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Programming Manual

UTG900E Series Function/Arbitrary Waveform Generator

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Warranty and Statement

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Statement

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SCPI Introduction

SCPI (Standard Commands for Programmable Instruments) is a standard instrument programming language based on the existing IEEE 488.1 and IEEE 488.2 standards, following the floating point arithmetic rules of IEEE754 standard, 7-bit coding character of information change in ISO646 (equivalent to ASCII programming), and etc. In this section, we describe the format, notations, parameters, abbreviation rules of the SCPI command.

Commands Format

The SCPI command in a tree hierarchy includes several subsystems, each consisting of a root keyword and one or more hierarchical keywords. The command line usually starts with a colon ":". Keywords are separated by a colon ":", followed by optional Parameter settings. The command keyword and the first Parameter are separated by a space. The command string must end with a < Newline > (<NL>) character. Add the question mark "? " to the end of command line, which usually means to query this function.

Notations

The following four notations are not the part of SCPI command, not sent with the command, but generally used to help illustrate The parameters in the command.

- Brace { }

It usually contains multiple optional parameters, one of which must be selected when the command is sent. For example, :DISPlay:GRID:MODE { FULL | GRID | CROSS | NONE} command.

- Vertical Bar |

It is used to separate multiple Parameter options, one of which must be selected when the command is sent. For example, :DISPlay:GRID:MODE { FULL | GRID | CROSS | NONE} command.

- Square Bracket [ ]

The content in square bracket (command keywords) is omitted. If The parameter is omitted, it will be set as the default value by the instrument.

For example, in the :MEASure:NDUTy? [<source>] command, [<source>] means the current channel.

- Angle Bracket < >

The parameter in triangular bracket must be replaced by a valid value.
For example, DISPlay:GRID:BRIGhtness <count> command is sent as the format of
DISPlay:GRID:BRIGhtness 30

Parameters

The parameters contained in the commands in this manual can be divided into five types: Boolean, Integer, Real, Discrete, and ASCII Strings.

- Boolean Type

The parameter value is "ON" (1) or "OFF" (0).

For example, :SYSTem:LOCK {{1 | ON} | {0 | OFF}}

- **Integer Type**

  The parameter can be any integer value within a valid range unless otherwise noted. Note: Now, please do not set The parameter to decimal format to avoid abnormity.
  For example, The parameter < count > in the command of :DISPlay:GRID:BRIGhtness <count> can be any integer value within range of 0~100.

- **Real Type**

  The parameter can be any value within a valid range unless otherwise noted. For example, the value of Parameter<offset> in CHANnel1: OFFSet <offset>, CH1 command is real.

- **Discrete Type**

  The parameter can only be specified value or character.
  For example, The parameter in :DISPlay:GRID:MODE { FULL | GRID | CROSS | NONE} command can only be FULL, GRID,CROSS, NONE.

- **ASCII Strings**

  The string parameter can virtually contain all ASCII character sets. Strings must begin and end with paired quotes; you can use single or double quotes. The quotation separator can also be used as part of a string by typing it twice without adding any characters, such as the IP setting: SYST:COMM:LAN:IPAD "192.168.1.10".

Abbreviation Rules

All commands can identify the capital letter and small letter. You must type all capital letters in the command format when you want to abbreviate.

Data Return

Data Return is divided into single data return and batch data return, and single data returns the corresponding Parameter types, while the real type returns data in scientific notation, the part before e retaining three digits after the decimal, and the e part retains three digits. Batch data must be returned the string data in the IEEE 488.2 # format: '#' + Byte bit width[1 Byte] + ASCII value in valid data + valid data + last symbol [' \n '], e.g. # 3123XXxxxxxxXXXXXXxxx \n represents the return format of valid batch data with 123 bytes, here '3' means that the '123' occupies 3 character positions.

SCPI Details

IEEE488.2 Common Commands

*IDN?

- Command Format
  *IDN?
- Function
  Query the manufacturer name, signal source model, product serial number and software versioning.
- Return Format
  The query returns the manufacturer name, signal source model, product serial number and the software versioning separated by dot.
  Note: The returning model should be same as the nameplate.
- Example
  UNI-T Technologies, UTG900, 000000001, 00.00.01

*RST

- Command Format
  *RST
- Function
  Restore factory settings, clear all error messages and send/receive queue buffers.

SYSTem Commands

It is used for the most basic operation of signal source, mainly including the operation of full keyboard lock and the system data setting.

:SYSTem:LOCK

- Command Format
  :SYSTem:LOCK {{1|ON}|{0|OFF}}
  :SYSTem:LOCK?
- Function
  Lock or unlock the full keyboard keys and touch input.
- Return Format
  The query returns the full keyboard status, and 0 in UNLOCK, 1 in LOCK.
- Example

:SYSTem:LOCK ON	Full keyboard LOCK
:SYSTem:LOCK OFF	Full keyboard UNLOCK
:SYSTem:LOCK?	Query returns 1, LOCK

:SYSTem:CONFigure

- Command Format
  :SYSTem:CONFigure <file>
  :SYSTem:CONFigure?
- Function
  Read and write the configuration file, sending commands first, and send configuration file data to the signal source.

<file> means the configuration file.

- Return Format

  The query returns the current configuration file data of signal source.

- Example

  :SYSTem:CONFigure

  Write the configuration file data into signal source and load it.

  :SYSTem:CONFigure?

  The query returns a binary stream of current configuration file data of signal source.

:SYSTem:PHASe:MODe

- Command Format

  :SYSTem:PHASe:MODe {INDependent | SYNChronization}

  :SYSTem:PHASe:MODe?

- Function

  Control the phase mode between channels. The starting phases of two channels are synchronized if it is synchronous, otherwise independent.

- Return Format

  The query returns the phase mode between channels.

- Example

  :SYSTem:PHASe:MODe INDependent

  Set the independent phase mode between channels.

  :SYSTem:PHASe:MODe?

  The query returns INDependent.

:SYSTem:LANGuage

- Command Format

  :SYSTem:LANGuage {ENGLish|CHINese}

  :SYSTem:LANGuage?

- Function

  Control the system language.

- Return Format

  The query returns system languages.

- Example

  :SYSTem:LANGuage ENGLish

  Set the system language to English.

  :SYSTem:LANGuage?

  The query returns ENGLish.

:SYSTem:BEEP

- Command Format

  :SYSTem:BEEP {{1 | ON} | {0 | OFF}}

  :SYSTem:BEEP?

- Function

  Control the buzzer of system.

