 1-5: The Deskew menu

12. Enter appropriate values for the Upper Range and the Lower Range side menu items.
13. To start the deskew utility, press Perform Deskew (side).

Figure 1–6 shows an example of the utility when it is finished.

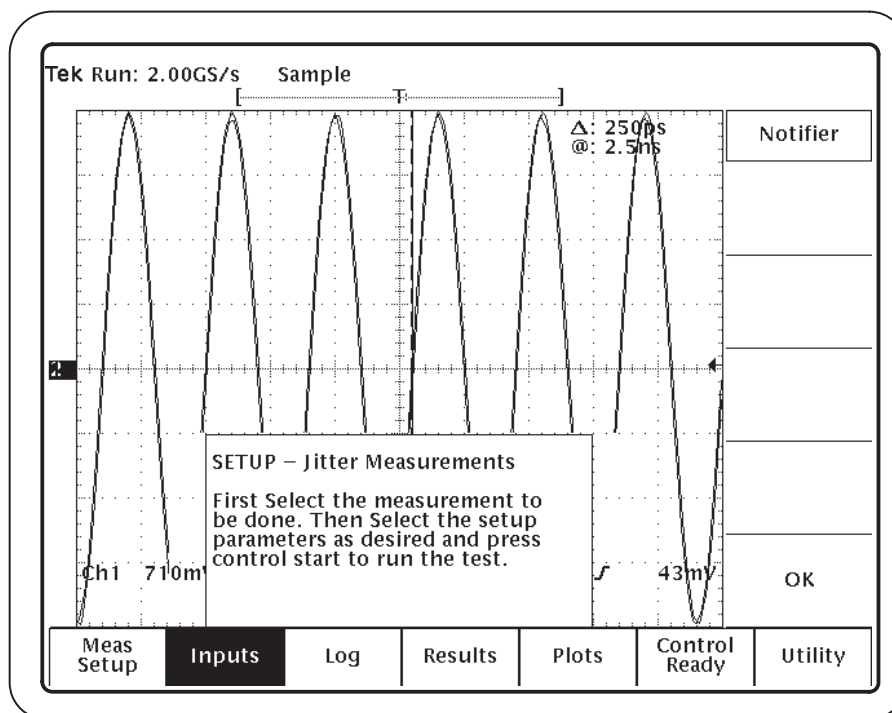


Figure 1–6: Deskewing complete

14. Press OK (side).

Figure 1–7 shows an example of using the oscilloscope V Bar cursors to measure the adjusted skew. In this example, the skew between channels 1 and 2 was reduced to 320 ps.

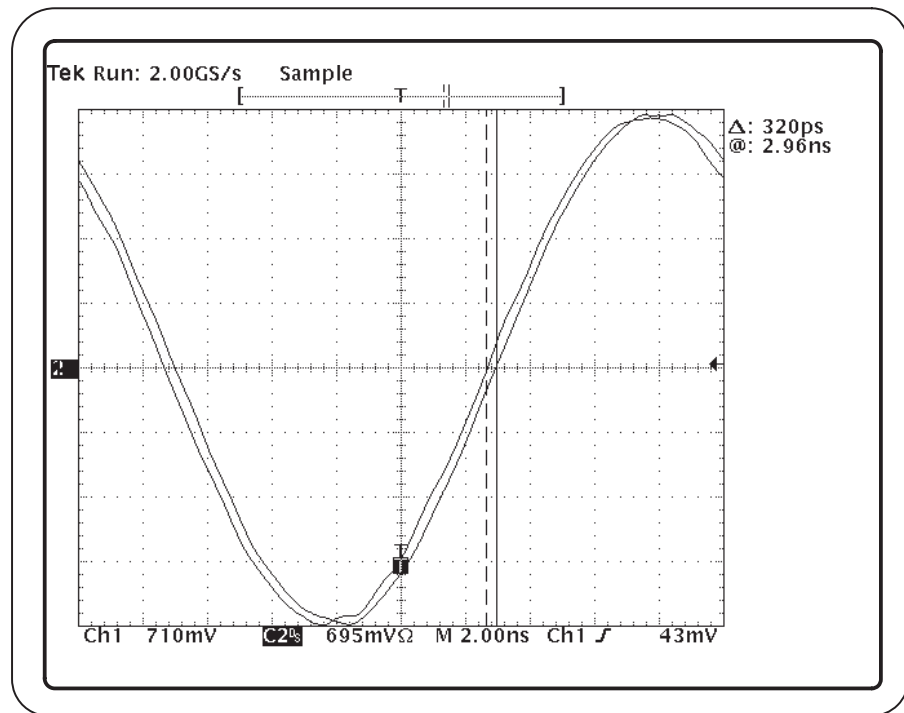


Figure 1-7: Adjusted skew

15. Press the SHIFT, and then the APPLICATION front-panel menu button to return to the application.
16. Do not change the Main Input Source channel, and deskew the remaining channels if you will be using them to take jitter measurements.

Connecting to a System Under Test

Although you can use any compatible probes to connect between your SUT (system under test) and oscilloscope, Tektronix P6330 3 GHz Differential probes and P6249 4 GHz Differential probes are recommended. One connection is usually to a clock signal.

The General, Clock, and Data measurements require one input waveform. The Clock-Data and the Ch-Ch measurements require two input waveforms.

Table 1–1 shows the default channel-to-waveform and reference waveform-to-plot assignments. You can change the assignments to match your configuration.

Table 1–1: Default waveform assignments

Channel or reference	Waveform assignment
Ch 1	Main input waveform, such as a clock signal
Ch 2	Second (2nd) input waveform
Ch 3	Qualifier input waveform
Ref1	Histogram plot format for the first measurement
Ref2	Time Trend plot format for the first measurement
Ref3	Cycle Trend plot format for the first measurement
Math1	Spectrum plot format for the first measurement



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.*

Power down the SUT before connecting the probes to it.



Operating Basics

Basic Operations

This section contains information on the following topics and tasks:

- Application interface
- Using basic oscilloscope functions
- Setting up the application
- Taking measurements
- Warning messages
- Analyzing the results
- Saving the results to a file
- Importing a data log file
- Saving and recalling setups
- Exiting the application

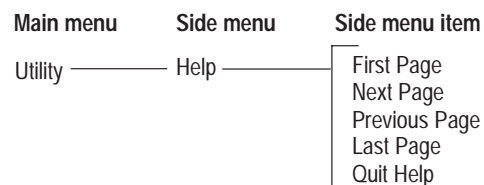
Application Menu Structure

There are two types of menus in the application menu structure: main menus and side menus. Some side menus contain common items as shown in Table 2–1.

Main and Side Menus

The main menu names appear in the bottom of the display, and the side menu names appear on the right side of the display. To see the complete application menu structure, refer to Figure 3–1 on page 3–1.

When you press the front-panel button associated with a main menu, the side menu changes. In many cases, when you press a side menu, new side menu items appear. As an example, the next figure shows you how to access the Help selections through the main Utility menu and the Help side menu.



Common Menu Items

Table 2–1 lists common side menu items.

Table 2–1: Common menu items

Menu item	Description
Cancel	Returns to the previous menu without performing the operation specific to the current menu
Done	Indicates that you are through making changes to that set of side menus; the application returns to the previous menu
OK	Confirms an action
–more– x of y	Scrolls to another page of a menu where x is the current page and y is the total number of pages

Utility Menus

Table 2–2 lists the Utility menus.

Table 2–2: Utility menus

Utility name	Description
Help	Accesses the online help pages and displays useful information on the application
Exit	Exits the application
Display Options	Accesses other menus where you can change display settings, such as whether the dialog box is opaque or transparent
Save/Recall Setup	Accesses the save and the recall menus for application setups

Using Basic Oscilloscope Functions

You can use the Utility menu to access help information about the application. You can also use other oscilloscope functions and easily return to the application.

Using Local Help

The application includes local help information about the measurements modes, with some explanation of the individual controls.

To display the local help, follow these steps:

1. Press Utility (main) → Help (side).
2. Use the side menu buttons to navigate through the help.

Returning to the Application

You can easily switch between the TDSJIT1V2 application and other oscilloscope functions.

To access other oscilloscope functions, press the desired front-panel control. To return to the application, press the **SHIFT** and then the **APPLICATION** front-panel menu buttons as shown in Figure 2–1.

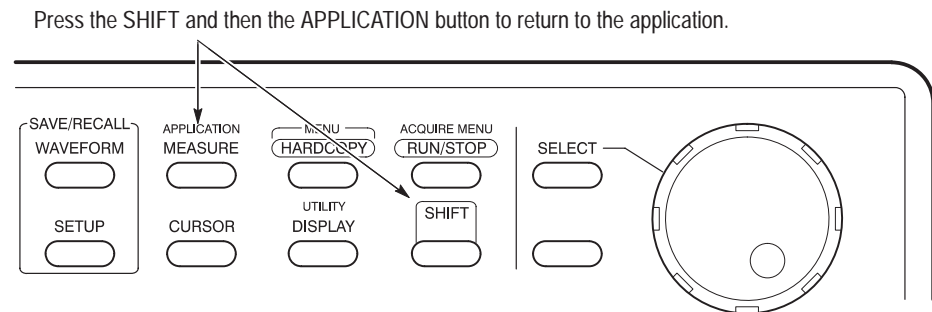


Figure 2–1: Returning to the application

Default Directories. Table 2–3 lists default directory names and their use.

Table 2–3: Default directory names

Directory name	Used for
hd0:/APP/TDSJITV2/TEMP	Setup files, data log files, and min/max waveform files
hd0:/WFMS	Waveform files used in the tutorial



WARNING. To avoid corrupting the application, do not access the **SYSTEM** directory. Some files are only for internal use by the application.

File Name Extensions. Table 2–4 lists file name extensions used or generated by the application.

Table 2–4: File name extensions

Extension	Type
.csv	Log file that uses a “comma separated variable” format
.wfm	Waveform file that can be recalled into a reference memory
.ini	Application setup file
.set	Oscilloscope setup file created by the application

Configuring the Display

You can change how dialog boxes appear on your oscilloscope, as well as the color of waveforms. The next figure shows how to access the Display Options menu, and Table 2–5 lists the options with a brief description of each.

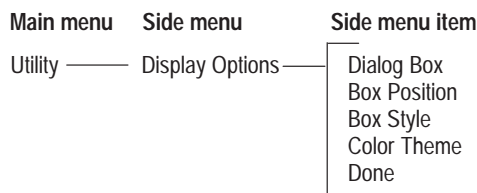


Table 2–5: Display Options menu selections

Selection	Description
Dialog Box	Makes dialog boxes visible or invisible
Box Position	Positions the dialog box in the display to the left, middle, or right
Box Style	Selects the style of dialog boxes to be opaque or transparent
Color Theme	Selects a set of colors for waveforms and dialog boxes; the application offers seven color themes

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 four formats, and save the statistical results or the worst case waveforms to a file to view later.

Selecting Measurements

The next figure shows how to access the selections in the Select Measurement side menu, and Table 2–6 lists the measurements with a brief description of each.

NOTE. You can choose the Clear All Selected side menu item to remove all the measurements in the Select Active Measurements menu.

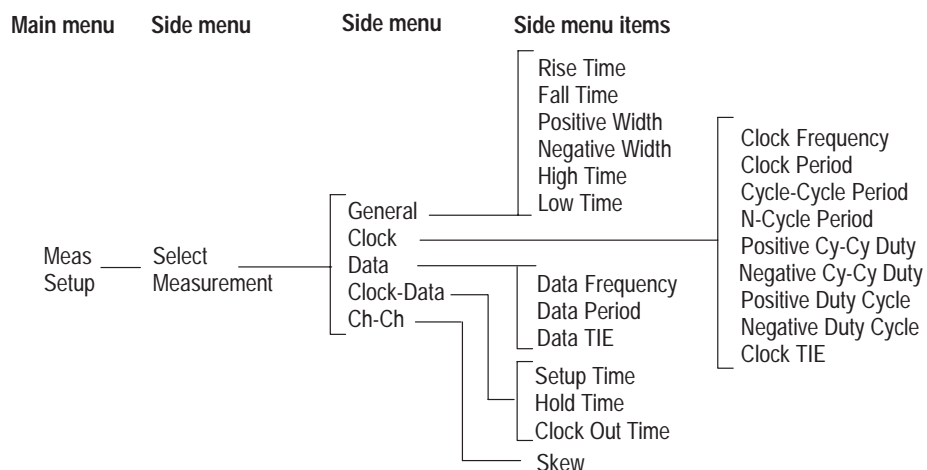


Table 2–6: Select Measurement menu selections

Group	Selection	Description
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	Difference in time between the leading edge and trailing edge of a pulse
	Negative Width	Difference in time between the trailing edge and leading edge of a pulse
	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
Clock	Clock Period*	Elapsed time between when a waveform crosses a specific reference voltage level twice
	Clock 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 period measurements from cycles between two consecutive groups of N-cycles where N is any number
	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
	Clock 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)
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

Table 2–6: Select Measurement menu selections (Cont.)

Group	Selection	Description
	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)
Clock-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 own 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
Ch-Ch	Skew*	Difference in time between the designated edge on a principal waveform to the designated edge on another waveform

* Requires configuration.

Selecting a Measurement to Configure

You may need to configure one or more of the selected measurements. The next figure shows how to select the measurement for configuration.

Configuring a Measurement

Many measurements require configuration, as indicated in Table 2–7. The next figure shows how to access the Configure Selected menu for each measurement.



Table 2–7 lists the measurements and configuration selections with a brief description of each. Refer to the *Parameters* section for default values.

Table 2–7: Measurements and configuration selections

Measurement	Selection	Description
Rise Time, Fall Time, Positive Width, Negative Width, High Time, Low Time, Positive Cy-Cy Duty, Negative Cy-Cy Duty, Data Period, Data Frequency, Data TIE	None	No configuration is required for these measurements
Clock Frequency, Clock Period, Cycle-Cycle Period, Positive Duty Cycle, Negative Duty Cycle, and Clock TIE, N-Cycle Period, Setup Time, Hold Time, Clock Out Time	Common Cycle Start Edge	Defines which edge of the Main input is used to calculate all active clock-based measurements

Table 2–7: Measurements and configuration selections (Cont.)

Measurement	Selection	Description
N-Cycle Period	Cycle Span N=	Number of cycles between cycles actually measured
	Meas Made Every	Specifies if the measurement is taken on all 2N groups (option 1) or on every Nth 2N group (option N)
	Start Meas at Cycle #	Number of cycles skipped prior to starting the measurement
Setup Time, Hold Time, Clock Out Time	Common Data Cycle Edge	Edge on the data waveform used to take the measurement; you can define the waveform in the Inputs: 2nd menu
	Range Max*	Specify the maximum range of valid measurement values
	Range Min*	Specify the minimum range of valid measurement values
Skew	From Edge	Edge on the Main waveform used to take the measurement
	To Edge	Edge on the 2nd waveform used to take the measurement
	Range Max*	Specify the maximum range of valid measurement values
	Range Min*	Specify the minimum range of valid measurement values

* Although you can enter the same values for the Range Max and Range Min side menu items, the application requires that they always be at least one resolution apart. The application displays the actual value for Range Max or Range Min, whichever was last selected, in the upper right corner of the display.

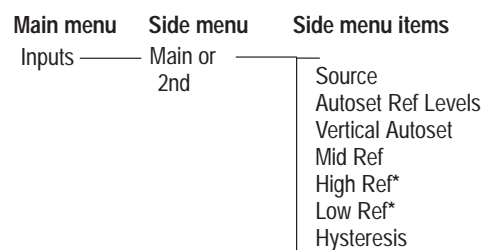
Specifying Inputs

The application takes measurements from waveforms specified as inputs.

NOTE. All General, Clock, and Data measurements require a Main input.

All Clock-Data and Ch-Ch measurements require a Main input and a 2nd input.

The next figure shows how to access parameters in the Main Input and 2nd Input menus.



*Only available for the Main Input.

NOTE. The Input Summary shows the settings of all the Input menus.

Table 2–8 lists the Main Input and 2nd Input menu selections with a brief description of each.

