Tektronix®

NRZ-M4 Application

Printable Application Help

077-1545-00

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www.tek.com
077-1545-00

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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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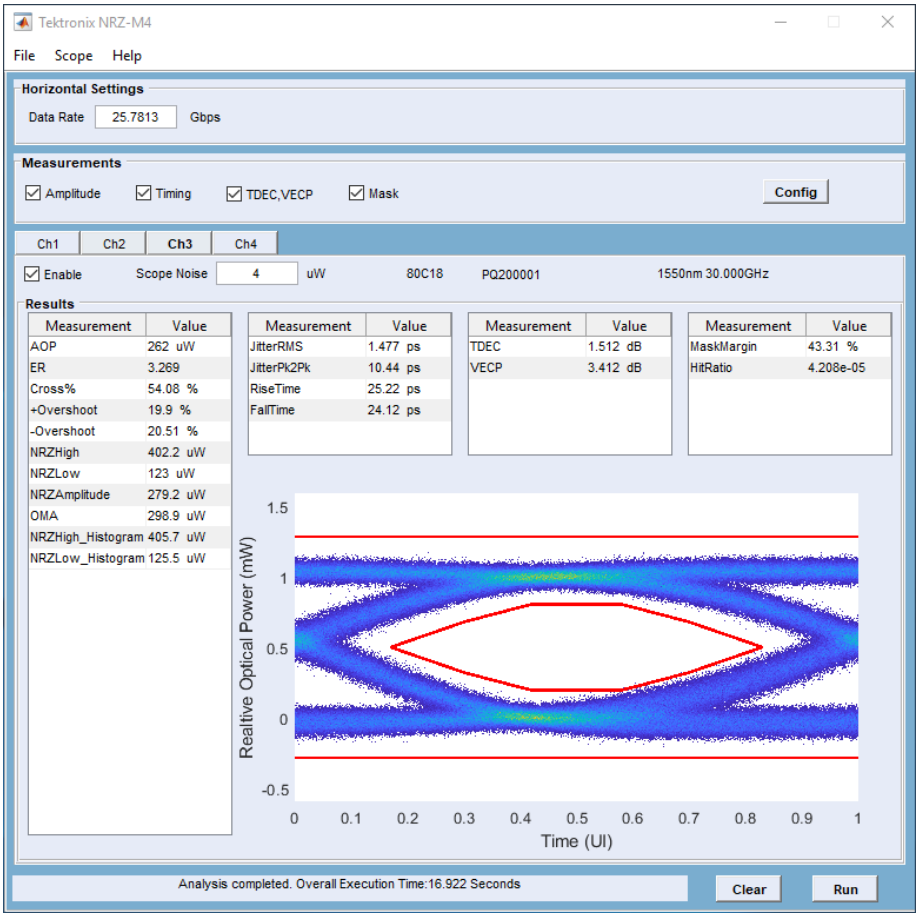
Guide to connect the oscilloscope

Welcome

The Tektronix NRZ-M4 application provides NRZ signaling analysis, including TDEC (Transmitter and Dispersion Eye Closure) measurement. The application brings together NRZ optical measurements in a simple and easy to use application. This application is designed to minimize the computation time of waveform analysis which suits the manufacturing environment.



This application is intended to be installed on a PC and works by connecting to the sampling scope. Application allows you to acquire signal directly from the connected DSA8300 sampling oscilloscope and analyze the acquired waveform data.

NOTE. *NRZ-M4 application requires the installation of an option key on the target DSA8300 oscilloscope to enable establishing a connection from the NRZ-M4 application to the DSA8300. Refer to the documentation provided with the DSA8300 for instructions of adding a new option key.*

Key features

The NRZ-M4 application performs comprehensive analysis of optical NRZ signals, including TDEC, Mask margin and other optical measurements.

NRZ-M4 application provides the following features:

- Simultaneously analyze up to 4 optical channels
- Characterization of 100Gbps Optical transceivers (SR4, LR4) devices with Mask margin measurements. Perform optimal mask fitting for better margin.
- Supports TDEC (Transmitter and Dispersion Eye Closure)
- Signal characterization measurements such as Amplitude and Timing measurements
- Support for Phase reference characterization clock for more accurate results.
- Support for measurements at various population limits.
- Show results as numeric and graphical display.
- Display 2D eye diagrams with embedded mask
- Save the analysis results to a file.
- Run multiple instances of the application and connect each of them to different DSA8300s' and perform parallel analysis of multiple channels.

Getting help and support

Conventions

Help uses the following conventions:

- The term "Application" and "Software" refers to the Tektronix NRZ-M4 application.
- The term “select” is a generic term that applies to the different methods of choosing a screen item (button, control, list item): using a mouse or using the touch screen.

Table 1: Icon descriptions

Icon	Meaning
	This icon identifies important information.
	This icon identifies conditions or practices that could result in loss of data.
	This icon identifies additional information that will help you use the application more efficiently.

Related documentation

The following documentation is available as part of the NRZ-M4 application.

Table 2: Product documentation

Item	Purpose	Location
Help	Application operation and User Interface help	
PDF of the help	Printable version of the compiled help	 PDF file that ships with the NRZ-M4 application. You can download the PDF version of the manual from the Tektronix website. *www.tek.com*

See also: *Technical support*

Technical support

Tektronix values your feedback on our products. To help us serve you better, please send us your suggestions, ideas, or comments on your application or oscilloscope. Contact Tektronix through mail, telephone, or the Web site. See *Contacting Tektronix* at the front of this document for contact information.

When you contact Tektronix Technical Support, please include the following information (be as specific as possible):

General information

- All instrument model numbers
- Hardware options, if any
- Modules used
- Your name, company, mailing address, phone number, FAX number
- Please indicate if you would like to be contacted by Tektronix about 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 setup files for all the instruments used and the application

Getting started

Computer requirements

The NRZ-M4 application is designed to run on a PC running Windows operating system. A high performance PC is recommended to minimize the computation time of waveform analysis.

These are the minimum requirements to successfully run the NRZ-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 NRZ-M4 application directly on a DSA8300 sampling oscilloscope is not permitted.*

Software requirements

The NRZ-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 NRZ-M4 installation.
- Matlab runtime: Matlab 2017b version 9.3 is required. The Matlab runtime is available from MathWorks® (*www.mathworks.com*).

Instruments and accessories required

The following are the instruments and accessories required.

Table 3: Instruments and accessories required

Instrument/Accessory	Model number	Quantity
Mainframe	DSA8300	1
Optical modules	80C17, 80C18, 80C20, 80C21, 80C10C	2 (Min 1 Qty)
Phase reference module	82A04B	1 (Optional)

NOTE. *Optical module 80C10C has performance limitation. The overall execution time of the measurement with this module is greater than the other modules.*

TekVISA software

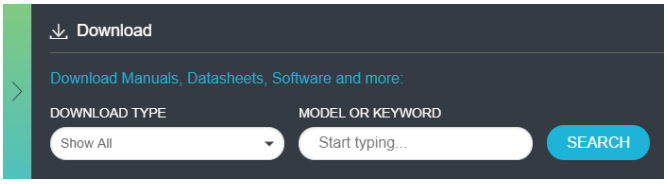
TekVISA is preinstalled on the DSA8300 sampling oscilloscopes, but to use this protocol to connect and communicate with a DSA8300 sampling oscilloscope, TekVISA must also be installed on the PC (where the NRZ-M4 application resides).

