Tektronix®

400G-M4
Application Help

Printable Application Help

077-1471-03

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Printable Application Help

www.tek.com
077-1471-03

This document supports 400G-M4 software version 1.1.X and greater, for use with the DSA8300 oscilloscope.

Application help system part number: 076-0423-03

Printable version of the application Help (PDF): 077-1471-03

Contacting Tektronix

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

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Welcome

The 400G-M4 analysis application provides PAM4 signaling analysis, including TDECQ (Transmitter and Dispersion Eye Closure Quaternary) measurement. The application brings together PAM4 optical measurements in a simple and easy to use application.

The application is intended to be installed on a PC and can operate in either offline or online mode.

- **Offline mode:** allows you to analyze a waveform file saved from the 80SJNB application (running on the DSA8300 Digital Sampling Oscilloscope) or a waveform file saved from the 400G-M4 application acquired from a connected DSA8300 sampling oscilloscope.
- **Online mode:** allows you to acquire directly from a connected DSA8300 Digital Sampling Oscilloscope and analyze acquired waveform data.

NOTE. *Online mode requires the installation of an option key on the target DSA8300 Digital Sampling Oscilloscope to enable establishing a connection from the 400G-M4 application. Refer to the documentation provided with the DSA8300 for instructions to add a new option key.*

Key features

The 400G-M4 application performs comprehensive analysis of PAM4 signals, including TDECQ measurements and other optical measurements.

400G-M4 provides the following features:

- Show results as numeric and graphical display
- Perform TDECQ (Transmitter and Dispersion Eye Closure Quaternary)
- PAM4 signal characterization measurement such as level and eye measurements
- Standard IEEE TDECQ Measurements (802.3bs, Section 121.8.5 and 802.3cd)
- Acquire complete pattern waveform with user defined Samples/UI
- Display 2-D eye diagrams
- Save acquisition results to a data file

See also:

Computer requirements (see page 2)

DSA8300 sampling oscilloscope requirements (see page 2)

Option key (see page 3)

Online mode (see page 31)

Offline mode (see page 29)

Computer requirements

The 400G-M4 application is designed to run on a PC running the Windows operating system. A high performance PC is recommended to minimize computation time to analyze the waveform data.

These are the minimum requirements to successfully run the 400G-M4 application. A PC with higher performance results in faster measurements.

- **Operating system:** Microsoft Windows 10 (64 bit) operating system.
- **Screen resolution:** 1920 x 1080.

NOTE. *Installing the 400G-M4 application directly on a DSA8300 Digital Sampling Oscilloscope is not permitted.*

Software requirements

The 400G-M4 application requires the following software to be installed on the PC.

- **TekVISA:** TekVISA version 4.2.0.10 is recommended. Installation is available during 400G-M4 installation.
- **Matlab runtime:** Matlab 2017b version 9.3 is required. The Matlab runtime is available from MathWorks® (https://www.mathworks.com).

See also:

TekVISA software (see page 3)

DSA8300 sampling oscilloscope requirements

The 400G-M4 application requires the following software to be installed on the connected DSA8300 sampling oscilloscope.

- **Scope Noise Characteristics:** This application is provided with the 400G-M4 installation. It is a separate installation file (bundled with the 400G-M4 download package) that is to be installed on the connected DSA8300. This application enables the 400G-M4 application to automatically obtain the scope noise value of the DSA8300.
- The option key for the 400G-M4 application must be installed on the DSA8300 to which the application connects for online mode of operation.

TekVISA software

TekVISA is preinstalled on the DSA8300 sampling oscilloscopes, but to use this protocol to connect and communicate with a DSA8300 sampling oscilloscope, TekVISA must also be installed on the PC (where the 400G-M4 application resides).

TekVISA is available with the 400G-M4 application installation file or can be downloaded for free from the Tektronix website (www.tek.com). Search for TekVISA Connectivity software.

Option key

To enable the 400G-M4 application to connect directly to a DSA8300 Digital Sampling Oscilloscope (online mode), the target DSA8300 must have a 400G-M4 option key installed.

Contact Tektronix to purchase a 400G-M4 option key.

Refer to the DSA8300 application help system for instructions to install option keys.

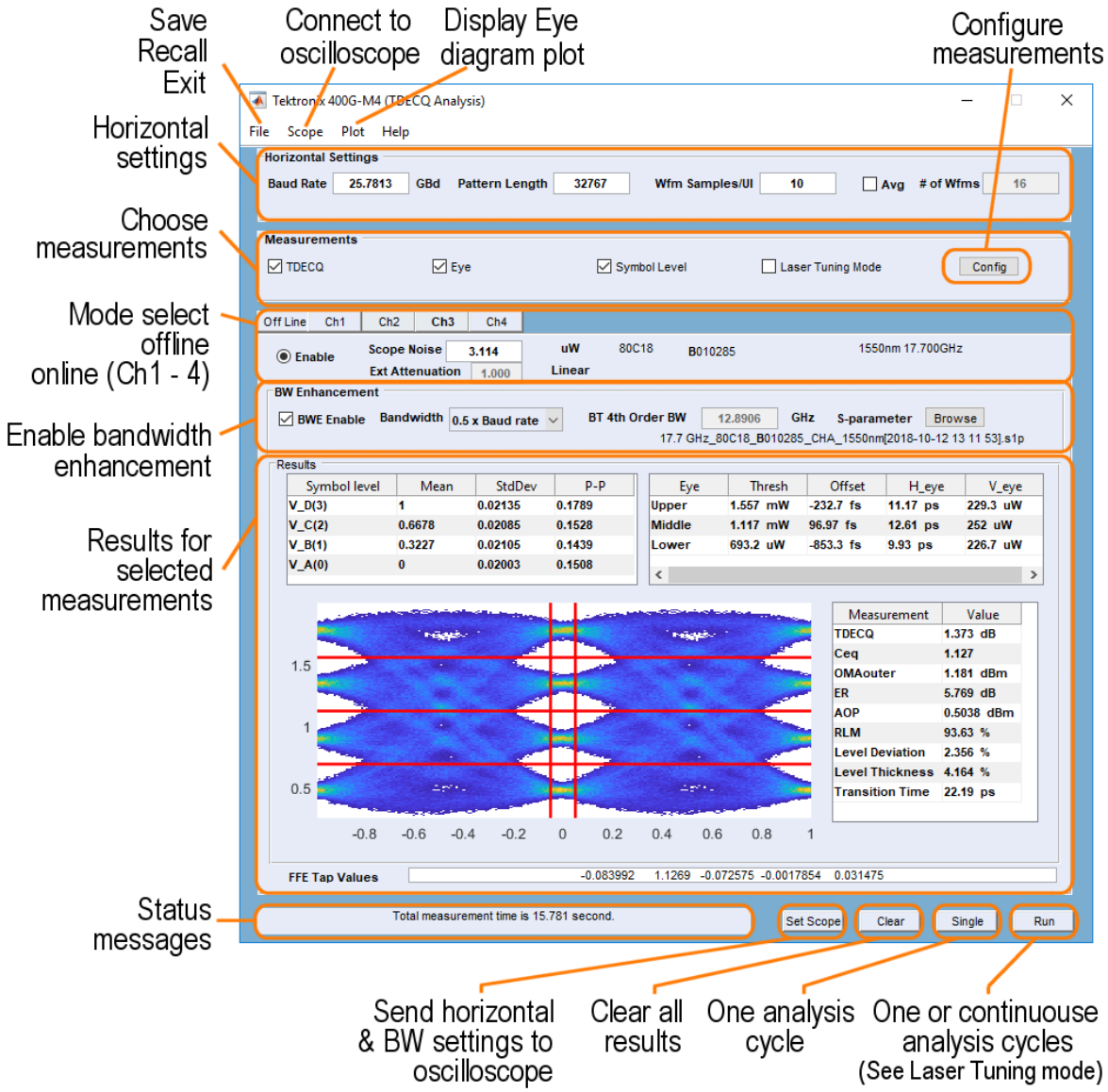
Documentation

The application help system is available from the Help menu.

In addition to the help system, a printable version of the Help is provided as a PDF in the following folder:

C:\Users\Public\Tektronix\TekApplications\400G-M4.

Elements of the display



File menu

The file menu provides the following operations:

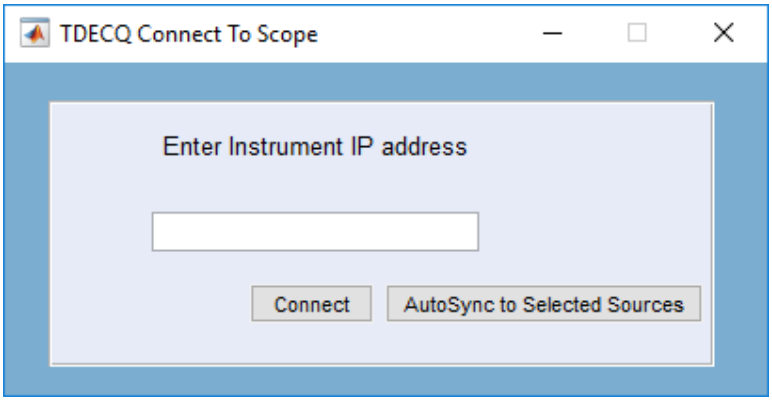
Table 1: File menu

Setting	Description
Save Waveform	Saving waveforms is only available when using the online mode. You can save the acquired waveform (or waveforms if multiple channels are enabled) from the connected DSA8300 oscilloscope. A dialog screen opens to allow you to navigate to name and save the waveform. Use the dialog screen to provide a base filename. The filename will be appended with the channel source of the waveform.
Save Setup	Use the dialog screen to navigate to a location to save the setup file to recall at a later time. Setup files use a file extension of .gm4. Setup files contains the following information: ■ Horizontal settings ■ Measurement selections ■ All measurement configuration settings ■ Offline setting ■ FFE tap values ■ Measurement results ■ BWE settings Setup files do not save information relating to the oscilloscope or modules, such as: ■ Scope IP address ■ Scope Noise ■ Vertical setting ■ Channels enabled ■ Module related information ■ External attenuation
Recall Setup	Use the dialog screen to navigate to a saved setup file to restore the application to a known setup.
Exit	Exits the application.