Table 2–8: Main Input and 2nd Input menus selections

Selection	Description
Source	Sets which waveform the application uses as the signal or clock source
Autoset Ref Levels	Refer to Table 2–9
Vertical Autoset	Changes the vertical scale and position for Ch 1, Ch 2, Ch 3, and Ch 4 waveforms so that they occupy the full vertical space available on the display without any part of the waveform missing (clipped)
Mid Ref	Sets the middle threshold level on the slope, in volts; refer to Figure 2–2
High Ref*	Sets the high threshold level on the slope, in volts; refer to Figure 2–2
Low Ref*	Sets the low threshold level on the slope, in volts; refer to Figure 2–2
Hysteresis	Sets the 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 <i>plus or minus half</i> the hysteresis

*Only available for the waveform defined in the Main Input menu.

NOTE. The application detects the minimum and maximum voltage levels of the waveform. If the reference voltage level *plus or minus* the hysteresis falls outside of 2.5% to 97.5% of the waveform peak-to-peak range, no measurement is taken.

Figure 2–2 shows how to determine the voltage reference levels.

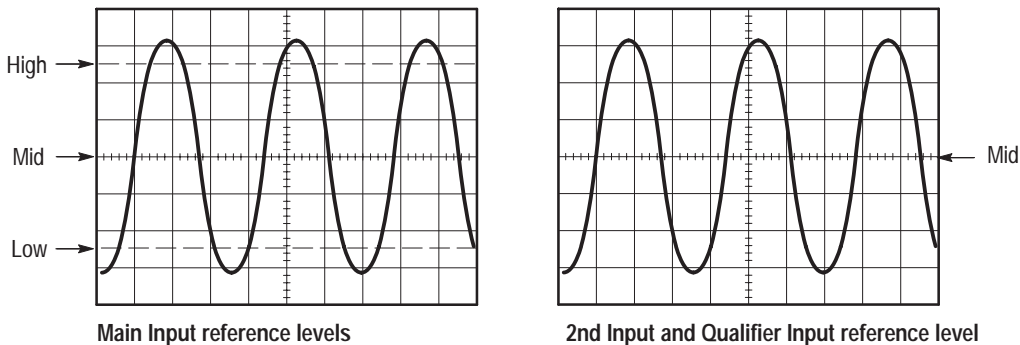


Figure 2–2: How to determine voltage reference levels

Autoset Ref Levels Menu. Autoset is only valid when Ch1, Ch2, Ch3, or Ch4 are selected as the Source for the Main Input, 2nd Input, or Qualifier Input menus. The next figure shows how to access parameters in the Autoset Ref Levels menus.

Side menu	Side menu items
Autoset Ref Levels	<div> Mid Ref High Ref* Low Ref* Hysteresis Perform Autoset </div>

*Only available for the Main Input.

Table 2–9 lists the Autoset Ref Levels menu selections with a brief description of each. The Autoset Ref Levels function is only valid for signals on Ch1, Ch2, Ch3, and Ch4.

Table 2–9: Autoset Ref Levels menu selections

Selection	Description
Mid Ref	Sets the middle threshold level as a percentage of the voltage levels relative to the minimum and maximum levels of the peak-to-peak values
High Ref*	Sets the high threshold level as a percentage of the voltage levels relative to the minimum and maximum levels of the peak-to-peak values
Low Ref*	Sets the low threshold level as a percentage of the voltage levels relative to the minimum and maximum levels of the peak-to-peak values
Hysteresis	Sets the threshold margin as a percentage of the voltage levels relative to the reference level which the voltage must cross to be recognized as changing; the margin is the voltage reference level <i>plus or minus half</i> the hysteresis
Perform Autoset	Calculates and sets the threshold levels and margin

*Only available for the waveform defined in the Main Input menu.

NOTE. If you perform an Autoset on Ch1, Ch2, Ch3, or Ch4 and then change the Source to a reference memory or math waveform, the application will retain the previous Autoset reference level values. If the values are not appropriate, you must set the values for the voltage reference levels and hysteresis manually.

Deskew Menu. The next figure shows how to access parameters in the Deskew menu and Table 2–10 lists the setup parameters with a brief description of each.

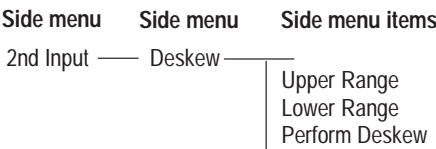


Table 2–10: Deskew menu selections

Selection	Description
Upper Range	Specifies the upper range of valid measurement values
Lower Range	Specifies the lower range of valid measurement values
Perform Deskew	Starts the Deskew utility

NOTE. To deskew the probes and oscilloscope channels, refer to Deskewing the Probes and Channels starting on page 1–4.

Specifying Qualifiers

Qualifiers allow you to focus the application on more narrowly defined conditions before taking measurements. This is one way to filter out information that is not useful to analyze.

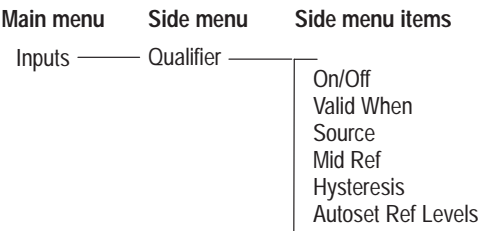


Table 2–11 lists the Qualifier Input menu selections with a brief description of each.

Table 2–11: Qualifier Input menu selections

Selection	Description
On/Off	Enables the qualifier
Valid When	Specifies the state condition of the qualifier that must be met as either a logical low (0) or a logical high (1)
Source	Sets which waveform the application uses as the qualifier source
Mid Ref	Sets the middle threshold level on the slope, in volts; refer to Figure 2–2

Table 2–11: Qualifier Input menu selections (Cont.)

Selection	Description
Hysteresis	Sets the 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 <i>plus or minus half</i> the hysteresis
Autoset Ref Levels	Refer to Table 2–9

NOTE. The *Qualifier Input* and *Gating* functions are mutually exclusive. If you enable both, the application displays an error message.

Specifying Gating

Gating allows you to focus the application on a specific area of the waveform bound by cursors before taking measurements. This is one way to filter out information that is not useful to analyze.

Main menu Side menu
Inputs — Gating: On/Off

NOTE. Disabling the *V Bars Cursors* on the oscilloscope causes the application to disable *Gating* although the application display will show that *gating* is *On*.

Using Horizontal Check

You can use the Horizontal Check to check if the Sample Rate is appropriate for the selected measurements. A message displays that tells you if the Sample Rate is appropriate for the Main Input or 2nd Input menus. Accurate measurements require at least two samples per edge. The next figure shows how to access this function.

Main menu Side menu
Inputs — Horizontal Check

Using Acquisition Timeout

You can use the Acquisition Timeout to set an appropriate amount of time that the application will wait to acquire data before it stops and displays an error message. The next figure shows how to access this function.

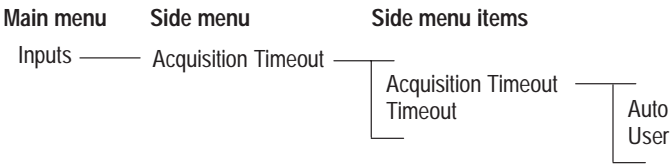


Table 2–12: Acquisition Timeout menu selections

Selection	Description
Acq Timeout	Auto sets the timeout to less than 0.1 hours; User allows you to enter a larger timeout value
Timeout	When User is selected, you can set the timeout from 0.1 hour to 24 hours

Taking Measurements

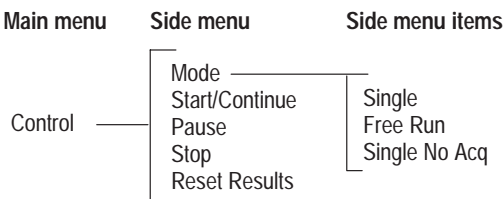
If you want to change trigger settings or localize the measurement, you should do so before you take any measurements.

NOTE. If you select a reference or math waveform as the source, you will need to recall and display the waveform before the application can take a measurement. For information on how to recall a waveform, refer to Recalling a Waveform File on page 2–29. To display the waveform, press the MORE button and the appropriate main menu item.

Be sure to press Control (main) → Reset Results (side) to reset the result values if you change the Vertical or Horizontal time settings between measurements.

Acquiring Data

You can start the application and oscilloscope to acquire data and take measurements through the Control menu. The next figure shows how to access parameters in the Control menu.



To take measurements from displayed waveforms, follow these steps:

1. Press Control (main). Table 2–13 lists selections in the Control menu.

Table 2–13: Control menu selections

Selection	Description
Mode	
Single	Performs measurements on a single acquisition and stops
Free Run	Repeatedly acquires the input waveform(s) and takes measurements
Single No Acq	Performs measurements on a previous acquisition and then stops
Start	The application starts to take measurements from the waveform(s)
Continue	When paused, the application continues taking measurements
Pause	The application pauses and resumes when you press Continue or stops when you press Stop
Stop	The application stops taking measurements
Reset Results	Resets all result values to zero; data log files have their own reset selection

NOTE. *Acquisition Timeout causes the application to stop after a specific amount of time has elapsed when acquiring data and taking measurements. If you change any oscilloscope settings, be sure to reset the results.*

2. Press Mode (side) to select Single or Free Run acquisition mode.
3. Press Start (side).

NOTE. *Do not change oscilloscope settings while a measurement is being taken, since this can cause an invalid measurement.*

Localizing Measurements

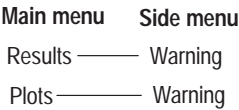
You can control the amount of data to measure by adjusting the Record Length, or the Trigger Position. By specifying the Trigger Position, the starting point, and the total length of the measurement, you can effectively size the area of interest.

NOTE. *If an error message displays because there are not enough cycles from which to take a measurement, you should increase the Record Length.*

Be sure to reset the results each time you change the Record Length or other oscilloscope settings.

Warning Messages

The application displays and saves warning messages if the input conditions do not support accurate measurements. You can view the most recent message, if any, for the current acquisition in the Results menu or the Plots menu. The next figure shows how to access warning messages.



Analyzing the Results

The application provides information on the variation of timing measurements as statistical values in a readout, or graphically as a Histogram, Time Trend, Cycle Trend, or Spectrum plot.

NOTE. Stop the acquisition before viewing the results as plots if you are taking measurements in the Free Run mode.

Figure 2–3 shows an example of the various results display formats.

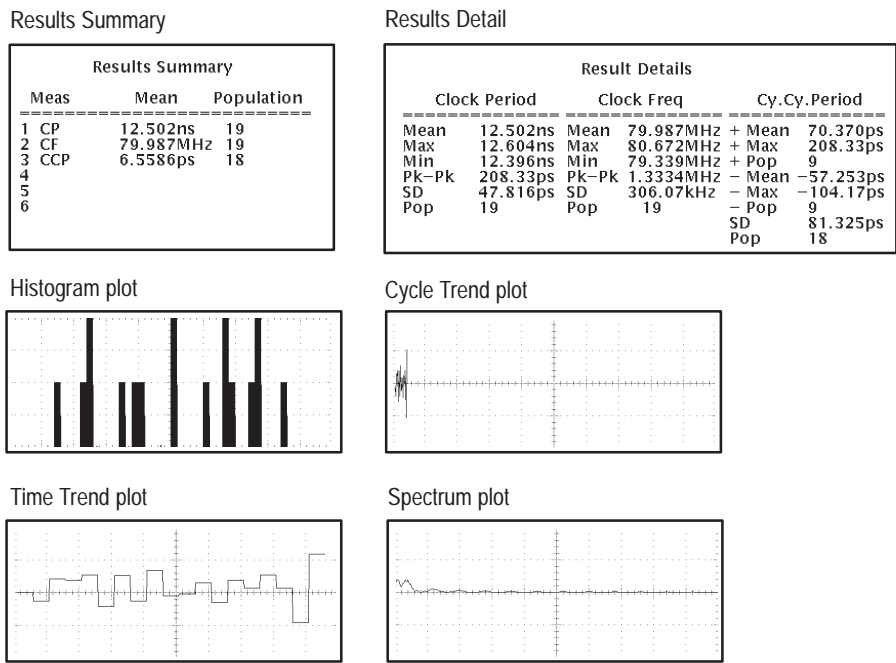


Figure 2–3: Example of the results and display formats

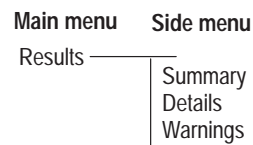
You can also log the data to a RESULTS.CSV file for viewing with a text editing, spreadsheet, database, or data analysis program on a personal computer. Figure 2–4 shows an example of how the RESULTS.CSV file might look in a spreadsheet.

TDSJITV2	Version V0.05	2000-11-07 '11:25:48'				
Result Type	Data Frequency(Hz)	Rise Time(s)	Positive Width(s)	Skew(s)	Clck Period(s)	
Mean	1.00 E+08	6.02 E-09	1.00 E-08	-2.41 E-09	2.00 E-08	
Std Dev	3.65 E+05	7.23 E-11	3.91 E-11	3.55 E-11	3.44 E-11	
Maximum	1.01 E+08	6.24 E-09	1.01 E-08	-2.33 E-09	2.01 E-08	
Minimum	9.92 E+07	5.91 E-09	9.90 E-09	-2.50 E-09	1.99 E-08	
Peak-Peak	1.73 E+08	3.35 E-10	1.93 E-10	1.89 E-10	1.38 E-10	
Population	124	63	62	63	62	
Positive Mean						
Positive Max						
Positive Population						
Negative Mean						
Negative Max						
Negative Population						
Serial Number	Data Frequency(Hz)	Rise Time(s)	Positive Width(s)	Skew(s)	Clck Period(s)	Annotation
1	1.00 E+08	6.11 E-09	9.99 E-09	-2.43 E-09	2.00 E-08	
2	1.00 E+08	5.97 E-09	1.00 E-08	-2.39 E-09	2.00 E-08	
3	9.98 E+07	6.11 E-09	9.99 E-09	-2.44 E-09	2.00 E-08	
4	9.98 E+07	6.08 E-09	1.00 E-08	-2.39 E-09	2.00 E-08	
5	1.00 E+08	5.98 E-09	9.99 E-09	-2.38 E-09	2.00 E-08	
6	1.00 E+08	6.09 E-09	1.00 E-08	-2.39 E-09	2.00 E-08	
7	9.99 E+07	5.82 E-09	1.00 E-08	-2.40 E-09	2.00 E-08	
8	9.98 E+07	5.92 E-09	1.00 E-08	-2.39 E-09	2.00 E-08	
9	1.00 E+08	6.03 E-09	1.00 E-08	-2.40 E-09	2.00 E-08	
10	1.00 E+08	6.09 E-09	9.98 E-09	-2.44 E-09	2.00 E-08	
11	9.98 E+07	6.01 E-09	1.00 E-08	-2.43 E-09	2.00 E-08	

Figure 2–4: A RESULTS.CSV file viewed in a spreadsheet program

Viewing Statistics

The application can display results for up to six measurements. The next figure shows how to access the Summary, Details, and Warnings message boxes.



The statistical information that displays will vary by measurement. In general, the Summary and Details message boxes contain statistical values for the mean, the standard deviation (StdDev), the peak-to-peak (Pk-Pk), the maximum (Max) and minimum (Min) values, and the population (the number of samples used to calculate the statistics).

Figure 2–5 shows an example of the results for three measurements.

Result Details					
Clock Period		Clock Freq		Cy.Cy.Period	
Mean	12.502ns	Mean	79.987MHz	+ Mean	70.370ps
Max	12.604ns	Max	80.672MHz	+ Max	208.33ps
Min	12.396ns	Min	79.339MHz	+ Pop	9
Pk-Pk	208.33ps	Pk-Pk	1.3334MHz	- Mean	-57.253ps
SD	47.816ps	SD	306.07kHz	- Max	-104.17ps
Pop	19	Pop	19	- Pop	9
				SD	81.325ps
				Pop	18

Figure 2-5: Results Details menu, example of three measurements

To view parts of the waveform that are obscured by the statistics, press the CLEAR MENU button. To return to the application, press the SHIFT, and then the APPLICATION front-panel menu buttons

NOTE. To view the waveform and the results, you can adjust the placement of the statistics in the display or make dialog boxes translucent through the Display Options side menu.

The next figure shows how to make the statistics and all dialog boxes visible or invisible.



Viewing Plots

You can graphically plot the results for easier analysis. There are four plot formats: Histogram, Time Trend, Cycle Trend, and Spectrum. The next figure shows how to access the Plots menus.