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

Installing the software

Complete the following steps to download and install the latest NRZ-M4 application. See *Computer requirements* for compatibility.

1. Go to *www.tek.com*.
2. Click **Downloads**. In the Downloads menu, select DOWNLOAD TYPE as Software and enter *NRZ-M4* in the MODEL OR KEYWORD field and click **SEARCH**.



3. Select the latest version of software and follow the instructions to download.
4. Double-click the executable and follow the on-screen instructions. The software is installed at *C:\Program Files\TekApplications\NRZ-M4*.
5. Double-click NRZ-M4 icon in the desktop to *Launch the application*.

File name extensions

The TekExpress NRZ-M4 application uses the following file name extensions:

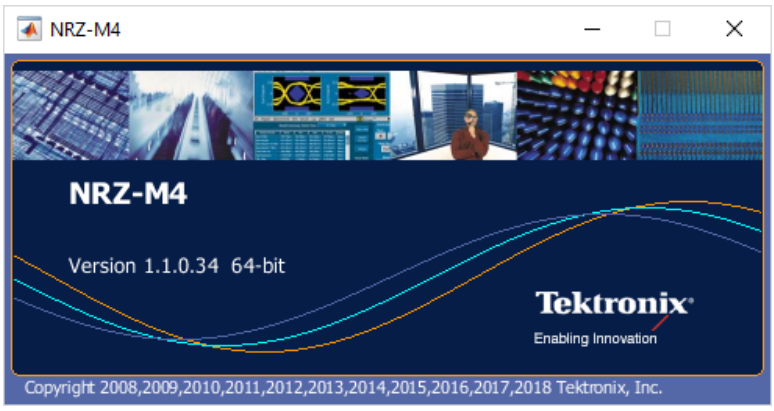
File name extension	Description
.gm4	Setup file format
.pl	Perl example for PI commands
.py	Python example file for PI commands
.csv	Results saving file format
.jpg	Plots image file format
.pdf	Test result reports Application help document
.chm	Application help file

See also *Application directories*

View software version

Use the following instructions to view the version information for the application.

To view version information for NRZ-M4, click **Help** > **About**.



NOTE. *This example shows a typical Version Details dialog box, and may not reflect the actual values as shown when you open this item in the application.*

Application directories

TekExpress NRZ-M4 application

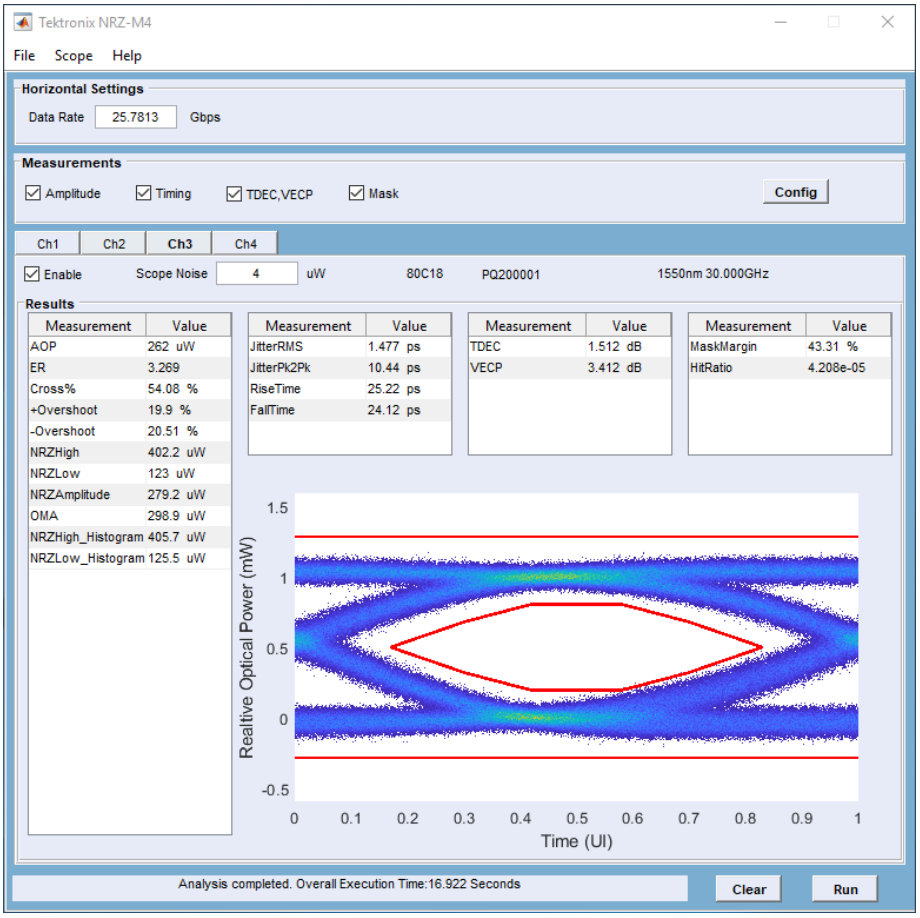
The TekExpress NRZ-M4 application files are installed at the following location:

C:\Program Files\TekApplication\NRZ-M4

Operating basics

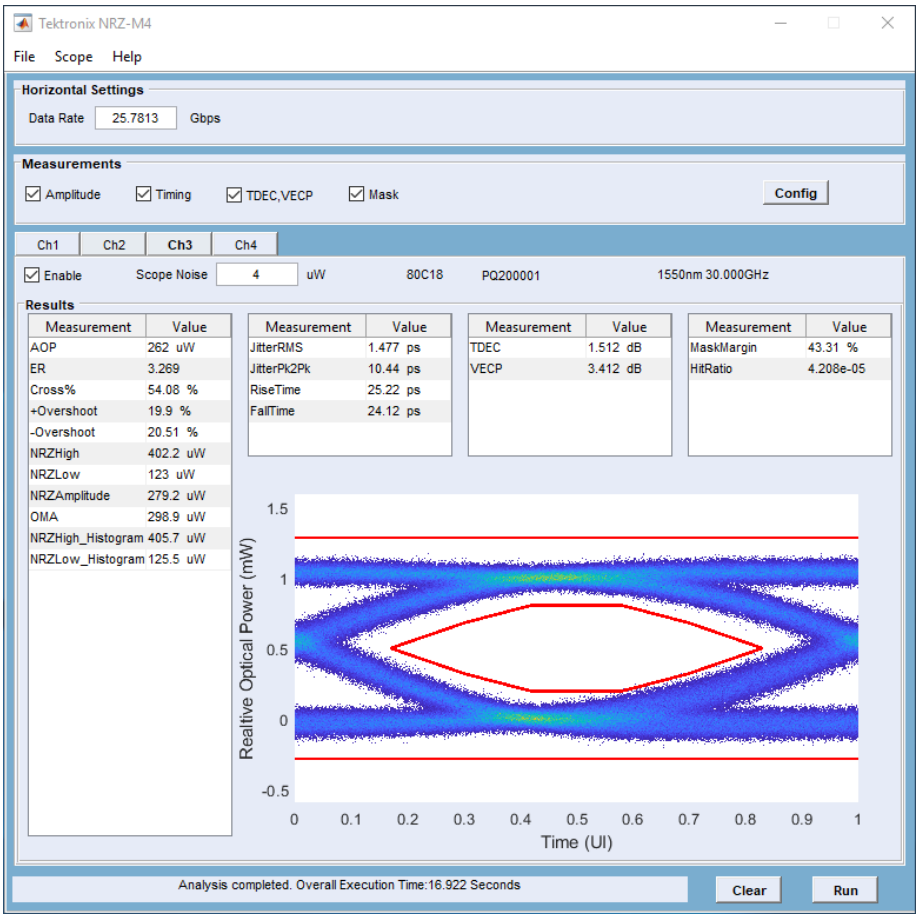
Launch the application

Double-click the NRZ-M4 icon in the desktop to launch the application.



See also *Application panel overview*

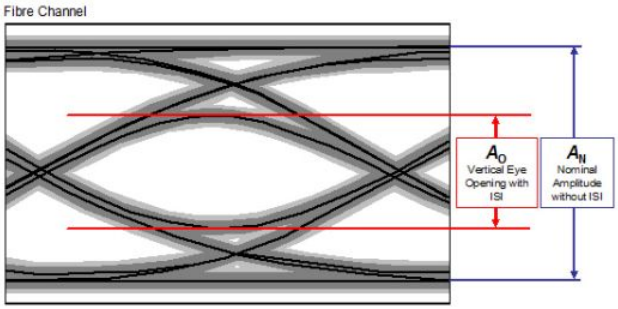
Application panels overview



Measurement selections The measurement selection includes all the available optical measurements.

Table 4: Measurement selections

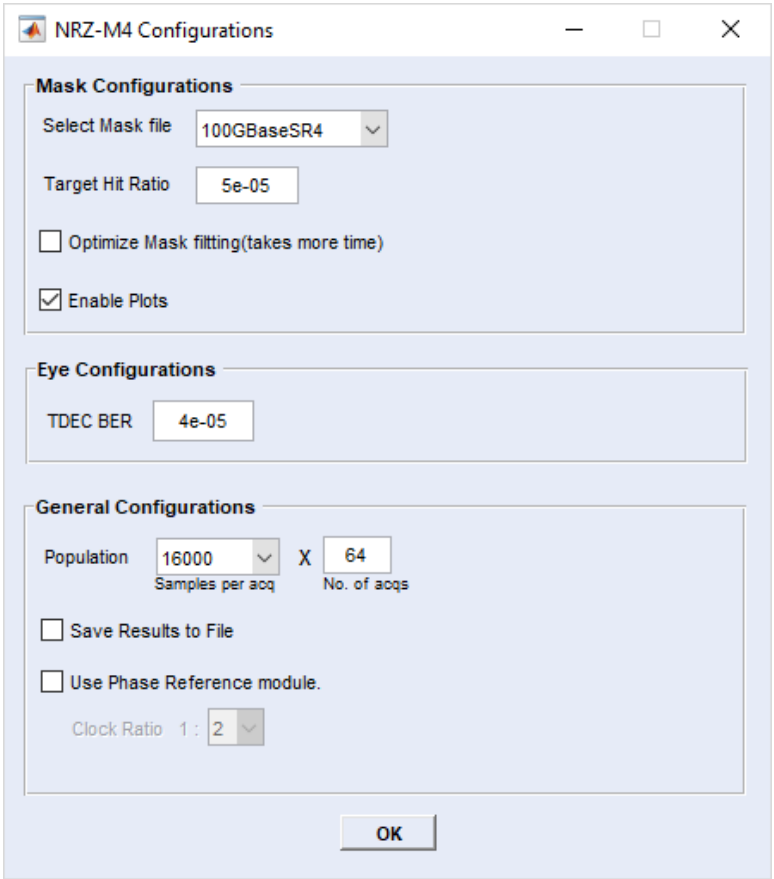
Measurements	Description
Amplitude	Includes the following amplitude measurements to the results section. ■ AOP: The average optical power of a NRZ optical signal. ■ ER: The extinction ratio of the highest and lowest optical power levels of a NRZ optical signal. ■ Cross%: The height of eye crossing as a percentage of eye height measured in the Eye Aperture. ■ +Overshoot: The ratio of the maximum value of the measured signal to its amplitude, expressed as a percentage. The waveform is scanned for the maximum value within the measurement region, while the amplitude is measured in the Eye Aperture. ■ -Overshoot: The ratio of the minimum value of the measured signal to its amplitude, expressed as a percentage. The waveform is scanned for the minimum value within the measurement region, while the amplitude is measured in the Eye Aperture. ■ NRZHigh: The logical 1 of the NRZ signal. ■ NRZLow: The logical 0 of the NRZ signal. ■ NRZAmplitude: The difference between the logical 1 level (High) and the logical 0 level (Low) of the NRZ signal. Both High and Low levels are measured within the Eye Aperture. ■ OMA: An approximation defined as the difference of the logical power 1 and 0 determined a vertical slice through the eye crossing. The levels are determined as the means of the histograms of the vertical data slice through the High (logical 1) and Low (logical 0) levels ■ NRZHigh_Histogram: Mean of the vertical histogram above the threshold, around the center 20% of the eye(40% to 60% of the eye opening). ■ NRZLow_Histogram: Mean of the vertical histogram below the threshold, around the center 20% of the eye(40% to 60% of the eye opening). ***NOTE.*** *NRZHigh_Histogram and NRZLow_Histogram are performed using the exported waveform database file from sampling oscilloscope.*
Timing	Includes the following timing measurements to the results section. ■ Jitter RMS: Jitter is the measure of time variance on the rising and falling edges at the NRZ eye crossing or at the mid-reference level. ■ Jitter Pk2Pk: The delta between the minimum and maximum of time crossings, with the mean of the histogram being Tcross. ■ RiseTime: Computes the time interval between the mean crossings of the low reference level and the high reference level to characterize the positive slope of the eye. ■ FallTime: NRZ Fall Time characterizes the negative slope of the NRZ eye by computing the time interval between the mean crossings of the high reference level and the low reference level.

Measurements	Description
TDEC, VECP	Includes the following measurements to the results section. ■ TDEC: Transmitter and Dispersion Eye Closure (TDEC) of a NRZ signal. $TDEC = 10 * log10\left(\frac{OMA}{\left(2 * R * \left(\sqrt{2} * erfcinv(targetBER * 2)\right)\right)}\right)$ ■ VECP: Vertical Eye Closure Penalty (VECP), a measure of the closure.  $VECP_{dB} = 10 * \log\left(\frac{A_n}{A_o}\right)$ Where, A_n - Normalized amplitude without ISI A_o - Vertical eye opening with ISI
Mask	Includes the following measurements to the results section. Mask margin explores the design margins of the signal. It measures the margin in percentage by expanding the mask on the NRZ eye until the mask hit ratio crosses the target hit ratio. User has to input the target hit ratio and mask to be used for the measurement. Following are the steps to calculate the Mask Margin: **1.** Find the eye center. Place the mask and measure the mask margin. ■ If the Margin is positive, the mask is well inside the open eye and mask has to be blown out to measure the positive mask margin.

