Online Help

Tektronix

TDSCPM2 Communication Pulse Measurements Application

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Adapted from Online Help, version 3.0.0

www.tektronix.com

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For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

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

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

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

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

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

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

 CAUTION
Refer to Help

Preface

Welcome to the TDSCPM2 Communication Pulse Measurements Application.

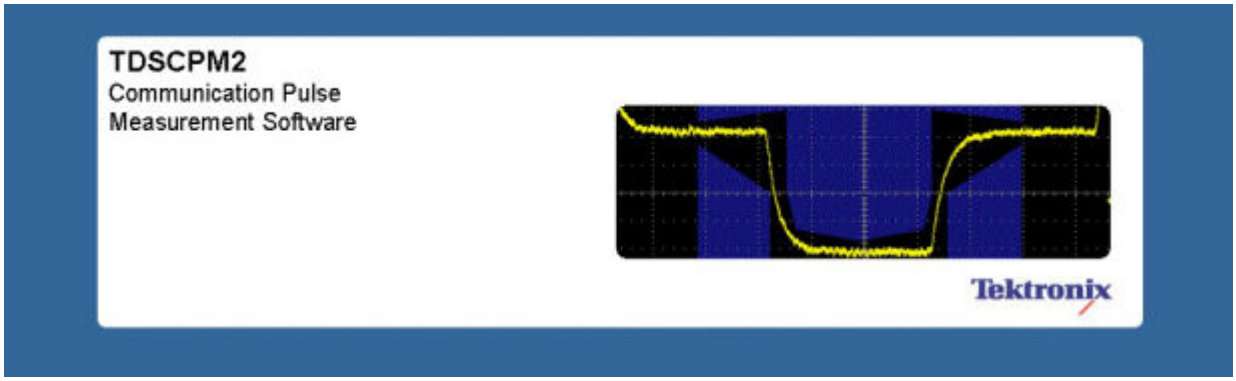

Figure 1: TDSCPM2 Communication Pulse Measurements Application

The TDSCPM2 Communications Pulse Measurements Application enhances basic capabilities of some Tektronix communications oscilloscopes.

The application provides pulse-and-eye-mask pattern, spectral power, pulse amplitude, and pulse balance testing for data rates defined in the ITU-T-G.703 and ANSI T1.102 communications standards.

The application also:

- Increases efficiency in performing compliance measurements
- Displays the results as Pass/Fail indicators
- Saves the results to a data log file
- Facilitates remote automation

Using Online Help

A help file has many advantages over a printed manual because of the advanced searching capabilities. Selecting Help on the right side of the application's Menu bar or pressing F-1 function key brings up the help file. The main (opening) Help screen is divided into three folders, each of which offers a unique mode of assistance.

- **Table of Contents (TOC)** - organizes the Help into book-like sections. Click books to open and select topics of interest.
- **Index** - enables you to scroll a list of alphabetical keywords. Click the topic of interest to bring up the appropriate help page.
- **Find** - allows a text-based search. Follow the steps below:

1. Type the word or phrase you want to find in the search box.
2. Select some matching words in the next box to narrow your search.
3. Choose a topic in the lower box, and then select the Display button.
    - To print a topic, select the Print button from the help topics menu bar. (To print color example screens, see Color Printing.)
    - Select Options from the menu bar for other commands, such as to annotate a topic, keep the help window on top or to use system colors.
    - Select the Back button to return to the previous help window. Sometimes you can jump from one topic to another through a hyperlink. If the Back button is "grayed out" or a jump is not available, choose the "Help Topics" button to return to the originating help folder.
    - Sometimes you will see a bolded "Note" in topic text. This indicates that very important (noteworthy) information is being imparted to the user.

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

Pop-up text is green (with no underlines). Select the green text to display a brief help message. Click to return to the topic.

Note: *Green-underlined text indicates a Jump (hyperlink) to another topic. Select the green text to jump to the related topic. For example, click the green text to jump to the topic on Online Help and Related Documentation.*

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

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

Color Printing

Some online help topics have color in the examples of the displayed application. If you want to print this type of topic on a monochrome printer, some information may not print because of certain colors. Instead, you should print the topic from PDF (portable document format) file that corresponds to the Online Help. You can find the file in the Documents directory on the *Optional Applications Software on a Windows-Based Oscilloscope CD*. The figures of application menus in the PDF file are gray scale and all of the information prints.

Related Documentation

In addition to the Online Help, you can access other information on how to operate the oscilloscope and application through the following related documents:

- Quick Reference; the application-specific quick reference contains a "mini" tutorial and a menu map that shows the structure of the user interface.
- Installation Instructions; the installation instructions provide information on how to install software.
- Oscilloscope Information; the user manual for your oscilloscope provides general information on how to operate the oscilloscope.
- Programmer Information; the online help for your oscilloscope provides details on how to use GPIB commands to control the oscilloscope.
- The ITU-T Recommendation G.704 (07/95), *General Aspects of Digital Transmission Systems*, document provides information on the ITU-T-G.703 standard.
- The *American National Standard for Telecommunications--Digital Hierarchy--Electrical Interfaces* document provides information on the ANSI T1.102 standard.

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

- Software warranty
- List of all available applications, compatible instruments, and relevant software and firmware version numbers
- Applying a new label
- Installing an application

- Enabling an application
- Downloading updates from the Tektronix Web site

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

Conventions

Online help uses the following conventions:

- This online help refers to the TDSCPM2 Communications Pulse Measurements Application as the TDSCPM2 application or as the application.
- When steps require a sequence of selections using the application interface, the ">" delimiter marks each transition between a menu and an option. For example, one of the steps to recall a setup file would appear as Measurements > Save/Recall > Recall.

Feedback

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

Direct your feedback to us through email to techsupport@tektronix.com and include the following information. Please be as specific as possible.

General information:

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

Application specific information:

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

Once you have gathered this information, you can contact technical support by phone or through e-mail. If using e-mail, be sure to enter in the subject line "TDSCPM2 Problem," and attach the .set, .ini, and .wfm files.

To include screen shots, from the oscilloscope menu bar, select File > Export…. The Export Dialog box displays. Enter a file name with a .bmp extension and Save. You can then attach the file to your email (depending on the capabilities of your email editor).

Getting Started

The TDSCPM2 Communications Pulse Measurements Application is a Java™–based application that augments general capabilities of select Tektronix Oscilloscopes. The application provides pulse parametric and eye pattern, spectral power, pulse amplitude, and pulse balance testing for data rates defined in the ITU–T G.703 and ANSI T1.102 communications standards.

The next figure shows an example of a pulse-mask pattern, a communications signal, and the results readout.

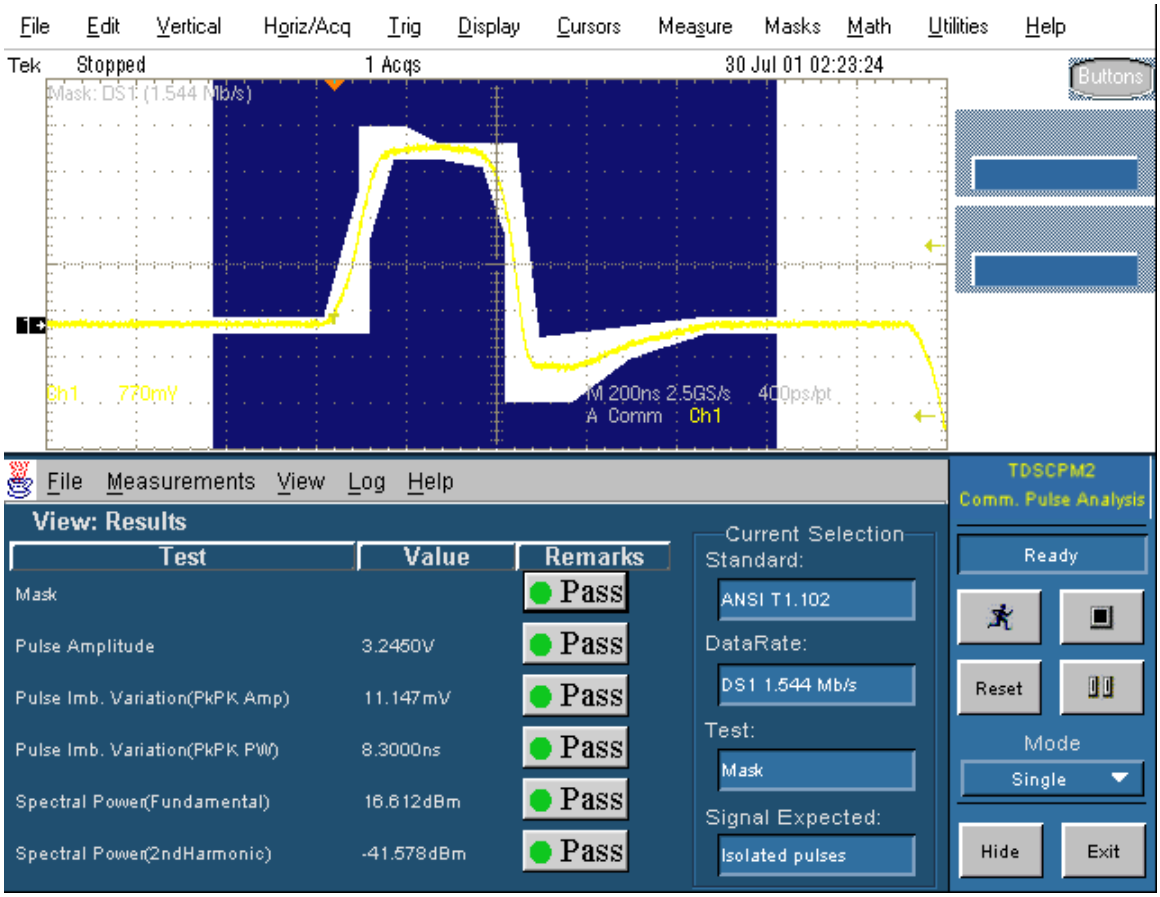

Figure 2: Communications Pulse Measurements Application

Compatibility

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

Requirements and Restrictions

The Sun Java Run-Time Environment V1.4.2 is automatically installed on the oscilloscope to operate the TDSCPM2 application and use the GPIB commands.

Standard Accessories

There are no standard accessories for this product.

Optional Accessories

The AFTDS Differential Signal Adapter and the AMT75 75/50 Ω Adapter (5x) are accessories that you can use with this product.

Installation

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

- Software Warranty
- List of applications, compatible instruments, and relevant software and firmware version numbers
- Applying a new label
- Installing an application
- Enabling an application
- Download updates from the Tektronix Web site

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

Connecting to a System Under Test

You can use an AFTDS or AMT75 electrical communication adapter to connect between your System Under Test (SUT) and the oscilloscope. These adapters match the output signal from 75 ohms to 50 ohms.