NOTE. *The File menu operations are unavailable if an analysis is currently running.*

Scope menu

Selecting Scope opens the TDECQ Connect To Scope dialog screen.



Enter the IP address or the computer name of the oscilloscope you want to connect to. The IP address can be found by viewing the Windows network connection status. The computer name can be found in the System properties.

Connect. Select the Connect button to make the connection. (The Connect button changes to Disconnect if a connection is established.)

The Status area at the bottom of the main screen also indicates a successful connection.

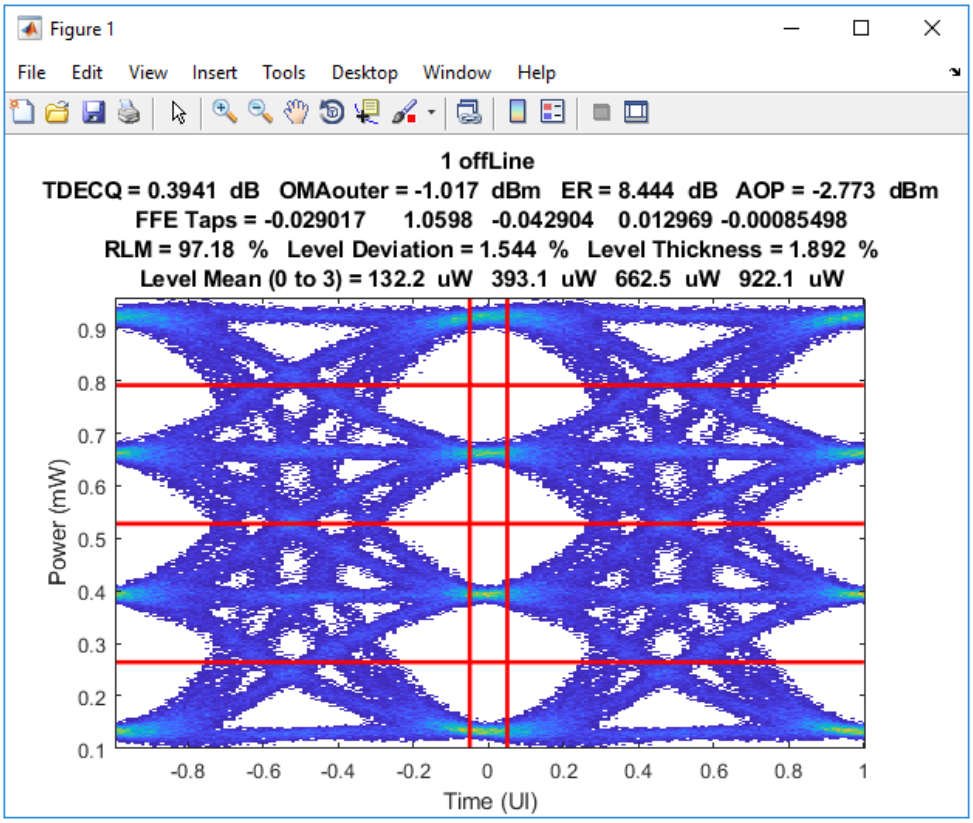
AutoSync to Selected Sources. During the connection process, the 400G-M4 application detects the modules installed in the oscilloscope along with their characteristics (such as the module type, serial number, filters or bandwidth). If you change a module or change a module's characteristics, use the AutoSync to Selected Sources button to easily update the 400G-M4 application without having to reconnect.

If you are having difficulty connecting to your oscilloscope, see the section Connection help and tips (see page 37).

NOTE. *The 400G-M4 application can only connect to one DSA8300 Digital Sampling Oscilloscope at a time.*

Plot menu

The Plot menu allows you to open the TDECQ eye plot display in Matlab.



Help menu

In addition to accessing the application help system, use the help button to obtain the application software version number.

This can help when contacting Tektronix about the application and to check if there are newer versions available from the Tektronix website (www.tek.com).

A printable version of the help system is provided as a PDF in the following folder:

C:\Program Files\TekApplications\400G-M4.

Horizontal settings

The horizontal settings are only applicable when using the online mode (connected to an oscilloscope). The settings are global for all online channels. In offline mode, these settings are automatically extracted from the waveform file.

Set the values as appropriate for the type of optical signal you are analyzing.

Table 2: Horizontal settings

Setting	Description
Baud Rate	Enter the GigaBaud rate of the signal you intend to acquire.
Pattern Length	Enter the Pattern Length of the signal you intend to acquire.
Wfm Samples/UI	Enter the number of waveform samples per user interval.
Avg	When enabled, enter the # of Wfms of to acquire. The acquired waveforms are then averaged together into a single waveform. Use the File –> Save Waveform to save the averaged waveform. ***NOTE.*** *When Averaging waveforms, no measurements are performed.*
# of Wfms *(Only available for live channels)*	With the Avg box enabled, enter the number of waveforms to average from the acquisition (not available for TDECQ measurements). Range: 1 to 1000.

Measurement selections

The measurement selection includes all the available optical measurements.

The selected measurements apply to the offline mode (file analysis) and to the online mode for all channels.

Table 3: Measurement selections

Measurements	Description
TDECQ	Includes the following measurements to the results section. ■ TDECQ: Transmitter and dispersion eye closure for PAM4 defined by IEEE 802.3bs (draft 3.5, dated 10-October-2017). ■ OMAouter: The outer Optical Modulation Amplitude. ■ ER: The extinction ratio of the highest and lowest optical power levels of a PAM4 optical signal. ■ AOP: The average optical power of a PAM4 optical signal.
Eye	Includes the following measurements to the results section. ■ RLM: Level separation mismatch ratio. ■ Level Deviation: The average deviation of level spacing from the ideal spacing. ■ Level Thickness: The averaged, normalized level standard deviation at minimum inter-symbol interference. ■ The Threshold/Offset/Horizontal Eye (H_eye)/Vertical Eye (V_eye) for each PAM4 eye.
Symbol Level	Includes all the Symbol level measurement results. ■ Symbol Levels: Provides the Mean, Standard Deviation, and Pk-Pk values of the V_D(3), V_C(2), V_B(1), V_A (0) symbol levels.
Laser Tuning Mode	Laser Tuning Mode changes the operation of the application to enable you to quickly adjust your laser settings while acquiring data. When enabled, two changes to operation take effect: ■ Pressing the Run button starts a continuous analysis cycle. To run a single analysis, you must use the Single button. ■ Some measurements such as symbol levels and RLM run much faster (but with slightly less accuracy).

TDECQ configuration

The measurement configuration allows you to further define the TDECQ measurement and adjust the Extinction Ratio results.

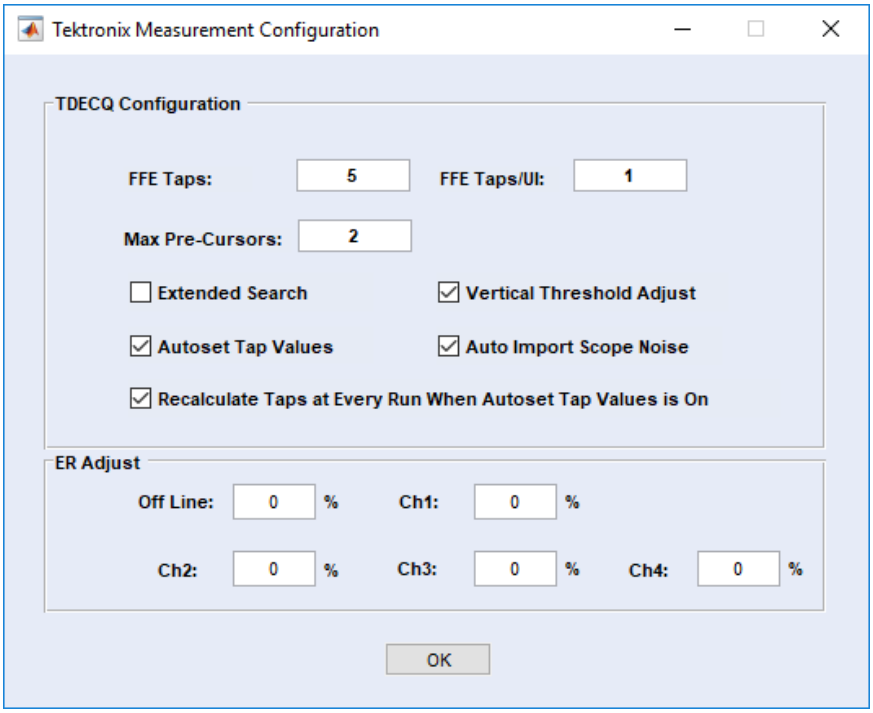


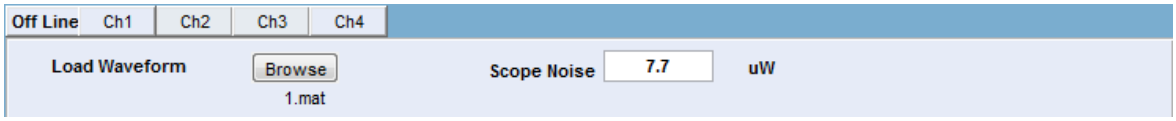
Table 4: Measurement configuration

TDEQ Configuration	
FFE taps	Enter the number of taps. The number of taps must be an odd value.
FFE Taps/UI	Enter the number of taps per unit interval (symbol) for FFE. The range of the value is 1 – 10.
Max Pre-Cursors	Enter the maximum number of pre-cursor taps for FFE. The value must be less than the number of FFE taps.
Extended Search	This is disabled by default. When enabled, the algorithms perform an extended search for the optimal FFE taps to minimize the TDECQ value (but increases the time to complete). When disabled, the FFE taps are adapted faster but may be less optimal.
Vertical Threshold Adjust	This is enabled by default. When enabled, the sub-eye threshold levels are allowed to adjust by ± 1% of the OMAouter. IEEE 802.3cd allows this option to be selected for TDECQ measurements. When disabled, the sub-eye threshold levels are determined by OMAouter and the average optical power.
Autoset Tap Values	When enabled, the application automatically calculates optimized FFE taps to minimize the TDECQ value. When disabled, the current FFE taps are used. You can manually input the FFE tap values via the FFE Tap Values area at the bottom of the application main screen. This is enabled by default.