Measurements	Description
	■ If the Margin is negative, the eye is already stressful and mask has to be blown-in to measure the negative mask margin. **2.** Binary search method is followed to come across results faster. **3.** Mask will be expanded/shrunk until the actual hit ratio exceeds the target hit ratio. Mask margin will be measured at the point where the actual hit ratio is just below the target hit ratio. Both Mask margin and actual hit ratio are given in results.

Measurement configuration

The measurement configuration applies to the NRZ measurement selection to further define the measurement parameters.



Measurements	Description
Mask Configurations	
Select Mask File	■ 100GBaseSR4 ■ 100GBaseLR4 ■ 10GBaseR
Target Hit Ratio	Enter the target hit ratio.
Optimize Mask Filtting (takes more time)	This is disabled by default. When enabled, the mask will be shifted in all directions (up, down, right and left) and best mask fitting is done to get the better margin.
Enable Plots	This is enabled by default. When enabled, displays the 2D Eye diagram plot with the embedded mask in it.
Eye Configurations	
TDEC BER	Enter the TDEC BER value.
General Configurations	
Population	Specify the acquisition population. Specify number of samples per each acquisition and number of acquisitions. Total population will be product of these two values.
Save Results to File	This is disabled by default. When enabled, this option saves the results to a .csv file at C: \Users\<username> \AppData\Local\Temp. File name format is "<AppInstance>_<ChannelName>_Results.csv".
Use Phase Reference module.	This is disabled by default. Select to enable the phase reference clock connected to channels. Also, select the clock ratio given to the phase reference module.

Mode selection

Measurements	Description
Enable	This is disabled by default. Enable the channel to analyze the signal. Channel can be enabled only if the supported module (CH1 to CH4) is installed and the option key is installed in the oscilloscope.
Scope Noise	Enter the scope noise value for the corresponding channel. Oscilloscope noise values are automatically read while connecting to the oscilloscope or while doing Autosync. Oscilloscope noise characterization tool has to be run on the oscilloscope to measure the oscilloscope noise for each channel before running the NRZ-M4 application.

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

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

File menu

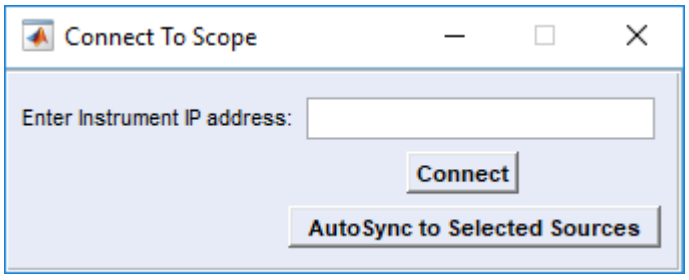
The file menu provides the following operations:

Setting	Description
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 .gm4 file extension.
Recall Setup	Use the dialog screen to navigate to a saved setup file to restore the application to a known setup.
Default	Use to configure the default settings in the application.
Exit	Exits the application.

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

Scope menu

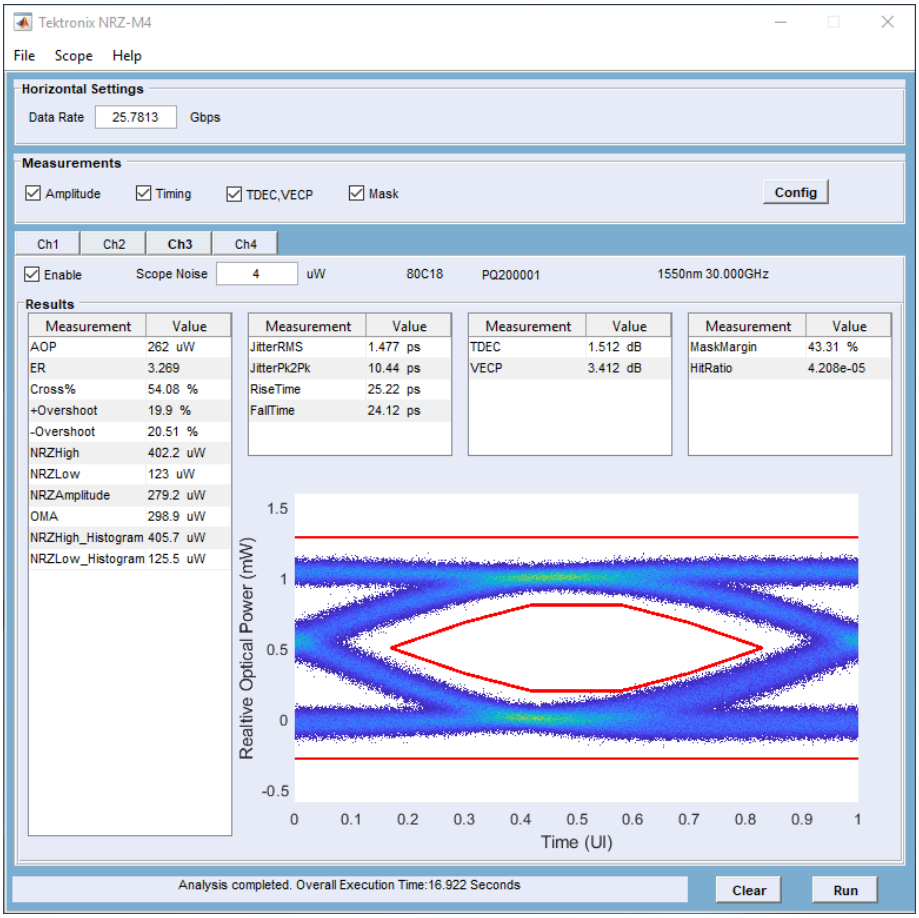
Selecting Scope opens the Connect To Scope dialog screen.



Item	Description
Enter Instrument IP address	Enter the IP address of the oscilloscope you want to connect.
Connect	Select the Connect button to make the connection. The Connect button changes to Disconnect if a connection is established. During the connection process, the NRZ-M4 application detects the modules installed in the oscilloscope along with their characteristics (such as the module type, serial number, filters or bandwidth).
AutoSync to Selected Sources	Click to update the NRZ-M4 application, when you change any module or the characteristics. The NRZ-M4 application detects the modules installed in the oscilloscope along with their characteristics (such as the module type, serial number, filters or bandwidth).

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.