Note: *Input impedance to the instrument must be 50 ohms.*

To connect the electrical communication adapter between the SUT and the oscilloscope, refer to the figure below and follow these steps:

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

1. Power off the SUT.
2. Connect the AFTDS or AMT75 electrical communication adapter to CH 1 of the oscilloscope.
3. Connect the electrical communication adapter to the appropriate communication signal in the SUT.

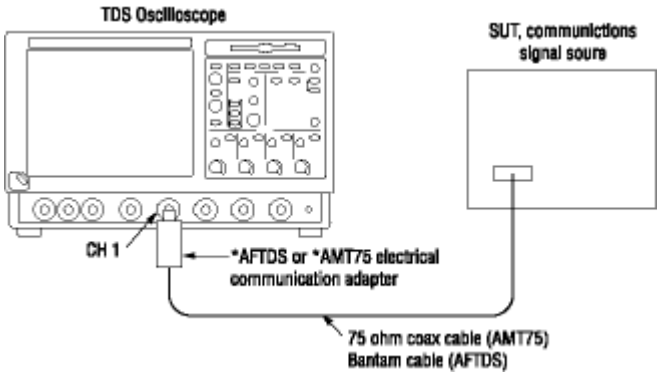

Figure 3: Connecting to a system under test

Note: *If you are using a TekConnect™ version of high performance oscilloscopes, a TCA-BNC adapter is required. For DPO7000 series oscilloscopes, use TPA-BNC adapter.*

Operating Basics

This section contains information on the following topics and tasks:

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

Application Interface

The application uses a Windows interface.

Note: *The oscilloscope application shrinks to half size and appears in the top half of the display when the application is running. If the application is running but hidden from view, select the App button or Restore application menu on the screen to return it to view.*

Table 1: Application Interface Menu Controls

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

Running the Application

Depending on the type of oscilloscope that you have, you can start the software in one of the following ways:

- Select File > Run application in the oscilloscope menu bar. Then select Communications Pulse Measurements 2.
- Select App > Communications Pulse Measurements 2.
- Select Analyze > Communications Pulse Measurements 2.

Minimizing and Maximizing the Application

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

The way you maximize the application depends on the oscilloscope model. To maximize the application, do one of the following:

- Select TDSCPM2 in the Windows toolbar.
- Select the App > Restore Application on the oscilloscope menu bar.
- Select the Analyze > Restore Application on the oscilloscope menu bar.

- Click the App button on the top right of the oscilloscope.

Figure 4: File Menu

Hiding and Returning to the Application

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

- Select the Hide button in the application display
- Choose the Menu-bar or Toolbar mode on the oscilloscope and access menus

To return to the application, choose the App button on the top menu bar of the TDS oscilloscope.

To return to the application, choose Analyze > Restore Application on the DPO oscilloscope.

Exiting the application

To exit the application, choose File > Exit or the Exit button in the lower right corner of the application. When you exit the application, you can select to keep the oscilloscope setup currently in use with the application or to restore the oscilloscope setup that was present before you started the application.

Application Directories and File Names

The application uses directories to save and recall setup files and uses extensions appended to file names to identify the file type.

The next table lists default directory names.

Table 2: Default Directory Names

Directory	Used for
C:\TekApplications\tdscpm2	Home location
C:\TekApplications\tdscpm2\logs	Data log files
C:\TekApplications\tdscpm2\setup	Setup files

Table 3: File Name Extensions

Extension	Type
.csv	Log file that uses a “comma separated variable” format
.ini	Application setup file
.set	Oscilloscope setup file saved and recalled with an .ini file; both files will have the same name

Setting Up the Application to Take Measurements

You can set up the application to take measurements for data rates defined in the ITU-T G.703 and ANSI T1.102 communications standards, and to display the results or save them to a data log file.

There are two Measurements menus. One allows you to select and the other to configure a measurement.

Table 4: ITU-T G.703 Data Rates and Tests

Test	E1, both	E2	E3	E4	STM–1E
Pulse Amplitude	Yes	Yes	Yes	- - -	- - -
Peak–Peak	- - -	- - -	- - -	Yes	Yes
Pulse Symmetry	Yes	Yes	Yes	- - -	- - -
Zero Level	Yes	Yes	Yes	- - -	- - -
Mask	Yes	Yes	Yes	Yes	Yes

Table 5: ANSI T1.102 Data Rates and Tests

Test	DS1	DS3	DS4NA	STS–1	STS–3
Pulse Amplitude	Yes	Yes	- - -	- - -	- - -
Pulse Imbalance: Variation	Yes	- - -	- - -	- - -	- - -
Pulse Imbalance: Ratio	- - -	Yes	- - -	- - -	- - -
Spectral Power	Yes	Yes	Yes	Yes	Yes
Mask	Yes	Yes	Yes	Yes	Yes

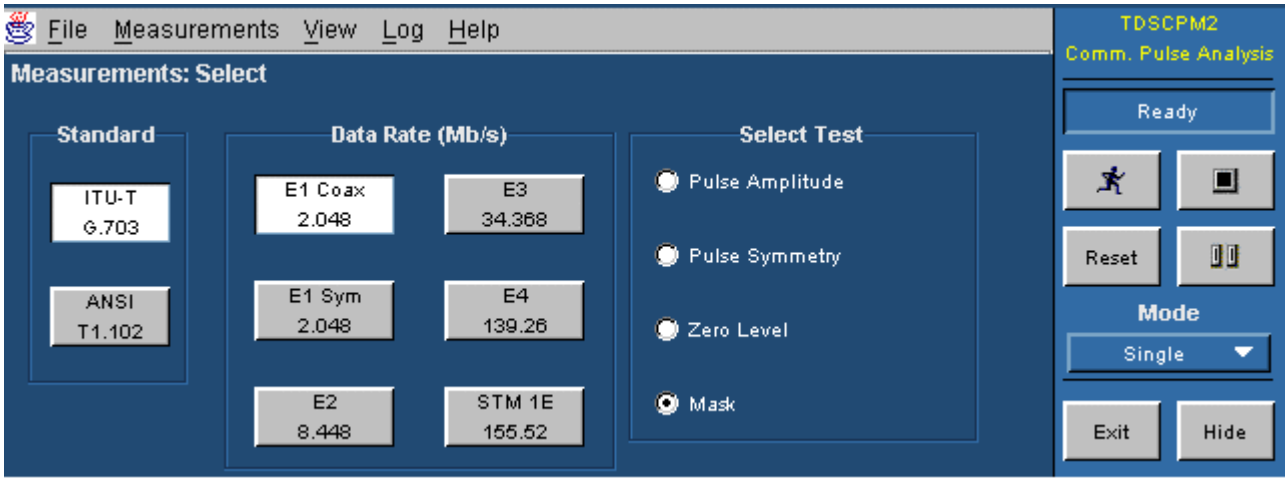

Figure 5: ITU G.703 Measurement Selections

Selecting Measurements

Table 6: Data Rate Menu Options for ITU-T G.703 Standard

Option	Description*
E1 2.048 Mb/s Coax Pair	Signal defined in Section 9, Table 7, and Figure 15 medium, 75 Ohm coaxial pair
E1 2.048 Mb/s Sym Pair	Signal defined in Section 9, Table 7, and Figure 16 medium, 120 Ohm symmetrical pair
E2 8.448 Mb/s	Signal defined in Section 10, Table 8, and Figure 16
E3 34.368 Mb/s	Signal defined in Section 11, Table 9, and Figure 17
E4 139.26 Mb/s	Signal defined in Section 12, Table 10, Figure 19, and Figure 20
STM–1E 155.52 Mb/s	Signal defined in Section 15, Table 12, Figure 22, and Figure 23
*** Found in ITU–T G.703, the ITU–T Recommendation G.704 (07/95), General Aspects of Digital Transmission Systems printed in October 1998**	
**** Found in ITU–T G.703 printed in 1991**	

Table 7: Data Rate Menu Options for ANSI T.102 Standard

Option	Description*
DSI 1.544 Mb/s	Signal defined in Section 6.1, Table 1, and Figure 1
DS3 44.736 Mb/s	Signal defined in Section 6.4, Table 4, and Figure 4
DS4NA 139.26 Mb/s	Signal defined in Section 6.6, Table 6, Figure 7, and Figure 8
STS–1 51.840 Mb/s	Signal defined in Section 6.5, Table 5, and Figure 5
STS–3 155.52 Mb/s	Signal defined in Section 6.7, Table 7, Figure 9, and Figure 10
*** Found in ANSI T1.102–1993, the American National Standard for Telecommunications - Digital Hierarchy - Electrical Interfaces**	