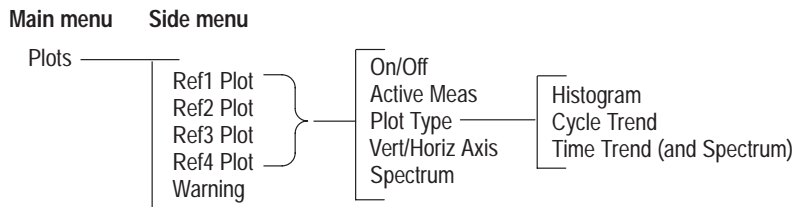


Table 2-14 lists the plot formats with a brief description of each.

Table 2–14: Plot Type selections

Selection	Description
Histogram	Plots the results such that the horizontal axis represents the measurement values and the vertical axis represents the number of times that the value occurred
Cycle Trend	Plots the results such that the vertical axis represents the measurement value and the horizontal axis represents the index number of the measurement which can be used to observe the variation of a measurement
Time Trend*	Plots the results such that the vertical axis represents the measurement value and the horizontal axis represents the time the measurement occurred; the horizontal time span is the same as the input waveform
Spectrum**	Plots the spectral content (FFT) of the Time Trend plot where the vertical axis represents magnitude and the horizontal axis represents frequency

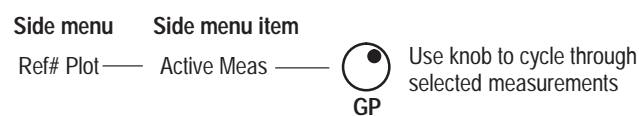
* Limited to a 50,000 point record length; if the plot exceeds this limit, use Decimation.

** Limited to a 10,000 point record length; if the plot exceeds this limit, use Decimation.

NOTE. You must take a measurement before displaying the results as a plot. The application will automatically display a plot when it is enabled.

Be sure to reset the results each time you change oscilloscope settings.

The next figure shows how to select an active measurement to display as a plot.



Vert/ Horiz Axis for a Histogram Plot. The next figure shows how to access the Vert/ Horiz Axis parameters for a Histogram plot.

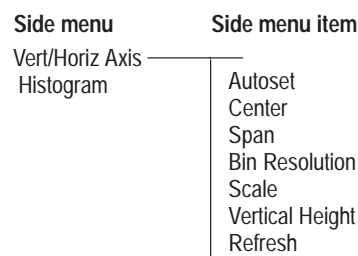


Table 2–15 lists the Vert/ Horiz Axis parameters for a Histogram plot with a brief description of each.

Table 2–15: Vert/Horiz Axis Histogram menu selections

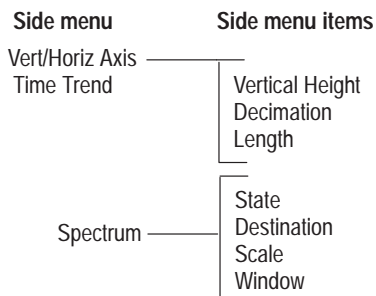
Selection	Description
Autoset*	Uses the results to determine logical values for the Center and Span parameters if the population of the measurement is 3 or more, and redraws the plot in the corresponding reference memory After using Autoset, the oscilloscope cursors are not available
Center	Numeric value for the horizontal center position of the histogram
Span	Numeric value for the total horizontal range of the histogram
Bin resolution	Selects the resolution as defined by bins to be Low (20 bins), Medium (100 bins), or High (500 bins)
Scale	Vertical axis is in logarithmic or in linear scale
Vertical Height	Height of the plot in number of divisions
Refresh	Updates the plot with the latest Center and Span values entered

***You must select On for the Ref# Plot that will store the Histogram and take a measurement before using Autoset.**

NOTE. Use the *HORIZONTAL SCALE* knob to adjust the horizontal scale of the waveform to fit the screen for proper viewing.

Use the Autoset function to set the optimum Center and Span values. You can use Autoset only after taking measurements and storing them as a Histogram plot.

Vert/Horiz Axis for a Time Trend and Spectrum Plots. The next figure shows how to access the Vert/Horiz Axis parameters for a Time Trend plot, and how to access the Spectrum plot.



NOTE. The Time Trend plot is limited to a 50,000 point record length; the Spectrum plot is limited to a 10,000 point record length. If the record length exceeds these limits, use Decimation to plot the results with fewer samples.

Table 2–16 lists the Vert/Horiz Axis parameters for a Time Trend plot with a brief description of each.

Table 2–16: Vert/Horiz Axis Time Trend menu selection

Selection	Description
Vertical Height	Height of the plot in number of divisions
Decimation	Produces a waveform with fewer samples than in the original acquisition
Length	For decimation, the length of the plot in number of record points

To view the results in a Time Trend plot, follow these steps:

1. Take jitter measurements.
2. If the record length is greater than 50,000 points, enable Decimation and select an appropriate value for the Length side menu item.
3. Enable the Time Trend plot; the application automatically displays the plot.

Table 2–17 lists the parameters for a Spectrum plot with a brief description of each.

Table 2–17: Spectrum menu selection

State	Enables the application to plot the results as a spectrum
Destination	Sets the Math1, Math2, or Math3 waveform in which to store the plot
Scale	Vertical axis is in logarithmic or in linear scale
Window	Reduces spectral leakage in the Fast Fourier Transform (FFT) waveform; a Hanning window (raised cosine) on the Time Trend data

To view the results in a Spectrum plot, follow these steps:

1. Take jitter measurements.
2. If the record length is equal to or less than 10,000 points, go to step 3.

If the record length is greater than 10,000 points, enable Decimation and select an appropriate value for the Length side menu item that is equal to or less than 10,000 points.

3. Enable the Time Trend plot; the application automatically displays the plot.
4. Enable the Spectrum plot; the application automatically displays the plot in the MORE menu of the oscilloscope.
5. To return to the application, press the SHIFT, and then the APPLICATION front-panel menu buttons.

Vert/Horiz Axis for a Cycle Trend Plot. The next figure shows how to access the Vert/Horiz Axis parameters for a Cycle Trend plot.

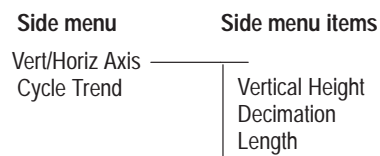


Table 2–18 lists the Vert/Horiz Axis parameters for a Cycle Trend plot with a brief description of each.

Table 2–18: Vert/Horiz Axis Cycle Trend menu selections

Selection	Description
Vertical Height	Height of the plot in number of divisions
Decimation	Produces a waveform with fewer samples than in the original acquisition
Length	For decimation, the length of the plot in number of record points

Clearing Results To reset the results to zero, press Control (main) → Reset Results (side). You do not have to wait for a measurement to complete to clear the results.

Saving the Results to a File

You can save the results for all active measurements as statistics to a data log file or save the minimum and maximum worst case waveforms to waveform files. You can also change the active measurements and continue to log data to the same data log file.

Logging Statistics This type of logging saves the statistical results and the individual result points of activated measurements to a data log file. The next figure shows how to access the Log Results menu.

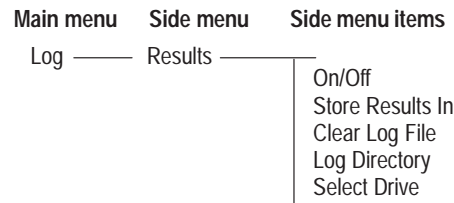


Table 2–19 lists the Log Results menu selections with a brief description of each.

Table 2–19: Log Results menu selections

Selection	Description
On/Off	Enables or disables the data log file; when enabled, stores the measurement results in a “comma separated variable” formatted file (.CSV file) that you can view on a personal computer
Store Results In	Allows you to enter a name for the .CSV file
Clear Log File	Clears the data log file; you must disable the log file before you can clear its contents
Log Directory	Selects the directory in which the .CSV file will be saved; when you select this side menu item, the directory structure of the selected drive displays.
Select Drive	Selects the drive on which the .CSV file will be stored

NOTE. If the disk is full or not present, the application displays an error message and stops taking measurements.

A data log file larger than 1.4 MB exceeds the capacity of a floppy disk. Refer to Appendix D: Example Program to Copy Large Files for an example of a GPIB program that you can use to transfer a large data log file from the oscilloscope to a personal computer.

Data Log File Format

The data log file contains three parts: a header row, statistical results, and individual result points. The header row of the log file contains the application name, the version number of the application, and the date and time on which the file was created.

For statistical results, the application updates the rows for all of the active measurements. For individual result points, the application appends rows of results to each active measurement.

NOTE. If you are using a GPIB program to execute the application, such as in automated test environments, you can add your own annotation through the *logAnnotate GPIB* command. You can add information consisting of up to 20 characters; the custom information will appear as the last column in the individual result records of that acquisition.

Logging Min/Max Waveforms

This type of logging saves the acquired waveforms where the minimum and maximum worst cases occur. When enabled, the waveforms are saved to a set of .wfm files that are stored with the other application files.

The next figure shows how to access the Log Min/Max Wfms menu.

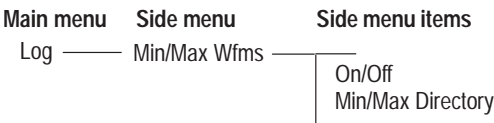


Table 2–20 lists the Log Min/Max Wfms menu selections with a brief description of each.

Table 2–20: Log Min/Max Wfms menu selections

Selection	Description
On/Off	Enables the saving of worst case waveforms; see Table 2–21 for definition
Min/Max Directory	Changes the directory in which .wfm files will be stored

NOTE. File names for the waveforms are unique to each measurement. The *Min1* and *Max1* waveform files are for the Main input. The *Min2* and *Max2* waveform files are for the 2nd input.

Table 2–21 lists the file names of the minimum and maximum worst case waveforms for various measurements.

Table 2–21: File names for Min/Max waveforms

Measurement	Min waveform	Max waveform
Rise Time	RISEMin1.wfm	RISEMax1.wfm
Fall Time	FALLMin1.wfm	FALLMax1.wfm
Positive Width	PWMin1.wfm	PWMax1.wfm

Table 2-21: File names for Min/Max waveforms (Cont.)

Measurement	Min waveform	Max waveform
Negative Width	NWMin1.wfm	NWMax1.wfm
High Time	HIGHMin1.wfm	HIGHMax1.wfm
Low Time	LOWMin1.wfm	LOWMax1.wfm
Clock Frequency	CFMin1.wfm	CFMax1.wfm
Clock Period	CPMin1.wfm	CPMax1.wfm
Cycle-Cycle Period	CCPMin1.wfm	CCPMax1.wfm
N-Cycle Period	NCPMin1.wfm	NCPMax1.wfm
Positive Cy-Cy Duty	PCCDMin1.wfm	PCCDMax1.wfm
Negative Cy-Cy Duty	NCCDMin1.wfm	NCCDMax1.wfm
Positive Duty Cycle	PDCMin1.wfm	PDCMax1.wfm
Negative Duty Cycle	NDCMin1.wfm	NDCMax1.wfm
Clock TIE	TIEMin1.wfm	TIEMax1.wfm
Data Frequency	DFMin1.wfm	DFMax1.wfm
Data Period	DPMIn1.wfm	DPMax1.wfm
Data TIE	DTIEMin1.wfm	DTIEMax1.wfm
Setup Time	SUMin1.wfm SUMin2.wfm	SUMax1.wfm SUMax2.wfm
Hold Time	HOLDMin1.wfm HOLDMin2.wfm	HOLDMax1.wfm HOLDMax2.wfm
Clock Out Time	TCOMin1.wfm TCOMin2.wfm	TCOMax1.wfm TCOMax2.wfm
Skew Time	SKEWMin1.wfm SKEWMin2.wfm	SKEWMax1.wfm SKEWMax2.wfm

Importing a Data Log File to a Personal Computer

You can import the .CSV data log file (comma separated variable format) into a text editing, spreadsheet, database, or data analysis program on your personal computer for further analysis.

If you saved the data log file on the hard disk drive, you need to copy it to a floppy disk. To do so, follow these steps:

1. Insert a blank, DOS-formatted floppy disk into the floppy disk drive of the oscilloscope.

2. Copy the .CSV file from the hard disk drive to the floppy disk. For details on how to do this, refer to step 5 on page 2–41 in the *Tutorial* section.

To import a data log file to a personal computer, follow these steps:

1. Insert the floppy disk into the floppy disk drive on your personal computer.
2. Copy the .CSV file.
3. Open the file using a text editing, spreadsheet, database, or data analysis program.

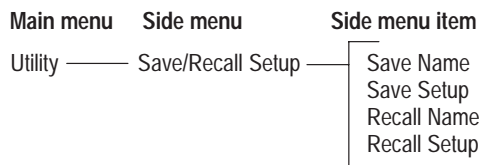
Figure 2–4 shows an example of the .CSV file viewed in a spreadsheet program.

If you take different measurements and store them in one data log file, you can group the measurements by sorting them in a program on a personal computer.

Saving and Recalling Setups

You can use the Save/Recall Setup menu to save and recall application setups. The Save/Recall function also saves the oscilloscope set up.

The next figure shows how to access the Save/Recall Setup menu.



Saving a Setup

To save the application setup to the file displayed in the Save Name menu item, press Save Setup (side).

To create a new file in which to save the application setup, follow these steps:

1. Press Save Name (side).
2. Use the direction arrows and Delete Char (side) to clear the existing file name or part of the file name.
3. Use the General Purpose (GP) knob to select each character in the file name. Press Enter Char (side) after selecting each character.

The file name can be up to eight characters long excluding the extension. The application automatically appends a .ini and .set extension to the name.

4. Press OK Accept (side) to save the file name.
5. Press Save Setup (side) to store the application setup in the file just created.

6. Press OK (side).

7. Done (side).

Application setups are usually saved in the APPS/TDSJIT1V2/TEMP directory (accessed through the File Utilities menu) on the oscilloscope. Once you have saved a setup, you must recall it to use it again.

Recalling a Setup

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

1. Press Recall Name (side); use the GP knob to select the directory where the setup file resides.

NOTE. *The application starts with all parameters set to default values regardless of which setup file was last used.*

2. When you have found the setup file to recall, press Recall Setup (side).

3. Press OK (side).

4. Press Done (side).

Exiting the Application

To exit the application, press Utility (main) → Exit (side). To confirm, press OK (side).

Tutorial

This tutorial teaches you how to set up the application, take two types of measurements, and view the results in the various formats. Further operating information is located in the *Operating Basics* section.

Before you begin the tutorial, you must do the following tasks:

- Set up the oscilloscope
- Start the application
- Recalling waveforms to reference memories

Setting Up the Oscilloscope

To set up the oscilloscope, follow these steps:

1. Press **SETUP** → Recall Factory Setup (main) → OK Confirm Factory Init (side) to set the oscilloscope to the default factory settings.
2. Press the **WAVEFORM OFF** button as often as necessary to remove active waveforms from the display.
3. Press **HORIZONTAL MENU** → –more– 1 of 3 (side) → 5000 points in 100 divs (side) to set the Record Length to 5000.

Starting the Application

To perform these lessons, the TDSJIT1V2 application must be installed on the oscilloscope. See *Installation* on page 1–3.

To start the application, refer to Figure 2–6, and follow these steps:

1. Press **SETUP** → Select Application (main).
2. Use the general purpose (GP) knob to select hd0: and press **SELECT**.
3. Use the GP knob to select the TDSJIT1V2.APP file and press **Activate Application** (side).

The application starts up and displays as shown in Figure 2–7.