- Return Format

  The query returns the buzzer ON/OFF status.

- Example

:SYSTem:BEEP ON	Turn buzzer on
:SYSTem:BEEP?	The query returns 1

:SYSTem:NUMBer:FORMat

- Command Format
  :SYSTem:NUMBer:FORMat {COMMa|SPACe|NONe}
  :SYSTem:NUMBer:FORMat?
- Function
  Control the separator of system number format.
- Return Format
  The query returns the separator of system number format.
- Example
  :SYSTem:NUMBer:FORMat NONe
  Set the system number format to be none
  :SYSTem:NUMBer:FORMat?
  The query returns NONe

:SYSTem:BRIGhtness

- Command Format
  :SYSTem:BRIGhtness { 10|30|50|70|90|100}
  :SYSTem:BRIGhtness?
- Function
  Control the brightness of system backlight.
- Return Format
  The query returns the brightness of system backlight.
- Example
  :SYSTem:BRIGhtness 30
  Set the brightness of system backlight to 30%
  :SYSTem:BRIGhtness?
  The query returns 30

:SYSTem:SLEEP:TIMe

- Command Format
  :SYSTem:SLEEP:TIMe { CLOSe | 1 |5 | 15 |30 |60}

  :SYSTem:SLEEP:TIMe?
- Function:
  Control the sleep time of system, in "Minute" unit.
- Return Format
  The query returns the sleep time.
- Example
  :SYSTem:SLEEP:TIMe 5 MIN
  Set the system to auto-sleep in 1 minute
  :SYSTem:SLEEP:TIMe?
  The query returns 1

:SYSTem:CYMometer

- Command Format
  :SYSTem:CYMometer {{1 | ON} | {0 | OFF}}

:SYSTem:CYMometer?

- Function

  Control the system frequency meter ON/OFF.

  Note: Synchronous output of channel will be off when this function on.

- Return Format

  The query returns the system frequency meter ON/OFF, 0 in OFF, 1 in ON.

- Example

  :SYSTem:CYMometer ON System frequency meter ON

  :SYSTem:CYMometer? The query returns 1

:SYSTem:CYMometer:FREQuency

- Command Format

  :SYSTem:CYMometer:FREQuency?

- Function

  Get the currently measured frequency of frequency meter.

- Return Format

  The query returns the currently measured frequency of frequency meter, in "Hz" unit, using scientific notation to return the data.

- Example

  :SYSTem:CYMometer:FREQuency?

  The query returns 2e+3.

:SYSTem:CYMometer:PERiod

- Command Format

  :SYSTem:CYMometer:PERiod?

- Function

  Get the currently measured period of frequency meter.

- Return Format

  The query returns the currently measured period of frequency meter, in "S" unit, using scientific notation to return the data.

- Example

  :SYSTem:CYMometer:PERiod? The query returns 2e-3

:SYSTem:CYMometer:DUTY

- Command Format

  :SYSTem:CYMometer:DUTY?

- Function

  Get the currently measured duty ratio of frequency meter.

- Return Format

  The query returns currently measured duty ratio of frequency meter, in "%" unit.

- Example

  :SYSTem:CYMometer:DUTY?

  The query returns 20, meaning the duty ratio 20%

CHANnel Commands

Set the related functions of signal source channels.

:CHANnel<n>:OUTPut

- Command Format
  :CHANnel<n>:OUTPut {{1|ON}|{0|OFF}}
  :CHANnel<n>:OUTPut?
- Function
  Set the specified channel output ON/OFF.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the specified channel output status, 0 in OFF, 1 in ON.
- Example

:CHANnel1:OUTPut ON	Set the channel 1 output ON
:CHANnel1:OUTPut?	The query returns 1

:CHANnel<n>:INVersion

- Command Format
  :CHANnel<n>:INVersion {{1|ON}|{0|OFF}}
  :CHANnel<n>:INVersion?
- Function
  Set the specified channel reverse ON/OFF.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the specified channel reverse, 0 in OFF, 1 in ON.
- Example
  :CHANnel1:INVersion ON
  Set the reverse output of channel 1 ON
  :CHANnel1:INVersion?
  The query returns 1

:CHANnel<n>:OUTPut:SYNC

- Command Format
  :CHANnel<n>:OUTPut:SYNC {{1|ON}|{0|OFF}}
  :CHANnel<n>:OUTPut:SYNC?
- Function
  Set the sync output of channel.
  Note: Only one sync output interface in the device, and can only open the sync output of one channel.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the sync output of specified channel, 0 in OFF, 1 in ON.
- Example
  :CHANnel1:OUTPut:SYNC ON
  Set the sync output of channel 1 ON
  :CHANnel1:OUTPut:SYNC?

The query returns 1

:CHANnel<n>:LIMit:ENABle

- Command Format
  :CHANnel<n>:LIMit:ENABle {{1|ON}|{0|OFF}}
  :CHANnel<n>:LIMit:ENABle?
- Function
  Set the amplitude limiting ON/OFF of specified channel.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the amplitude limiting status of specified channel.
- Example
  :CHANnel1:LIMit:ENABle ON
  Set the amplitude limiting of channel 1 ON
  :CHANnel1:LIMit:ENABle?
  The query returns 1

:CHANnel<n>:LIMit:LOWer

- Command Format
  :CHANnel<n>:LIMit:LOWer {<voltage>}
  :CHANnel<n>:LIMit:LOWer?
- Function
  Set the lower amplitude limit of specified channel.
  <voltage> means the voltage, and its unit is the specified unit of current channel.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the lower amplitude limit of specified channel, using scientific notation to return.
- Example
  :CHANnel1:LIMit:LOWer 2
  Set the lower amplitude limit of channel 1 to 2V
  :CHANnel1:LIMit:LOWer?
  The query returns 2e+0

:CHANnel<n>:LIMit:UPPer

- Command Format
  :CHANnel<n>:LIMit:UPPer {<voltage>}
  :CHANnel<n>:LIMit:UPPer?
- Function
  Set the upper amplitude limit of specified channel.
  <voltage> means voltage, and its unit is the specified unit of current channel.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the upper amplitude limit of specified channel, using scientific notation to return.
- Example
  :CHANnel1:LIMit:UPPer 2
  Set the upper amplitude limit of channel 1 to 2V
  :CHANnel1:LIMit:UPPer?