Table 4: Measurement configuration (cont.)

TDEQ Configuration	
Auto Import Scope Noise	This is enabled by default. When enabled, the application automatically retrieves the measured oscilloscope noise from the connected DSA8300 oscilloscope when in online mode. The Scope Noise Characteristics application must be installed and run prior to importing the oscilloscope noise.
Recalculate Taps	This is disabled by default. When enabled, the application recalculates taps at every run when Autoset Tap Values is On. This uses the FFE tap seed from the previous calculation or recalculates a new one. You can save the measurement time by using the FFE tap seed from the previous calculation.
ER Adjust	
Off Line Ch1 – Ch4	ER Adjust allows you to add or subtract a specified percentage from the measured extinction ratio value, adjusting for a better match between multiple oscilloscopes. This can be set individually for Off Line mode and each individual channel when in online mode.

Mode selection



The mode selection allows you to either analyze a saved data file (offline mode) or make a live acquisition (online mode) directly from one (or all) of the four optical channel selections available on the DSA8300.

The offline mode requires you to navigate to a saved data file for analysis.

The online mode requires a connection to a DSA8300 oscilloscope.

The instrument acquisition status during the measurement process in a live acquisition is displayed in the Acquisition_statusFile.txt. This file is located in the directory “C:\Users\<user name>\AppData\Local\Temp”. The file lists the instrument state as either Idle or Acquire. When in Idle, an instrument can be used by more than one application at a time.

For more information, see the topics Offline mode (see page 29) and Online mode (see page 31).

Bandwidth enhancement (BWE)

Bandwidth enhancement can be used whether analyzing a saved file (offline mode) or when connected to an instrument (online mode). The feature operates the same for either mode.

When using in online mode, the feature can be enabled or disabled independently for each channel.

Table 5: Measurement configuration

Item	Description
BWE Enable	Enables the bandwidth enhancement feature for the selected file (Offline mode) or the channel (Online mode). The Bandwidth Enhancement controls allow you to use DSP processing to achieve more accurate oscilloscope channel response. For example, the BWE can make the oscilloscope channel response to be ORR compliant even if the hardware is not.
Bandwidth	Select the bandwidth filter to use during the analysis. ■ **HW only**: uses the instrument hardware. ■ **0.5 Baud rate**: sets the bandwidth of the 4th order Bessel-Thomson filter to be 0.5 × Baud Rate. ■ **0.75 Baud rate**: sets the bandwidth of the 4th order Bessel-Thomson filter to be 0.75 × Baud Rate. ■ **User**: This allows a user to dial in the bandwidth of a 4th order 4th order Bessel-Thomson filter.
BT 4th Order BW	Enter the Bessel -Thomson reference receiver filter when the Bandwidth is set to User.
S-parameter	You can load a scattering parameter (S-parameter) file that characterizes the optical sampling module available for the DSA8300. ***NOTE.*** *An S-parameter file is supplied with the 80C20 and 80C21 optical sampling modules. These files are unique to each module.* Use the Browse button to navigate to a saved S-parameter file. The S-parameter file name contains the module type, serial number, and hardware filter information.

Set Scope button

The Set Scope button simplifies the setup of the connected oscilloscope.

When Set Scope is pressed, the application sets several of the oscilloscope's horizontal and vertical settings that are appropriate for the chosen baud rate.

The BW Enhancement settings (except for S-parameters) are also set in the 400G-M4 application.

Clear button

The Clear button removes all measurement results, including the TDECQ plot display.

Single button

Press the Single button to run one acquisition and analysis cycle. At least one measurement must be selected.

The analysis cycle includes acquiring waveforms and performing the selected measurements.

NOTE. *The Single button allows you to runs a single analysis cycle when in Laser Tuning Mode. When Laser Tuning is enabled, pressing the Run button puts the analysis cycle into a continuous mode (rather than a single analysis).*

When in online mode, a connection must be established to a DSA8300, containing supported modules.

Run button

Press the Run button to start an analysis cycle. At least one measurement must be selected.

The analysis cycle includes acquiring waveforms and performing the selected measurements.

The action of the Run button changes depending on the status of the Laser Tuning Mode.

Laser Tuning Mode:

- Disabled: A single analysis cycle is run.
- Enabled: The analysis and measurement cycle runs continuously until stopped. (In this mode, the Run button changes to Stop. Press Stop to end the analysis cycle.)

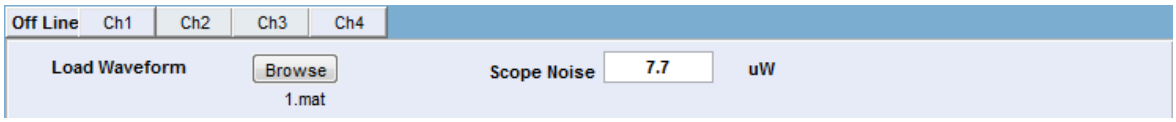
  See Laser Tuning Mode in Measurement selections (see page 13) for details of the measurement actions.

When in offline mode, a file must be loaded before pressing the Run button.

When in online mode, a connection must be established to a DSA8300 containing supported modules.

Offline mode

Using the application in Offline mode simply means you can analyze a saved waveform file without connecting to a sampling oscilloscope.



Click the Off Line tab and use the Browse button to navigate to waveform file (saved from the 80SJNB application or the 400G-M4 application) for analysis.

TDECQ measurement requires the input of scope noise, σs, defined as the standard deviation of the noise of the optical probe and oscilloscope combined. It is calibrated with no optical input signal and the same settings used to capture the optical signal, after the application of applicable ORR.

Loading a waveform file automatically inputs the scope noise value associated with the loaded file if available.

Once the file is loaded, select the measurements you want returned, and then press the Run button. The various result panels will be populated based on the selected measurements.

Online mode

Online mode allows you to acquire waveforms directly from the connected oscilloscope, analyze the data, and display the results. (A connection to the oscilloscope must be made prior to selecting the Run button. See the Scope menu (see page 7).)

The 400G-M4 application currently supports the following optical modules (installed in a DSA8300 mainframe):

- 80C17
- 80C18
- 80C20
- 80C21
- 80C10C

NOTE. *If you would like to use a non-supported module, add it to "SupportedModules.xml" file located in the installation directory. Performance and measurement accuracy are not guaranteed for non-supported modules.*

Selecting any of the channel tabs enters the Online mode.

With a channel tab open, select Enable to enable acquiring waveforms from that channel of the oscilloscope. With a connection established, the information about the optical module installed in that channel is displayed.

NOTE. *If the module installed in the channel is not supported, the Enable button is inactive.*

There are four channels available on the DSA8300 oscilloscope. You can enable any number of channels. Each channel must be enabled in its channel tab.

TDECQ measurement requires the input of scope noise, σs, defined as the standard deviation of the noise of the optical probe and oscilloscope combined. It is calibrated with no optical input signal and the same settings used to capture the optical signal, after the application of applicable ORR. You must set the scope noise value for each channel intended to use for testing. This value can be automatically imported from the connected DSA8300. See Scope Noise auto import below.

When the analysis is started, the waveforms are acquired from each enabled channel. If one channel calculation is aborted during the live channel measurement, the rest of the channel calculations continue.

The scope front panel is locked when data acquisition starts. The front panel is unlocked when acquisition is complete.

The results displayed are for the current channel. Use the channel tabs to display the results for each channel.

Scope noise auto import

The Scope Noise value can be imported directly from the connected DSA8300 if the following conditions are met:

- The Scope Noise Characteristics application must be installed on the connected DSA8300.
- The Scope Noise Characteristics application had been run on the DSA8300 (with modules installed) prior to starting the analysis cycle of the 400G-M4 application.
- The Measurement Configuration must have Auto Import Scope Noise enabled.

External attenuation

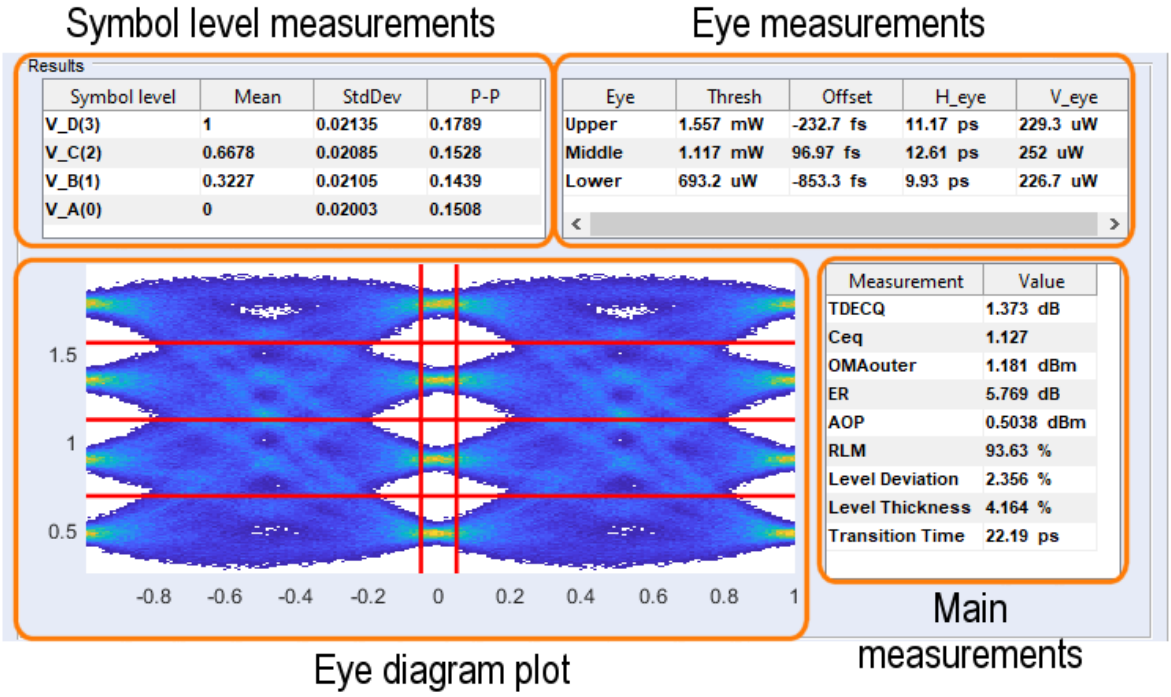
External attenuation can be applied to the scope channel input signal. The external attenuation units are set by the DSA8300 and can be either Linear or dB.