Programmatic interface

Remote control introduction

The NRZ-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:

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

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 commands into the "NRZ" variable.
2. The GPIB controller polls the handshake variable (VARIABLE:VALUE? "NRZ") 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 "NRZ", "single" writes the string "single" into the variable "NRZ".
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 NRZ-M4 Analysis application, examples of automatic testing script written in Perl and Python 3.7 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 NRZ-M4 is running, you can start the client with the following Perl script.

perl NRZ-M4_PI_Client.pl

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

perl NRZ-M4_PI_Client.pl –startApp

NOTE. *You may need to use the –filePath "<NRZ-M4>" 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 3.7 or above needs to be installed and in the user's path

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

python NRZ-M4_PI_Client.py

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

NOTE. *You may need to use the -filePath "<NRZ-M4.exe>" 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 for more details and examples.

NRZ-M4.exe <instanceId>

Running Using TCP/IP Address

For an IP connect, use the following command

perl NRZ-M4_PI_Client.pl -cmdfilepath=\\ip address\c$\Program Files \TekApplications\NRZ-M4

This starts NRZ-M4.exe at C:\Program Files\TekApplications\NRZ-M4\NRZ-M4.exe. The TCPIP

requires that the C: drive on the target running the NRZ-M4 application is publicly accessible. In the example, it shares as "c$".

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 "NRZ”,"<variableName>:<variableValue>"

To query the value in a variable:

VARIABLE:VALUE? "NRZ","<variableName>"

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.*

Variable name arguments and queries

Table 5: Control commands and queries

Commands	Description
:VARIABLE:VALUE: "NRZ","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.
Syntax	:VARIABLE:VALUE: "NRZ","CONNECT:<ip_address>"
Example	:VARIABLE:VALUE: "NRZ","CONNECT:134.62.9.4" connects to the instrument with the given IP address. :VARIABLE:VALUE:? "NRZ","CONNECT" returns the IP address of a connected instrument.
Return Example	Returns: $response = ’134.62.9.4'
:VARIABLE:VALUE: "NRZ","DISCONNECT"	Disconnects the application from the oscilloscope.
Syntax	:VARIABLE:VALUE: "NRZ","DISCONNECT"
:VARIABLE:VALUE: "NRZ","CLEAR"	Command only. Clears all measurement results.
Syntax	:VARIABLE:VALUE: "NRZ","CLEAR"
:VARIABLE:VALUE "NRZ","EXIT"	Command only. Exits the application.
Syntax	:VARIABLE:VALUE "NRZ","EXIT"
:VARIABLE:VALUE "NRZ", "ANALYZE"	Command only. Starts the measurement execution.
Syntax	:VARIABLE:VALUE "NRZ", "ANALYZE"
:VARIABLE:VALUE? "NRZ", "STATUS"	Query only. Returns the status of measurement execution.
Syntax	:VARIABLE:VALUE? "NRZ", "STATUS"
:VARIABLE:VALUE "NRZ","AUTOSYNC"	Command only. Synchronizes the noise value and module detail with the connected oscilloscope.
Syntax	:VARIABLE:VALUE "NRZ","AUTOSYNC"
:VARIABLE:VALUE? "NRZ","INSTANCEID"	Query only. Returns the instance id of the application.
Syntax	:VARIABLE:VALUE? "NRZ","INSTANCEID"
:VARIABLE:VALUE "NRZ", "ACTIVATE:5"	Command only. Sets the instance id for the application window.
Syntax	:VARIABLE:VALUE "NRZ", "ACTIVATE:5"

Commands	Description
:VARIABLE:VALUE "NRZ", "DEFAULTSETUP"	Command only. Sets the oscilloscope to default configuration.
Syntax	:VARIABLE:VALUE "NRZ", "DEFAULTSETUP"
:VARIABLE:VALUE "NRZ", "SAVESETUP:<FILEPATH>"	Command only. Saves the setup in the path.
Syntax	:VARIABLE:VALUE "NRZ", "SAVESETUP:<FILEPATH>" <FILEPATH> = File name with the path.
Example	:VARIABLE:VALUE "NRZ", "SAVESETUP:D:\test1.gm4" saves the setup file.
:VARIABLE:VALUE "NRZ", "RECALLSETUP:<FILEPATH>"	Command only. Recalls the setup in the path.
Syntax	:VARIABLE:VALUE "NRZ", "RECALLSETUP:<FILEPATH>" <FILEPATH> = File name with the path.
Example	:VARIABLE:VALUE "NRZ", "RECALLSETUP:D:\test1.gm4" recalls the setup file.
:VARIABLE:VALUE? "NRZ", "ONLINE"	Query only. Returns the status of the application license.
Syntax	:VARIABLE:VALUE? "NRZ", "ONLINE" Returns 0 if the application license is disabled Returns 1 if the application license is enabled

Table 6: Horizontal settings commands and queries

Commands	Description
:VARIABLE:VALUE: "NRZ","DATARATE:<INTEGER>"	Sets or returns the data rate value.
Syntax	:VARIABLE:VALUE: "NRZ","DATARATE:<INTEGER>" <INTEGER> = 10 to 55
Example	:VARIABLE:VALUE: "NRZ","DATARATE:10e9" sets the datarate as 10e9. :VARIABLE:VALUE:? "NRZ","DATARATE" returns the IP address of a connected instrument.
Return Example	Returns: $response = '10e9'

Table 7: Measurement select commands and queries

Commands	Description
:VARIABLE:VALUE: "NRZ", "eyemeasurements:1|0"	Sets or returns the Enabled stated (enables or disabled) for eye measurement.
Syntax	:VARIABLE:VALUE: "NRZ", "eyemeasurements:1|0" 1 enables the TDEC measurement. 0 disables the TDEC measurement.
Example	:VARIABLE:VALUE: "NRZ", "eyemeasurements:1" enables the TDEC measurement. :VARIABLE:VALUE:? "NRZ", "eyemeasurements" returns 1 if TDEC measurement is selected.
Return Example	Returns: $response = '1'

Commands	Description
:VARIABLE:VALUE: "NRZ", "amplitudemeasurements:1|0"	Sets or returns the Enabled stated (enables or disabled) for amplitude measurement.
Syntax	:VARIABLE:VALUE: "NRZ", "amplitudemeasurements:1|0" 1 enables the amplitude measurement. 0 disables the amplitude measurement.
Example	:VARIABLE:VALUE: "NRZ", "amplitudemeasurements:1" enables the amplitude measurement. :VARIABLE:VALUE:? "NRZ", "amplitudemeasurements" returns 1 if amplitude measurement is selected.
Return Example	Returns: $response = '1'
:VARIABLE:VALUE: "NRZ", "timingmeasurements:1|0"	Sets or returns the Enabled stated (enables or disabled) for timing measurement.
Syntax	:VARIABLE:VALUE: "NRZ", "timingmeasurements:1|0" 1 enables the timing measurement. 0 disables the timing measurement.
Example	:VARIABLE:VALUE: "NRZ", "timingmeasurements:1" enables the timing measurement. :VARIABLE:VALUE:? "NRZ", "timingmeasurements" returns 1 if timing measurement is selected.
Return Example	Returns: $response = '1'
:VARIABLE:VALUE: "NRZ", "maskmeasurements:1|0"	Sets or returns the Enabled stated (enables or disabled) for mask measurement.
Syntax	:VARIABLE:VALUE: "NRZ", "maskmeasurements:1|0" 1 enables the mask measurement. 0 disables the mask measurement.
Example	:VARIABLE:VALUE: "NRZ", "maskmeasurements:1" enables the mask measurement. :VARIABLE:VALUE:? "NRZ", "maskmeasurements" returns 1 if mask measurement is selected.
Return Example	Returns: $response = '1'
:VARIABLE:VALUE: "NRZ", "SELECT:CH<X>:1|0"	Sets or enables the selected channel.
Syntax	:VARIABLE:VALUE: "NRZ", "SELECT:CH<X>:1|0" <X> = 1 to 4
Example	:VARIABLE:VALUE: "NRZ", "SELECT:CH1:1" selects the channel CH1. :VARIABLE:VALUE:? "NRZ", "SELECT:CH1" returns 1 if CH1 is selected.
Return Example	Returns: $response = '1'
:VARIABLE:VALUE: "NRZ", "CHANNEL:CH<X>"	
Syntax	:VARIABLE:VALUE: "NRZ", "CHANNEL:CH<X>" <X> = 1 to 4
Example	:VARIABLE:VALUE: "NRZ", "CHANNEL:CH1" enables the mask measurement. :VARIABLE:VALUE:? "NRZ", "CHANNEL" returns 1 if mask measurement is selected.
Return Example	Returns: $response = '1'