The query returns 2e+0

:CHANnel<n>:AMPLitude:UNIT

- Command Format
  :CHANnel<n>:AMPLitude:UNIT {VPP | VRMS | DBM}
  :CHANnel<n>:AMPLitude:UNIT?
- Function
  Set the unit of output amplitude in specified channel.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the unit of output amplitude in specified channel.
- Example
  :CHANnel1:AMPLitude:UNIT VPP
  Set the unit of output amplitude in channel 1 to VPP.
  :CHANnel1:AMPLitude:UNIT?
  The query returns VPP

:CHANnel<n>:LOAD

- Command Format
  :CHANnel<n>:LOAD <resistance>
  :CHANnel<n>:LOAD?
- Function
  Set the output load of specified channel.
  <resistance> means the load resistance, in "Ω" unit.
  <n>: Channel No., n value 1, 2.
  Note: The resistance value should be within the range of 1~10000, and the 10000 is for high resistance.
- Return Format
  The query returns the load resistance of specified channel, using scientific notation to return.
- Example
  :CHANnel1:LOAD 50
  Set the output load of channel 1 to 50Ω
  :CHANnel1:LOAD?
  The query returns 50e+0

:CHANnel<n>:BASE:WAVe

- Command Format
  :CHANnel<n>:BASE:WAVe { SINe | SQUare | PULSe | RAMP | ARB | NOISe | DC }
  :CHANnel<n>:BASE:WAVe?
- Function
  Set the fundamental wave types of specified channel, including the Sine Wave, Square Wave, Pulse Wave, Ramp Wave, Arbitrary Wave, Noise, DC.
  <n>: Channel No, n value 1, 2.
- Return Format
  The query returns the fundamental wave types of specified channel.
- Example
  :CHANnel1:BASE:WAVe SINe
  Set the channel 1 to sine wave.

:CHANnel1:BASE:WAVe?
The query returns SINe.

:CHANnel<n>:BASE:FREQuency

- Command Format
  :CHANnel<n>:BASE:FREQuency {<freq>}
  :CHANnel<n>:BASE:FREQuency?
- Function
  Set the output frequency of specified channel.
  <freq> means the frequency value, in "Hz" unit. (1e-6s ~ current max. frequency of wave)
  <n>: Channel No, n value 1, 2.
- Return Format
  The query returns the output frequency of specified channel, using scientific notation to return.
- Example
  :CHANnel1:BASE:FREQuency 2000
  Set the output frequency of channel 1 to 2KHz
  :CHANnel1:BASE:FREQuency?
  The query returns 2e+3

:CHANnel<n>:BASE:PERiod

- Command Format
  :CHANnel<n>:BASE:PERiod {<period>}
  :CHANnel<n>:BASE:PERiod?
- Function
  Set the output period of specified channel.
  <period> means period, in "S" unit.
  If sine wave: max. ~ 1e3s
  <n>: Channel No, n value 1, 2.
- Return Format
  The query returns the upper amplitude limit of specified channel, using scientific notation to return.
- Example
  :CHANnel1:BASE:PERiod 0.002
  Set the output period of channel 1 to 2ms
  :CHANnel1:BASE:PERiod?
  The query returns 2e-3

:CHANnel<n>:BASE:PHASe

- Command Format
  :CHANnel<n>:BASE:PHASe {<phase>}
  :CHANnel<n>:BASE:PHAse?
- Function
  Set the output phase of specified channel.
  <phase> means the phase, in "°" unit, range of -360~360.
  <n>: Channel No, n value 1, 2.
- Return Format
  The query returns the output phase of specified channel.
- Example

:CHANnel1:BASE:PHAse 20
Set the output phase of channel 1 to 20°
:CHANnel1:BASE:PHAse?
The query returns 20

:CHANnel<n>:BASE:AMPLitude

- Command Format:
  :CHANnel<n>:BASE:AMPLitude { <amp>}
  :CHANnel<n>:BASE:AMPLitude?
- Function
  Set the output amplitude of specified channel.
  <amp> means voltage, unit is the specified one of current channel. 1mVpp ~ is the max.output in the current load condition.
  When the current unit is VPP, the current max.load=current load*20/ (50+current load)
  <n>: Channel No, n value 1, 2.
- Return Format
  The query returns the output amplitude of specified channel, using scientific notation to return.
- Example
  :CHANnel1:BASE:AMPLitude 2
  Set the output amplitude of channel 1 to 2V
  :CHANnel1:BASE:AMPLitude?
  The query returns 2e+0

:CHANnel<n>:BASE:OFFSet

- Command Format
  :CHANnel<n>:BASE:OFFSet { <voltage>}
  :CHANnel<n>:BASE:OFFSet?
- Function
  Set the DC output offset of specified channel.
  <voltage> means voltage, in "V" unit, range of 0~±max.DC of current load.
  Max.DC of current load= current load*10/ (50+ current load)-current min.AC/2.
  Min.AC is 2mVpp, value 0 in DC mode.
  <n>: Channel No, n value 1, 2.
- Return Format
  The query returns the DC output offset of specified channel, using scientific notation to return.
- Example
  :CHANnel1:BASE:OFFSet 2
  Set the DC output offset of channel 1 to 2V
  :CHANnel1:BASE:OFFSet?
  The query returns 2e+0

:CHANnel<n>:BASE:HIGH

- Command Format
  :CHANnel<n>:BASE:HIGH { <voltage>}
  :CHANnel<n>:BASE:HIGH?
- Function
  Set the high signal output value of specified channel.

<voltage> means voltage and its unit is the specified unit of current channel.

<n>: Channel No, n value 1, 2.

- Return Format

  The query returns the high signal output value of specified channel, using scientific notation to return.

- Example

  :CHANnel1:BASE:HIGH 2

  Set the high signal output value of channel 1 to 2V

  :CHANnel1:BASE:HIGH?

  The query returns 2e+0

:CHANnel<n>:BASE:LOW

- Command Format

  :CHANnel<n>:BASE:LOW { <voltage>}

  :CHANnel<n>:BASE:LOW?

- Function

  Set the low signal output value of specified channel.

  <voltage> means voltage and its unit is the specified unit of current channel.

  <n>: Channel No., n value 1, 2.

- Return Format

  The query returns the low signal output value of specified channel, using scientific notation to return.

- Example

  :CHANnel1:BASE:LOW 2

  Set the low signal output value of channel 1 to 2V

  :CHANnel1:BASE:LOW?

  The query returns 2e+0

:CHANnel<n>:BASE:DUTY

- Command Format

  :CHANnel<n>:BASE:DUTY { <duty>}

  :CHANnel<n>:BASE:DUTY?

- Function

  Set the duty ratio of signal output in specified channel.