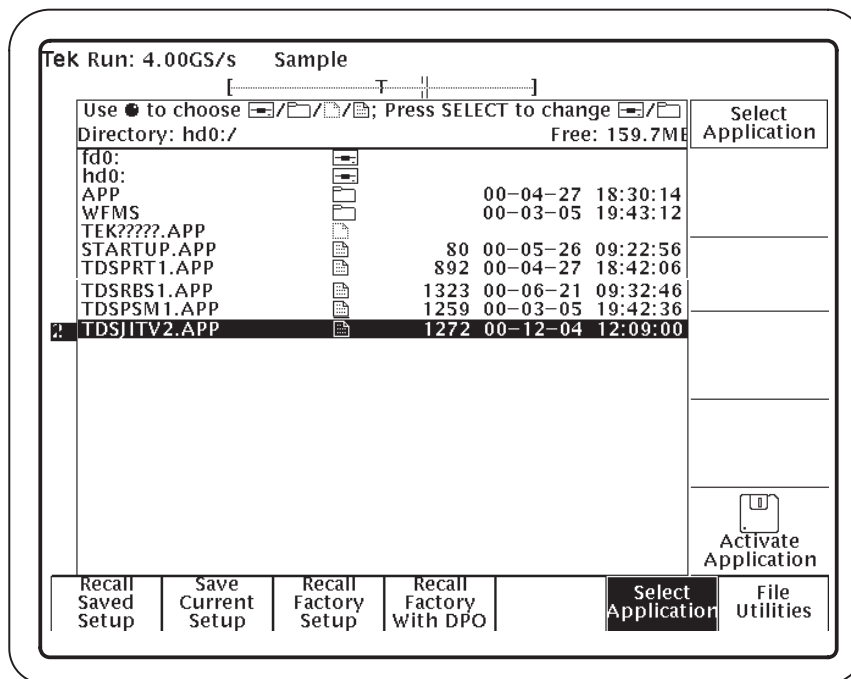


Figure 2-6: Starting the application

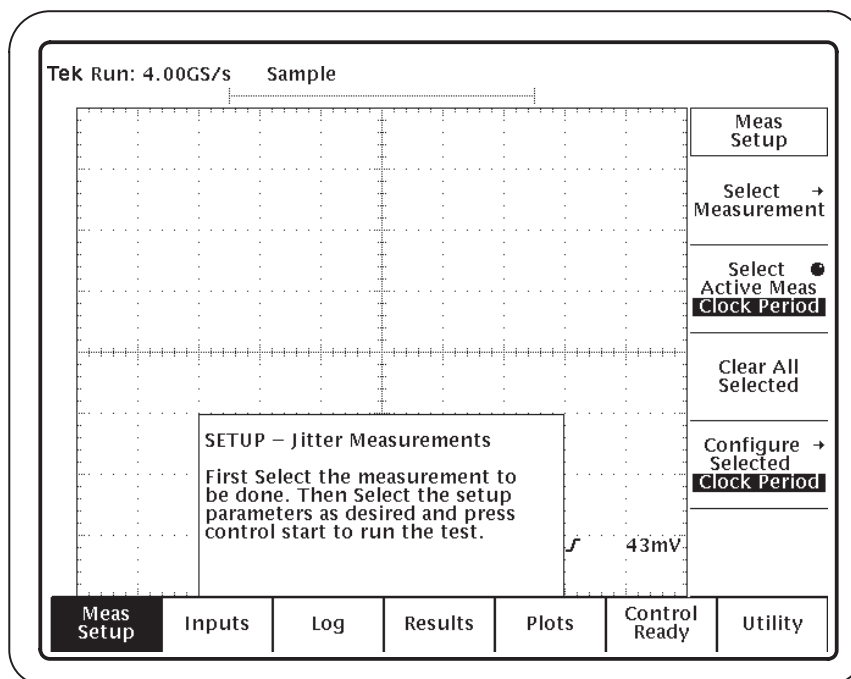


Figure 2-7: TDSJITV2 application initial display

Recalling a Waveform File

The application includes waveform files for use with this tutorial. Table 2–22 shows the types of signals that these waveforms represent and the reference memory that you will recall them to.

Table 2–22: Tutorial waveforms and signal types

Waveform name	Signal type	Recall to reference
J1V2_CLK.WFM	A clock signal	Ref4
J1V2_DAT.WFM	A data signal	Ref3

To recall the clock waveform to Ref1, follow these steps:

1. Press WAVEFORM → Recall Wfm to Ref (main) → Recall from file (side).
2. Use the general purpose (GP) knob to select hd0: and press SELECT.
3. Use the GP knob to select WFMS and press SELECT.
4. Use the GP knob to select J1V2_CLK.WFM; press To Ref4 active/empty (side). Figure 2–8 shows how to recall a waveform.

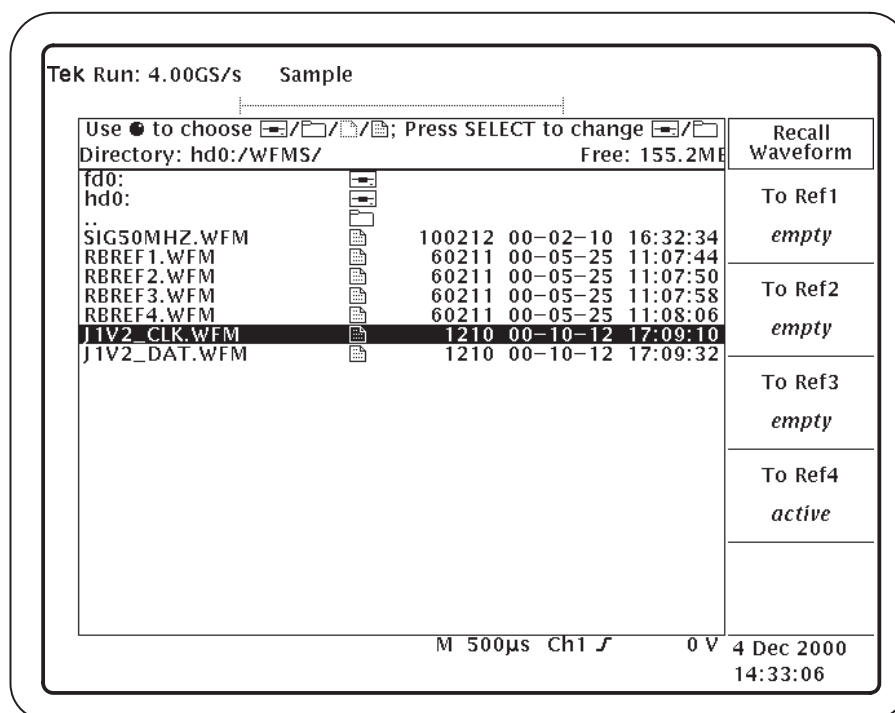


Figure 2–8: Recalling a waveform to a reference memory

5. Press the MORE front-panel button, and then Ref4 (main) to display the waveform. Figure 2–9 shows the J1V2_CLK.WFM recalled to Ref4.

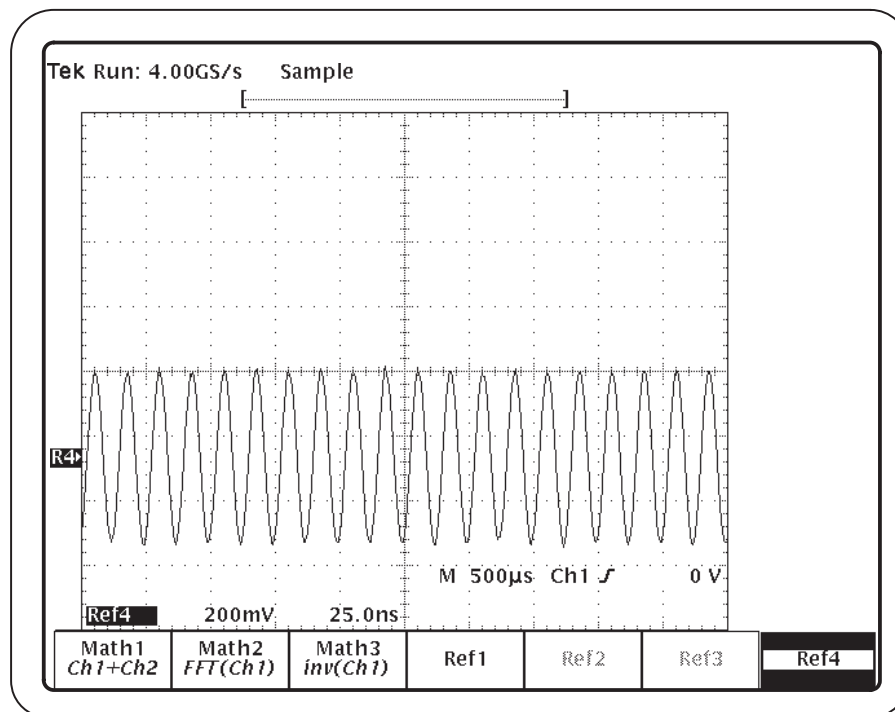


Figure 2–9: J1V2_CLK.WFM recalled to Ref1

6. Press the SHIFT, and then the APPLICATION front-panel menu button to return to the application.

Taking a Clock Period Measurement

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 take a Clock Period measurement, follow these steps:

1. Select Inputs (main) → Main (side) → Source (side) → –more– 1 of 4 (side) → –more– 2 of 4 (side) → Ref4 (side). Figure 2–10 shows the Main Input menu setup.

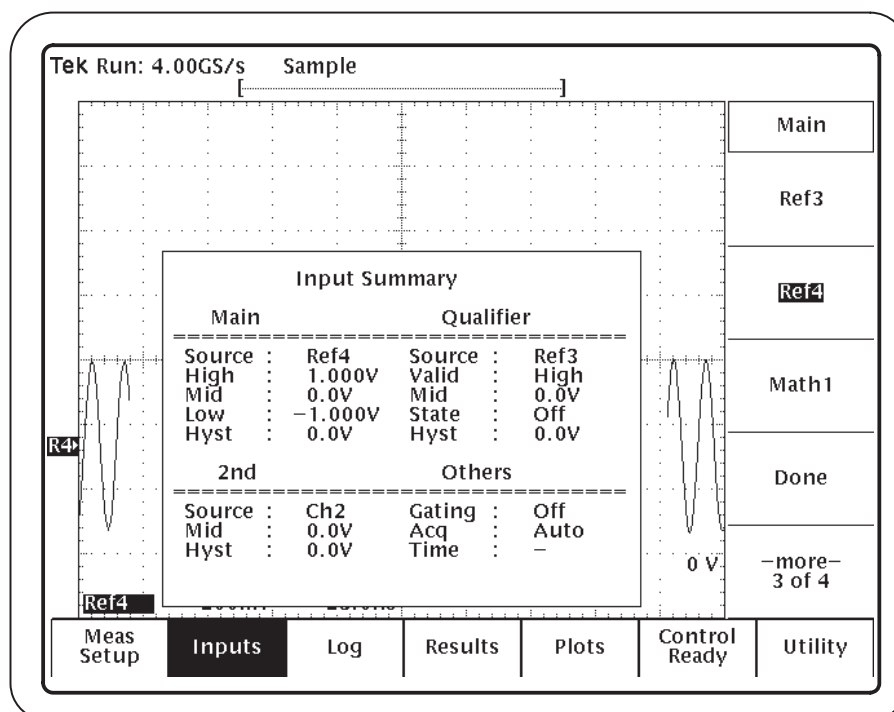


Figure 2-10: Main Input menu setup

2. Press Done (side) twice.
3. To take the measurement, press Control (main) → Start (side).

NOTE. When the input is a reference waveform, the measurement performs a single measurement cycle regardless of the acquisition mode.

The Control menu (main) displays Control Sequencing while the application is executing. When the Control menu displays Control Ready, the application has completed the calculations.

4. Wait for the calculations to complete. Figure 2-11 shows the results.

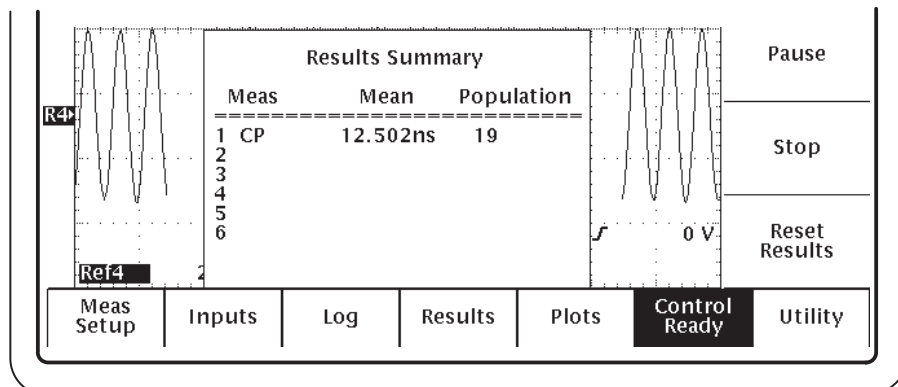


Figure 2-11: Clock Period lesson: Results Summary readout

- To set up the Histogram plot format, select Plots (main) → Ref1 Plot (side) and select On.

Figure 2-12 shows the setup for the Histogram plot.

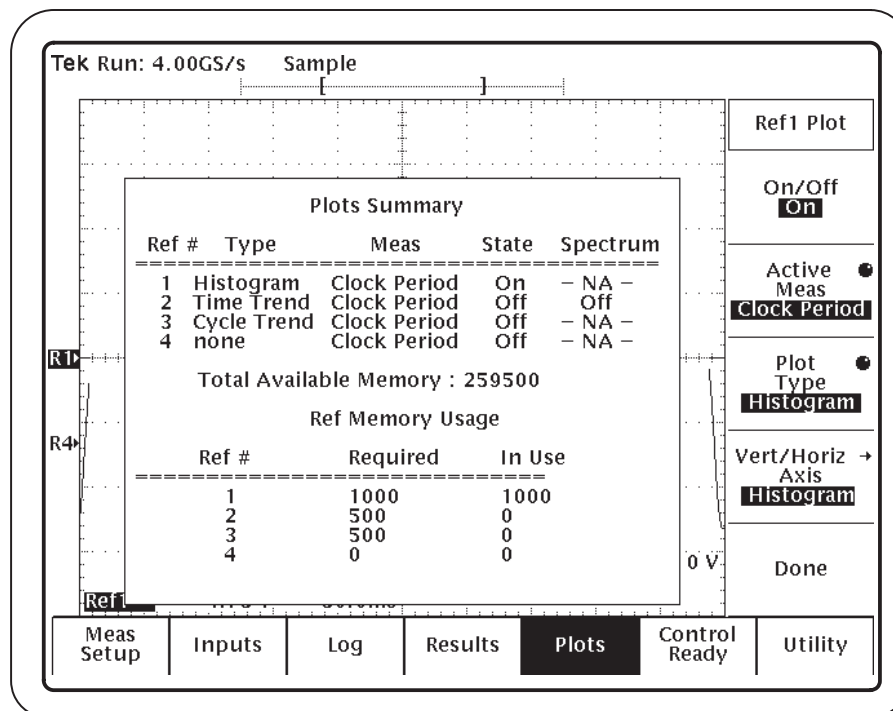


Figure 2-12: Setup for a Histogram plot

6. Press Vert/ Horiz Axis Histogram(side) → Autoset (side) → Done (side).
7. Press the CLEAR MENU front-panel button.

Figure 2–13 shows the Histogram plot.

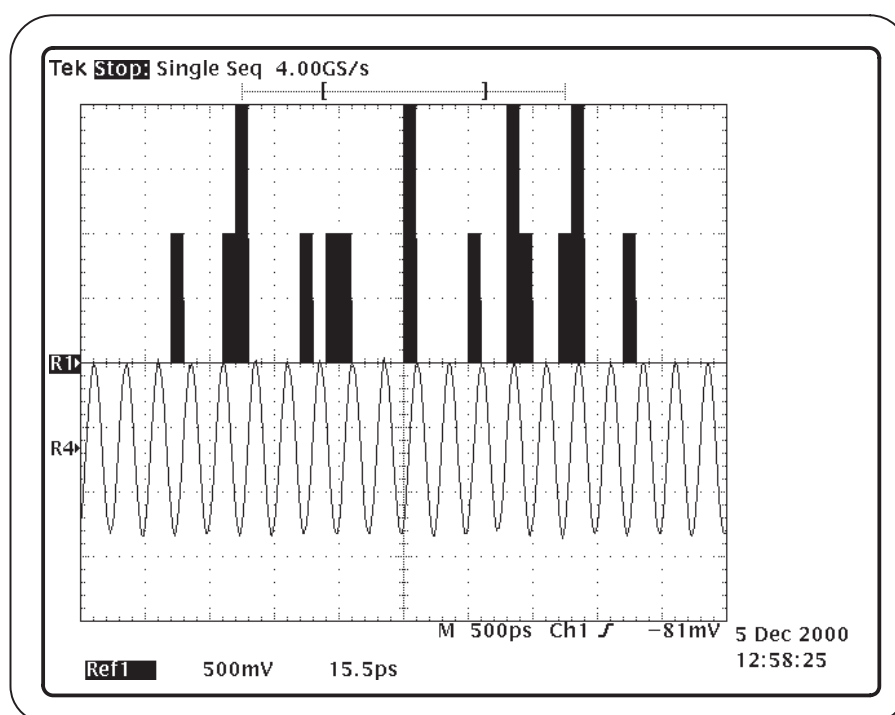


Figure 2–13: Results as a Histogram plot

8. Press the SHIFT, and then the APPLICATION front-panel menu button to return to the application.
9. To deselect the Histogram plot, press Off (side) → Done (side).
10. To set up the Time Trend plot format, select Ref2 Plot (side) → On (side).
11. Press the CLEAR MENU front-panel button.