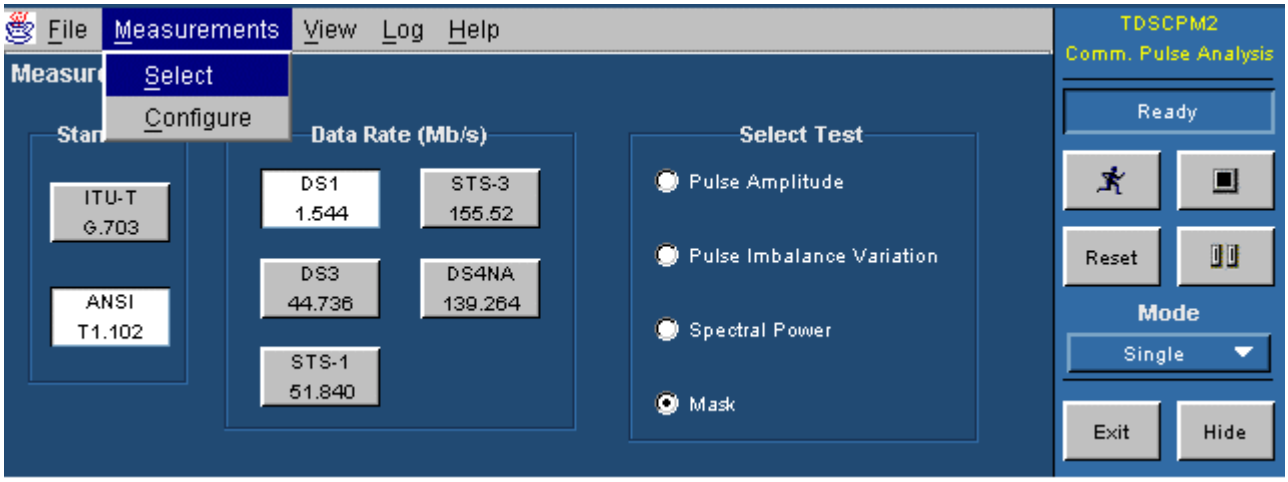

Figure 6: Measurements Select Menu, ANSI

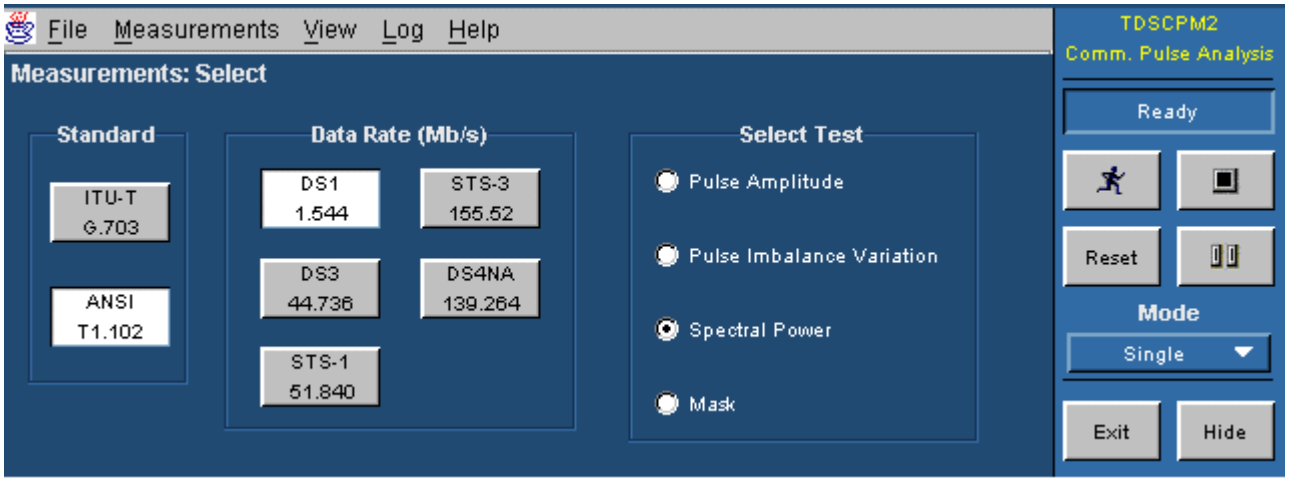

Figure 7: ANSI T1.102 Measurement Selections

Tests

Eight tests are available using this application.

***Note**: Available tests depend on the selected standard and data rate. See ANSI T1.102 Data Rates and Tests or see ITU-T G.703 Data Rates and Tests.*

Table 8: Select Test Area Options

Test	Description
Pulse Amplitude	Measures the amplitudes of isolated positive and negative pulses relative to the zero level on data rates that use AMI coding. Precise techniques for performing these measurements vary between data rates and standards. (Binary or pseudorandom PRBS)
Pulse Imbalance Variation	Measures the variation of pulse amplitudes and widths on the DS1 for the ANSI T1.102 standard 1.544 Mb/s data rate over 17 consecutive bits. (Ideally the user should provide an all 1's signal but pseudo-random sequences are also valid.)
Pulse Imbalance Ratio	Measures the ratio of amplitudes of positive and negative isolated pulses.
Pulse Symmetry	Calculates the ratio of pulse amplitudes and widths of positive and negative isolated pulses on some ITU–T G.703 data rates
Peak-Peak	Measures the amplitude of isolated positive and negative edges
Zero Level	Verifies whether the maximum and minimum values of a logical zero (such as no pulse) are within 10% of the nominal amplitude
Spectral Power	Determines whether a communications waveform is within the spectral power level constraints set by the standards Narrowband: Measures transmitted power of an “all ones” signal in two frequency bands, each 3 kHz ” 1 kHz; the center frequencies of the two bands are half the bit rate (fundamental) and the bit rate (2nd harmonic); the power at the fundamental must fall within a specified range and the power in the 2nd harmonic must be lower than the fundamental by at least a specified amount Wideband: Measures the total power below a designated bandwidth as specified, usually in a frame structure (not an “all ones” signal); the bandwidth limit is three to four times the bit rate
Mask	Takes measurements based on the pulse– or eye–shaped mask associated with the selected data rate and the setup parameters that correspond with the selected test

Configuring Measurements

The Setup parameters section of the Measurements: Config panel allows you to configure your measurements. The Configure Menu Options table lists all of the setup options with a brief description of each.

***Note**: Setup options vary by data rate for the Mask test. See ITU-G.703 data rates and Mask Options and ANSI T1.102 Data Rates and Tests.*

Table 9: Configure Menu Options and Mask Symbol Options

Option	Description
Input	Selects the input channel for the measurement
Num Avg	Specifies the number of waveform acquisitions that are averaged prior to testing
Autofit Mode	Allows the instrument to zero in on a passing mask solution based on an iterative movement along the horizontal and vertical axis
***Mask Margin	Controls how much tolerance is permitted in providing a passing solution.
Mask Symbol	See table below
***If margins are not equal, the results are shown in yellow.**	

Mask Symbol Options

Selections	Data Rate
Eye or Pulse	STS-1 51.840
Binary 0 or Binary 1	E4, STM1-E
Standard or Max Output	STS-3, DS4NA

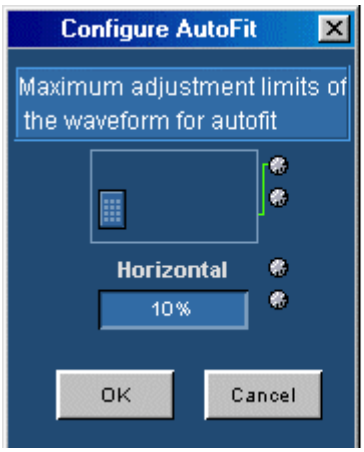

Figure 8: Configure Autofit Menu

Taking Measurements

The TDSCPM2 application will override user-specified trigger and time base settings before performing any of the measurements.

***Note**: Remember to select Reset to set the results to zero if you change the oscilloscope Vertical or Horizontal time settings between measurements.*

Lower bit rate mask tests utilize math channel 1 to provide a filtered signal (350 MHz Low Pass filter) for testing. Due to this filtering, the signal appears on the math channel (M1).

Performing Compliance Tests

To acquire data from waveforms, follow these steps:

1. Select a Sequence mode (Free-run or Single).

***Note**: The Sequence Control menu is always accessible in the right side of the application display.*

2. Press the Run button icon  to start the acquisition.

***Note**: Do not change oscilloscope settings while taking a measurement, since this can cause an invalid measurement.*

Analyzing the Results

The application displays the selected pulse-mask pattern with the communications waveform for visual analysis and can display the results from selected measurements as statistics. You can also log the data to a RESULTS.CSV file for viewing with a spreadsheet, database, or data analysis program.

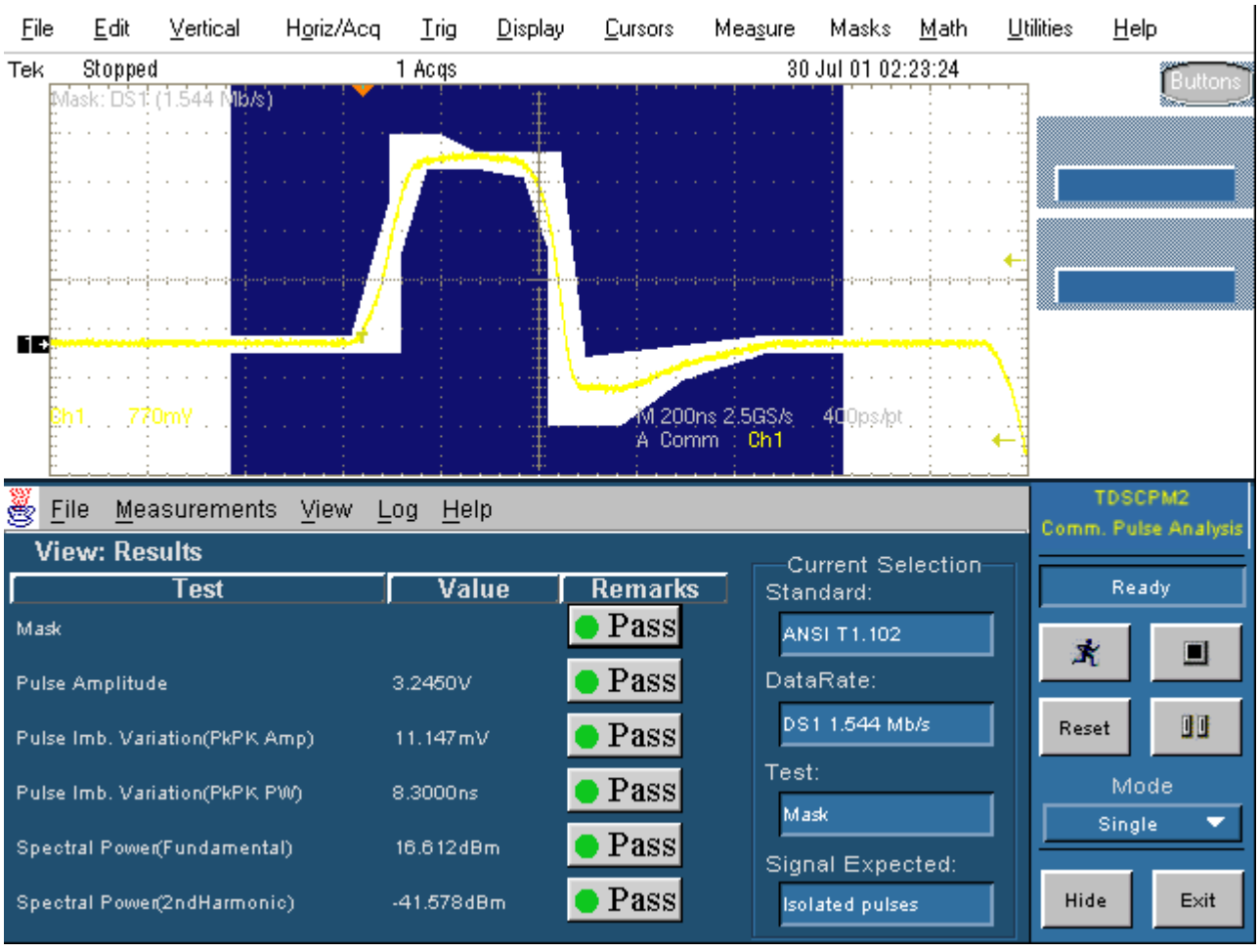

Figure 9: Pulse-Mask Pattern

tdscpm2	Version 1.1	Fri Aug 03 11:56:33 PDT 2001					
Standard	Data Rate	Test	Value	Units	Hit Count(For mask Test Only)	Error Code	Time Stamp
ANSI T1.1(	DS1 1.544	Pulse Imb.	26.100m	V		PASS	Fri Aug 03
ANSI T1.1(	DS1 1.544	Pulse Imb.	1.3104n	s		PASS	Fri Aug 03
ANSI T1.1(	DS1 1.544	Pulse Imb.	26.100m	V		PASS	Fri Aug 03
ANSI T1.1(	DS1 1.544	Pulse Imb.	2.0551n	s		PASS	Fri Aug 03
ANSI T1.1(	DS1 1.544	Pulse Imb.	22.000m	V		PASS	Fri Aug 03
ANSI T1.1(	DS1 1.544	Pulse Imb.	1.5571n	s		PASS	Fri Aug 03
ANSI T1.1(	DS1 1.544	Mask			0	PASS	Fri Aug 03

Figure 10: CSV Spreadsheet Example

RESULTS	Value	Remarks
Pulse Amplitude	2.3050V	
Pulse Symmetry(Amp Ratio)	1.0132	PASS
Pulse Symmetry(PW Ratio)	998.53m	PASS
Zero Level	−25.000mV	Too high
Mask		PASS

Figure 11: Results Readout

Clearing Results

To clear results, select the Reset button on the Sequence Control menu. You do not have to wait for a measurement to complete to clear the results.