  <duty> means the duty ratio, in "%" unit, range of 0~100.

  <n>: Channel No., n value 1, 2, 3, 4.

- Return Format

  The query returns the duty ratio of signal output in specified channel.

- Example

  :CHANnel1:BASE:DUTY 20

  Set the duty ratio of signal output in channel 1 to 20%

  :CHANnel1:BASE:DUTY?

  The query returns 20

:CHANnel<n>:RAMP:SYMMetry

- Command Format

  :CHANnel<n>:RAMP:SYMMetry { < symmetry >}

  :CHANnel<n>:RAMP:SYMMetry?

- Function

Set the signal output symmetry of ramp wave in specified channel.

< symmetry > means symmetry, in "%" unit, range of 0~100.

<n>: Channel No., n value 1, 2.

- Return Format

The query returns the signal output symmetry of ramp wave in specified channel.

- Example

:CHANnel1:RAMP:SYMMetry 20

Set the ramp wave signal symmetry of channel 1 to 20%

:CHANnel1:RAMP:SYMMetry?

The query returns 20

:CHANnel<n>:PULSe:RISe

- Command Format

:CHANnel<n>:PULSe:RISe {<width>}

:CHANnel<n>:PULSe:RISe?

- Function

Set the rising edge pulse width of signal pulse wave in specified channel.

<width> means the pulse width, in "S" unit.

<n>: Channel No., n value 1, 2.

- Return Format

The query returns the rising edge pulse width of signal pulse wave in specified channel, using scientific notation to return.

- Example

:CHANnel1:PULSe:RISe 0.002

Set the rising edge pulse width of channel 1 signal to 2ms

:CHANnel1:PULSe:RISe?

The query returns 2e-3

:CHANnel<n>:PULSe:FALL

- Command Format

:CHANnel<n>:PULSe:FALL {<width>}

:CHANnel<n>:PULSe:FALL?

- Function

Set the falling edge pulse width of signal pulse wave in specified channel.

<width> means the pulse width, in "S" unit.

<n>: Channel No., n value 1, 2.

- Return Format

The query returns the falling edge pulse width of signal pulse wave in specified channel, using scientific notation to return.

- Example

:CHANnel1:PULSe:FALL 0.002

Set the falling edge pulse width of channel 1 signal to 2ms

:CHANnel1:PULSe:FALL?

The query returns 2e-3

:CHANnel<n>:MODe

- Command Format

:CHANnel<n>:MODe {CONTINUE | AM | PM | FM | FSK | Line | Log }
:CHANnel<n>:MODe?

- Function

Set the signal types of specified channel, CONTINUE, AM, PM, FM, FSK, Line, Log.
<n>: Channel No., n value 1, 2.

- Return Format

The query returns the signal types of specified channel.

- Example

:CHANnel1:MODe AM
Set the channel 1 signal to AM
:CHANnel1:MODe?
The query returns AM

:CHANnel<n>:MODulate:WAVe

- Command Format

:CHANnel<n>:MODulate:WAVe { SINe|SQUare|UPRamp|DNRamp|ARB|NOISe }
:CHANnel<n>:MODulate:WAVe?

- Function

Set the modulated wave mode of specified channel signal, with modes of Sine Wave, Square Wave, Upper Ramp, Lower Ramp, Arbitrary Wave, and Noise.
<n>: Channel No., n value 1, 2.

- Return Format

The query returns the modulated wave mode of specified channel signal.

- Example

:CHANnel1:MODulate:WAVe SINe
Set the modulated wave of signal in channel 1 to Sine Wave
:CHANnel1:MODulate:WAVe?
The query returns SINe

:CHANnel<n>:MODulate:FREQuency

- Command Format

:CHANnel<n>:MODulate:FREQuency {<freq>}
:CHANnel<n>:MODulate:FREQuency?

- Function

Set the modulated frequency of specified channel signal.
<freq> means frequency, in "Hz" unit.
<n>: Channel No., n value 1, 2.

- Return Format

The query returns the modulated frequency of specified channel signal, and the sampling scientific notation.

- Example

:CHANnel1:MODulate:FREQuency 2000
Set the modulated frequency of signal in channel 1 to 2KHz
:CHANnel1:MODulate:FREQuency?
The query returns 2e+3

:CHANnel<n>:MODulate:ARB:INDex

- Command Format
  :CHANnel<n>:MODulate:ARB:INDex {<index >}
  :CHANnel<n>:MODulate:ARB:INDex?
- Function
  Set the specified channel to load the modulated arbitrary wave index stored in signal source.
  <index> means arbitrary wave index
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the modulated arbitrary wave index in specified channel.
- Example
  :CHANnel1:MODulate:ARB:IND 2
  Set the channel 1 to load the modulated arbitrary wave index 2 stored in signal source
  :CHANnel1:MODulate:ARB:IND?
  The query returns 2

:CHANnel<n>:MODulate:ARB:SOURce

- Command Format
  :CHANnel<n>:MODulate:ARB:SOURce { INTernal|EXTernal }
  :CHANnel<n>:MODulate:ARB:SOURce?
- Function
  Set the modulated arbitrary wave source of specified channel, Internal and External.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the modulated arbitrary wave source of specified channel.
- Example
  :CHANnel1:MODulate:ARB:SOURce INTernal
  Set the modulated arbitrary wave source of channel 1 to be internal
  :CHANnel1:MODulate:ARB:SOURce?
  The query returns the INTernal

:CHANnel<n>:MODulate:SOURce

- Command Format
  :CHANnel<n>:MODulate:SOURce { INTernal|EXTernal }
  :CHANnel<n>:MODulate:SOURce?
- Function
  Set the modulated source of specified channel, Internal and External.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the modulated source of specified channel.
- Example
  :CHANnel1:MODulate:SOURce INTernal
  Set the modulated source of channel 1 to be internal
  :CHANnel1:MODulate:SOURce?
  The query returns the INTernal

:CHANnel<n>:MODulate:DEPTh

- Command Format
  :CHANnel<n>:MODulate:DEPTh { <depth>}
  :CHANnel<n>:MODulate:DEPTh?
- Function
  Set the modulation depth of specified channel.
  <depth> means the modulation depth, in "%" unit, range of 0% ~ 100%, and AM modulation depth is 0% ~ 120%.
  <n>: Channel No., n value 1, 2, 3, 4.
- Return Format
  The query returns the modulation depth of specified channel.
- Example
  :CHANnel1:MODulate:DEPTh 50
  Set the modulation depth of channel 1 to 50%
  :CHANnel1:MODulate:DEPTh?
  The query returns 50