Results elements

The results area is populated with the latest measurements from the latest analysis. The areas populated with results depend on the selected measurements to make during analysis.

When in offline mode, the results display the measurements for the waveform file loaded.

When in online mode, the results displayed are for the selected channel tab. Use the channel tabs to see results for the various channels. (There are no results for a channel if the channel was not enabled prior to starting the analysis.)



Capturing results

You can reduce test time by using the TDECQ_ResultsFile.txt file that is saved in C:\Users\<user name>\\AppData\Local\Temp. Measurement results are captured in this file, which allows you to access all of the measurement results in a single file instead of querying results one at a time. Note that “ERROR” will show if the measurement has errors.

The following is a TDECQ example TDECQResults.txt for an offline channel case:

"offLine:TDECQ","0.87886","offLine:TDECQMeasIsInQuestion","0","offLine:OMA","-3.8533","offLine:ER","5.4282","offLine:AOP","-4.3916",

Symbol level measurement

When the Symbol Level measurement is selected, the Symbol Levels result area is populated for the following four symbol levels. An Eye plot will show after the measurement even if TDECQ is not checked.

- **V_D(3):** For the top symbol level, this is the voltage at the center of the unit interval across all instances of symbol 3s in the complete waveform. The mean, standard deviation and peak-to-peak range are shown. Only the mean value is used in the computation of RLM .
- **V_C(2):** Same as V_D(3), except for the symbol 2's.
- **V_B(1):** Same as V_D(3), except for the symbol 1's.
- **V_A(0):** Same as V_D(3), except for the symbol 0's.

Table 6:

Result	Description
Mean	Mean value (watts) of the measurements.
Standard deviation	Standard deviation of the measurements.
P-P	Peak-to-peak value of the measurements.

Eye results

When the Eye measurement is selected, the Eye result area is populated with the eye measurements for all three eye openings (Upper, Middle, Lower).

Table 7:

Result	Description
Threshold	The reference voltage levels for each PAM4 TDECQ eye.
Offset	The horizontal offset, in time, from the center of the sub-eye to the measured center of the eye as rendered, at the corresponding reference voltage.
H_eye (Width)	The eye width of the corresponding (upper, middle or lower) eye.
V_eye (Height)	The eye height of the corresponding (upper, middle or lower) eye.

TDECQ and PAM4 results

When the TDECQ measurement is selected, the TDECQ result is provided along with various PAM4 measurements.

Table 8:

Result	Description
TDECQ	As defined by IEEE 802.3bs, Section 121.8.5 and 802.3cd.
Ceq	Equalizer noise enhancement coefficient.
	NOTE. *TDECQ – 10log10(Ceq) measurement can be calculated from TDECQ and Ceq values.*
OMAouter	Outer Optical Modulation Amplitude, reported in dBm.
ER	Extinction Ratio
AOP	Average Optical Power The average power of a PAM4 optical signal, reported in dBm.
RLM	Level separation mismatch ratio.
FFE taps	Taps for the Feed-Forward Equalizer (FFE).
Level Deviation	A measure of the deviation of the vertical intervals between levels from perfectly equal spacing, where 0% represents perfect spacing. The measurement is computed as: $\text{Level Deviation} = \frac{1}{3}\sum_{ij=10,21,32} \frac{\left\lvert d_{ij} - \frac{(Pk-PK)}{3} \right\rvert}{\frac{(Pk-Pk)}{3}} \times 100\%$
Level Thickness	An overall measure of the vertical thickness of the symbol levels in the correlated waveform, where an ideal signal with maximally open eyes would have a thickness of 0%. The measurement is computed as: $\text{Level Thickness} = \frac{1}{4}\sum_{i=0}^{3} \frac{\sigma_i}{(Pk-Pk)\div 2} \times 100\%$
Transition Time	Transmitter transition time is defined as the slower of the following: ■ The time interval of the transition from 20% of OMAouter to 80% of OMAouter (rising edge). ■ The time interval of the transition from 80% of OMAouter to 20% of OMAouter (falling edge).

Check network access

The first step to troubleshoot a connection problem is to check the network access.

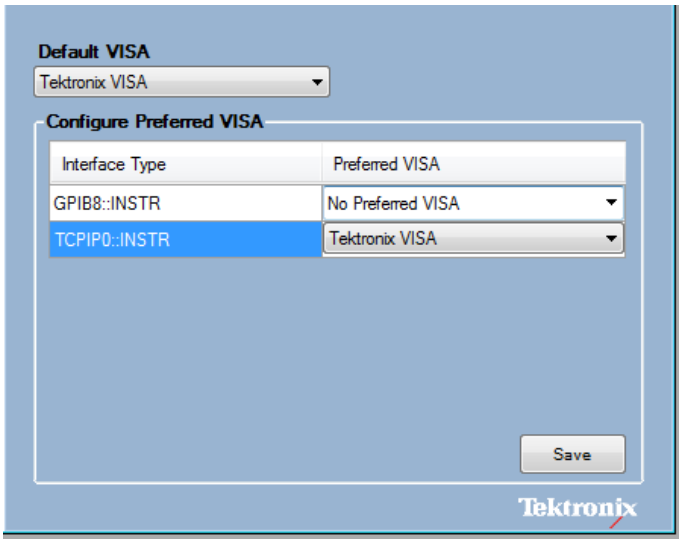
Ensure that the DSA8300 is connected to the network, and the TekScope application is running.

TekVISA setup and troubleshooting

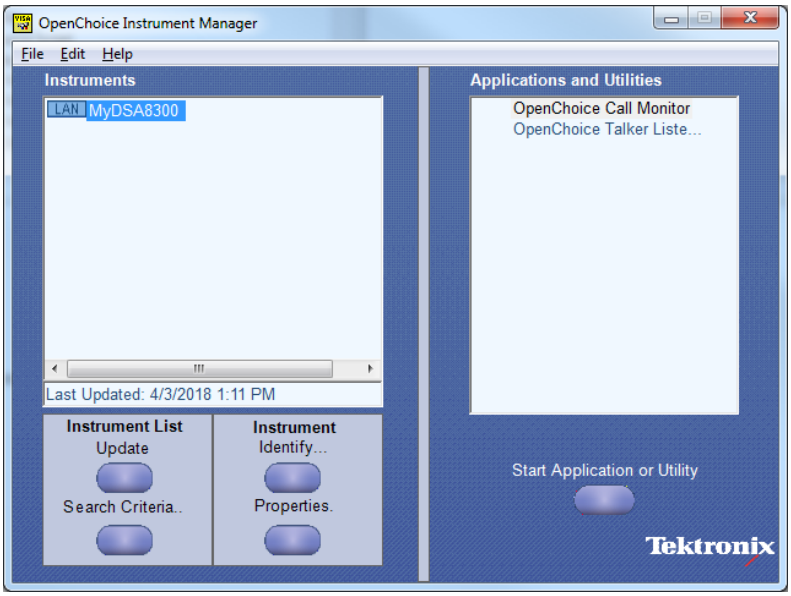
- Verify that TekVISA is installed on the PC.
  - TekVISA is required to be running on both the PC and the target oscilloscope.

    Look for the TekVISA icon in task bar. 

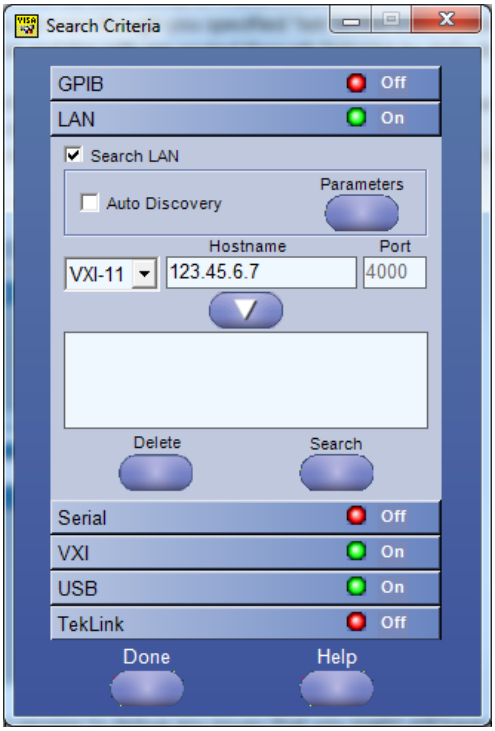
- If other VISA software is installed on the PC, verify that TekVISA is the default VISA. Use the OpenChoice VISA64 Conflict Manger (available in the list of applications under the TekVISA program folder).



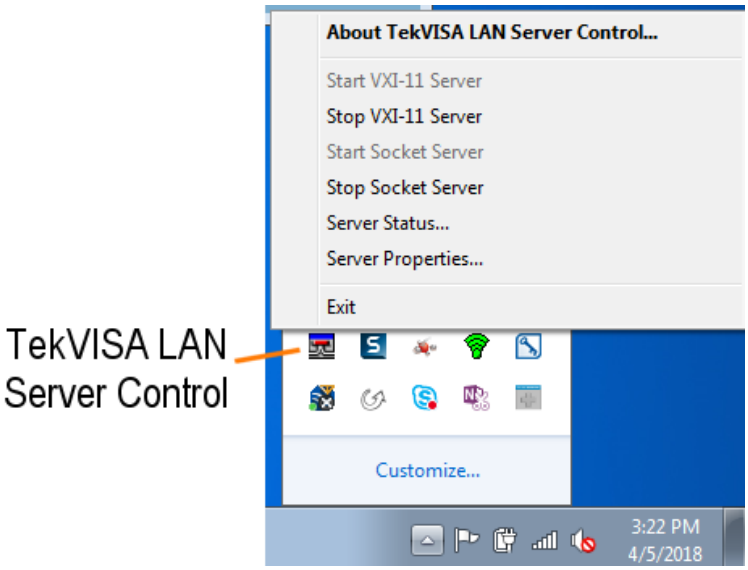
- Make sure that the instrument is detected in the TekVISA Open Choice Instrument Manager (available in the list of applications under the TekVISA program folder).