Commands	Description
:VARIABLE:VALUE: "NRZ", "NOISE:CH<X>:<INTEGER>"	Sets or returns the scope noise value.
Syntax	:VARIABLE:VALUE: "NRZ", "NOISE:CH<X>:<INTEGER>" <X> = 1 to 4 <INTEGER> = 0 to 100
Example	:VARIABLE:VALUE: "NRZ", "NOISE:CH1:0.00002" sets the scope noise value as 0.00002. :VARIABLE:VALUE:? "NRZ", "NOISE:CH1" returns returns the scope noise value.
Return Example	Returns: $response = '0.00002'
:VARIABLE:VALUE:? "NRZ", "MODULE:CH<X>"	Returns the module number for configured optical module for the specified channel.
Syntax	:VARIABLE:VALUE:? "NRZ", "MODULE:CH<X>" <X> = 1 to 4
Example	:VARIABLE:VALUE:? "NRZ", "MODULE:CH1" returns the module number for configured optical module of the specified channel.
:VARIABLE:VALUE:? "NRZ", "SERIALNUM:CH<X>"	Returns the serial number for configured optical module for the specified channel.
Syntax	:VARIABLE:VALUE:? "NRZ", "SERIALNUM:CH<X>" <X> = 1 to 4
Example	:VARIABLE:VALUE:? "NRZ", "SERIALNUM:CH1" returns the serial number for configured optical module of the specified channel.
:VARIABLE:VALUE:? "NRZ", "MODFILTER:CH<X>"	Returns the module filter for configured optical module for the specified channel.
Syntax	:VARIABLE:VALUE:? "NRZ", "MODFILTER:CH<X>" <X> = 1 to 4
Example	:VARIABLE:VALUE:? "NRZ", "MODFILTER:CH1" returns the module filter for configured optical module of the specified channel.
:VARIABLE:VALUE:? "NRZ", "MODBW:CH<X>"	Returns the module bandwidth for configured optical module for the specified channel.
Syntax	:VARIABLE:VALUE:? "NRZ", "MODBW:CH<X>" <X> = 1 to 4
Example	:VARIABLE:VALUE:? "NRZ", "MODBW:CH1" returns the module bandwidth for configured optical module of the specified channel.

Table 8: Configuration commands and queries

Commands	Description
:VARIABLE:VALUE: "NRZ", "CONFIG:TDECBER:<NR3>"	Sets or returns the TDEC BER value.
Syntax	:VARIABLE:VALUE: "NRZ", "CONFIG:TDECBER:<NR3>" <NR3> (Floating point value with an exponent) = 0.000000001 to 1
Example	:VARIABLE:VALUE: "NRZ", "CONFIG:TDECBER:6e-7" sets the TDEC BER value as 6e-7 :VARIABLE:VALUE:? "NRZ", "CONFIG:TDECBER" returns the TDEC BER value.
Return Example	Returns: $response = '6e-7'

Commands	Description
:VARIABLE:VALUE: "NRZ", "CONFIG:HITRATIO:<NR3>"	Sets or returns the hit ratio value.
Syntax	:VARIABLE:VALUE: "NRZ", "CONFIG:HITRATIO:<NR3>" <NR3> (Floating point value with an exponent) = 0.000000001 to 1
Example	:VARIABLE:VALUE: "NRZ", "CONFIG:HITRATIO:4e-7" sets the TDEC BER value as 4e-7 :VARIABLE:VALUE:? "NRZ", "CONFIG:HITRATIO" returns the TDEC BER value.
Return Example	Returns: $response = '4e-7'
:VARIABLE:VALUE: "NRZ", "CONFIG:SELECTMASK:<FILENAME>"	Sets or returns the mask file name.
Syntax	:VARIABLE:VALUE: "NRZ", "CONFIG:SELECTMASK:<FILENAME>"
Example	:VARIABLE:VALUE: "NRZ", "CONFIG:SELECTMASK:100GBaseSR4" selects the mask file as 100GBaseSR4. :VARIABLE:VALUE: "NRZ", "CONFIG:SELECTMASK:100GBaseSR4" returns the selected mask file name.
Return Example	Returns: $response = '100GBaseSR4'
:VARIABLE:VALUE: "NRZ", "CONFIG:ENABLEPLOT:ON|OFF"	Sets or returns the enable plot (enabled or disabled) in configuration settings.
Syntax	:VARIABLE:VALUE: "NRZ", "CONFIG:ENABLEPLOT:ON|OFF" ON enables the enable plot in configuration settings. OFF disables the enable plot in configuration settings
Example	:VARIABLE:VALUE: "NRZ", "CONFIG:ENABLEPLOT:ON" enables the enable plots in configuration settings. :VARIABLE:VALUE:? "NRZ", "CONFIG:ENABLEPLOT" returns 1 if enable plots is enabled.
Return Example	Returns: $response = '1'
:VARIABLE:VALUE: "NRZ", "CONFIG:OPTIMIZEMASKFITTING:ON|OFF"	Sets or returns the optimize mask fitting (enabled or disabled) in configuration settings.
Syntax	:VARIABLE:VALUE: "NRZ", "CONFIG:OPTIMIZEMASKFITTING:ON|OFF" ON enables the optimize mask fitting in configuration settings. OFF disables the optimize mask fitting in configuration settings
Example	:VARIABLE:VALUE: "NRZ", "CONFIG:OPTIMIZEMASKFITTING:ON" enables the Optimize Mask Fitting in configuration settings. :VARIABLE:VALUE: "NRZ", "CONFIG:OPTIMIZEMASKFITTING" returns 1 if Optimize Mask Fitting is enabled.
Return Example	Returns: $response = '1'
:VARIABLE:VALUE: "NRZ", "CONFIG:USEPHASEREF:ON|OFF"	Sets or returns the use phase reference (enabled or disabled) in configuration settings.
Syntax	:VARIABLE:VALUE: "NRZ", "CONFIG:USEPHASEREF:ON|OFF" 1 enables the use phase reference in configuration settings. 0 disables the use phase reference in configuration settings.
Example	:VARIABLE:VALUE: "NRZ", "CONFIG:USEPHASEREF:ON" enables the Use Phase Reference in configuration settings. :VARIABLE:VALUE: "NRZ", "CONFIG:USEPHASEREF" returns 1 if Use Phase Reference is enabled.