:CHANnel<n>:ARB:INDex

- Command Format
  :CHANnel<n>:ARB:INDex {<index >}
  :CHANnel<n>:ARB:INDex?
- Function
  Set the specified channel to load arbitrary wave index stored in signal source.
  <index > means arbitrary wave index.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the arbitrary wave index of specified channel.
- Example
  :CHANnel1:ARB:IND 2
  Set the channel 1 to load the arbitrary wave index 2 stored in signal source
  :CHANnel1:ARB:IND?
  The query returns 2

:CHANnel<n>:ARB:SOURce

- Command Format
  :CHANnel<n>:ARB:SOURce { INTernal|EXTernal }
  :CHANnel<n>:ARB:SOURce?
- Function
  Set the arbitrary wave source of specified channel, Internal and External.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the arbitrary wave source of specified channel.
- Example
  :CHANnel1:ARB:SOURce INTernal
  Set the arbitrary wave source of channel 1 to be internal
  :CHANnel1:ARB:SOURce?
  The query returns INTernal

:CHANnel<n>:FM:FREQuency:DEV

- **Command Format**
  :CHANnel<n>:FM:FREQuency:DEV { <freq>}
  :CHANnel<n>:FM:FREQuency:DEV?
- **Function**
  Set the frequency deviation of specified channel.
  <freq> means the frequency deviation, in "Hz" unit. 0Hz ~ is the current fundamental frequency.
  <n>: Channel No., n value 1, 2.
- **Return Format**
  The query returns the frequency deviation of specified channel, using scientific notation to return the data.
- **Example**
  :CHANnel1:FM:FREQuency:DEV 2000
  Set the frequency deviation of channel 1 to 2KHz
  :CHANnel1:FM:FREQuency:DEV?
  The query returns 2e+3

:CHANnel<n>:PM:PHASe:DEV

- **Command Format**
  :CHANnel<n>:PM:PHASe:DEV { <phase>}
  :CHANnel<n>:PM:PHASe:DEV?
- **Function**
  Set the phase deviation of specified channel.
  < phase > means phase deviation, in "°" unit, range of 0~360.
  <n>: Channel No., n value 1, 2.
- **Return Format**
  The query returns the phase deviation of specified channel.
- **Example**
  :CHANnel<n>:PM:PHASe:DEV 30
  Set the phase deviation of channel 1 to 30°
  :CHANnel<n>:PM:PHASe:DEV?
  The query returns 30

:CHANnel<n>:FSK:HOPPing:FREQuency

- **Command Format**
  :CHANnel<n>:FSK:HOPPing:FREQuency { <freq>}
  :CHANnel<n>:FSK:HOPPing:FREQuency?
- **Function**
  Set the hopping frequency of specified channel output.
  < freq > means frequency, in "Hz" unit.
  <n>: Channel No., n value 1, 2.
- **Return Format**
  The query returns the hopping frequency of specified channel output, using scientific notation to return the data.
- **Example**
  :CHANnel1:FSK:HOPP:FREQ 2000
  Set the hopping frequency of of channel 1 to 2KHz

:CHANnel1:FSK:HOPP:FREQ?
The query returns 2e+3

:CHANnel<n>:SWEep:FREQuency:STARt

- Command Format
  :CHANnel<n>:SWEep:FREQuency:STARt <freq>
  :CHANnel<n>:SWEep:FREQuency:STARt?
- Function
  Set the start frequency of sweep in specified channel.
  < freq > means frequency, in "Hz" unit.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the start frequency of sweep in specified channel, using scientific notation to return the data.
- Example
  :CHANnel1:SWE:FREQ:STAR 2000
  Set the start frequency of sweep in channel 1 to 2KHz
  :CHANnel1:SWE:FREQ:STAR?
  The query returns 2e+3

:CHANnel<n>:SWEep:FREQuency:STOP

- Command Format
  :CHANnel<n>:SWEep:FREQuency:STOP <freq>
  :CHANnel<n>:SWEep:FREQuency:STOP?
- Function
  Set the stop frequency of sweep in specified channel.
  < freq > means frequency, in "Hz" unit.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the stop frequency of sweep in specified channel, using scientific notation to return the data.
- Example
  :CHANnel1:SWE:FREQ:STOP 2000
  Set the stop frequency of sweep in channel 1 to 2KHz
  :CHANnel1:SWE:FREQ:STOP?
  The query returns 2e+3

:CHANnel<n>:SWEep:TIMe

- Command Format
  :CHANnel<n>:SWEEP:TIMe { <time>}
  :CHANnel<n>:SWEEP:TIMe?
- Function
  Set the sweep time of specified channel.
  < time > means time, in "S" unit, range of 1ms ~ 500s.
  <n>: Channel No., n value 1, 2.
- Return Format
  The query returns the sweep time of specified channel, using scientific notation to return the data.

- Example

  :CHANnel1:SWEEP:TIMe 2

  Set the sweep time of channel 1 to 2S

  :CHANnel1:SWEEP:TIMe?

  The query returns 2e+0

WARB Commands

It is used to write file commands of arbitrary wave, including the fundamental arbitrary wave and modulated arbitrary wave writing configuration.

:WARB<n>:MODulate

- Command Format

  :WARB<n>:MODulate <arb file>

- Function

  Write the modulated arbitrary wave and the wave data in 4K points. Send the command firstly, and send the arbitrary wave file data to the signal source.

  <arb file> means the arbitrary wave file.

- Example

  :WARB1:MODulate

  Write the modulated arbitrary wave of channel 1

:WARB<n>:CARRier

- Command Format

  :WARB<n>:CARRier <arb file>

- Function

  Write the fundamental arbitrary wave and the wave data in 4K points. Send the command firstly, and send the arbitrary wave file data to the signal source.

  <arb file> means the arbitrary wave file.

- Example

  :WARB1:CARRier

  Write the fundamental arbitrary wave file of channel 1

DISPlay Commands

It is used in signal source display information.

:DISPlay?

- **Command Format**
  :DISPlay?
- **Function**
  Query the image data in current screen of oscilloscope.
- **Return Format**
  The query returns the image data, and the returning data matches with Appendix 2：IEEE 488.2 binary data format.
- **Example**
  :DISPlay? The query returns the image data

Programming Instructions

Describe some troubles and solutions during the programming operation, and please follow instructions if any trouble met.

Programming Preparation

The programming preparation is only for the Visual Studio and LabVIEW programming in the Windows operating system.