To detect an instrument for through TekVISA, select the Search Criteria button and then select LAN. Search on the IP address.



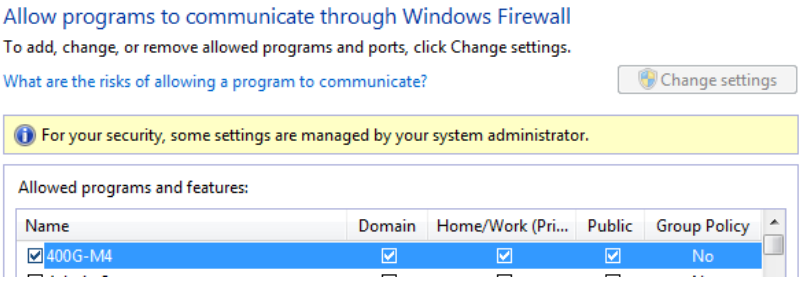
- Make sure that the VXI-11 server under TekVISA LAN Server is started on the DSA8300. The server is turned off after the instrument is rebooted, so user needs to start it manually.



Firewall exceptions

- Make sure that TekVISA inbound and outbound traffic are allowed through the Windows Firewall on both the DSA8300 instrument and the PC running 400G-M4 application.
- Make sure that 400G-M4 application is added to the Windows Firewall exception list on the PC.

  Open the "Windows Firewall" from "Control Panel" and follow instructions under "Allow an app or feature through Windows Firewall".



Remote control introduction

The 400G-M4 software application can be controlled programmatically through the programmatic interface. Communication with the application is accomplished using VARIABLE:VALUE remote GPIB commands.

For information on how to operate the sampling oscilloscope and use its application-specific GPIB commands, refer to the programmers guide for your sampling oscilloscope.

Your program should comply with the following guidelines:

- The application startup must complete before sending additional GPIB commands to the application.
- The measurements cycle must complete before you query data.

See also:

Variable:Value Commands (see page 43)

Program example configure and operate the 400G-M4 (see page 59)

Handshaking protocol

The application handles GPIB communications through its own protocol handshaking.

The requirements for GPIB communications with a controller are as follows:

1. Once the application has started, it writes an "OK" status to the application handshake variable. This tells the controller that it may now write a valid command into the "tdecq" variable.
2. The GPIB controller polls the handshake variable (VARIABLE:VALUE? "tdecq") until it detects the OK status.
3. The GPIB controller writes a command string into the application handshake variable. For example, sending the command VARIABLE:VALUE "tdecq", "single" writes the string "single" into the variable "tdecq".
4. The application GPIB function polls the handshake variable, reads the command string and interprets it as a command. If the command is not understood, it writes an ERROR handshake value to the variable.
5. A good command is parsed and executed. On successful execution, the application writes an OK to the handshake variable. When the GPIB controller reads the OK status, it may send a new command string.

Setting up the PI environment

To help users get started with using GPIB commands to operate the 400G-M4 Analysis application, examples of automatic testing script written in Perl and Python 3.5 is included. These are examples only. Users are free to use any programming language of their choice as long as the handshaking protocol is followed.

Start Client with Perl

The prerequisites are:

- Matlab runtime needs to be installed and in the user's path
- Perl v5.24.3 or later needs to be installed and in the user's path

When the 400G-M4 is running, you can start the client with the following Perl script.

perl TDECQ_PI_Client.pl

When the 400G-M4 is not running, the script needs to start the 400G-M4 as well as set up the environment by using:

perl TDECQ_PI_Client.pl –startApp

NOTE. *You may need to use the –filePath "<pathToTDECQexe>" to tell the client where to connect to the currently running Applications' process.*

Start Client with Python

The prerequisites are:

- Matlab runtime needs to be installed and in the user's path
- Python 3.5 or above needs to be installed and in the user's path

When the 400G-M4 is running, you can start the client with the following Python script.

python TDECQ_PI_Client.py

When the 400G-M4 is not running, the script needs to start the 400G-M4, as well as set up the environment by using:

NOTE. *You may need to use the -filePath "<pathToTDECQexe>" to tell the client where to connect to the currently running Applications' process.*

Running Multiple Instances

Use the following to start the main UI program with assigned instance id of <instanceId>. The default <instanceId> is 1. See the Example Main Program Execution (see page 60) for more details and examples.

400G-M4.exe <instanceId>

Running Using TCP/IP Address

For an IP connect, use the following command

perl TDECQ_PI_Client.pl -cmdfilepath=\\ip address\c$\Program Files\TekApplications\400G-M4

This starts 400G-M4.exe at C:\Program Files\TekApplications\400G-M4\400G-M4.exe. The TCPIP requires that the C: drive on the target running the 400G-M4 application is publicly accessible. In the example, it shares as "c$".

Reducing test time

You can reduce test time by using the TDECQ_ResultsFile.txt file that is saved in C:\Users\<user name>\\AppData\Local\Temp. Measurement results are captured in this file, which allows you to access all of the measurement results in a single file instead of querying results one at a time. Note that “ERROR” will show if the measurement has errors.

The following is a TDECQ example TDECQResults.txt for an offline channel case:

"offLine:TDECQ","0.87886","offLine:TDECQMeasIsInQuestion","0","offLine:OMA","-3.8533","offLine:ER","5.4282","offLine:AOP","-4.3916",

Syntax

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

To set a variable to a value, use the syntax:

```
VARIABLE:VALUE "tdecq","<variableName>:<variableValue>"
```

For example, the following commands sets the BWE mode to ON.

```
VARIABLE:VALUE "tdecq","bwe:on"
```

To query the value in a variable:

```
VARIABLE:VALUE? "tdecq","<variableName>"
```

For example, the following command queries the state of the BWE mode.

```
VARIABLE:VALUE? "tdecq","bwe"
```

NOTE. *The arguments <variableName> and <variableValue> are required in the order indicated, no spaces, and use of proper capitalization.*

Your program will not operate correctly if you do not follow these requirements.

See also:

Variable:Value Command Arguments and Queries (see page 44)

Program example configure and operate 400GM4 (see page 59)

Variable name arguments and queries

Table 9: Control commands and queries

Commands	Description
:variable:value "tdecq","activate:<NR1>"	Command only. Starts the 400G-M4 application. Required before any further processing or setup commands can be executed. Use the command :variable:value? "tdecq","instanceId" to return the instance ID.
Syntax	:variable:value "tdecq","activate:<NR1>" <NR1> = instance ID.
Example	`:variable:value "tdecq","activate"` starts the 400G-M4 application.
:variable:value? "tdecq","attunit:ch1"	Query only. Returns the external attenuation unit (Linear or dB) for CH1.
Syntax	:variable:value? "tdecq"," attunit:ch1"
Example	`:variable:value? "tdecq","attunit:ch1"` might return dB.
Return Examples	Returns: $response = 'Linear' Returns: $response = 'dB' Returns: $response = 'None' means that CH1 is not connected.
:variable:value? "tdecq","attvalue:ch1"	Query only. Returns CH1 external attenuation value.
Syntax	:variable:value? "tdecq","attvalue:ch1"
Example	`:variable:value? "tdecq","attvalue:ch1"` returns the CH1 external attenuation value.
Return Example	Returns: $response = '1'

Table 9: Control commands and queries (cont.)

Commands	Description
:variable:value? "tdecq", "config:recalctapvalues?"	Query only. Enables the FFE taps recalculation.
Syntax	:variable:value? "tdecq","config:recalctapvalues?"
Example	`:variable:value? "tdecq","config:recalctapvalues?"` returns the recalculated FFE taps values.
Return Example	Returns: $response = '1 ' 1 indicates the Recalculate taps box is checked. 0 indicates the Recalculate taps box is unchecked.
:variable:value? "tdecq","instanceId"	Query only. Returns the instance ID.
Syntax	:variable:value? "tdecq","instanceId"
Example	`:variable:value? "tdecq","instanceId"` returns the ID.
Return Example	Returns: $response = '1'
:variable:value "tdecq","connect:<ip_address>"	The set form provides the IP address or the computer name of the oscilloscope to connect to the application. The query form returns the IP address of the connected oscilloscope if it exists. Make sure TekVISA is turned on and the instrument can be found via the TekVisa before setting the IP address. For help with connection issues, refer to Oscilloscope connection tips (see page 37).
Syntax	:variable:value "tdecq","connect:<ip_address>"
Example	`:variable:value "tdecq","connect:134.62.9.4"` connects to the instrument with the given IP address. `:variable:value? "tdecq","connect"` returns the IP address of a connected instrument.
Return Example	Returns: $response = '134.62.9.4'
:variable:value "tdecq","disconnect"	Command only. Disconnects the application from the oscilloscope in online mode (returns to offline mode).
Syntax	:variable:value "tdecq","disconnect"
Example	`:variable:value "tdecq","disconnect"` disconnects the application from the connected oscilloscope.
:variable:value? "tdecq","online"	Query only. Checks if the application is connected to an oscilloscope and has a valid license.

Table 9: Control commands and queries (cont.)

Commands	Description
Syntax	:variable:value? "tdecq","online"
Example	`:variable:value? "tdecq","online"` verifies an oscilloscope connection and a valid license.
Return Example	Returns: $response = '1' indicates connected. Returns: $response = '0' indicates no connection.
:variable:value "tdecq","autosync"	Command only. Loads the module information from the connected oscilloscope (when in online mode). Use this command to re-sync module information if any changes have been made to the modules after the initial connection to the oscilloscope. See queries for "various module data fields" to retrieve module information after sending this command.
Syntax	:variable:value "tdecq","autosync"
Example	`:variable:value "tdecq","autosync"` synchronize the module information with the application.
:variable:value "tdecq","analyze"	Command only. Starts the analysis measurements on the currently loaded data. This is equivalent to pressing the "Run" button. This is required before querying any measurement results. ***NOTE.*** *After analysis is complete, results of all active channels are also available in* ***%TEMP%\TDECQ_ResultsFile.txt****. For TDECQ instances other than the default, results are written to* ***%TEMP%\TDECQ_ResultsFile<instanceId>.txt****.*
Syntax	:variable:value "tdecq","analyze"
Example	`:variable:value "tdecq","analyze"` starts the analysis process.
:variable:value "tdecq","clear"	Command only. Clears all measurement results.
Syntax	:variable:value "tdecq","clear"
Example	`:variable:value "tdecq","clear"` clears all result measurements.
:variable:value? "tdecq","status"	Query only. Returns the contents of the status line.
Syntax	:variable:value? "tdecq","status"
Example	`:variable:value? "tdecq","status"` returns the current string from the status line.
Return Example	Returns: $response = 'No waveform File'

Table 9: Control commands and queries (cont.)