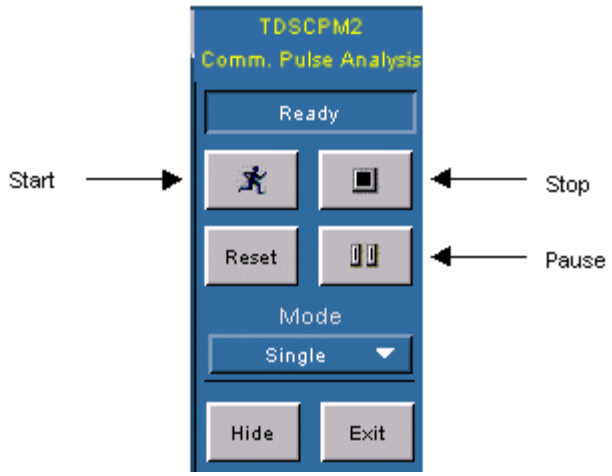

Figure 12: Sequence Control Menu

Table 10: Sequence Control Menu Options

Option/button (icon)	Description
Mode Single	Performs measurements on a single acquisition and stops
Free Run	Repeatedly acquires the input waveform(s) and takes measurements
Start/Continue button	Starts to take measurements from the input waveform(s); when paused, continues taking measurements
Pause button	Pauses and resumes when you select the Continue button or stops when you select the Stop button
Stop button	Stops taking measurements
Reset button	Resets all result values to zero

Saving Results to a File

You can save (log) the results for all active measurements to a data log file.

Logging

This type of logging saves the statistical results and the individual result points of active measurements to a data log file. To access the Statistics Log menu, go to the Log menu in the menu bar and select Statistics.

Table 11: Log: Options and Buttons

Option/button	Description
Logging	Enables the application to save the measurement results for all active measurements, as well as the individual results to a data log file
Clear	Clears the data log file; you must turn off the logging before you can clear the contents of the data log file
Log File Name: Browse	Allows you to select the directory in which to save the data log file and to enter a name for the file; the extension must be .csv

Table 12: Log Menu Parameters

Parameter	Selection	Default setting
Logging	On, Off	Off
Clear	None	
Log File Name: Browse	Any file	C:\TekApplications\tdscpm2\logs \results.csv

Data Log File Format

The data log file consists of one header row and rows of logged information. The header row contains the application name, the version number of the application, and the date and time on which the file was created.

The remaining rows contain information for the measurements. The information is in the following order:

```
Application name  Version Number  Date  Time
Standard  Data Rate  Test  Result  Value  Hit Count  Unit  Result  Remark  Date  Time
```

Figure 13: Data Log File Format

***Note**: If you are using a GPIB program to execute the application, such as 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.*

Viewing a Data Log File

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

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 File menu to save and recall different configuration setups. To access the Save and Recall options, go to the File menu in the menu bar and select Save or Recall.

***Note**: Do not edit the .ini or the .set files, or recall setup files not generated by the application, since this can cause the application to become unstable.*

The File menu Save/Recall function includes the settings of the oscilloscope application. When you exit the application, you can choose whether to restore the settings of the oscilloscope to those present before starting the application.

Table 13: Save/Recall Measurement Options

Option	Description
Recall Default	Recalls the initial application state.
Recall	Allows you to select a saved application setup file for recall. Also restores the application to the state prior to saving the setup file.
Save*	Allows you to select a file name in which to save the current state of the file.
Recently Recalled	Select from a list of the four most recently recalled setup files to recall the setup.
Recently Saved	Allows you to select and save a file from a list of the four most recently saved files.
***Also saves a scope setup file of the same name.**	

Saving a Setup

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

1. Select the File menu.
2. Select the Save option.

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

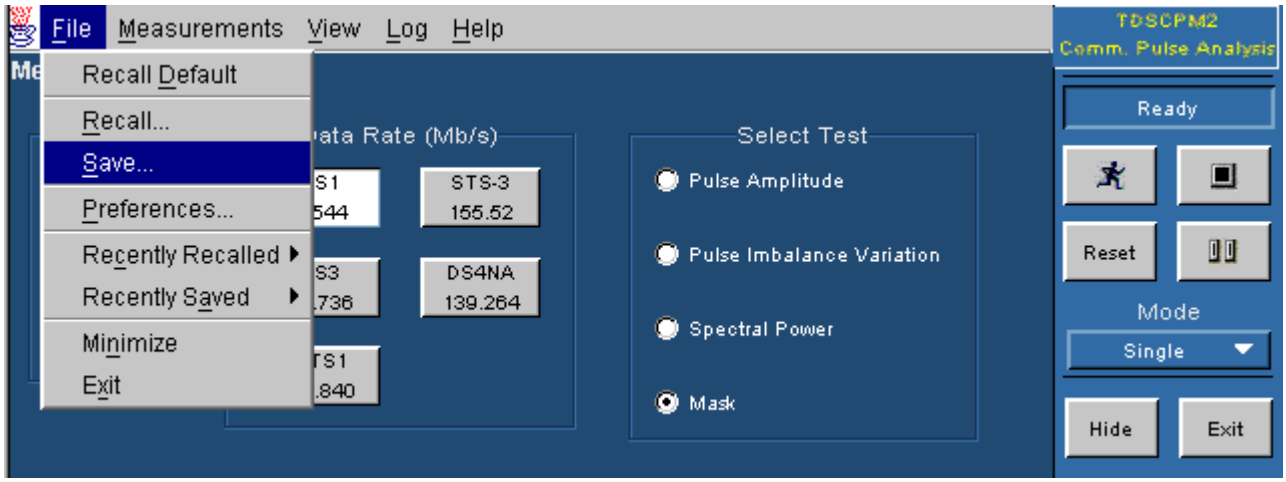

Figure 14: Save Setup Step 1

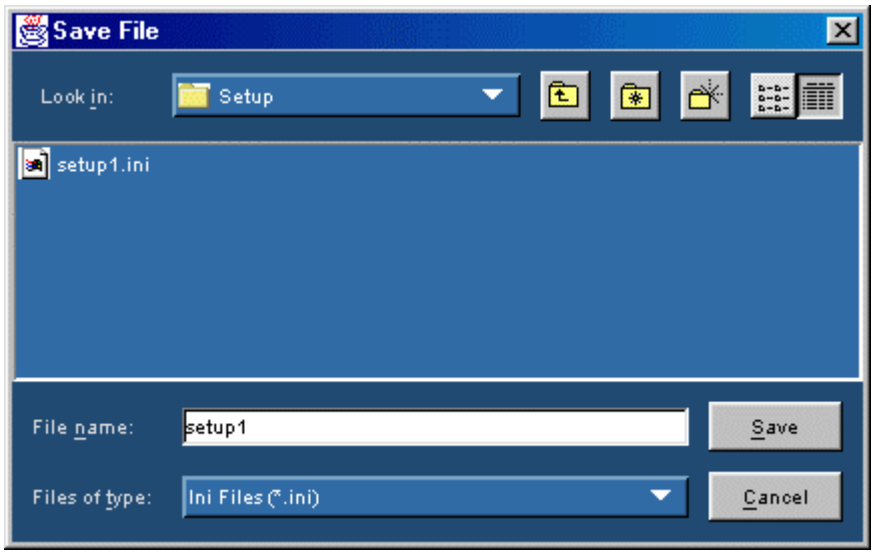

Figure 15: Save Setup Step 2

Recalling a Saved Setup

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

1. Select File > Recall.
2. Select the directory in which the setup file is located.
3. Select or enter a setup file name.
4. Select Recall.

***Note**: The application also recalls the oscilloscope setup from a .set file when you recall an application setup.*

Recalling the Default Setup

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

1. Select File > Recall Default from the menu.

   You will receive the message, "Default State Recalled Successfully!"
2. Select OK to return to main screen.

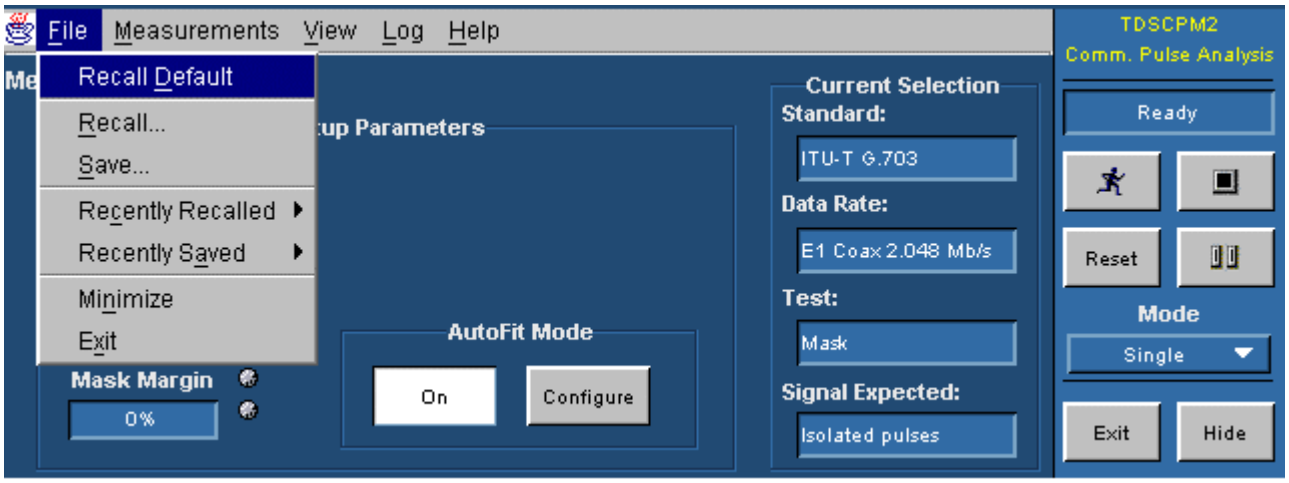

Figure 16: Recall Default Menu

Tutorial

This tutorial teaches you how to set up, take measurements, and view the results on the display or from a data log file. In addition, it teaches you how to stop and return to the tutorial.