Make sure that your computer has been installed VISA library of NI (Download in https://www.ni.com/en-ca/support/downloads/drivers/download.ni-visa.html), and the default installation path in this page: C:\Program Files\IVI Foundation\VISA.

Establishing communication with PC, please use USB cable to connect the USB DEVICE interface of device with the USB interface of PC.

VISA Programming Example

Given some programming Example, this page can help you understand how to use VISA, operate the device as per the commands details, and develop more applications.

VC++ Example

- Condition: Windows System & Visual Studio.
- Description: Access the device through the USBTMC and TCP/IP, and send the "*IDN?" command in NI-VISA to check the device information.
- Steps

1. Open the Visual Studio software, and newly create a VC++ win32 console project.
2. Set the project condition for calling NI-VISA library, with Static Library and Dynamic Library.

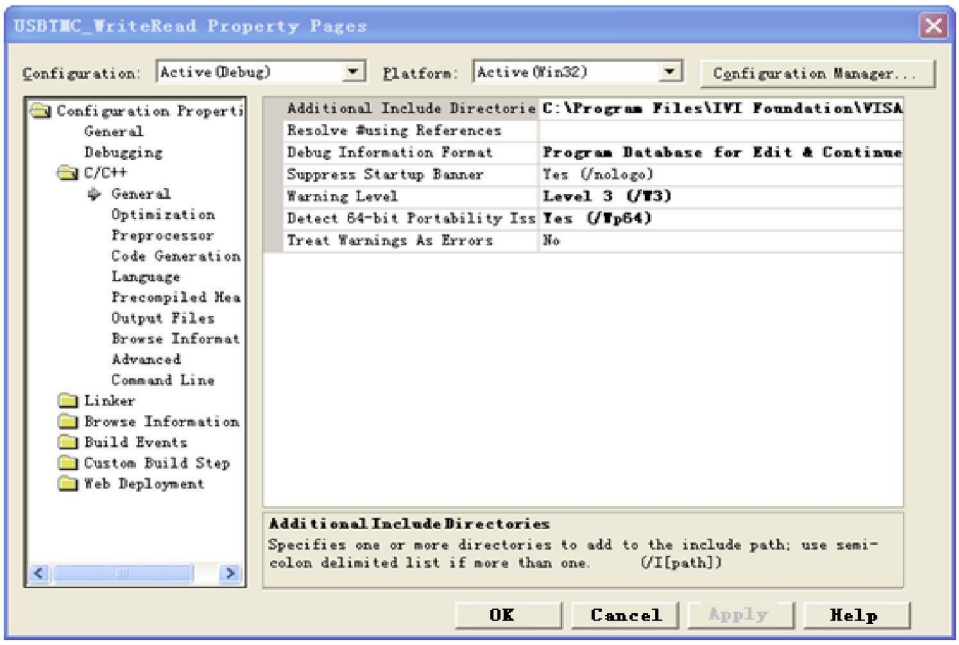
a) Static Library

Copy the visa.h, visatype.h, visa32.lib files in NI-VISA installation path to the root path of VC++ project and add them to the project. Add the following codes to the projectname.cpp file:

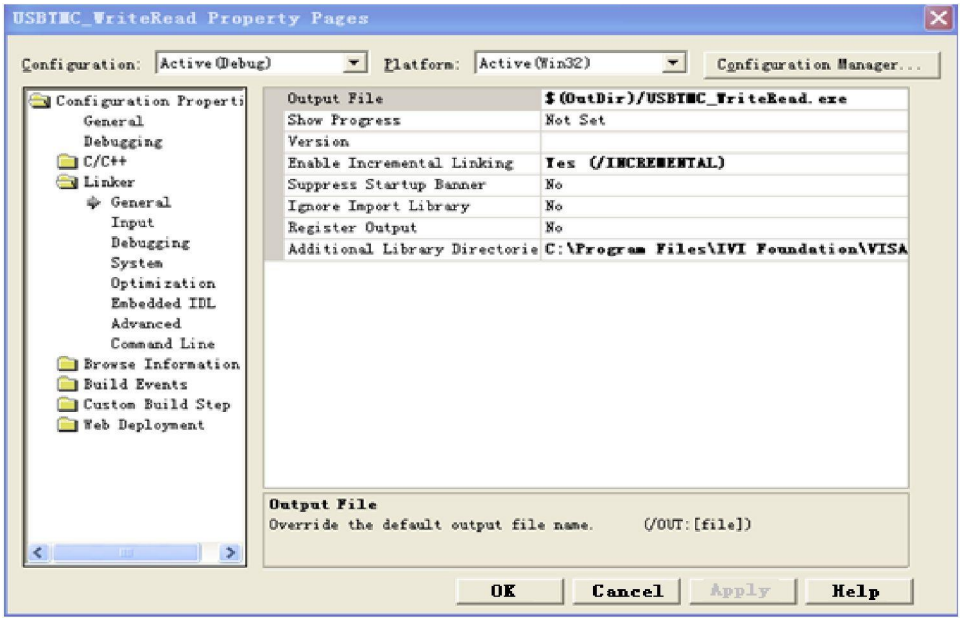
```
#include "visa.h"
#pragma comment(lib,"visa32.lib")
```

b) Dynamic Library

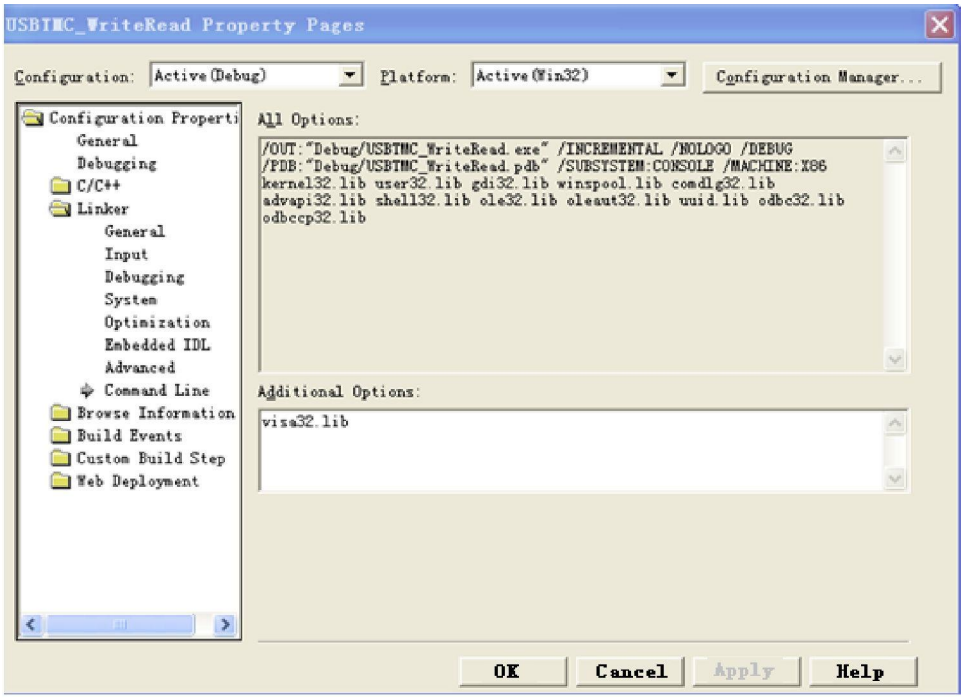
Click the "project>>properties", select the "c/c++---General" in the left side of properties dialog, and set the "Additional Include Directories" content to the installation path of NI-VISA,(For example, C:\ProgramFiles\IVI Foundation\VISA\WinNT\include), as followings showed.