Commands	Description
:variable:value "tdecq","exit"	Command only. Exits the 400G-M4 application. If and analysis is in process, the program exits after the analysis is complete.
Syntax	:variable:value "tdecq","exit"
Example	`:variable:value "tdecq","exit"` exits the 400G-M4 application.
:variable:value "tdecq","recallsetup:C:\Users\Public\Tektronix\TekApplications\400G-M4\test.gm4"	Command only. Recalls the 400G setup file. (Read about what information is saved in setup files in the table in the File menu (see page 7) topic.)
Syntax	:variable:value "tdecq","recallsetup:C:\Users\Public\Tektronix\TekApplications\400G-M4\test.gm4"
Example	`:variable:value? "tdecq","recallsetup:C:\Users\Public\Tektronix\TekApplications\ 400G-M4\test.gm4"` recalls the test.gm4 setup.
:variable:value "tdecq","savesetup:C:\Users\Public\Tektronix\TekApplications\400G-M4\test.gm4"	Command only. Saves the 400G setup to a *.gm4 file. (Read about what information is saved in setup files in the table in the File menu (see page 7) topic.)
Syntax	:variable:value "tdecq","savesetup:C:\Users\Public\Tektronix\TekApplications\400G-M4\test.gm4"
Example	`:variable:value? "tdecq","savesetup:C:\Users\Public\Tektronix\TekApplications\400G-M4\test.gm4"` saves a 400G setup as test.gm4.
:variable:value "tdecq","savewaveform:<filename>"	Command only. Saves the acquired live channel waveform into files for ch1 to ch 4. The files are saved in the specified directory.
Syntax	:variable:value "tdecq","savewaveform:<filename>" <filename> must include the filepath and filename.
Example	`:variable:value "tdecq","savewaveform:c:\test\waveform"` saves the file named “waveform” to the specified directory.
:variable:value "tdecq","savesetup:<setup-name>"	Command only. Saves the current settings to a setup file. The setup file is saved in the specified directory. Setup files use the file extension .gm4.

Table 9: Control commands and queries (cont.)

Commands	Description
Syntax	:variable:value "tdecq","savesetup:<setupname>" <setupname> must include the filepath and filename.
Example	`:variable:value "tdecq","savesetup:C:\Users\Public\Tektronix\TekApplications\400G-M4\setup1.gm4"` saves the setup file named “setup1” to the specified directory.
:variable:value "tdecq","recallsetup:<setupname>"	Command only. Recalls the named setup file from the specified directory. Setup files use the file extension .gm4.
Syntax	:variable:value "tdecq","recallsetup:<setupname>" <setupname> must include the filepath and filename.
Example	`:variable:value "tdecq","recallsetup:C:\Users\Public\Tektronix\TekApplications\400G-M4\setup1.gm4"` recalls the setup file named “setup1” from the specified directory.

Table 10: Horizontal settings commands and queries

Commands	Description
:variable:value "tdecq","patternLength:<Integer>"	Sets or returns the horizontal pattern length value.
Syntax	:variable:value "tdecq","patternLength:<Integer>" <Integer> = value from 21 to 10E3
Example	`:variable:value "tdecq","patternLength:8191"` sets the pattern length to 8191. `:variable:value? "tdecq","patternLength"` returns the current pattern length.
Return Example	Returns: $response = '8191'
:variable:value "tdecq","baudRate:<Integer>"	Sets or returns the horizontal baud rate value (GHz) in symbols/second.
Syntax	:variable:value "tdecq","baudRate:<Integer>" <Integer> = value from 10 to 100.
Example	`:variable:value "tdecq","baudRate:20"` sets the baud rate to 20 G symbols/second. `:variable:value? "tdecq","baudRate"` returns the current symbols/second value.
Return Example	Returns: $response = '20000000000'

Table 10: Horizontal settings commands and queries (cont.)

Commands	Description
:variable:value "tdecq","samplesPerBit:<Integer>"	Sets or returns the horizontal waveform samples per bit of the signal.
Syntax	:variable:value "tdecq","samplesPerBit:<Integer>" <Integer> = value from 5 to 100.
Example	`:variable:value "tdecq","samplesPerBit:10"` sets the waveform samples per bit to 10. `:variable:value? "tdecq","samplesPerBit"` returns the waveform samples per bit value.
Return Example	Returns: $response = '10'

Table 11: Measurement select commands and queries

Commands	Description
:variable:value "tdecq","tdecqMeas:1|0"	Sets or returns the state (enabled or disabled) of the TDECQ measurement. This is a global setting for both offline and online modes.
Syntax	:variable:value "tdecq","tdecqMeas:1|0" 1 enables the TDECQ measurement. 0 disables the TDECQ measurement.
Example	`:variable:value "tdecq","tdecqMeas:1"` enables the TDECQ measurement.
Return Example	Returns: $response = '1'
:variable:value "tdecq","levelMeas:1|0"	Sets or returns the state (enabled or disabled) of the Symbol Level measurement. This is a global setting for both offline and online modes.
Syntax	:variable:value "tdecq","levelMeas:1|0" 1 enables the Symbol Levels measurements. 0 disables the Symbol Levels measurements.
Example	`:variable:value "tdecq","levelMeas:1"` enables the Symbol Level measurements.
Return Example	Returns: $response = '1'
:variable:value "tdecq", "eyeMeas:1|0"	Sets or returns the state (enabled or disabled) of the Eye measurements. This is a global setting for both offline and online modes.
Syntax	:variable:value "tdecq","eyeMeas:1|0" 1 enables the Eye measurements. 0 disables the Eye measurements.
Example	`:variable:value "tdecq","eyeMeas:1"` enables the Eye measurements.

Table 11: Measurement select commands and queries (cont.)

Commands	Description
Return Example	Returns: $response = '1'
:variable:value "tdecq", "laserTuningMode:1|0"	Sets or returns the state (enabled or disabled) of the Laser Tuning Mode. This is a global setting for both offline and online modes.
Syntax	:variable:value "tdecq","laserTuningMode:1|0" 1 enables the Laser Tuning Mode. 0 disables the Laser Tuning Mode.
Example	`:variable:value "tdecq","laserTuningMode:1"` enables the Laser Tuning Mode.
Return Example	Returns: $response = '1'

Table 12: Configuration commands and queries

Commands	Description
:variable:value "tdecq","config:ExtendedSearch:0|1"	Sets or returns the state of the Extended Search (enabled or disabled). When enabled, the whole waveform is searched.
Syntax	:variable:value "tdecq","config:ExtendedSearch:0|1" 1 enables the Extended search capability. 0 disables the Extended search capability.
Example	`:variable:value "tdecq","config:ExtendedSearch:1"` enables the Extended search capability. `:variable:value? "tdecq","config:ExtendedSearch"` returns the state.
Return Example	Returns: $response = '1'
:variable:value "tdecq","config:VerticalThresholdFlex:0|1"	Sets or returns the state of the Vertical Threshold Adjust (enabled or disabled) for the TDECQ measurement configuration.
Syntax	:variable:value "tdecq","config:VerticalThresholdFlex:0|1" 1 enables the Vertical Threshold Adjust capability. 0 disables the Vertical Threshold Adjust capability.
Example	`:variable:value "tdecq","config:VerticalThresholdFlex:1"` enables the Vertical Threshold Adjust capability. `:variable:value? "tdecq","config:VerticalThresholdFlex"` returns the state.
Return Example	Returns: $response = '1'

Table 12: Configuration commands and queries (cont.)

Commands	Description
:variable:value "tdecq","config:AutoSetTapValues:0|1"	Sets or returns the state of the Auto Tap Values (enabled or disabled) for the TDECQ measurement configuration.
Syntax	:variable:value "tdecq","config:AutoSetTapValues:0|1" 1 enables the Auto Tap Values capability. 0 disables the Auto Tap Values capability.
Example	`:variable:value "tdecq","config:AutoSetTapValues:1"` enables the Auto Tap Values capability. `:variable:value? "tdecq","config:AutoSetTapValues"` returns the Auto Tap Values state.
Return Example	Returns: $response = '1'
:variable:value "tdecq","config:AutoImportNoise:0|1"	Sets or returns the state of the Auto Import Noise (enabled or disabled) for the TDECQ measurement configuration.
Syntax	:variable:value "tdecq","config:AutoImportNoise:0|1" 1 enables the Auto Import Noise capability. 0 disables the Auto Import Noise capability.
Example	`:variable:value "tdecq","config:AutoImportNoise:1"` enables the Auto Import Noise capability. `:variable:value? "tdecq","config:AutoImportNoise"` returns the Auto Import Noise state.
Return Example	Returns: $response = '1'
:variable:value "tdecq","config:NumTaps:<Integer>"	Sets or returns the FFE tap length of the equalizer.
Syntax	:variable:value "tdecq","config:NumTaps:<Integer>" <Integer> = value from 1 to 99 and must be an odd number.
Example	`:var:value "tdecq","config:NumTaps:31"` sets the FFE tap length to 31. `:var:value? "tdecq","config:NumTaps"` returns the FFE tap length.
Return Example	Returns: $response = '31'
:variable:value "tdecq","config:SamplesPerUI:<Integer>"	Sets or returns the samples per FFE tap for the equalizer.
Syntax	:variable:value "tdecq","config:SamplesPerUI:<Integer>" <Integer> = value from 1 to 10
Example	`:variable:value "tdecq","config:SamplesPerUI:3"` sets the samples per FFE tap to 3. `:variable:value? "tdecq","config:SamplesPerUI"` returns the samples per FFE tap.

Table 12: Configuration commands and queries (cont.)