Figure 2–14 shows the Time Trend plot.

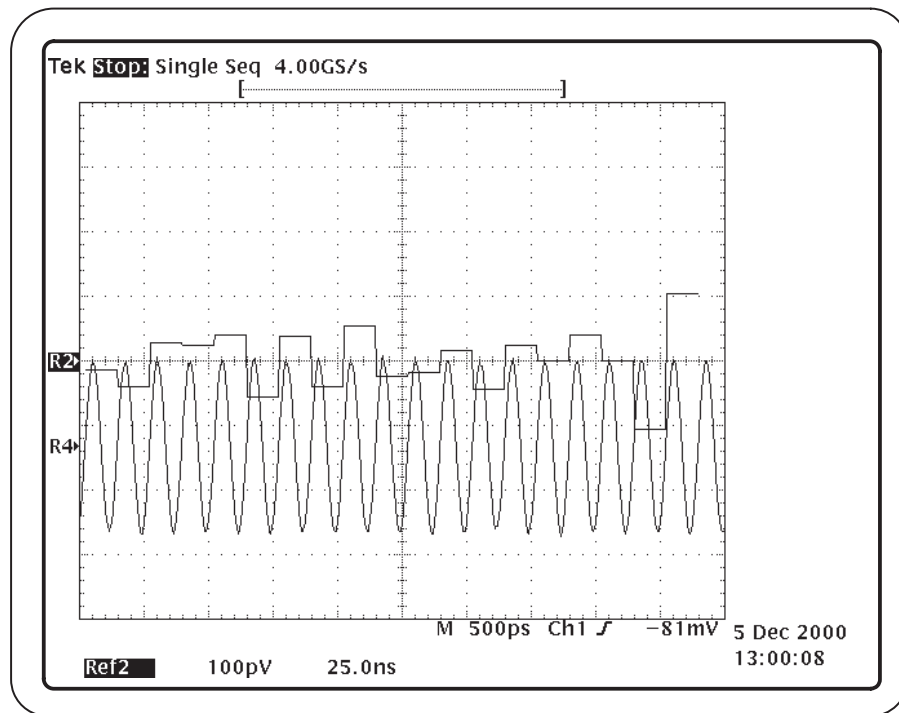


Figure 2-14: Results as a Time Trend plot

12. Press the SHIFT, and then the APPLICATION front-panel menu button to return to the application.
13. To set up the Spectrum plot format, select –more– 1 of 2 (side) → Spectrum (side). Figure 2-15 shows the setup for a Spectrum plot.
14. Select State (side) → On (side). As soon as you select On, the Spectrum plot displays as Math1 in the MORE menu of the oscilloscope.

Figure 2-16 shows the Spectrum plot.

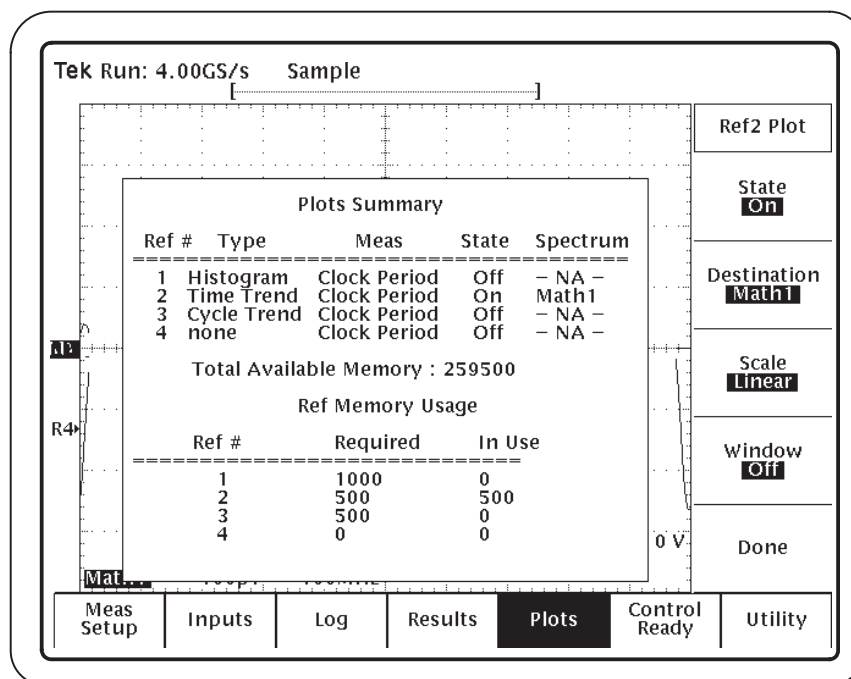


Figure 2-15: Setup for a Spectrum plot

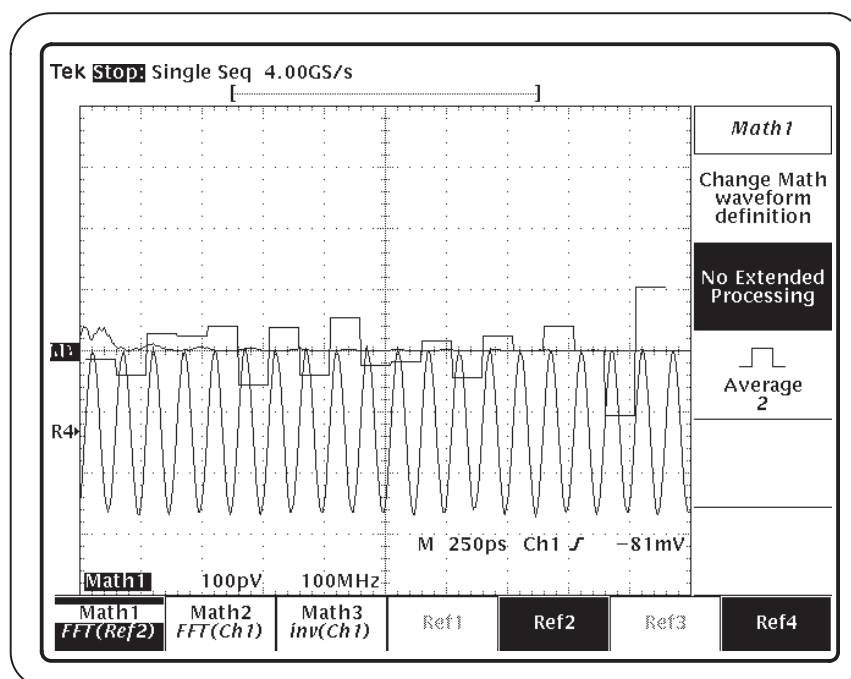


Figure 2-16: Results as a Spectrum plot

15. Press the **SHIFT**, and then the **APPLICATION** front-panel menu button to return to the application.
16. To deselect the Time Trend plot, press **Done (side)** → **–more– 2 of 2 (side)** → **Off (side)** → **Done (side)**. This also deselects the Spectrum plot.
17. To set up the Cycle Trend plot format, select **Ref3 Plot (side)** → **On (side)**.
18. Press the **CLEAR MENU** front-panel button.

Figure 2–14 shows the Cycle Trend plot.

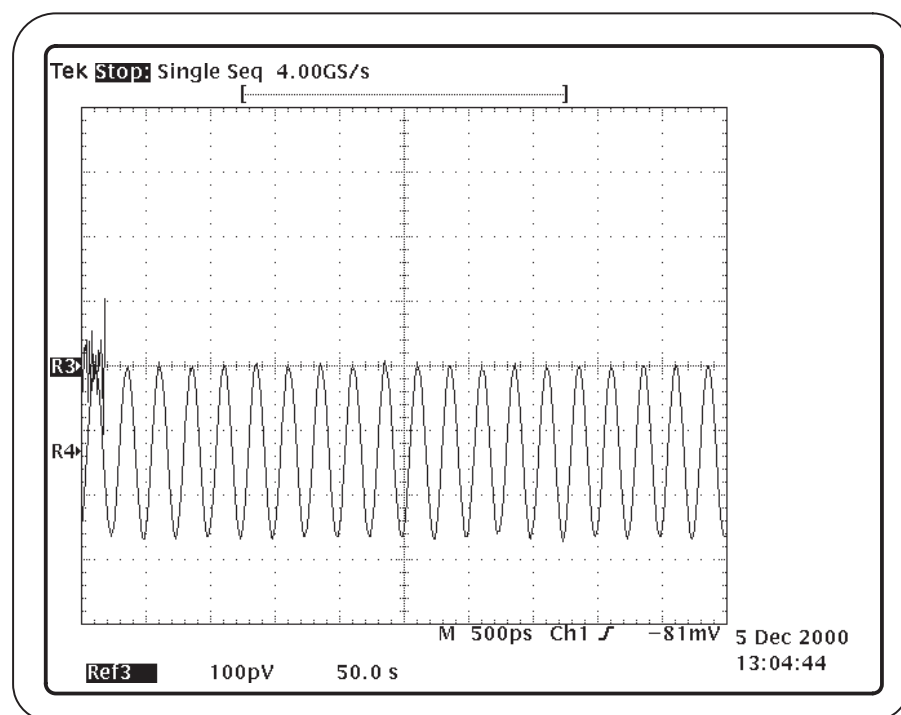


Figure 2–17: Results as a Cycle Trend plot

19. Press the **SHIFT**, and then the **APPLICATION** front-panel menu button to return to the application.
20. To deselect the Cycle Trend plot, press **Off (side)** → **Done (side)**.

Taking a Clock Out Time Measurement

In this example, you will learn how to use the application to take Clock Out Time (clock to output) and Clock Period measurements. To take a Clock Out Time measurement, you need two waveforms.

Retain the Main Input setup for Ref1 from the previous lesson. That waveform will be used in both measurements.

To recall the data waveform to Ref3, follow these steps:

1. Press WAVEFORM → Recall Wfm to Ref (main) → Recall from file (side).
2. Use the general purpose (GP) knob to select hd0: and press SELECT.
3. Use the GP knob to select WFMS and press SELECT.
4. Use the GP knob to select J1V2_DAT.WFM; press To Ref3 active/empty (side).
5. Press the MORE front-panel button, and then Ref3 (main) to display the waveform. Use the Vertical Position knob to center the reference waveforms. Figure 2–18 shows the J1V2_DAT.WFM recalled to Ref3.

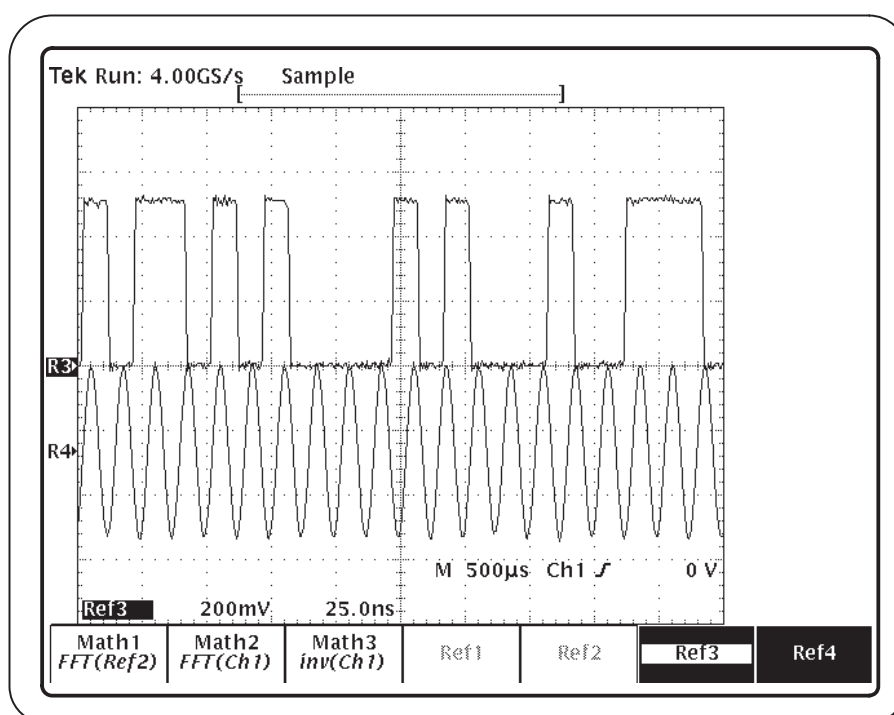


Figure 2–18: J1V2_CLK.WFM recalled to Ref3

6. Press the SHIFT, and then the APPLICATION front-panel menu button to return to the application.

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

1. Press Meas Setup (main) → Select Measurement (side) → –more– 1 of 2 (side) → Clock-Data (side) → Clock Out (side), and select On.
2. Press Done (side) two times.
3. Press Select Active Meas (side) and use the GP knob to select Clock-to-Output Time in the list of selected measurements. Figure 2–19 shows the list of selected measurements.

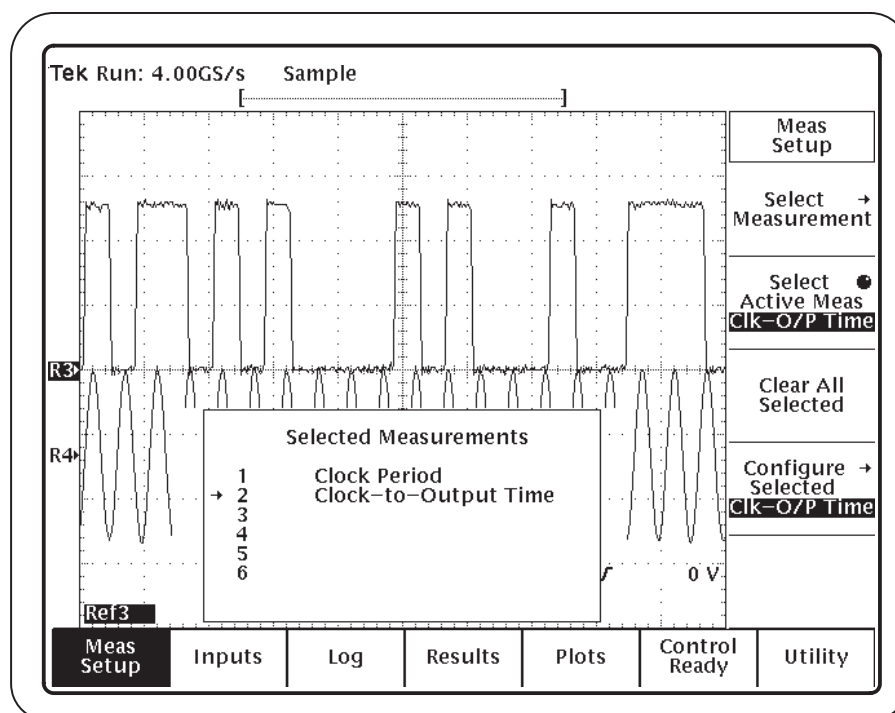


Figure 2–19: Selected Measurements list

4. Select Inputs (main) → 2nd (side) → Source (side) → –more– 1 of 4 (side) → –more– 2 of 4 (side) → Ref 3 (side).
5. Press Done (side) two times. Figure 2–20 shows the 2nd Input menu setup.