Select the "Linker-General" in the left side of properties dialog, and set the "Additional Library Directories" content to the installation path of NI-VISA, (For example, C:\Program Files\IVI Foundation\VISA\WinNT\include), as followings showed.



Select the "Linker-Command Line" in the left side of properties dialog, and set the "Additional" content to the visa32.lib, as followings showed.



Add the visa.h file to the projectname.cpp.

```
#include <visa.h>
```

1. Source Code

a) USBTMC Example

```
int usbtmc_test()
{ /** This code demonstrates sending synchronous read & write commands
    * to an USB Test & Measurement Class (USBTMC) instrument using NI-VISA
   * The example writes the "*IDN?\n" string to all the USBTMC
   * devices connected to the system and attempts to read back
```

```
* results using the write and read functions.
* Open Resource Manager
* Open VISA Session to an Instrument
* Write the Identification Query Using viPrintf
* Try to Read a Response With viScanf
* Close the VISA Session*/
ViSession defaultRM;
ViSession instr;
ViUInt32 numInstrs;
ViFindList findList;
ViStatus status;
char instrResourceString[VI_FIND_BUFLEN];
unsigned char buffer[100];
int i;
status = viOpenDefaultRM(&defaultRM);
if (status < VI_SUCCESS)
{
    printf("Could not open a session to the VISA Resource Manager!\n");
    return status;
}
/*Find all the USB TMC VISA resources in our system and store the number of resources in the
system in numInstrs.*/
status = viFindRsrc(defaultRM, "USB?*INSTR", &findList, &numInstrs, instrResourceString);
if (status<VI_SUCCESS)
{
    printf("An error occurred while finding resources. \nPress Enter to continue.");
    fflush(stdin);
    getchar();
    viClose(defaultRM);
    return status;
}
/** Now we will open VISA sessions to all USB TMC instruments.
*     We must use the handle from viOpenDefaultRM and we must
*     also use a string that indicates which instrument to open. This
*     is called the instrument descriptor. The format for this string
*     can be found in the function panel by right clicking on the
*     descriptor parameter. After opening a session to the
*     device, we will get a handle to the instrument which we
*     will use in later VISA functions. The AccessMode and Timeout
*     parameters in this function are reserved for future
*     functionality. These two parameters are given the value VI_NULL. */
for (i = 0; i < int(numInstrs); i++)
{
    if (i > 0)
    {
        viFindNext(findList, instrResourceString);
    }
    status = viOpen(defaultRM, instrResourceString, VI_NULL, VI_NULL, &instr);
```

```
            if (status < VI_SUCCESS)
            {
                printf("Cannot open a session to the device %d. \n", i + 1);
                continue;
            }
            /** At this point we now have a session open to the USB TMC instrument.
            *We will now use the viPrintf function to send the device the string "*IDN?\n",
            *asking for the device's identification. */
            char * cmmand = "*IDN?\n";
            status = viPrintf(instr, cmmand);
            if (status < VI_SUCCESS)
            {
                printf("Error writing to the device %d. \n", i + 1);
                status = viClose(instr);
                continue;
            }
            /** Now we will attempt to read back a response from the device to
            *the identification query that was sent. We will use the viScanf
            *function to acquire the data.
            *After the data has been read the response is displayed. */
            status = viScanf(instr, "%t", buffer);
            if (status < VI_SUCCESS)
            {
                printf("Error reading a response from the device %d. \n", i + 1);
            }
            else
            {
                printf("\nDevice %d: %s\n", i + 1, buffer);
            }
            status = viClose(instr);
        }
        /*Now we will close the session to the instrument using viClose. This operation frees all
        system resources.*/
        status = viClose(defaultRM);
        printf("Press Enter to exit.");
        fflush(stdin);
        getchar();
        return 0;
    }

    int _tmain(int argc, _TCHAR* argv[ ])
    {
        usbtmc_test();
        return 0;
    }
```

b) TCP/IP Example

```
int tcp_ip_test(char *pIP)
```

```
{
    char outputBuffer[VI_FIND_BUFLEN];
    ViSession defaultRM, instr;
    ViStatus status;
    /* First we will need to open the default resource manager. */
    status = viOpenDefaultRM(&defaultRM);
    if (status < VI_SUCCESS)
    {
        printf("Could not open a session to the VISA Resource Manager!\n");
    }
    /* Now we will open a session via TCP/IP device */
    char head[256] = "TCPIP0::";
    char tail[] = "::inst0::INSTR";
    strcat(head, pIP);
    strcat(head, tail);
    status = viOpen(defaultRM, head, VI_LOAD_CONFIG, VI_NULL, &instr);
    if (status < VI_SUCCESS)
    {
        printf("An error occurred opening the session\n");
        viClose(defaultRM);
    }
    status = viPrintf(instr, "*idn?\n");
    status = viScanf(instr, "%t", outputBuffer);
    if (status < VI_SUCCESS)
    {
        printf("viRead failed with error code: %x \n", status);
        viClose(defaultRM);
    }
    else
    {
        printf("\nMesseage read from device: %*s\n", 0, outputBuffer);
    }
    status = viClose(instr);
    status = viClose(defaultRM);
    printf("Press Enter to exit.");
    fflush(stdin);
    getchar();
    return 0;
}

int _tmain(int argc, _TCHAR* argv[])
{
    printf("Please input IP address:");
    char ip[256];
    fflush(stdin);
    gets(ip);
    tcp_ip_test(ip);
    return 0;
```

```
}
```