Before you begin the tutorial, you need to do the following tasks:

- Connect to a communication signal
- Set up the oscilloscope
- Start the application

Connecting to a Communications Signal

Connect a communications signal on the SUT to CH 1 on the oscilloscope as described in connecting to a system under test (SUT).

***Note**: Be sure to power on the SUT.*

Setting Up the Oscilloscope

To set up the oscilloscope, follow these steps:

1. Push Default Setup.
2. Push Autoset.
3. Verify that your signal of interest is on the screen.

Starting the Application

To perform the tutorial, the TDSCPM2 application must be installed on the oscilloscope. See the *Optional Applications Software on a Windows-Based Oscilloscope Installation Manual.*

To start the application, follow these steps:

1. Select File > Run application in the oscilloscope menu bar. Then select Communications Pulse Measurements 2, or
   Select App > Communications Pulse Measurements 2, or
   Select Analyze > Communications Pulse Measurements 2.

2. The application starts and displays the opening or Measurements: Select menu.

3. Choose the standard and data rate that corresponds to the SUT.

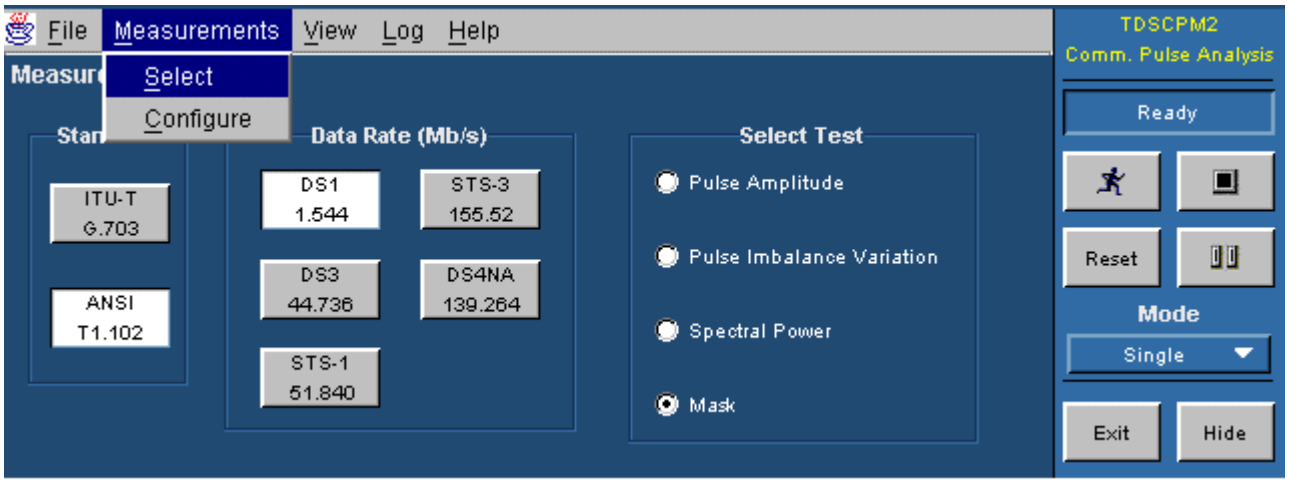

Figure 17: Measurement Select Menu

Taking a Measurement

This lesson teaches you how to use the TDSCPM2 application to take measurements from a standard communications signal.

To take a measurement, follow these steps:

1. Be sure that you are displaying a signal on the oscilloscope.

2. Select Test > Mask.

3. Select Measurements > Config > Input > Ch1 (already set as default).

4. Press  to start the Acquisition.

***Note**: The TDSCPM2 application properly aligns the pulse-diagram of the communications signal over the selected pulse-shaped mask pattern.*

5. Select another test and repeat step 3.

***Note**: The Results page accumulates successive test results.*

Saving Results to a Data Log File

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

1. Go to the Log menu in the menu bar and select Statistics.

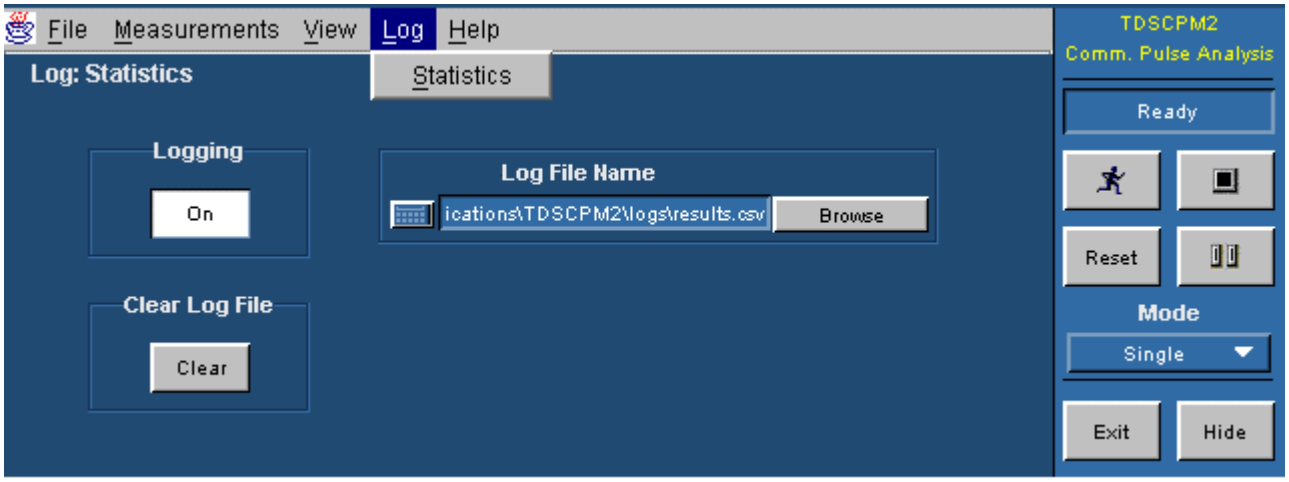

Figure 18: Set Up Log File

2. Select Logging On.
3. Press  to start the acquisition.
4. Select Logging Off before viewing the data log file.
5. Exit the application.

Viewing a Data Log File

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

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.

***Note**: You can use Notepad or WordPad to view quickly the results in the data log file.*

Stopping the Tutorial

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

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

Returning to the Tutorial

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

Reference

Menus and Parameters

This section describes the TDSCPM2 application parameters, and includes the menu default settings. You should refer to the user manual for your oscilloscope for operating details of other controls, such as front-panel buttons.

Refer to the GPIB Programming section of this Help file for a complete list of the GPIB Control Parameters. This topic includes a complete list of the GPIB commands along with the arguments, variables, and variable values that correspond to the TDSCPM2 parameters.

View Menu

There are no parameters for the View menu.

Help Menu

There are no parameters for the Help menu.

File Menu

You can perform basic operations such as opening, closing, saving and printing of files from the File menu.

Table 14: File Menu Parameters

Option	Description	Default Setting
Recall Default	Recalls default state	
Recall	Browse and select file to recall application settings	C:\TekApplications\tdscpm2\setup\setup1.ini
Save	Save current application settings	C:\TekApplications\tdscpm2\setup\setup1.ini
Recently Recalled	Select from a list of recently recalled setup files	None
Recently Saved	Save again by selecting from a list of recently saved files	None
Minimize	Minimizes the application to a button on the Windows taskbar	None
Exit	Exit the application	None

Figure 19: File Menu

Measurements Menus

There are two Measurements menus:

- Measurements Select
- Measurements Configure

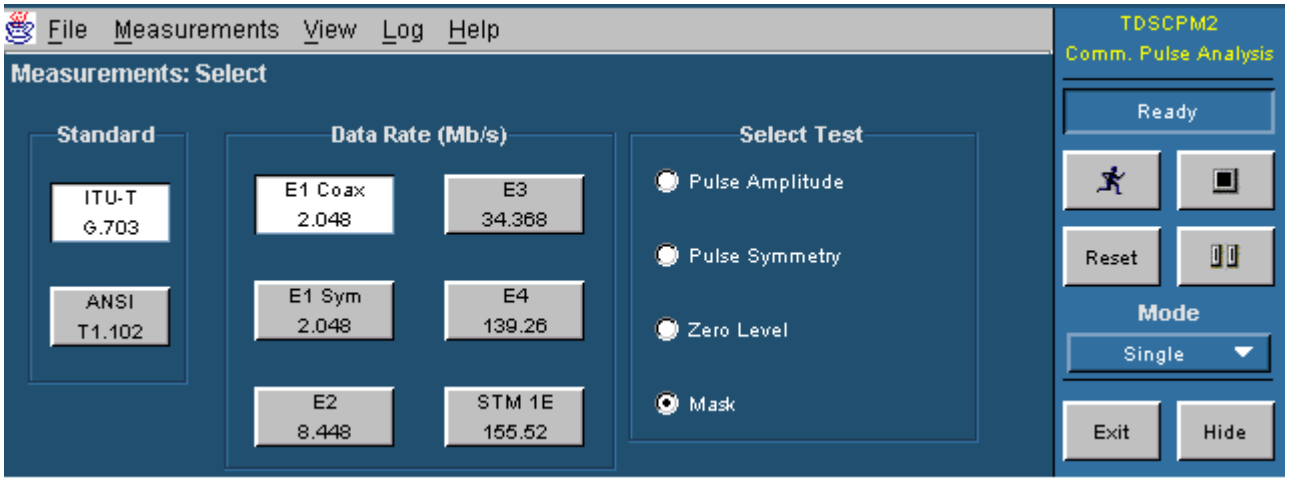

Figure 20: Measurement Select Menu

Standard Area

The Standard area includes the following selections:

- Data Rate Area, ITU
- Data Rate Area, ANSI

Data Rate Area, ITU

The ITU-T G.703 standard data rate includes the following selections:

- E1 2.048 Mb/s Coax Pair
- E1 2.048 Mb/s Sym Pair
- E2 8.448 Mb/s
- E3 34.368 Mb/s
- E4 139.26 Mb/s
- STM–1E 155.52 Mb/s

The application takes measurements based on these data rates as defined in the *ITU-T Recommendation G.704, General Aspects of Digital Transmission*

Systems, ITU-T G.703 document. Data Rate Menu Options for ITU-T G.703 Standard lists the location of the data rate definitions in the standard.