Commands	Description
Return Example	Returns: $response = '3'
:variable:value "tdecq","config:MaxPreCursor:<Integer>"	Sets or returns the maximum pre cursor for the FFE equalizer.
Syntax	:variable:value "tdecq","config:MaxPreCursor:<Integer>" <Integer> = value from 0 to the length of the FFE taps minus 1.
Example	`:variable:value "tdecq","config:MaxPreCursor:3"` sets the maximum pre cursor to 3. `:variable:value? "tdecq","config:MaxPreCursor"` returns the maximum pre cursor.
Return Example	Returns: $response = '3'
:variable:value "tdecq","ffetapvalue[:(offline|ch<x>)]:<float>"	Sets or returns the FFE tap values for the offline mode or the specified channel. The input needs to be float, and the taps must match the FFE tap length. See :variable:value "tdecq","config: NumTaps:<Integer>"
Syntax	:variable:value "tdecq","ffetapvalue[:(offline|ch<x>)]:<float>" Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used. <float> = string of tap values.
Example	`:variable:value "tdecq","ffetapvalue:offline:0.1 0.2 0.3 0.4 0.5"` sets the tap value for 5 FFE taps. `:variable:value? "tdecq","ffetapvalue:offline"` returns the current tap values.
Return Example	Returns: $response = '0.1 0.2 0.3 0.4 0.5 '
:variable:value "tdecq","erAdjustment[:(offline|ch<x>)]:<float>"	Sets or returns the Extinction adjustment values for the offline mode or the specified channel. The input needs to be a float value from –100 to 100.
Syntax	:variable:value "tdecq","erAdjustment[:(offline|ch<x>)]:<float>" Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used. <float> = value from –100 to 100.
Example	`:variable:value "tdecq","erAdjustment:ch1:4"` sets the ER adjustment value for channel 1 to 4%. `:variable:value? "tdecq","erAdjustment:offline"` returns the ER adjutment value for the Off Line mode.
Return Example	Returns: $response = '4 '

Table 13: Offline and Online mode commands and queries

Commands	Description
:variable:value "tdecq","channel:(offline|ch<x>)"	The set form selects either the offline mode or one of the channels in the online mode. The query form returns either the offline mode or a channel (online mode).
Syntax	:variable:value "tdecq","channel:(offline|ch<x>)" <x> = 1 to 4.
Examples	`VARIABLE:VALUE "tdecq","channel:offline"` selects the offline mode. `VARIABLE:VALUE "tdecq","channel:ch2"` selects the channel 2 online mode. `VARIABLE:VALUE? "tdecq","channel"` returns the current mode or channel.
Return Example	Returns: $response = 'offline'
:variable:value "tdecq","noise[:(offline|ch<x>)]:<float>"	Sets or returns the scope noise value (in W) for the specified channel or offline mode.
Syntax	:variable:value "tdecq","noise[:(offline|ch<x>)]:<float>" Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used. <x> = 1 to 4. <float> = 0 to 1.
Example	`:variable:value "tdecq","noise:ch1:5e-6"` sets the channel 1 scope noise to 5 µW. `:variable:value? "tdecq","noise:ch1"` returns the scope noise value for channel 1.
Return Example	Returns: $response = '5e-6'
:variable:value "tdecq","jnb_filename:<filename>"	The set form loads the specified JNB filename for offline measurement analysis. The query form returns the currently loaded filename and filepath.
Syntax	:variable:value "tdecq","jnb_filename:<filename>" <filename> must include the filepath and filename.
Example	`:var:value "tdecq","jnb_filename: c:\test\jnbTest.mat"` loads the file named jnbTest.mat. `:var:value? "tdecq","jnb_filename"` returns the currently loaded filename and filepath.
Return Example	Returns: $response = 'c:\test\jnbTest.mat'
:variable:value? "tdecq","module:[(offline|ch<x>)]"	Query only. Returns the module data fields of the module located in the specified channel of the DSA8300 oscilloscope when in online mode.

Table 13: Offline and Online mode commands and queries (cont.)

Commands	Description
Syntax	:variable:value? "tdecq","module:[(offline|ch<x>)]" Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used.
Example	`:variable:value? "tdecq","module:ch4"` returns the information of the module that is installed in channel 4 of the DSA8300.
Return Example	Returns: $response = '80C21'
:variable:value? "tdecq","serialnum:[(offline|ch<x>)]"	Query only. Returns the serial number of the module located in the specified channel of the DSA8300 oscilloscope when in online mode.
Syntax	:variable:value? "tdecq","serialnum:[(offline|ch<x>)]" Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used.
Example	`:variable:value? "tdecq","serialnum:ch4"` returns the serial number of the module installed in channel 4 of the DSA8300.
Return Example	Returns: $response = 'B010564'
:variable:value? "tdecq","modfilter:[(offline|ch<x>)]"	Query only. Returns the filter selection of the module located in the specified channel of the DSA8300 oscilloscope when in online mode.
Syntax	:variable:value? "tdecq","modfilter:[(offline|ch<x>)] Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used.
Example	`:variable:value? "tdecq","modfilter:ch4"` returns the filter selection of the module installed in channel 4 of the DSA8300.
Return Example	Returns: $response = 'none'
:variable:value? "tdecq","modbw[:(offline|ch<x>)]"	Query only. Returns the bandwidth selection of the module located in the specified channel of the DSA8300 oscilloscope when in online mode.
Syntax	:variable:value? "tdecq","modbw[:(offline|ch<x>)]" Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used.
Example	`:variable:value? "tdecq","modbw:ch4"` returns the bandwidth selection of the module installed in channel 4 of the DSA8300.
Return Example	Returns: $response = '49.999E+9'

Table 14: BW Enhancement commands and queries

Commands	Description
:variable:value "tdecq","bwe[:(offline|ch<x>)]:ON|OFF"	Sets or returns the BWE state (enabled or disabled) to the offline mode or the specified channel. When BWE is enabled, the selection of the “bwe:select” value can be made.
Syntax	variable:value "tdecq","bwe[:(offline|ch<x>)]:ON|OFF" Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used. ON enables the BWE mode. OFF disables the BWE mode.
Example	`VARIABLE:VALUE "tdecq","bwe:ch3:ON"` enables BWE on channel 3. `VARIABLE:VALUE? "tdecq","bwe:ch3"` returns the BWE state for channel 3.
Return Example	Returns: $response = 'ON' Use to :variable:value "tdecq","bwe[:(offline|ch<x>)]:ON|OFF"
:variable:value "tdecq","bwe[:(offline|ch<x>)]:select:<NR1>"	Sets or returns the BWE filter selection type for the offline mode or the specified channel. ***NOTE.*** *BWE must be enabled before selecting a filter. See the command :variable:value "tdecq","bwe[:(offline|ch<x>)]:ON|OFF"*
Syntax	:variable:value "tdecq","bwe[:(offline|ch<x>)]:select:<NR1>" Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used. <NR1> = an integer between 1 and 4. 1 = HW only 2 = 0.5 X Baud rate 3 = 0.75 X Baud rate 4 = User selected
Example	`:variable:value "tdecq","bwe:ch3:select:1"` sets the BWE filter for channel 3 to HW only. `:variable:value? "tdecq","bwe:ch3:select"` returns the BWE filter selection for channel 3.
Return Example	Returns: $response = '1'
:variable:value "tdecq","bwe[:(offline|ch<x>)]:btbw:<NR1>"	Sets or returns the "BT 4th Order BW" user supplied filter value (in Hz) for the offline mode or the specified channel. ***NOTE.*** *BWE must be enabled and the filter type set to User.* *See the commands:* *:variable:value "tdecq","bwe[:(offline|ch<x>)]:ON|OFF"* *:variable:value "tdecq","bwe[:(offline|ch<x>)]:select:<NR1>"*

Table 14: BW Enhancement commands and queries (cont.)

Commands	Description
Syntax	:variable:value "tdecq","bwe[:(offline|ch<x>)]:btbw:<NR1>" Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used. <NR1> = value from 13.2813e9 to 100e9 and must be larger than ½ baud rate.
Example	`:variable:value "tdecq","bwe:ch3:btbw:10e9"` sets the Bessel -Thomson 4th Order bandwidth to 10 GHz. `:variable:value? "tdecq","bwe:ch3:btbw"` returns the Bessel -Thomson 4th Order bandwidth setting.
Return Example	Returns: $response = '10000000000'
:variable:value "tdecq","sparam_filename[:(offline|ch<x>)]:<filename>"	The set form loads the specified S-parameter filename and filepath for the offline mode or the specified channel for measurement analysis. The query form returns the filename and filepath of the S-parameter file.
Syntax	:variable:value "tdecq","sparam_filename[:(offline|ch<x>)]:<filename>" Offline or ch<x> are optional. If not specified, the currently selected mode or channel is used. <filename> must include the filepath and filename.
Example	`:variable:value "tdecq","sparam_filename:ch1:c:\test\ch1Sparameter.s1p"` loads the ch1Sparameter.s1p file. `:variable:value? "tdecq","sparam_filename:ch1"` returns the S-parameter filename and filepath for channel 1.
Return Example	Returns: $response = 'c:\test\ch1Sparameter.s1p'

Table 15: Measurement result queries

Commands	Description
:variable:value? "tdecq","TDECQ"	Query only. Returns the TDECQ measurement result for the active mode or channel.
Syntax	:variable:value? "tdecq","TDECQ"
Example	`:variable:value? "tdecq","TDECQ"` returns the TDECQ result for the active mode or channel.
Return Example	Returns: $response = 'TDECQ:3.0726'
:variable:value? "tdecq","ceq"	Query only. Returns the Ceq measurement result for the active mode or channel.
Syntax	:variable:value? "tdecq","ceq"
Example	`:variable:value? "tdecq","ceq"` returns the Ceq measurement result for the active mode or channel.

Table 15: Measurement result queries (cont.)