Commands	Description
Return Example	Returns: $response = '1'
:VARIABLE:VALUE: "NRZ", "CONFIG:PHASEREFCLOCKRATIO:1|2|4|8"	Sets or returns the phase reference clock ratio.
Syntax	:VARIABLE:VALUE: "NRZ", "CONFIG:PHASEREFCLOCKRATIO:1|2|4|8"
Example	:VARIABLE:VALUE: "NRZ", "CONFIG:PHASEREFCLOCKRATIO:1" sets the phase reference clock value as 1. :VARIABLE:VALUE: "NRZ", "CONFIG:PHASEREFCLOCKRATIO" returns the phase reference clock value as 1.
Return Example	Returns: $response = '1'
:VARIABLE:VALUE: "NRZ", "CONFIG:SAMPLESPERACQ:1000|2000|4000|8000|16000"	Sets or returns the samples per acquisition.
Syntax	:VARIABLE:VALUE: "NRZ", "CONFIG:SAMPLESPERACQ:1000|2000|4000|8000|16000"
Example	:VARIABLE:VALUE: "NRZ", "CONFIG:SAMPLESPERACQ:1000" sets the samples per acquisition value as 64. :VARIABLE:VALUE:? "NRZ", "CONFIG:SAMPLESPERACQ" returns the samples per acquisition value as 1000.
Return Example	Returns: $response = '1000'
:VARIABLE:VALUE: "NRZ", "CONFIG:NOOFACQS:<INTEGER>"	Sets or returns the number of acquisitions value.
Syntax	:VARIABLE:VALUE: "NRZ", "CONFIG:NOOFACQS:<INTEGER>" <INTEGER> = 50 to 1000
Example	:VARIABLE:VALUE: "NRZ", "CONFIG:NOOFACQS:64" sets the acquisitions value as 64. :VARIABLE:VALUE:? "NRZ", "CONFIG:NOOFACQS" returns the acquisitions value as 64.
Return Example	Returns: $response = '64'
:VARIABLE:VALUE "NRZ", "CONFIG:SAVERESULTSTOFILE:ON|OFF"	Sets or disables the save results to file.
Syntax	:VARIABLE:VALUE "NRZ", "CONFIG:SAVERESULTSTOFILE:ON|OFF" ON | 1 enables the save results to file. OFF | 0 disables the save results to file.
Example	:VARIABLE:VALUE "NRZ", "CONFIG:SAVERESULTSTOFILE:ON" enables the save results to file.

Table 9: Results commands and queries

Commands	Description
:VARIABLE:VALUE? "NRZ", "RESULT:CH<X>:<MeasurementList>"	Returns the measurement result for the selected channel.
Syntax	:VARIABLE:VALUE? "NRZ", "RESULT:CH<X>:<MeasurementList>" <X> = 1 to 4 <MeasurementList> = ALLMEAS | AOP | ER | TDEC | +Overshoot
Example	:VARIABLE:VALUE? "NRZ", "RESULT:Ch2:ALLMEAS" returns the measurement result for channel 2

Programming examples

Perl program example: configure and operate NRZ-M4

With available offline analysis, NRZ-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 NRZ-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 "NRZ_CommandFile.txt" and "NRZ-M4_LogFile.txt" to the current working directory (C:\Users\<user>\AppData\Local\Temp) for communication and logging. For multiple instances, the files "NRZ_CommandFile<instanceId>.txt" and "NRZ-M4_LogFile<instanceId>.txt" are used. See below for examples.

  The measurement results are captured in NRZ-M4_ResultsFile.txt at the same directory.
- 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

NRZ-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 "NRZ_CommandFile<instanceId>.txt". e.g., upon execution of the following:

NRZ-M4.exe 1

NRZ-M4.exe 2

NRZ-M4.exe 3

, client 1 may connect to instance 1 via %TEMP%\NRZ_CommandFile.txt, and client 2 may connect to instance 2 via %TEMP%\NRZ_CommandFile2.txt, and client 3 may connect to instance 3 via %TEMP%\NRZ_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 NRZ-M4_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 NRZ-M4_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 "NRZ", "ACTIVATE"

:VARIABLE:VALUE "NRZ", "CONNECT:134.64.245.72"

:VARIABLE:VALUE "NRZ", "eyemeasurements:1"

:VARIABLE:VALUE "NRZ", "amplitudemeasurements:1"

:VARIABLE:VALUE "NRZ", "timingmeasurements:1"

:VARIABLE:VALUE "NRZ", "maskmeasurements:1"

:VARIABLE:VALUE "NRZ", "ANALYZE"

:VARIABLE:VALUE? "NRZ", "STATUS"

:VARIABLE:VALUE? "NRZ", "RESULT:ALLCHANNELS:ALLMEAS"