Data Rate Area, ANSI

The ANSI T1.102 standard data rate includes the following selections:

- DSI 1.544 Mb/s
- DS3 44.736 Mb/s
- DS4NA 139.26 Mb/s
- STS-1 51.840 Mb/s
- STS-3 155.52 Mb/s

The application takes measurements based on these data rates as they are defined in the *American National Standard for Telecommunications - Digital Hierarchy - Electrical Interfaces, ANSI T1.102-1993* document. Data Rate Menu Options for ANSI T.102 Standard lists the location other data rate definitions in the standard.

Test Area, ITU

The ITU-T G.703 data rates includes the following test selections:

- Pulse Amplitude (only for AMI signals)
- Peak-Peak (only for CMI signals)
- Pulse Symmetry
- Zero Level
- Mask

Note: *Available tests depend on the selected standard and data rate. See ITU-T-G.703 Data Rates and Tests for test selections.*

Test Area, ANSI

The ANSI T1.102 data rates include the following test selections:

- Pulse Amplitude
- Pulse Imbalance Variation
- Pulse Imbalance Ratio
- Spectral Power
- Mask

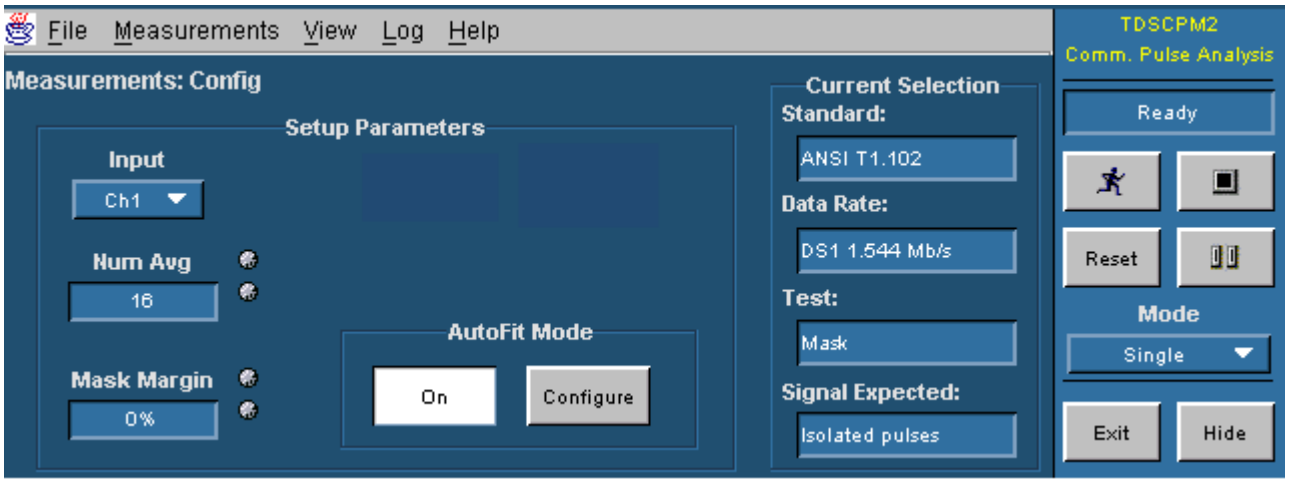

Figure 21: Measurement Config Menu

Table 155: Sequence control Menu

Option/button (icon)	Description
Mode Single	Performs measurements on a single acquisition and stops
Free Run	Repeatedly acquires the input waveform(s) and takes measurements
Start/Continue button	Starts to take measurements from the input waveform(s); when paused, continues taking measurements
Pause button	Pauses and resumes when you select the Continue button or stops when you select the Stop button
Stop button	Stops taking measurements
Reset button	Resets all result values to zero

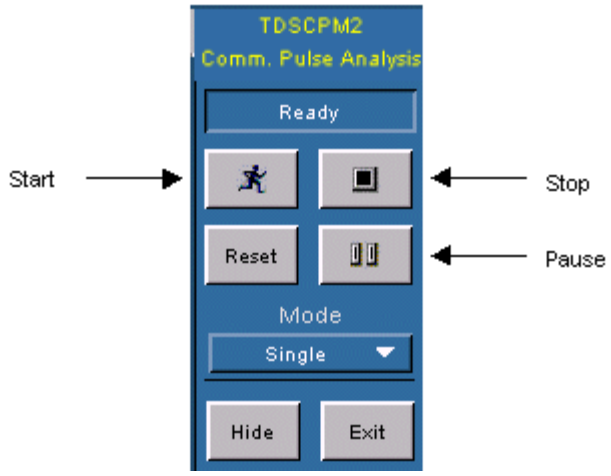

Figure 22: Sequence Control Menu

Table 16: Configure Menu Parameters

Parameter	Selections	Default setting
Input	Ch1, Ch2, Ch3, Ch4	Ch1
Num Avg	2 through 10,000	16
Mask Symbol	Binary 0, Binary 1	Binary 0
Mask Time Base Adj	Yes, No	No
Mask Offset Adj	Yes, No	No
Mask Margin	–50.0 to 50.0 V, see Mask Margin Limits	0 V
Mask Time Base	Full Mask, Time Details	Full Mask
Max Symbol	Max Output (default), Standard	No
Mask Symbol	Pulse, Eye	Pulse

Select Menu Parameters

Mask

The Mask measurement checks the communications signal to see if it conforms to corresponding mask parameters. This application uses Option SM (Serial Mask) on the oscilloscope to perform this test.

The application offers the following parameters that you can use to customize the Mask test.

Table 17: Mask Parameters

Parameter	Description
Vertical	Select Autofit Mode On button to set up autofit mode. Then select Configure button to access the vertical setting.
Horizontal	Select Autofit Mode On button to set up autofit mode. Then select Configure button to access the horizontal setting. See Autofit dialogue box.
Mask Margin	The application uses this parameter to relax or restrict the signal space for a selected mask. A positive margin causes the signal space to be smaller and makes the Mask test harder to pass. A negative margin causes the signal space to be larger and makes the Mask test easier to pass.

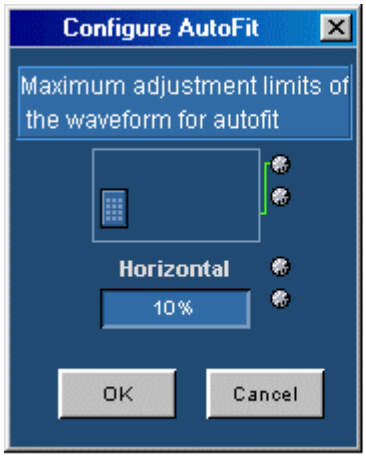

Figure 23: Configure Autofit Menu

Mask Margin Limits

The next table lists the upper and lower masks margins for each standard and data rate.

Note: *The values for all fields default to zero.*

Table 168: Mask Margin Limits

Standard and data rate	Upper margin	Lower margin
ITU–T G.703		
E1 Coax	6.3%	-33%
E1 Sym	6.3%	-33%
E2	6.3%	-33%
E3	6.3%	-33%
E4 (Binary 0)	6.3%	-33%
E4 (Binary 1)	6.3%	-33%
STM–1E (Binary 0)	6.3%	-33%
STM–1E (Binary 1)	6.3%	-33%
ANSI T1.102		
DS1	6.3%	-33%
DS3	6.3%	-33%
DS4NA (Standard)	50%	-50%
DS4NA (Max Output)	50%	-50%
STS–1 (Eye)	50%	-50%
STS–1 (Pulse)	6.3%	-33%
STS–3 (Standard)	50%	-50%
STS–3 (Max. Output)	50%	-50%

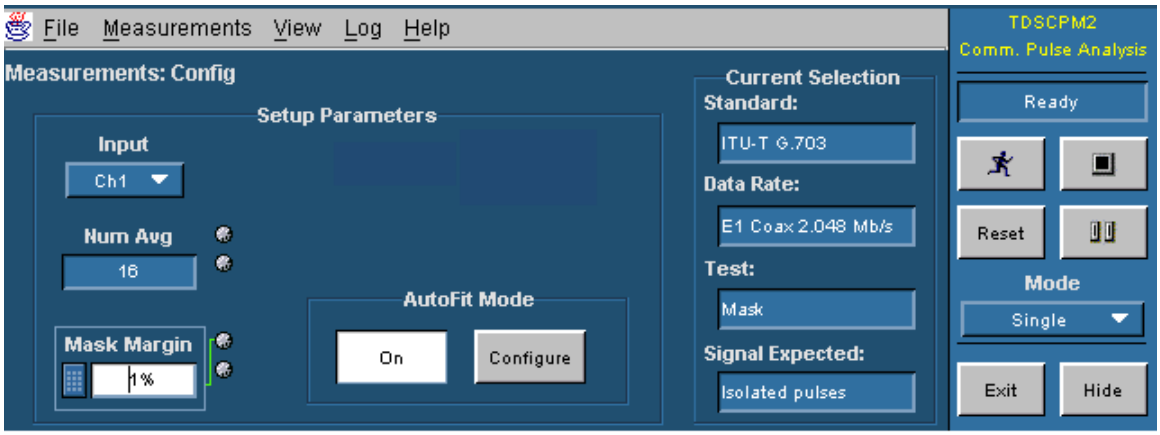

Figure 24: Configure Mask Margins

Additional Mask Parameters

The Mask Symbol parameter for the ITU-T G.703 E4 and STM-1E data rates offers two kinds of masks: Binary 0 or Binary 1. You can select the mask in the Configure Measurement menu.

The Mask Symbol parameter for the ANSI T1.102 DS4NA and STS-3 data rates and offers two kinds of masks: Max Output and Standard.

The Mask Symbol parameter for the ANSI T1.102 STS-1 data rate offers two kinds of masks: Eye and Pulse.