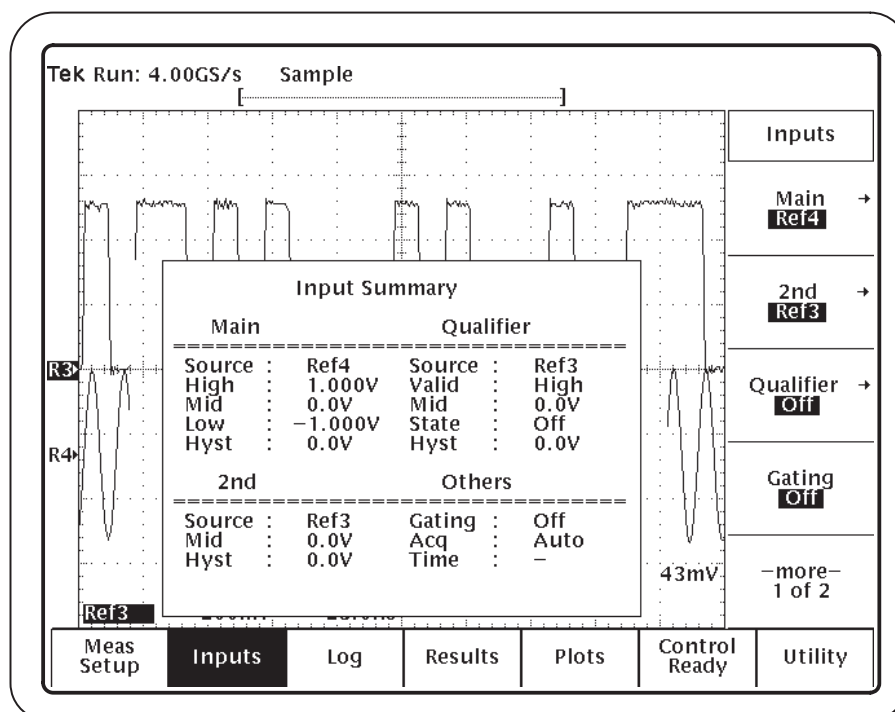


Figure 2-20: 2nd Input menu setup

- To reset previous results to zero, press Control (main) → Reset Results (side).
- To take the measurement, press Control (main) → Start (side).

Wait for the calculations to complete. Figure 2-11 shows the results.

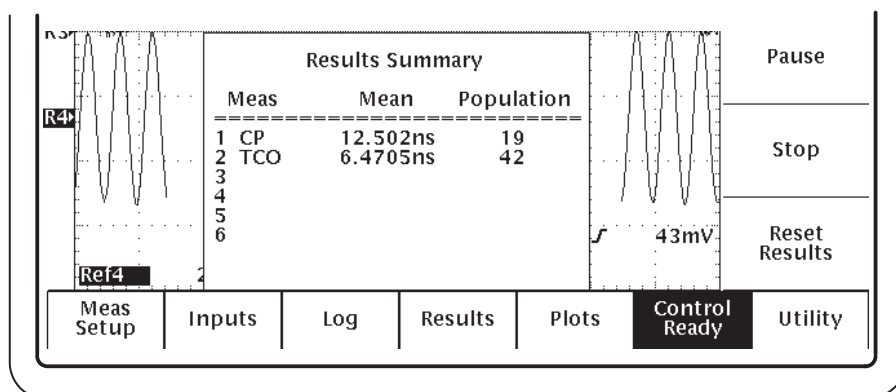


Figure 2-21: Clock Out Time lesson: Results Summary results

8. Press Results (main) → Result Details (side). Figure 2–22 shows the Results Details readout.

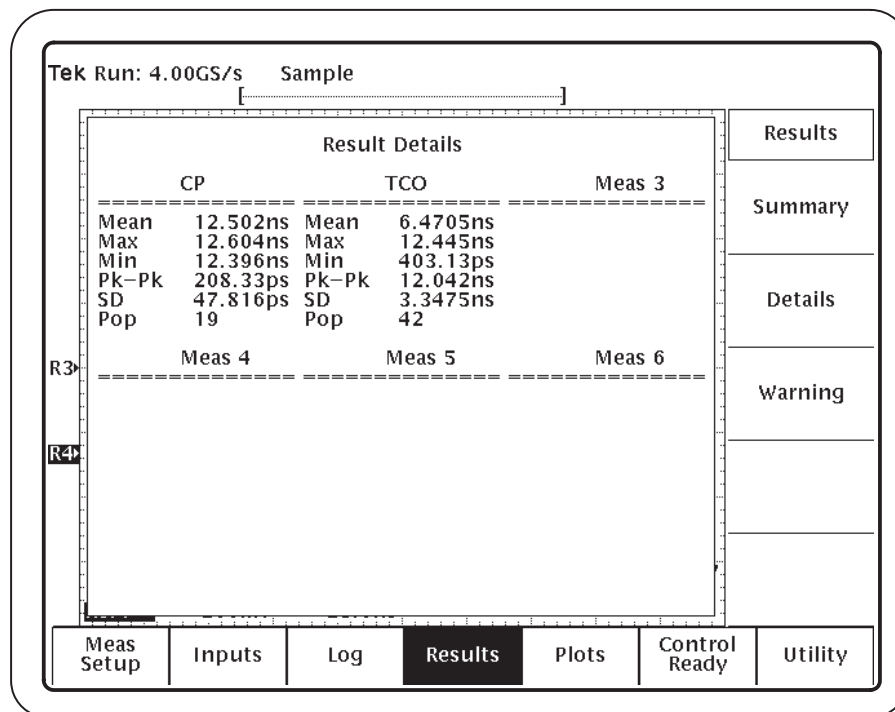


Figure 2–22: Result Details shows the statistical values for all measurements

Saving the Results to a Data Log File

To save the measurement results to a data log file, follow these steps:

1. Press Log (main) → Log Results (side) and select On.
2. Press Done (side). Figure 2–23 shows the Log Results menu.

NOTE. The RESULTS.CSV file is stored on the hard disk drive by default. It is faster to save data to a log file on the hard disk drive than to a floppy disk.

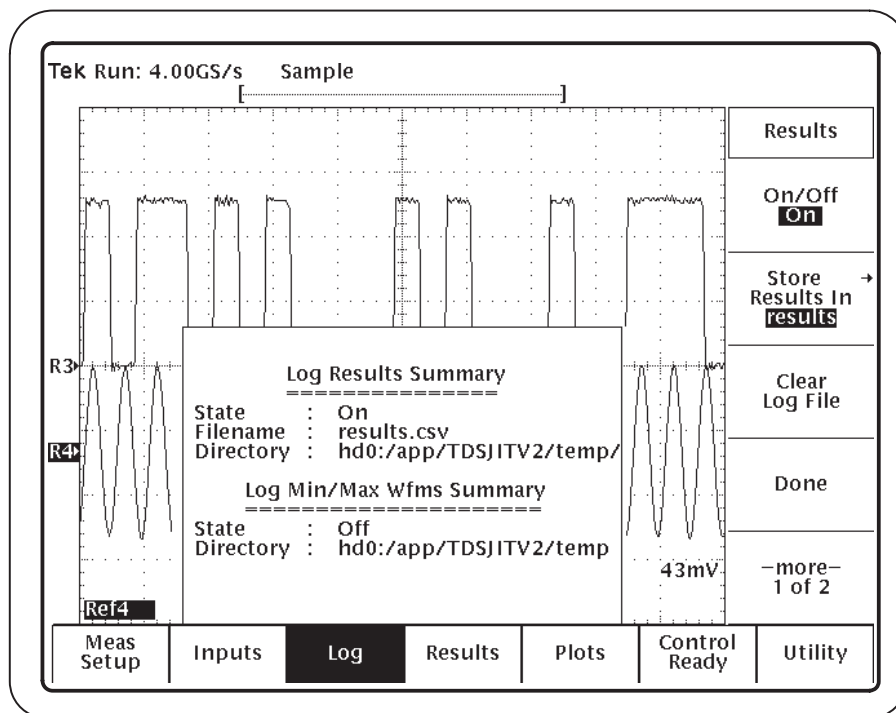


Figure 2-23: Log Results menu

3. To log the results to a .CSV file, press Control (main) → Start (side).

The “comma separated variable” file format (.CSV) is compatible with many spreadsheet, database, and data analysis programs on a personal computer.

4. After the measurement completes, press Control (main) → Start (side) to log more data to the RESULTS.CSV file.
5. To copy the RESULTS.CSV file to a floppy disk to view on a personal computer, follow these steps:
 - a. Insert a blank, DOS-formatted floppy disk into the floppy disk drive on the oscilloscope.
 - b. Press SAVE/RECALL SETUP → File Utilities (main).
 - c. Use the GP knob to highlight hd0:, and press SELECT.
 - d. Use the GP knob to highlight APP, and press SELECT.
 - e. Use the GP knob to highlight TDSJIT1V2, and press SELECT.
 - f. Use the GP knob to highlight TEMP, and press SELECT.

Figure 2-24 shows the RESULTS.CSV file and the path to it.

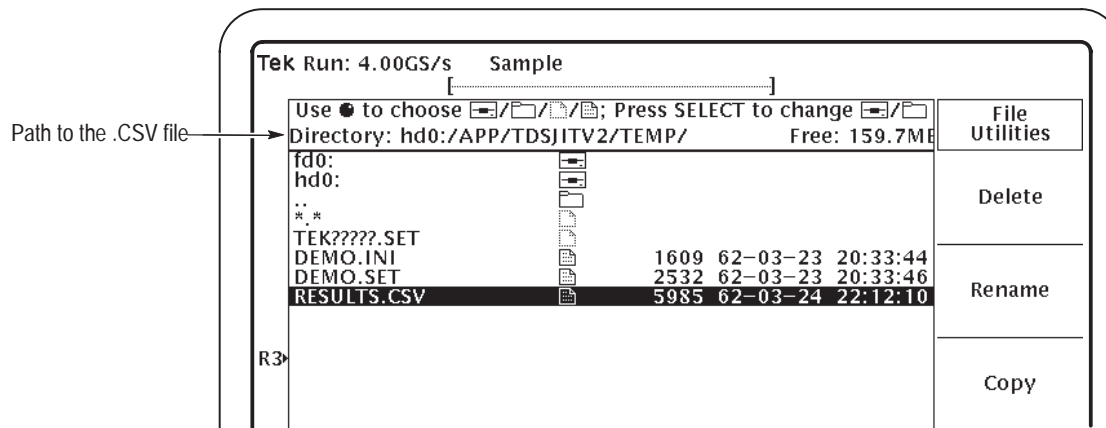


Figure 2-24: Path to the RESULTS.CSV file on the hard drive

- g. Use the GP knob to highlight RESULTS.CSV, and press Copy (side).
- h. Use the GP knob to highlight fd0:, and press Copy RESULTS.CSV to selected directory (side). Figure 2-25 shows this side menu item.

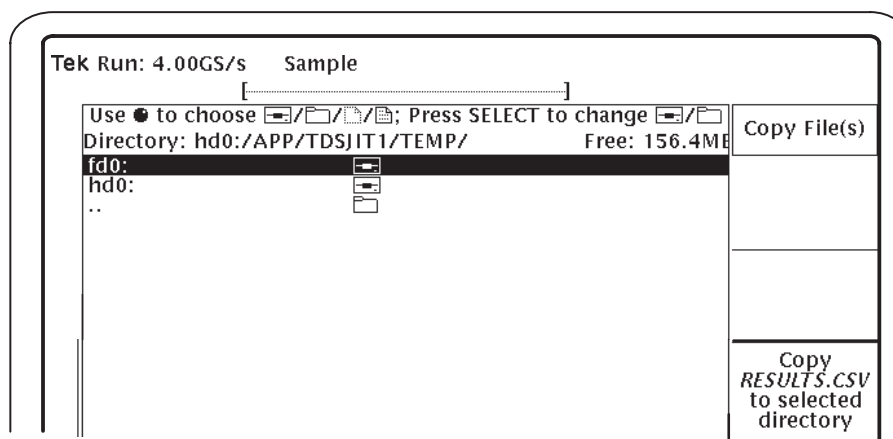


Figure 2-25: Copying the RESULTS.CSV file to a floppy disk

6. Press the SHIFT, and then the APPLICATION front-panel menu button to return to the application.
7. Eject and remove the floppy disk from the floppy disk drive.

Viewing the RESULTS.CSV File (Data Log)

You can import the RESULTS.CSV file to a DOS-based personal computer and then view the data log file with a spreadsheet, database, or data analysis program. Figure 2–4 on page 2–15 shows an example of how the RESULTS.CSV file might look in a spreadsheet program on a personal computer.

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 do so, you will need to save the application and oscilloscope setups.

To save the setups and stop your session, refer to *Saving a Setup* on page 2–24 and to *Exiting the Application* on page 2–25.

Returning to the Tutorial

To return to the tutorial setup, you can start the application and then recall the saved application and oscilloscope setups from within the application.

To recall the application and oscilloscope setups, refer to *Recalling a Setup* on page 2–25.

GPIB Program Example

This section contains an example of a GPIB program that can execute the TDSJIT1V2 application. The application floppy disk contains this program in the tdsjit1ctrl.c file.

Guidelines

Your GPIB program should comply with the following guidelines:

- Turn off the GPIB response headers with the “HEADER OFF” command; refer to the programmer information (in online help) for your oscilloscope.
- 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.

Program Example

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

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

Refer to *Appendix B: GPIB Command Syntax* for a complete list of the GPIB command syntax with the arguments, variables, and variable values.

```
/* TDSJITV2
 * This is a reference program to illustrate how to communicate to TDSJIT1V2
 * using Remote GPIB facilities.

    Typical Application does following steps

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

    For the current program, we will recall "Default" settings (This has only one active
    measurement - Clock Period).

    You can save setup files according to your own needs using the application interface.

*/

#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 ReadBuffer[100];    //    Read data buffer
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* ErrorMessage)
{
    printf("Error : %s\nibsta = 0x%x iberr = %d (%s)\n",
           ErrorMessage, ibsta, iberr, ErrorMnemonic[iberr]);
    if (ud != -1)
    {
        printf("Cleanup: Taking device offline\n");
        ibonl(ud, 0);
    }
    exit(0);
}

/* Start Jitter Analysis application */

int start_application( int scope ) {
    char write_buffer[100];
    char read_buffer[100];
    char app_name[] = "\"TDSJITV2\"";
    int status, timer;

    /* Start the application */
    sprintf(write_buffer, "%s", "Application:activate \"hd0:/TDSJITV2.APP\"");
    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 name */
    sprintf(write_buffer, "%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;
    }

    /* 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 blank string */
timer = 1;

while (1) {

    if (timer > 60) {
        return 0;
    }
    sprintf(write_buffer, "%s", "Variable:value? \"setup\"");
    ibwrt(scope, write_buffer, strlen(write_buffer));
    /* read the answer */
    ibrd(scope, readBuffer, 99);

    if (ibsta & ERR) {
        GPIBCleanup(scope, "Unable to write to device");
    }

    readBuffer[ibcnt] = '\0';

    if (strcmp(readBuffer, "\" \"\n") == 0) {
        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) {

        if (timer > 90) {
            printf("*****Test Time Out *****\n");
            return 0;
        }
        sprintf(write_buffer, "%s", "Variable:value? \"sequencerState\"");
        ibwrt(scope, write_buffer, strlen(write_buffer));
        /* read the answer */