Commands	Description
Return Example	Returns: $response = 'CEQ:1.06'
:variable:value? "tdecq","OMA"	Query only. Returns the OMA measurement result for the active mode or channel.
Syntax	:variable:value? "tdecq","OMA"
Example	`:variable:value? "tdecq","OMA"` returns the OMA measurement result for the active mode or channel.
Return Example	Returns: $response = 'OMA:0.0013304'
:variable:value? "tdecq","ER"	Query only. Returns the ER measurement result for the active mode or channel.
Syntax	:variable:value? "tdecq","ER"
Example	`:variable:value? "tdecq","ER"` returns the ER measurement result for the active mode or channel.
Return Example	Returns: $response = 'ER:14.891'
:variable:value? "tdecq","AOP"	Query only. Returns the AOP measurement result for the active mode or channel.
Syntax	:variable:value? "tdecq","AOP"
Example	`:variable:value? "tdecq","AOP"` returns the AOP measurement result for the active mode or channel.
Return Example	Returns: $response = 'AOP:0.00068321'
:variable:value? "tdecq","Rlm"	Query only. Returns the RLM measurement result for the active mode or channel.
Syntax	:variable:value? "tdecq","Rlm"
Example	`:variable:value? "tdecq","Rlm"` returns the RLM measurement result for the active mode or channel.
Return Example	Returns: $response = 'RLM:0.94991'
:variable:value? "tdecq","Deviation"	Query only. Returns the Deviation measurement result for the active mode or channel.
Syntax	:variable:value? "tdecq","Deviation"
Example	`:variable:value? "tdecq","Deviation"` returns the Deviation measurement result for the active mode or channel.
Return Example	Returns: $response = 'levelDeviation:0.027654'

Table 15: Measurement result queries (cont.)

Commands	Description
:variable:value? "tdecq","Thickness"	Query only. Returns the Thickness measurement result for the active mode or channel.
Syntax	:variable:value? "tdecq","Thickness"
Example	`:variable:value? "tdecq","Thickness"` returns the Thickness measurement result for the active mode or channel.
Return Example	Returns: $response = 'levelThickness:0.070283'
:variable:value? "tdecq","transitiontime"	Query only. Returns the Transition Time measurement result for the active mode or channel.
Syntax	:variable:value? "tdecq","transitiontime"
Example	`:variable:value? "tdecq","transitiontime"` returns the Transition Time measurement result for the active mode or channel.
Return Example	Returns: $response = 'transitionTime:0.00000000000722'
:variable:value? "tdecq","AllMeas[:(offline|ch<x>|active)]"	Query only. Returns all available measurements from the most recent analysis from the offline mode, specified channel, or simply the currently active mode/channel.
Syntax	:variable:value? "tdecq","AllMeas[:(offline|ch<x>|active)]" **offline** returns all measurements from the offline analysis run. **ch<x>** returns all measurements from the specified channel source. **active** returns all measurements across all active online sources. Each "<measTypeX>" field will be prefixed with the specific source's name. e.g., "ch1:TDECQ","7.3698+13.6438i","ch1:OMA","-0.0041289", Offline, ch<x>, or active are optional. If not specified, the currently selected mode or channel is used.

Table 15: Measurement result queries (cont.)

Commands	Description
Example	`:variable:value? "tdecq","AllMeas:active"` returns all measurements from the all enabled channels. The response format is a list of "<measType1>","<measValue1>","<measType2>","<measValue2>",... This may provide more data than the individual measurement queries, as well as space-delimited arrays of values for particular measurement types. A sample response might look like the following: `"TDECQ","3.5884","OMA","0.0013259","ER","14.9446","AOP","0.0006836","V:mean","6.8129e-07 0.00044641 0.00091906 0.0013689","V:std","3.8602e-05 4.7552e-05 4.0125e-05 4.9945e-05","V:pk2pk","0.00027391 0.00036793 0.00028668 0.00030382","RLM","0.95458","levelThickness","0.064398","levelDeviation","0.024212","eye:Upper:Thresh","0.0011315","eye:Upper:Offset","1.0756e-13","eye:Upper:H_eye","3.6034e-12","eye:Upper:V_eye","0.00014137","eye:Middle:Thresh","0.00070909","eye:Middle:Offset","3.0882e-13","eye:Middle:H_eye","4.1471e-12","eye:Middle:V_eye","0.00012724","eye:Lower:Thresh","0.00021014","eye:Lower:Offset","-2.2588e-13","eye:Lower:H_eye","3.6894e-12","eye:Lower:V_eye","0.0001365"`
Return Example	Returns: "TDECQ","3.5884","OMA","0.0013259","ER","14.9446","AOP","0.0006836","V:mean","6.8129e-07 0.00044641 0.00091906 0.0013689","V:std","3.8602e-05 4.7552e-05 4.0125e-05 4.9945e-05","V:pk2pk","0.00027391 0.00036793 0.00028668 0.00030382","RLM","0.95458","levelThickness","0.064398","levelDeviation","0.024212","eye:Upper:Thresh","0.0011315","eye:Upper:Offset","1.0756e-13","eye:Upper:H_eye","3.6034e-12","eye:Upper:V_eye","0.00014137","eye:Middle:Thresh","0.00070909","eye:Middle:Offset","3.0882e-13","eye:Middle:H_eye","4.1471e-12","eye:Middle:V_eye","0.00012724","eye:Lower:Thresh","0.00021014","eye:Lower:Offset","-2.2588e-13","eye:Lower:H_eye","3.6894e-12","eye:Lower:V_eye","0.0001365"

Perl program example: configure and operate 400G-M4

With available offline analysis, 400G-M4 offers a programmatic interface similar to that of TekScope, JNB, or other on-scope applications. A client needs to know how to interface and synchronize with the application. The Perl script below gives an example of such a client (similar clients could be implemented in Python, .NET, etc.). A file interface is used to communicate between 400G-M4 and the client.

NOTE. *The examples presume that you are familiar with designing GPIB programs.*

All words within quotes are case sensitive and must be entered exactly as shown, including spaces and quotes.

Prerequisites

- Matlab runtime needs to be installed and in the user's path
- Perl needs to be installed and in the user's path
- The client expects to be able to write "CommandFile.txt" and "TDECQ_LogFile.txt" to the current working directory (C:\Users\<user>\AppData\Local\Temp) for communication and logging. For multiple instances, the files "CommandFile<instanceId>.txt" and "TDECQ_LogFile<instanceId>.txt" are used. See below for examples.

  The measurement results are captured in TDECQ_ResultsFile.txt at the same directory.

  "ERROR" will show if the measurement has errors.
- The client by default enters an 'interactive' mode, reading from STDIN (which times out and exits after 5 minutes). At this point you can send any of the specified commands and queries.

Example Main Program Execution

```
400G-M4.exe <instanceId>
```

Starts the main UI program with assigned instance id of <instanceId>. The default instanceId is 1. For each instance other than 1, a separate client may connect to each unique instance. Each separate client for instanceIds other than 1 can connect to that particular <instanceId> via the corresponding "CommandFile<instanceId>.txt". e.g., upon execution of the following:

```
400G-M4.exe 1

400G-M4.exe 2

400G-M4.exe 3
```

, client 1 may connect to instance 1 via %TEMP%\CommandFile.txt, and client 2 may connect to instance 2 via %TEMP%\CommandFile2.txt, and client 3 may connect to instance 3 via %TEMP%\CommandFile3.txt.

NOTE. *For the Example Client Execution below, you would need to use the "–appInstance=<instanceId>" to tell the client to connect to the specific <instanceId> UI execution. See the example using the "-appInstance" flag below.*

Example Client Execution

```
perl TDECQ_PI_Client.pl
```

Starts the client in interactive mode, which reads the commands/queries from stdin. This is ideal if the UI is already running.

NOTE. *You may need to use the –filePath "<pathToTDECQexe>" to tell the client where to connect to the currently running Appplication's process).*

```
perl TDECQ_PI_Client.pl –startApp
```

Starts the client and the main application (ideal if the UI is not running yet) which in turn reads the set of commands/queries from stdin.

Once stdin is ready to read commands, an example set to send is:

```
:variable:value "tdecq","activate"
:variable:value "tdecq","select:offline"
:variable:value "tdecq","jnb_filename:1.mat"
:variable:value "tdecq","analyze"
:variable:value?  "tdecq","TDECQ"
:variable:value?  "tdecq","OMA"
:variable:value?  "tdecq","ER"
:variable:value "tdecq","exit"
perl TDECQ_PI_Client.pl –startApp < TDECQ_PI_Client_Example_CmdSet.txt
```

Starts the client which in turn reads the set of commands/queries from the .txt file.

Example output from similar commands is:

```
...
> :variable:value?  "tdecq","tdecq" $response = 'TDECQ:5.8421'
> :variable:value "tdecq","exit" Beginning shutdown...
...shutdown complete.
```

```
perl TDECQ_PI_Client.pl –startApp –appInstance=2
```

Starts the client and the main application with the instance ID 2, which in turn reads the set of commands/queries from stdin. A query of :var:val? "tdecq","instanceid" at this point should return the value of "2".

NOTE. *The log file at "%TEMP%\TDECQ_LogFile.txt" will contain trace and debug information from any client run, including the TDECQ MatLab processing output after exiting the client.*

Many other behaviors may be configured by the client, such as file paths and run modes. See the "$configParams" section for details.

Python example

A simple Python programming example file is provided.

The example establishes a connection to the 400G-M4 application and provides a simple interface to send commands to the application.

NOTE. *Python is required to be installed on the PC.*

1. Open a DOS command window.
2. Enter the Python example file name “TDECQ_PIClient.py”.
3. Wait for the program to run and for the UI window to open to send commands.

The actual Python example file is located at C:\Users\Public\Tektronix\TekApplications\400G-M4\PIExamples.

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 about your application or oscilloscope. Send your feedback to techsupport@tektronix.

Please be as specific as possible and include the following information:

General information

- Oscilloscope model number, firmware version number, and hardware/software options, if any.
- Module and probe configuration. Include model numbers and the channel/slot location.
- Serial data standard.
- Signaling rate.
- Pattern type and length.
- Your name, company, mailing address, phone number, FAX number.

NOTE. *Please indicate if you would like Tektronix to contact you regarding your suggestion or comments.*

Application-specific information

- 400G-M4 application version number.
- Description of the problem such that technical support can duplicate the problem.
- Configuration of the 400G-M4 application. Use screen shots to capture application parameters.
- If possible, save the acquired oscilloscope waveform file. (**File > Save Waveform**).
- If possible, save the DSA8300 settings to a .stp file.

Once you have gathered this information, contact technical support by phone or through email. If using email, be sure to enter “400G-M4 Problem” in the subject line, and attach supporting files.

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