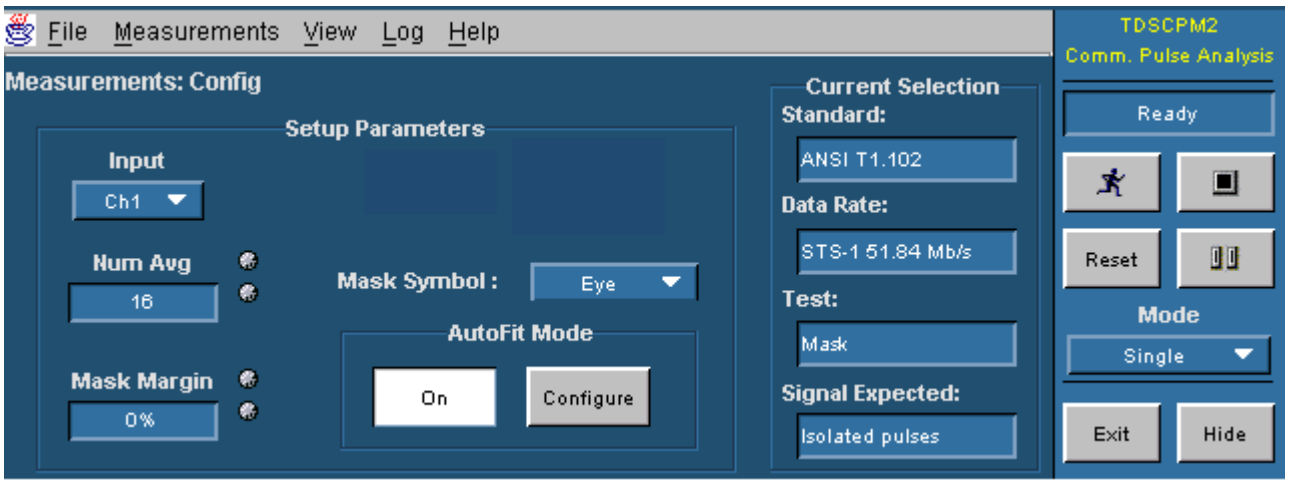

Figure 25: STS1 Eye-Pulse Selection

Log Menu

Table 19: Log Menu Parameters

Parameter	Selection	Default setting
Logging	On, Off	Off
Clear	None	
Log File Name: Browse	Any file	C:\TekApplications\tdscpm2\logs\results.csv

Measurement Algorithms

The TDSCPM2 application may display a specified pulse-mask pattern behind the communications signal being acquired. The application also takes measurements from the communication signal.

The application performs the measurement according to the following algorithm:

1. Acquires the communications signal.
2. Performs the measurement or senses mask hits.
3. Uses the results in the Results readout, or saves the results to a data log file.

Oscilloscope Setup Guidelines

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

1. The application will generally set the vertical settings at a pre-specified level in accordance to the standard being tested.
2. The input power level must be less than 500 mW or 27 dBm.

Measurements

All communications signal measurements are based on the spectral power components, its amplitude, or the timing of edges within each acquisition. Pulse–mask patterns are defined in the Standard and the Data Rate areas of the Select Measurement Menu.

Pulse Amplitude

This measurement applies to ANSI T1.102, DS1 and DS3 data rate, and to the ITU-T G.703, E1, E2 and E3 data rates.

The Pulse Amplitude test measures the amplitude of isolated positive and negative pulses. The test is performed on standards that use AMI line coding.

The application calculates the measurement using the following equation:

$PA = Avg\ (PA_{Isolated\ +1}, Abs(PA_{Isolated\ -1}))$

Where:

PA is the amplitude of the pulse

Avg is the average of the two input parameters determined by adding the inputs and dividing it by two

$PA_{Isolated\ +1}$ is the result of the Measure → High measurement on the oscilloscope of the Isolated +1 signal

$PA_{Isolated\ -1}$ is the result of the Measure → Low measurement on the oscilloscope of the Isolated –1 signal

Abs $(PA_{Isolated\ -1})$ is the absolute value of its input parameter

Peak-Peak

This measurement applies to ITU-T G.703, E4 and STM-1E data rates.

The Peak-to-Peak test measures the amplitude of isolated positive and negative edges. This test is performed on standards, which uses CMI line coding.

The application calculates the measurement using the following equation:

PP = Result of the Measure → PK2PK measurement on the oscilloscope

Where:

PP is the peak-to-peak amplitude of the pulse

Pulse Imbalance Variation

This measurement applies to ANSI T1.102, DS1 data rate.

This measurement is the maximum variation of the pulse amplitude and pulse widths based on an All 1 signal. The application assumes that the signal is an All 1s data stream but does not attempt to validate this.

The application calculates the measurement using the following equations:

PIV(PK2PK Amplitude) = Absolute Average (pkpkPositiveAmplitude, pkpkNegativeAmplitude)

PIV(PK2PK Pulse Width) = Absolute Average (pkpkPositivePW, pkpkNegativePW)

Where:

Absolute Average returns the average of its input ignoring the sign

pkpkPositiveAmplitude is the Peak-to-Peak vertical histogram variation of the Positive 1 of an AMI 17 consecutive 1s signal

pkpkNegativeAmplitude is the Peak-to-Peak vertical histogram variation of the Negative 1 of an AMI 17 consecutive 1s signal

pkpkPositivePW is the Peak-to-Peak horizontal histogram variation of the Positive 1 of an AMI 17 consecutive 1s signal

pkpkNegativePW is the Peak-to-Peak horizontal histogram variation of the Negative 1 of an AMI 17 consecutive 1s signal

Pulse Imbalance Ratio

This measurement applies to ANSI T1.102, DS3 data rate.

The Pulse Imbalance Ratio measurement is the ratio of positive and negative isolated pulses.

The application calculates the measurement using the following equation:

PulseImbalance Amp ratio = meanPPA/meanNPA

Where:

meanPPA is the mean value of the vertical histogram placed on the positive isolated pulse

meanNPA is the mean value of the vertical histogram placed on the negative isolated pulse

Pulse Symmetry

This measurement applies to ITU-T G.703, E1, E2, and E3 data rates.

The Pulse Symmetry measurement is the amplitude and width symmetry of AMI signals between positive and negative pulses.

The application calculates the measurement using the following equation:

PulseSymmetry(Amp Ratio) = meanPPA/meanNPA

PulseSymmetry(PW Ratio) = meanPositivePW/meanNegativePW

Where:

meanPPA is the mean value of the vertical histogram placed on the positive isolated pulse

meanNPA is the mean value of the vertical histogram placed on the negative isolated pulse

meanPositivePW is the positive width of Isolated plus 1 signal

meanNegativePW is the negative width of Isolated minus 1 signal

Zero Level

This measurement applies to ITU-T G.703, E1, E2, and E3 data rates.

The Zero Level measurement verifies if the maximum and minimum values of a logical zero (no pulse) signal is within the expected limits for the signal.

The application calculates the measurement using the following equation:

ZeroLevel = Average(ZeroLevelMax, ZeroLevelMin)

Where:

ZeroLevelMax is equal to the average of Max1 and Max2

ZerolevelMin is equal to the average of Min1 and Min2

Average is the average of the two input parameters determined by adding the inputs and dividing it by two

Max1 is equal to Mean1 + PeakPeak1/2

Min1 is equal to Mean1 – PeakPeak1/2

Max2 is equal to Mean2 + PeakPeak2/2

Min2 is equal to Mean2 –PeakPeak2/2

Mean1 is the mean value of a vertical histogram placed on an Isolated + 1 pulse

PeakPeak1 is the peak-to-peak value of a vertical histogram placed on an Isolated + 1 pulse

Mean2 is the mean value of a vertical histogram placed on an Isolated –1 pulse

PeakPeak2 is the peak-to-peak value of a vertical histogram placed on an Isolated –1 pulse

Spectral Power

This measurement applies to ANSI T1.102, DS1, DS3, STS-1, STS-3 and DS4NA data rates.

The Spectral Power measurement determines whether a communications signal is within the spectral power limits set by the ITU-T G.703 or ANSI T1.102 standards. To calculate the spectral power, the application uses the FFT (Fast Fourier Transform) function of the oscilloscope to convert a time domain signal into a frequency domain signal.

The application calculates the measurement using the following equation:

$$W = \frac{1}{\Omega N^2} \sum_{k=0}^{N-1} X_{k^2}$$

Where:

W is the power of the spectrum

W is the characteristic impedance of the signal being measured, and not the 50W of the oscilloscope input; the adapter provides the proper termination and voltage translation so the application displays the voltage level as if the input of the oscilloscope was 75/100/110/120 W.

N is the number of waveform samples

For the spectral display, the oscilloscope uses the following equation:

$$A\sqrt{2}\,\frac{Xk}{N}$$

Where:

A is the window adjustment scalar and the $\sqrt{2}$ accounts for both the + and – frequencies; A equals 1 for a rectangular window

This means (ignoring A for the moment) that the oscilloscope calculates the spectral power using the following equation:

$$W = \frac{1}{\Omega N^2} \sum_{k=0}^{\frac{N}{2}-1} X_{k^2}$$

Narrow Band

This measurement applies to ANSI T1.102, DS1 data rate.

The Narrow Band measurement checks the transmitted power in the 3 kHz and 1 kHz frequency bands. The center frequencies of the two bands are half the bit rate (fundamental) and the bit rate (2nd harmonic). The power at the fundamental must fall within a specified range. The power in the second harmonic must be lower than the fundamental by a specified amount or more. The measurements are made using an All 1s signal. The application assumes that the signal is an All 1s data stream but does not attempt to validate this.

For narrow-band power measurements, you must use a window to correct the power calculation.

The application uses a Hanning FFT window, which results in multiplying the power by a factor of 2/3rds as shown in the following equation:

Let:

M = number of harmonics to include

m := 0 ... M - 1

Let f be an array of frequencies of the fundamental and each of the possible harmonics. Then m is an index to select a harmonic. This array was built by measuring the maximum amplitude of the spectrum at the frequency locations where the harmonics occur.

The calculation for power at a given point in the spectrum is shown below with the function P(f):

$$P(f) := \frac{(|X(f))^2}{R}$$

Where:

P(f) is the power of a given point in the spectrum.

X(f) is a sample of the complex spectrum from an FFT at the frequency, f.

R is the reference resistance the voltage is assumed to be across.

A value of 50 ohms is used by the measurement.

Compute power of the fundamental:

$P1 := P(f_1)$

Compute power of the second harmonic:

P2 := P(f_2)

Compute the difference in dB between fundamental and second harmonic:

d:= 10 log (P1) – 10 log (P2)

If d > 29 dB, then pass.

Wide Band

This measurement applies to ANSI T1.102, DS3, STS-1, and DS4NA data rates.

For this measurement, the power, P, is the total power in the fundamental and harmonics of the signal.

$$P := \sum_m P(f_m)$$

Where m takes on values of m = 1 ... M -1 with M being the desired number of harmonics to include. The fundamental is at m = 1.