```

```

        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));

    /* read the answer */
    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\", \"CP\"");
    ibwrt(scope, write_buffer, strlen(write_buffer));

    Sleep(2000);
    printf("\tClock Period Results\n");
    // ***** Mean
    sprintf(write_buffer, "%s", "Variable:value? \"mean\"");
    ibwrt(scope, write_buffer, strlen(write_buffer));

    /* read the answer */
    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));

/* read the answer */
ibrd(scope, read_buffer, 99);
read_buffer[ibcnt] = '\\0';

printf("population:%s\\n", read_buffer);
}

int main(){
    int Dev, i;
    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");
}

recall_setup(Dev, "Default");

do_single_test(Dev);

// Print the results
display_results(Dev);

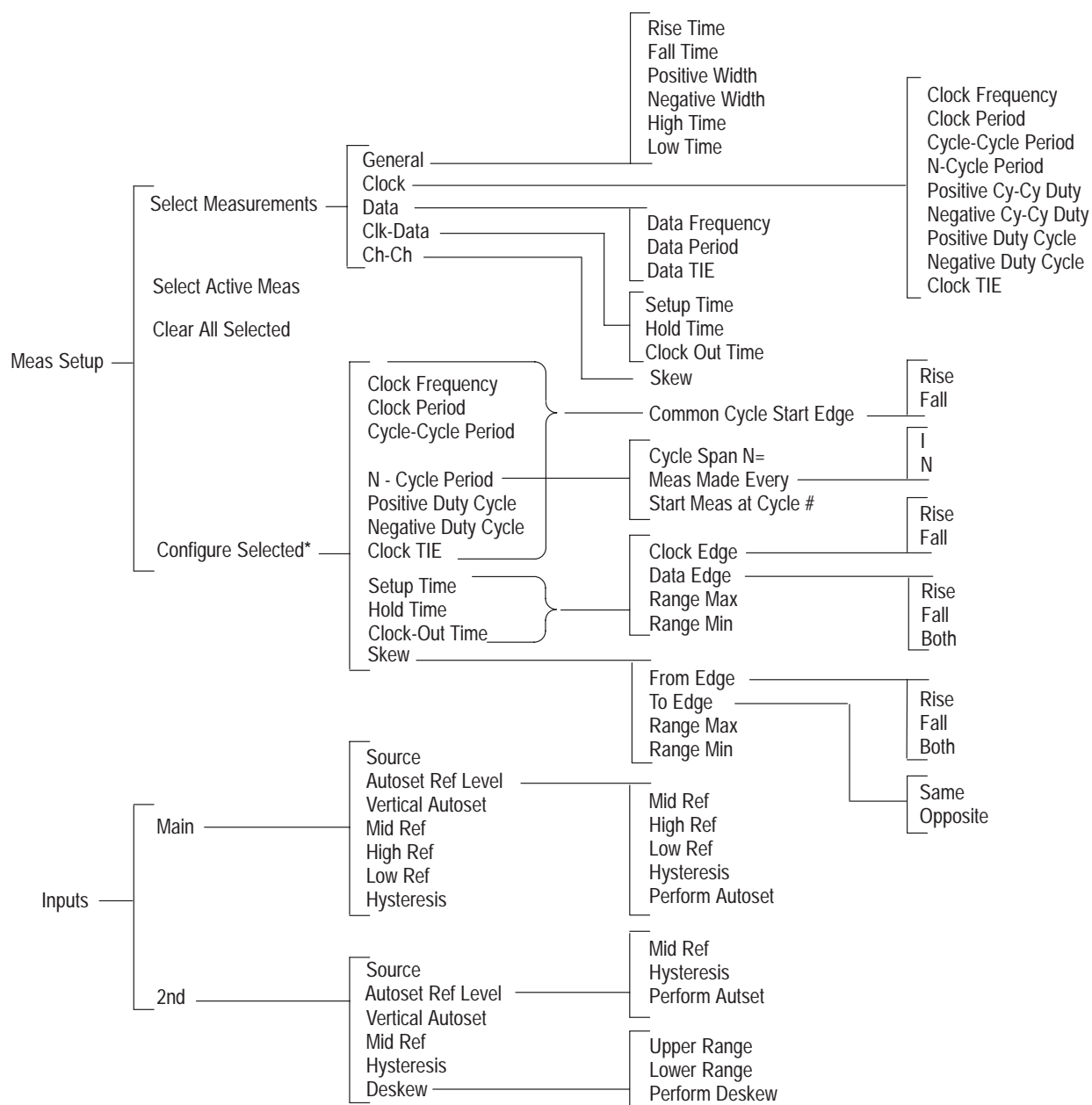
exit_application(Dev);
/* leave the device back elegantly */
printf("Cleanup: Taking device offline\n");
ibonl(Dev, 0);
}
```



Reference

Menu Structure

Figure 3–1 shows the relationship of the application-specific menus.



* There is no configuration for the Rise Time, Fall Time, Positive Width, Negative Width, High Time, Low Time, Positive Cy - Cy Duty, Negative Cy - Cy Duty, Data Frequency, Data Period, and Data TIE measurements.

Figure 3–1: Menu structure

Figure 3–2 shows the relationship of the remaining menus.

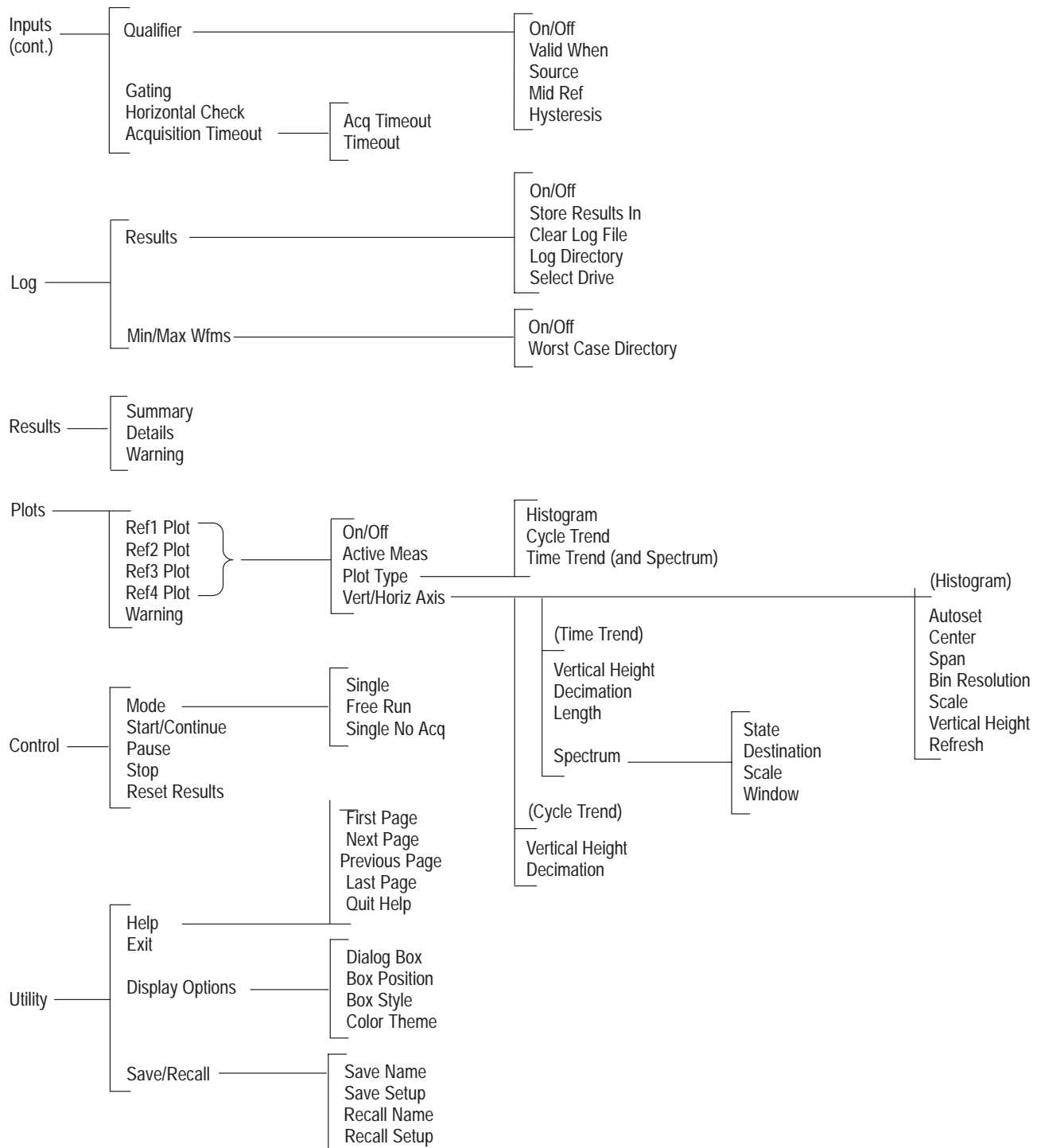


Figure 3–2: Menu structure (continued)

Parameters

This section describes the TDSJIT1V2 application parameters. You should refer to the user manual for your oscilloscope for operating details of other controls, such as front-panel buttons.

Refer to *Appendix B: GPIB Command Syntax* for a complete list of the GPIB command syntax with the arguments, variables, and variable values that correspond to the TDSJIT1V2 parameters.

Measurements Menus

There are two Meas Setup menus: Select Measurement, and Configure Selected, and two side menu items: Select Active Meas and Clear All Selected.

The Select Active Meas side menu item displays a list of up to six measurements activated in the Select Measurements menu. The selected active measurement is the measurement used as the Configure Selected item.

The Clear All Selected side menu item removes all activated measurements from the Select Active Meas side menu.

Select Measurements Menu

The selections in the Select Measurements menu by group are as follows:

- General group: Rise Time, Fall Time, Positive Width, Negative Width, High Time and Low Time
- Clock group: Clock Frequency, Clock Period, Cycle-Cycle Period, N-Cycle Period, Positive Cy-Cy Duty Cycle, Negative Cy-Cy Duty Cycle, Positive Duty Cycle, Negative Duty Cycle, Clock TIE
- Data group: Data Frequency, Data Period, and Data TIE
- Clock-Data group: Setup Time, Hold Time, and Clock Out
- Ch-Ch group: Skew

Configure Selected Menu

You do not need to configure the following measurements:

- General group (all): Rise Time, Fall Time, Positive Width, Negative Width, High Time and Low Time
- Clock group: Positive Cy-Cy Duty and Negative Cy-Cy Duty
- Data group (all): Data Frequency, Data Period, and Data TIE

Table 3–1 lists the parameters for the Configure Selected menu and the selections or range of values available for each.

Table 3–1: Configure Selected menu parameters

Parameter	Selections	Default setting
Common Cycle Start Edge	Rise, Fall	Rise
Cycle Span N=	1 to 1,000 in 1 cycle units	6
Meas Made Every	1, N	1
Start Meas at Cycle #	1 to 1,000 in 1 cycle units	1
Common Data Cycle Edge	Rise, Fall, Both	Rise
Range Max	–500.0 ms to 500.0 ms in 10 ps units	1.0 μ s
Range Min	–500.0 ms to 500.0 ms in 10 ps units	0 μ s
From Edge	Rise, Fall, Both	Rise
To Edge	Same as From, Opposite as From	Same as From
Range Max*	–500.0 ms to 500.0 ms in 10 ps units	1.0 μ s
Range Min*	–500.0 ms to 500.0 ms in 10 ps units	–1.0 μ s

* These range values are for the Skew measurement only.

Inputs Menus

There are four Inputs menus: Main Input, 2nd Input, Qualify Input, and Acquisition Timeout, and two side menu items: Gating, and Horizontal Check.

Gating makes cursors visible when you select On.

Horizontal Check checks if the Sample Rate is appropriate for the selected measurements; accurate measurements require at least two samples per edge.

Acquisition Timeout sets the amount of time that the application will wait to acquire data before it stops and displays an error message

Main Input and 2nd Input Menus

Table 3–2 lists the parameters for the Main Input and 2nd Input menus and the selections or range of values available for each.

Table 3–2: Main Input and 2nd Input menu parameters

Parameter	Selections	Default setting
Source	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4, Math1, Math2, Math3*	Ch1
Autoset Ref Levels	Refer to Table 3–3	
Vertical Autoset	None	
Mid Ref	–9.99 V to 9.99 V in 0.01 V units	0.00 V
High Ref**	–9.99 V to 10.0 V in 0.01 V units	1.00 V
Low Ref**	–10.0 V to 9.99 V in 0.01 V units	–1.00 V
Hysteresis	0 V to 5.0 V in 0.01 V units	0.00 V

* When deskewing channels, only use Ch1, Ch2, Ch3, or Ch4.

** Only available for the waveform defined in the Main Input menu.

Table 3–3 lists the parameters for the Autoset Ref Level menu and the selections or range of values available for each.

Table 3–3: Autoset Ref Level menu parameters

Parameter	Selections	Default setting
Mid Ref	1% to 99.0% in 1% units	50%
High Ref**	2% to 99.0% in 1% units	90%
Low Ref*	1% to 98.0% in 1% units	10%
Hysteresis	0% to 50.0% in 1% units	3.0%

* Only available for the waveform defined in the Main Input menu.

Table 3–3 lists the parameters for the Deskew menu and the selections or range of values available for each.

Table 3–4: Deskew menu parameters

Parameter	Selections	Default setting
Upper Range	–1.0 sec to 1.0 sec in 1 ms units	1.0 μ s
Lower Range	–1.0 sec to 1.0 sec in 1 ms units	–1.0 μ s

NOTE. The Perform Deskew side menu item starts the deskew utility. Refer to Deskewing the Probes and Channels on page 1–4 for more information.

Qualifier Input Menu

Table 3–5 lists the parameters for the Qualifier Input menu and the selections or range of values available for each.

Table 3–5: Qualifier Input menu parameters

Parameter	Selections	Default setting
On/Off	Off, On	Off
Valid When	Low, High	High
Source	Ch1, Ch2, Ch3, Ch4, Ref1, Ref2, Ref3, Ref4, Math1, Math2, Math3	Ref3
Mid Ref	–9.99 V to 9.99 V in 0.01 V units	0.00 V
Hysteresis	0 V to 5.0 V in 0.01 V units	0.00 V

Acquisition Timeout Menu

Table 3–6 lists the parameters for the Acquisition Timeout menu and the selections or range of values available for each.

Table 3–6: Acquisition Timeout menu parameters

Parameter	Selections	Default setting
Acq Timeout	Auto, User	Auto
Timeout	0.1 hrs to 24 hrs in 0.1 hr units*	0.1 hrs*

* When User is selected in the Acq Timeout side menu item.

Results Menus

There are no parameters for the Results Summary, Results Details, or Results Warning menus.

Plot Menus

There are three Plot menus: Histogram, Cycle Trend, and Time Trend. The Spectrum plot is an FFT of the Time Trend plot and is accessed through the Time Trend plot menu.

Histogram Plot Menu

Table 3–7 lists the parameters for the Histogram Plot menu and the selections or range of values available for each.

Table 3–7: Histogram Plot menu parameters

Parameter	Selections	Default setting
Autoset	None	
Center	Refer to Table 3–8	
Span	Refer to Table 3–8	
Bin resolution	High, Medium, Low	Medium
Scale	Linear, Log (logarithmic)	Linear
Vertical Height	1.0 V, 2.0 V, 3.0 V, 4.0 V	4.0 V

The parameters for the Horizontal Center and Horizontal Span vary by measurement. Table 3–8 lists the parameter selections and range of values.

Table 3–8: Horizontal Center and Span parameters by measurement

Measurements	Parameter	Selections	Default setting
Rise Time, Fall Time, Positive Width, Negative Width, High Time, Low Time, Clock Period, and Data Period	Center	10.0 ps to 1.0 s in units of 5 ps	500 ms
	Span	10.0 ps to 1.0 s in units of 5 ps	1 s
Cycle-Cycle Period, N-Cycle Period, Positive Cy-Cy Duty, Negative Cy-Cy Duty, TIE, Data TIE, Setup Time, Hold Time, Clock Out Time, and Skew	Center	0 s to 500.0 ms in units of 5 ps	500 ms
	Span	10.0 ps to 1.0 s in units of 5 ps	1 s
Clock Frequency, Data Frequency	Center	1 Hz to 1 GHz in units of 1 Hz	500 MHz
	Span	1 Hz to 1 GHz in units of 1 Hz	1 GHz
Positive Duty, and Negative Duty	Center	0% to 100% in units of 0.1%	50%
	Span	0% to 100% in units of 0.1%	100%

Cycle Trend Menu

Table 3–7 lists the parameters for the Cycle Trend Plot menu and the selections or range of values available for each.

Table 3–9: Cycle Trend Plot menu parameters

Parameter	Selections	Default setting
Vertical Height	1.0 Div, 2.0 Div, 3.0 Div, 4.0 Div	4.0 Div
Decimation	Off, On	Off

Table 3–9: Cycle Trend Plot menu parameters (Cont.)

Parameter	Selections	Default setting
Length	500, 1000, 2500*	500

* Selections vary and depend on the oscilloscope model and the record length.

Time Trend Menu

Table 3–10 lists the parameters for the Time Trend Plot menu and the selections or range of values available for each.

Table 3–10: Time Trend Plot menu parameters

Parameter	Selections	Default setting
Vertical Height	1.0 Div, 2.0 Div, 3.0 Div, 4.0 Div	4.0 Div
Decimation	Off, On	Off
Length	500, 1000, 2500, 5000, 15000, 30000, 50000*	500

* Selections vary and depend on the oscilloscope model and the record length.