perl NRZ-M4_PI_Client.pl –startApp < NRZ-M4_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? "NRZ","NRZ" $response = 'NRZ:
5.8421'
> :variable:value "NRZ","exit" Beginning shutdown...
...shutdown complete.
```

perl NRZ-M4_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%\NRZ-M4_LogFile.txt" will contain trace and debug information from any client run, including the NRZ-M4 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 NRZ-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 "NRZ-M4_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\NRZ-M4\ PIExamples*.

Guide to connect the oscilloscope

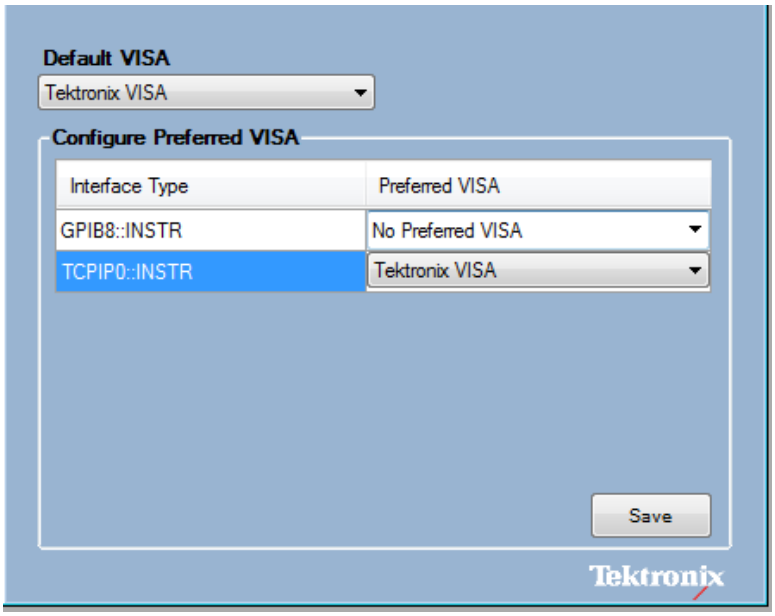
Check network access

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

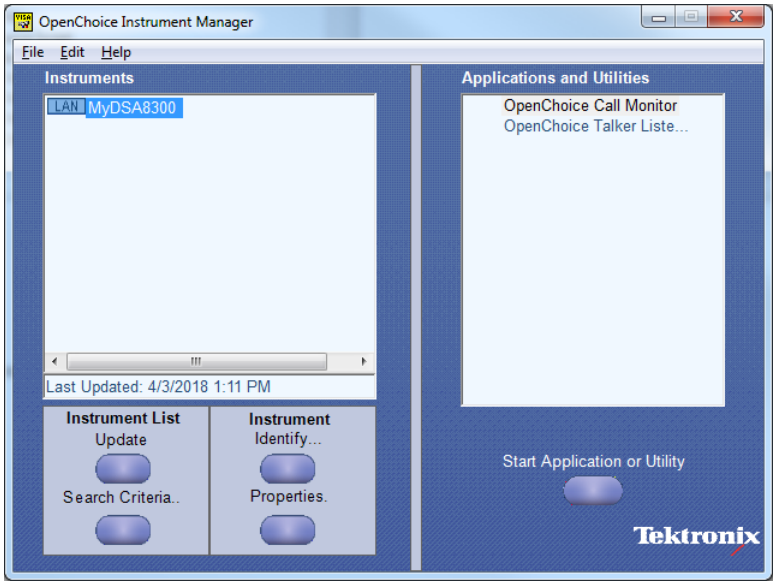
Ensure that the DSA8300 is connected to the network, and the TekScope application is running.

TekVISA setup and troubleshooting

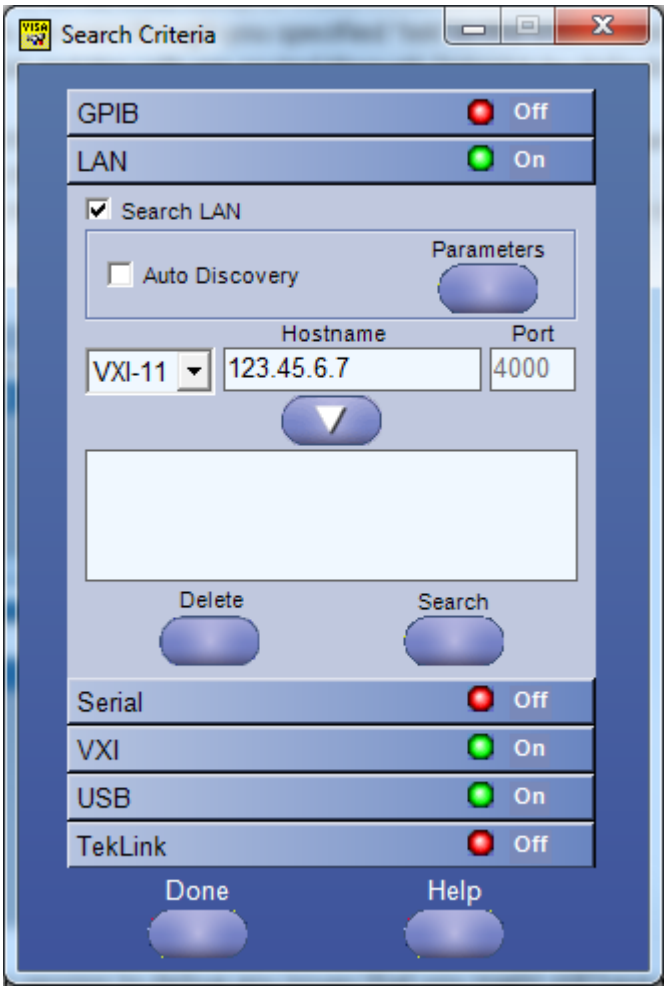
- Verify that TekVISA is installed on the PC.
  - TekVISA is required to be running on both the PC and the target oscilloscope.Look for the TekVISA icon in task bar.
- If other VISA software is installed on the PC, verify that TekVISA is the default VISA. Use the OpenChoice VISA64 Conflict Manger (available in the list of applications under the TekVISA program folder).



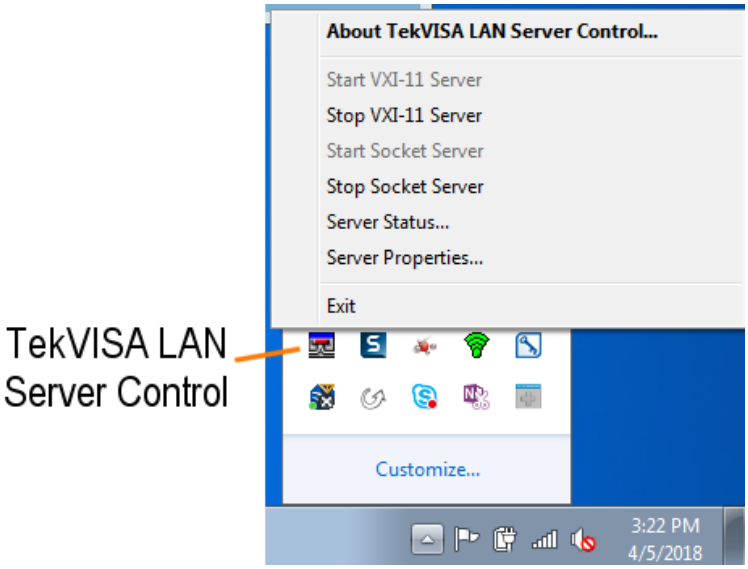
- Make sure that the instrument is detected in the TekVISA Open Choice Instrument Manager (available in the list of applications under the TekVISA program folder).



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


Search Criteria
GPIB
Off
LAN
On
Search LAN
Auto Discovery
Parameters
Hostname
Port
VXI-11
123.45.6.7
4000
Delete
Search
Serial
Off
VXI
On
USB
On
TekLink
Off
Done
Help

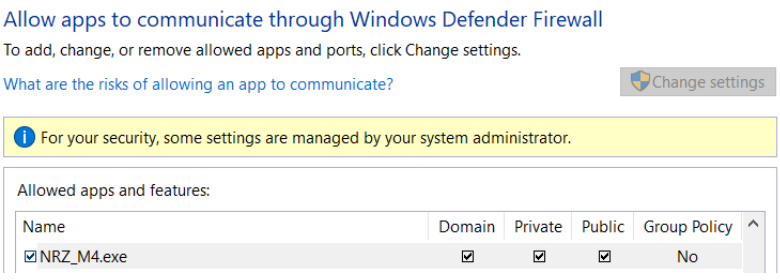
- Make sure that the VXI-11 server under TekVISA LAN Server is started on the DSA8300. The server is turned off after the instrument is rebooted, so user needs to start it manually.



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 NRZ-M4 application.
- Make sure that NRZ-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".



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