GPIB Programming

You can use GPIB command syntax in your GPIB program to do the following tasks:

- Start the application
- Recognize an active application with GPIB protocol
- Program and read application setup parameters
- Sequence Measurements
- Read measurement results

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

- The tdscpm2ctrl.c file on the oscilloscope hard drive (located in the c:\program files\tekapplications\tdscpm2 directory) and on the optional applications compact disc contains an example of a GPIB program that can execute the application
- The Guidelines to GPIB Programming section for guidelines to use while designing a GPIB program
- The Parameters Reference section for incremental units and default values of TDSCPM2 parameters
- The programmer information in the online help of your oscilloscope

You should be familiar with the following terms when using GPIB command syntax:

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.

Starting the Application in GPIB

To start the TDCPM2 application, you must send the oscilloscope the following GPIB command:

application:activate "Communications Pulse Measurements 2"

Variable: Value TDS Command

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 name>”,“<variable value>”

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

Table 17: Variable: Value TDS Command Arguments and Queries

Variable name	Variable value	Function	Query form
application	exit	Terminates the active application	Returns a string that corresponds to the name of the active application
logAnnotate*	Any string from one to twenty characters	Provides custom annotation to the data log file. Sets the string to be appended to result point logged	Returns the current LogAnnoate string
logger	{Reset}	Clears the current data log file	No query form
loggerDestination	Any string from one to eight characters from A to Z and/or zero to nine	Sets the data log file name (name should not include .ini extension)	Returns the data log file name
loggerState	{On, Off}	Sets the state of the logger function to on or off	Returns the state of the logger function
recallName	Any string that uses one to eight characters from A to Z and/or zero to nine	Sets the recalled setup file name	Returns the recall setup file name
saveName	Any string from one to eight characters from A to Z and/or zero to nine	Sets save setup file name	Returns the save setup file name
setup	{Default, Recall, Save}	Causes a save or recall	Returns the selected value of Default, Recall or Save
sequencerMode	{Free Run, Single}	Sets the sequencer mode	Returns the sequencer mode
sequencerState	{Ready, Paused, Sequencing}	Sets the state of the sequencer	Returns the state of the sequencer
*** Custom annotation in the data log file is only available through GPIB execution of the application.**			

Table 21: Measurements Results Queries

Variable name	Function
error	Returns the error dialog box, if one exists, associated with the last measurement
resultValue	Returns the result of the last test in the Name, Value, Remarks format

GPIB Program Example

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

- Start the application
- Select a data rate
- Select a test
- Enable the logger
- Take a measurement
- Check for an error
- Exit the application

Guidelines to GPIB Programming

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

Note: *You should allow at least a three- second delay in your program between specifying a test. If there is not enough time between data rate and test selections, the application reverts to the default test.*

GPIB Program Example

```
/*  TDSCPM2Validat */


/*
============================================================
=========

 *  Note: In order to build the .exe correctly, copy gpib-
32.obj from

 * "C:\Program Files\National
Instruments\GPIB\NI488\LangInt\C\" to the local workspace.


When executed, this program should operate as follows.

Test Result: "Mask 0.0 PASS"


Recalling setup file ds1pa

Do a single test...

Test Result: "Pulse Amplitude 3.05615V PASS"


Recalling setup file ds1mask

Do a single test...

Test Result: "Mask 0.0 PASS"


Recalling setup file ds1pa

Do a single test...

Test Result: "Pulse Amplitude 3.054750003V PASS"
```

```
Recalling setup file ds1mask

Do a single test...

Test Result: "Mask 0.0 PASS"


Recalling setup file ds1pa

Do a single test...

Test Result: "Pulse Amplitude 3.05475006V PASS"


  */  #include <string.h>

#include <stdio.h>

#include <sys/timeb.h>

#include <windows.h>

#include "C:\Program Files\National Instruments\NI-
488.2\Languages\DLL Direct Entry\decl-32.h"


int start_application (int scope);

int do_single_test (int scope);

void setupAndExecuteTest (char * Standard, int Scope);


void main (void)

{

      int scope;

      int status;


/*

 * Open session to TDS Scope with for IBIC

 */
```

```
      scope = ibfind ("DEV1");
      status = ibtmo (scope, T10s);
      if (start_application(scope)){
            while (1) {


/* DS1 testing
 * The way this works, is it recalls an application setup
file “ds1mask” which the
 * The user has setup before hand, and initiates a run
state.  After the application returns
 * To the Ready state we then query the measurement results
string, and print them.
 * This program simply cycles between a ds1mask setup and a
ds1pa (pulse amplitude
 * test).
 */


            setupAndExecuteTest("ds1mask", scope);
            setupAndExecuteTest("ds1pa", scope);
            }
      }
}


void setupAndExecuteTest(char * SetupName,int scope)
{
      char  read_buffer [100] = "";
      char  write_buffer      [100] = "";
      int   status;
```

```
/*

 * In order for this program to work correctly, the
instrument should be in "Header Off" state

 */

      sprintf (write_buffer, "%s", "Header Off");

      status = ibwrt (scope, write_buffer, strlen
(write_buffer));



/*

 * Recall the specified system setup file
"recallName","ds1pmpiv"  "setup", Recall"

 */


            printf ("Recalling setup file %s\n",SetupName);


            sprintf (write_buffer, "%s%s%s",
"Variable:value \"recallName\",\"",SetupName,"\"");

            status = ibwrt (scope, write_buffer, strlen
(write_buffer));


            sprintf (write_buffer, "%s", "Variable:value
\"setup\",\"\"");

            status = ibwrt (scope, write_buffer, strlen
(write_buffer));


            sprintf (write_buffer, "%s", "Variable:value
\"setup\",\"Recall\"");

            status = ibwrt (scope, write_buffer, strlen
(write_buffer));
```

```
/*
 * Do a single test
*/
            if (do_single_test(scope)){


/*
 * Query test result
 */
                  sprintf (write_buffer, "%s", "Variable:
value? \"resultValue\"");
                  status = ibwrt (scope, write_buffer,
strlen (write_buffer));
                  status = ibrd  (scope, read_buffer,
sizeof (read_buffer));
                  if (ibcnt != 4) {
/* It's not an empty string */


                        read_buffer [ibcnt] = 0;      /*
Get rid of extra characters */
                        printf ("Test Result: %s\n",
read_buffer);
                  }
                  else{
                        printf ("*** Computation Error
***\n");
                  }
            }
```

```
}


/*-------------------------------------------------------
----------------------

 * Function: start_application

 * Argument: scope

 * Return:   1 if success, 0 otherwise

 *

 * This function starts the application and confirms the
completion of startup

*/


int start_application(/* in */ int scope)

{

      char  read_buffer [100];

      char  write_buffer      [100];

      char  app_name[30]      = "\"tdscpm2\"\n";

      int   status;

      int   timer = 0;

      int   i = 0;


      /*

       * Has application already been started? Lets check
first.

      */

      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;      /* Get rid of extra
characters */


/* if return value from application query is tdscpm2 then
we are already running */

      if (strcmp(app_name, read_buffer) == 0){

            printf ("Application %s is already
running\n",app_name);

            return 1;    /* Application is running, don't
need to do anything */

      }

      /*

       * If application is not started up, start it and
wait for application to completely

       * start up

      */


sprintf (write_buffer, "%s", "Application:activate
\"Communications Pulse Measurements 2\"");

status = ibwrt (scope, write_buffer, strlen
(write_buffer));

printf ("Starting application, please wait...\n");

while (strcmp(app_name, read_buffer)!= 0){

      timer = timer + 1;

      if (timer > 30) { /* The application normally take 24
seconds to start up */

            printf ("***Application start up time
out***\n");
```

```
            return 0;   /* Something is wrong if
application does start up in 30s */

            }

            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;/* Get rid of extra
characters */

            //printf ("Debug Msg: App = %s\n",
read_buffer);

          Sleep(1000);

      }

      /* Application start up! */


      return 1;

}


/*-----------------------------------------------------------
-------

 * Function: do_single_test

 * Argument: scope

 * Return:   1 if success, 0 otherwise

 *

 * This function does a single measurement and checks error
status

*/
```

```
int do_single_test(/* in */ int scope)

{

      char  read_buffer [100];

      char  write_buffer      [100];

      char  state[10] = "\"Ready\"\n";

      int   status;

      int   timer = 0;

      int   i = 0;


      /*

       *  Start measurement

       */


      printf ("Do a single test...\n");

      sprintf (write_buffer, "%s", "Variable:value
\"sequencerState\",\"Sequencing\"");

      status = ibwrt (scope, write_buffer, strlen
(write_buffer));

      Sleep(1000);

       do{

            timer = timer + 2;

            if (timer > 90) { /* Assuming a single test
takes less than 60 seconds */

                  printf ("***Test time out***\n");

                  return 0;   /* Something is wrong if
sequencerState does not come back

                                                * to Ready */
```

```
            }

            sprintf (write_buffer, "%s", "Variable:value?
\"sequencerState\"");

            status = ibwrt (scope, write_buffer, strlen
(write_buffer));

            status = ibrd (scope, read_buffer, sizeof
(read_buffer));

            read_buffer [ibcnt] = 0;      /* Get rid of
extra characters */

          Sleep(3000);

      }while (strcmp(state, read_buffer)!= 0);



      /*

       *  Though sequencerState Back to Ready, need to
check the error variable

       *  to make no error occur during measurement

      */



      sprintf (write_buffer, "%s", "Variable:value?
\"error\"");

      status = ibwrt (scope, write_buffer, strlen
(write_buffer));

      status = ibrd  (scope, read_buffer, sizeof
(read_buffer));

      if (ibcnt != 4){                   /* error string
is not empty */

            read_buffer [ibcnt] = 0;      /* Get rid of
extra characters */

            printf ("*** Error: %s ***\n", read_buffer);

            return 0;

      }
```

```
      return 1;
}


/* This is a support utility in case you are also
controlling an Arbitrary Waveform Generator as
 * part of a test setup.
 */


int setupAWG(char * SetupName,int awg)
{
      char  write_buffer      [100];
      int   status;


      sprintf (write_buffer, "%s", "Header Off");
      status = ibwrt (awg, write_buffer, strlen
(write_buffer));
      printf ("Setting up AWG with setup file
%s\n",SetupName);
      sprintf (write_buffer, "%s%s%s", "AWGControl:SREStore
\"",SetupName,"\",\"MAIN\"");
      status = ibwrt (awg, write_buffer, strlen
(write_buffer));
      Sleep (2000);


      sprintf (write_buffer, "%s", "AWGControl:RUN");
      status = ibwrt (awg, write_buffer, strlen
(write_buffer));
      Sleep (1000);
```

```
      sprintf (write_buffer, "%s", "OUTPut1:STATe ON");

      status = ibwrt (awg, write_buffer, strlen
(write_buffer));


      Sleep (1000);

}
```

Index