NOTE. The Time Trend plot is limited to a 50,000 point record length; the Spectrum plot is limited to a 10,000 point record length.

Spectrum Menu

Table 3–11 lists the parameters for the Spectrum Plot menu and the selections or range of values available for each.

Table 3–11: Spectrum Plot menu parameters

State	On, Off	Off
Destination	Math1, Math2, Math3	Math1
Scale	dB, Linear	Linear
Window Data	On, Off	Off

Log Menus

There are two Log menus: Results and Min/Max Wfm.

Results Menu

Table 3–12 lists the parameters for the Log Results menu and the selections or range of values available for each.

Table 3–12: Log Results menu parameters

Parameter	Selections	Default setting
On/Off	On, Off	Off
Store Results In:	RESULTS.CSV, or new file name	RESULTS
Clear Log File	None	
Log Directory		hd0:/app/TDSJITV2/temp
Select Drive	fd0, hd0	hd0

Min/Max Wfms Menu

Table 3–13 lists the parameters for the Log Min/Max Wfms menu and the selections or range of values available for each.

Table 3–13: Log Min/Max Wfms menu parameters

Parameter	Selections	Default setting
On/Off	On, Off	Off
Min/Max Directory		hd0:/app/TDSJITV2/temp

Control Menu

Table 3–14 lists the parameters for the Control menu and the selections available.

Table 3–14: Control menu parameters

Parameter	Selections	Default setting
Mode	Single, Free Run, Single No Acq	Single
Start (or Continue)	None	
Pause	None	
Stop	None	
Reset Results	None	

Utility Menus

Table 3–15 lists each utility menu, the parameters, the selections available, and default settings.

Table 3–15: Utility menus and parameters

Utility menu	Parameter	Selections	Default setting
Help	Refer to page 2–1	None	
Exit	Refer to page 2–25	None	
Display Options	Dialog Box	On, Off	On
	Box Position	Left, Middle, Right	Middle
	Box Style	Opaque, Transparent	Opaque
	Color Theme	Based on the TDS oscilloscope color selections	TDS Default
Save/Recall Setup	Save Name	asetup, or new file name	asetup
	Save Setup	None	
	Recall Name	Default, or saved setup file names	Default
	Recall Setup	None	



Appendices

Appendix A: Measurement Algorithms

The TDSJIT1V2 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.

Single waveform measurements are: Rise Time, Fall Time, Positive Width, Negative Width, High Time, Low Time, Clock Period, Clock Frequency, Cycle-Cycle Period, N-Cycle Period, Positive Cycle-Cycle Duty, Negative Cycle-Cycle Duty, Positive Duty Cycle, Negative Duty Cycle, Clock TIE, Data Period, Data Frequency, and Data TIE. Dual waveform measurements are: Setup Time, Hold Time, Clock-to-Output, and Skew.

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. However, you should be aware of the memory length limitations with Time Trend or Spectrum plots. For more information, refer to the procedures for viewing the results in a Time Trend or a Spectrum plot on page 2–19.

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: Frequency, Period, Duty Cycle
 - Three cycle-start edges: Cycle-Cycle, TIE
 - $2N + 1$ cycle-start edges: N-Cycle
 - Two edges on each of two waveforms: Skew
4. Performs the measurement.
 5. Displays the results as statistics, saves the results as a plot format in a reference waveform, 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. T_n 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.

Single Waveform Measurements

The Rise Time and Fall Time algorithms use both the VRefHi and VRefLo reference voltage levels. Each edge is defined by the slope, voltage reference level (threshold), and hysteresis.

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 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 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 this measurement using the following equation:

$$W_n^+ = T_n^- - T_n^+$$

$$W_n^- = T_n^+ - T_n^-$$

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 this measurement using the following equation:

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

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:

$$T_n^{Low} = T_n^{Lo+} - T_n^{Lo-}$$

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.

Cycle-Cycle Period Measurement

The Cycle-Cycle Period 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.

N-Cycle Period Measurement

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

The application calculates this measurement using the following equation:

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

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

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

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 this measurement using the following equation:

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

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

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.

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.

The application calculates this measurement using the following equation:

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

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

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.

T_n is the specified clock edge.

T'_n is the calculated ideal clock edge.

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:

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

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_n^{Data} .

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.

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.

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 Time Measurement

The Clock Out Time (clock to output) 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.

Appendix B: GPIB Command Syntax

This appendix describes the GPIB command syntax that you can use in your GPIB program to do the following tasks:

- Start the TDSJIT1V2 application
- Recognize an active application with GPIB protocol
- Program and read application setup parameters
- Sequence measurements
- Synchronously read measurement results

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

- The `tdsjit2ctrl.c` file on floppy disk 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 TDSJIT1V2 parameters

Description. Gives the function of the command, conditions of its use, and its interactions with other commands.

Syntax. Gives the valid select and query command forms. The required arguments are listed in their proper order.

For example, in the syntax definition

PATH= <Ad><Ars>

the arguments <Ad> and <Ars> are required in the order indicated

Arguments. The arguments to a command are defined along with their range of values.

Returns. Defines the data returned in response to a command query.

VARIABLE:VALUE TDS COMMAND

Description VARIABLE:VALUE TDS COMMAND accepts string arguments for a control or data variable and a value to which to set the argument.

Syntax VARIABLE:VALUE

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

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

VARIABLE:VALUE? "<variable name>" for query

Arguments and Returns Table B–1 lists the arguments, their function, and the query returns.

Table B–1: VARIABLE:VALUE TDS COMMAND arguments and queries

Variable name	Variable value	Function	Query form
application	{activate "hd0:/TDSJITV2.APP", exit}	Activates the application or terminates the active application	Returns the name of the currently active application
Sequencer			
sequenceMode	{Single_NoAcq, FreeRun, Single}	Sets the sequencer mode	Returns the sequencer mode
sequencerState	{Ready, Paused, Sequencing}	Sets the state of the sequencer: Sequencing, Ready, Paused	Returns the state of the sequencer
Save/Recall			
setup	{Default, Recall, Save}	Sets the Save/Recall/Default action	No query form
recallName	Any string from 1 to 8 characters from A to Z and/or zero to nine	Sets the recalled setup file name	Returns the saved setup file name
saveName	Any string from 1 to 8 characters from A to Z and/or zero to nine	Sets setup file name	Returns the setup file name
Logging Results			
logAnnotate*	Any string from 1 to 20 characters from A to Z and/or zero to nine	Provides custom annotation to the statistics log file	No query form
loggerDestination	Any string from 1 to 8 characters from A to Z and/or zero to nine	Sets the statistics log file name	Returns the statistics log file name
logDirectory	{Default}	Sets the directory to the default directory	No query form
logger	{Reset}	Clears the current statistics log file	No query form

Table B-1: VARIABLE:VALUE TDS COMMAND arguments and queries (Cont.)

Variable name	Variable value	Function	Query form
loggerState	{On, Off}	Sets the state of the statistics log; when on, the statistics from the current acquisition are logged	Returns the state of the data log
Result Variables resultFor	{CF, CP, TIE, CCP, NCP, PCCD, NCCD, PDC, NDC, PW, NW, RISE, FALL, HIGH, LOW, DF, DP, DTIE, SU, HOLD, TCO, SKEW}	Sets the measurement for which results are requested	See Table B-2

* Custom annotation in the data log file is only available through GPIB execution of the application.

Table B-2 lists the measurement results queries.

Table B-2: Measurement results queries

Variable name	Function
calcFrequency	Returns the calculated frequency of the result for the measurement selected in the resultFor variable
error	Returns the error, if any, from the last measurement taken
max	Returns the maximum value of the result for the measurement selected in the resultFor variable
mean	Returns the mean value of the result for the measurement selected in the resultFor variable
min	Returns the minimum value of the result for the measurement selected in the resultFor variable
pkpk	Returns the peak-to-peak value of the result for the measurement selected in the resultFor variable
population	Returns the population for the result for the measurement selected in the resultFor variable
positiveMax	Returns the positive maximum value for the result of the measurement selected in the resultFor variable
positiveMean	Returns the positive mean value of the result for the measurement selected in the resultFor variable
positivePopulation	Returns the positive population for the result for the measurement selected in the resultFor variable
negativePopulation	Returns the negative population for the result for the measurement selected in the resultFor variable
negativeMax	Returns the negative maximum value of the result for the measurement selected in the resultFor variable

Table B-2: Measurement results queries (Cont.)

Variable name	Function
negativeMean	Returns the negative mean value of the result for the measurement selected in the resultFor variable
stdDev	Returns the standard deviation value of the result for the measurement selected in the resultFor variable
warning	Returns the warning, if any, from the last measurement taken

Appendix C: Error Codes

This appendix describes the error codes that display when there is a problem with operating the application. Table C–1 lists the codes with a brief description of each and a possible solution.

NOTE. Be sure to deskew the probes and oscilloscope channels before taking jitter measurements. (Refer to Deskewing the Probes and Channels on page 1–4.) You may encounter problems that cause the application to display error codes because the probes and channels are not deskewed.

Table C–1: Error codes, descriptions and solutions

Number	Description	Solution
E001/E108	No measurement selected	Select a measurement in the Measure menu and acquire data
E002	No valid edge found at the data source	If using Single mode, reacquire data; if the application still cannot find a valid edge, change to Free Run mode and acquire data
E003	No valid edge found at the data destination	Same solution as E002
E004	Association of edges failed	Unable to associate the data signals with the clock signals; this may indicate an SUT (system under test) problem with time synchronization between the signals; also try solution for E002
E005	Search for edges terminated; waveform segment is too short	The application requires a minimum waveform length of two records; if the length of the acquired waveform is less than two, increase the record length and acquire data
E006	Too many edges; sampling frequency is too low	The application cannot accurately reconstruct the waveform; use the HORIZONTAL SCALE knob to decrease the horizontal scale and acquire data
E007	The waveform is above the hysteresis because the level is too low; the waveform does not cross the hysteresis and remains above it	Increase the level of the waveform; select Inputs (main) → (a waveform)(side) → Mid Ref (side) and turn the GP knob towards the right
E008	The waveform is below the hysteresis because the level is too high; the waveform does not cross the hysteresis and remains below it	Decrease the level of the waveform; select Inputs (main) → (a waveform)(side) → MidRef (side) and turn the GP knob towards the left
E009	The level is too high and the waveform does not cut into the upper boundary of the hysteresis	Increase the hysteresis of the waveform; select Inputs (main) → Hysteresis (side) and turn the GP knob towards the right or try the same solution as E008.
E010	The level is too low and the waveform does not cut into the lower boundary of the hysteresis	Decrease the hysteresis of the waveform; select Inputs (main) → Hysteresis (side) and turn the GP knob towards the left or try the same solution as E007.
E011	Hysteresis band is not within the central 95% peak-to-peak	Decrease the hysteresis of the waveform; select Inputs (main) → Hysteresis (side) and turn the GP knob towards the left

Table C-1: Error codes, descriptions and solutions (Cont.)

Number	Description	Solution
E012	VRefHi value is not appropriate	Check the VRefHi value; it should be more than the VRefLo value and the Level (VRefMid) value
E013	VRefLo value is not appropriate	Check the VRefLo value; it should be less than the VRefHi value and the Level (VRefMid) value
E014	Failed to import a waveform and sequencing stopped	The application did not acquire the waveform; check the connection of the live signal to the channel or check the reference memory to be sure that it contains the appropriate waveform
E101	Failed to acquire a signal; not able to trigger	Check that the signal is present and make sure that Trigger Settings are correct
E102	Failed to import the waveform	The application did not acquire the waveform; check the connection of the live signal to the channel or check the reference memory to be sure that it contains an appropriate waveform
E103	Record length changed between acquisitions	The record length was changed while the application was taking measurements; do not change any oscilloscope settings after the application starts taking measurements
E104	Not enough edges on the Qualifier Input	If you use Ch1, Ch2, Ch3, or Ch4 as the qualifier, increase the HORIZONTAL SCALE and/or increase the record length on the oscilloscope (HORIZONTAL MENU → Record Length (main) → select larger value); if the qualifier is a waveform recalled to a reference memory, then use a different waveform that has more edges
E105	Failed to enable the sources	No waveform is available as the source; if you are using a reference memory as an input, make sure that a waveform is recalled to the specified reference memory and that it is displayed
E106	Not enough edges to perform deskew	Increase the HORIZONTAL SCALE and/or increase the record length on the oscilloscope (HORIZONTAL MENU → Record Length (main) → select larger value)
E107/E109	Cannot deskew reference or math waveforms	Deskew works only on Ch1, Ch2, Ch3, and Ch4; change the source as appropriate in the Main Input and 2nd Input menus
E110	Qualifier Input and Gating are mutually exclusive	Check that either the Qualifier Input or Gating are enabled, not both
E201	Not enough edges for the application to take measurements	Increase the HORIZONTAL SCALE and/or increase the record length on the oscilloscope (HORIZONTAL MENU → Record Length (main) → select larger value)
E202	Upper Range must be greater than Lower Range	Verify that appropriate values are selected for the Upper Range and Lower Range side menu items
E301	Conflict found in the use of waveforms	Check if the waveform is used in more than one Input or Plot menu; if need be, disable the Input or Plot menu or change the selected waveform, and then select the waveform for the desired function
E302	Cannot enable a plot	Not able to plot the results because the length of the plot is greater than 50000, or there is not enough memory available; decrease the record length or enable Decimation

Table C-1: Error codes, descriptions and solutions (Cont.)

Number	Description	Solution
E401	No valid waveform present	Check the connection of the signals to CH 1, CH 2, CH 3, or CH 4 on the oscilloscope, or check if appropriate waveforms are recalled to the reference memories
E601	Cannot save Min/Max waveform files to disk	The oscilloscope cannot write to a file because the disk is full, the disk is write-protected, or the disk is bad
E701	Cannot save the data log file to disk	The oscilloscope cannot write to a file because the disk is full, the disk is write-protected, or the disk is bad
E801	Oscilloscope is not compatible	Application runs only on TDS694C, TDS784D, and TDS794D oscilloscopes
E802	RTE must be V1.2 and above	Check if the RTE Version of the Oscilloscope is greater than or equal to Version 1.2. If not, the Application is not compatible with the Oscilloscope.
E901	Time Trend plot must be equal to or less than 10,000	Spectrum plot will not display if the Time Trend Length is greater than 10,000; change the Time Trend Length to an appropriate value or enable Decimation
E902	Cannot display the Spectrum plot	Spectrum plot will not display if Time Trend plot is disabled

Appendix D: Example Program to Copy Large Files

This appendix contains an example of a GPIB program that you can use to copy a data log file that is larger than 1.4 MB. A data log file larger than 1.4 MB exceeds the capacity of a floppy disk. This GPIB program allows you to transfer large data log files from the oscilloscope to a personal computer.

Refer to *Appendix B: GPIB Command Syntax* for a complete list of the GPIB command syntax with the arguments, variables, and variable values.

```
/* Example Program to show how to copy file through
 * GPIB Interface

 * This Program reads the file named by global variable "read_from"
 * and copies that to file on your PC named by global variable
 "write_to".

 */

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

// 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"};

// Files: for reading and writing

char read_from[] = "hd0:/APP/TDSJITV2/TEMP/RESULTS.CSV";
char write_to[] = "c:\\temp\\sac.csv";
```

```

/*
 * 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 main(){

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

    int sleepTime = 1000;

    FILE *fp = fopen(write_to,"w");

    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\n", Dev);
    }

    printf("Copying the file. Wait for some time...\n");

    /* Set the File Name */
    sprintf(write_buffer, "%s%s%s", ":FILESYSTEM:READF \\",
read_from, "\\");
    status = ibwrt(Dev, write_buffer, strlen(write_buffer));

    if (ibsta & ERR){
        GPIBCleanup(Dev, "Unable to start the application");
        return 0;
    }

    /* Wait for Some Time after a readF */
    Sleep(sleepTime);

```

```
do {
    /* read the answer */
    ibrd(Dev, read_buffer, 99);

    read_buffer[ibcntl] = '\0';

    fprintf(fp,"%s",read_buffer);
} while (ibcntl !=0);

printf("Done \nCleanup: Taking device offline\n");
ibonl(Dev, 0);

fclose(fp);
}
```




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