C# Example

- Condition: Windows System & Visual Studio.
- Description: Access the device through the USBTMC and TCP/IP, and send "*IDN?" command in NI-VISA to check the device information.
- Steps

1. Open the Visual Studio software, and newly create a C# console project.
2. Add the C# reference of VISA, Ivi.Visa.dll and NationalInstruments.Visa.dll.
3. Source Code

a) USBTMC Example

```
class Program
{
        void usbtmc_test()
        {
            using (var rmSession = new ResourceManager())
            {
                var resources = rmSession.Find("USB?*INSTR");
                foreach (string s in resources)
                {
                    try
                    {
                        var mbSession = (MessageBasedSession)rmSession.Open(s);
                        mbSession.RawIO.Write("*IDN?\n");
                        System.Console.WriteLine(mbSession.RawIO.ReadString());
                    }
                    catch (Exception ex)
                    {
                        System.Console.WriteLine(ex.Message);
                    }
                }
            }
        }

        void Main(string[] args)
        {
            usbtmc_test();
        }
}
```

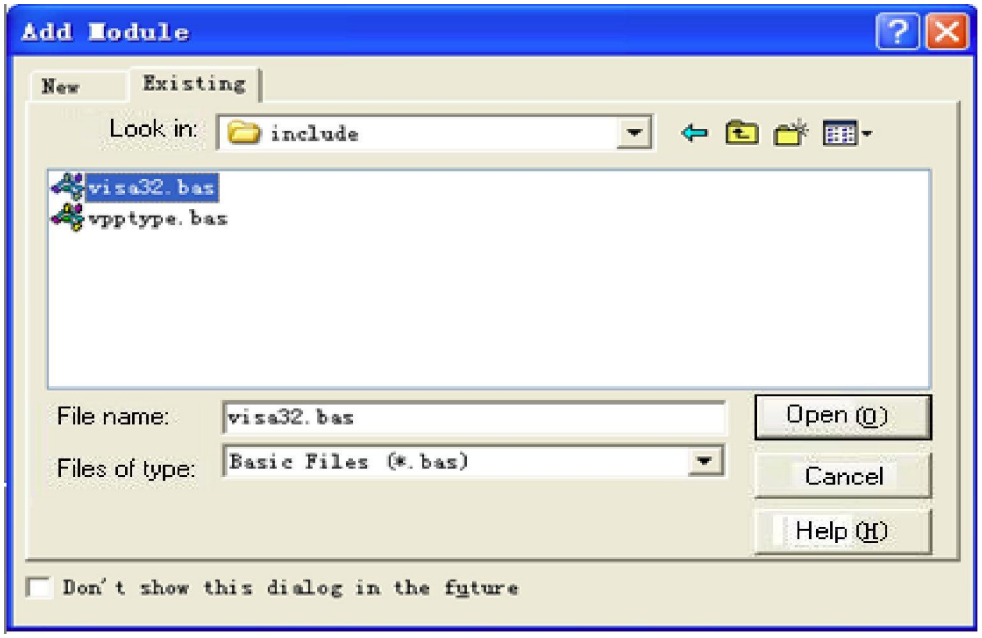
b) TCP/IP Example

```
class Program
  {
        void tcp_ip_test(string ip)
        {
            using (var rmSession = new ResourceManager())
            {
```

```
            try
            {
                var resource = string.Format("TCPIP0::{0}::inst0::INSTR", ip);
                var mbSession = (MessageBasedSession)rmSession.Open(resource);
                mbSession.RawIO.Write("*IDN?\n");
                System.Console.WriteLine(mbSession.RawIO.ReadString());
            }
            catch (Exception ex)
            {
                System.Console.WriteLine(ex.Message);
            }
        }
    }

    void Main(string[] args)
    {
        tcp_ip_test("192.168.20.11");
    }
}
```

VB Example

- Condition: Windows System & Microsoft Visual Basic 6.0.
- Description: Access the device through the USBTMC and TCP/IP, and send "*IDN?" command in NI-VISA to check the device information.
- Steps
  1. Open the Visual Basic software, and newly create a standard application.
  2. Set the project condition for calling NI-VISA library: Click the Existing tab of Project>>Add Existing Item, find the visa32.bas file in the "include" folder of NI-VISA installation path and add it, as followings showed.



  3. Source Code

a) USBTMC Example

```
PrivateFunction usbtmc_test() AsLong
' This code demonstrates sending synchronous read & write commands
' to an USB Test & Measurement Class (USBTMC) instrument using NI-VISA
' The example writes the "*IDN?\n" string to all the USBTMC
' devices connected to the system and attempts to read back
' results using the write and read functions.
' The general flow of the code is
' Open Resource Manager
' Open VISA Session to an Instrument
' Write the Identification Query Using viWrite
' Try to Read a Response With viRead
' Close the VISA Session

Const MAX_CNT = 200
Dim defaultRM AsLong
Dim instrsesn AsLong
Dim numInstrs AsLong
Dim findList AsLong
Dim retCount AsLong
Dim status AsLong
Dim instrResourceString AsString *VI_FIND_BUFLEN
Dim Buffer AsString * MAX_CNT
Dim i AsInteger

' First we must call viOpenDefaultRM to get the manager
' handle. We will store this handle in defaultRM.
status = viOpenDefaultRM(defaultRM)
If(status < VI_SUCCESS) Then
    resultTxt.Text = "Could not open a session to the VISA Resource Manager!"
    usbtmc_test = status
ExitFunction
EndIf

' Find all the USB TMC VISA resources in our system and store the
' number of resources in the system in numInstrs.
status = viFindRsrc(defaultRM, "USB?*INSTR", findList, numInstrs, instrResourceString)
If (status < VI_SUCCESS) Then
    resultTxt.Text = "An error occurred while finding resources."
    viClose(defaultRM)
    usbtmc_test = status
ExitFunction
EndIf

' Now we will open VISA sessions to all USB TMC instruments.
' We must use the handle from viOpenDefaultRM and we must
' also use a string that indicates which instrument to open.  This
' is called the instrument descriptor.  The format for this string
```

```
' can be found in the function panel by right clicking on the
' descriptor parameter. After opening a session to the
' device, we will get a handle to the instrument which we
' will use in later VISA functions.  The AccessMode and Timeout
' parameters in this function are reserved for future
' functionality.  These two parameters are given the value VI_NULL.
For i = 0 To numInstrs
If (i > 0) Then
    status = viFindNext(findList, instrResourceString)
EndIf
    status = viOpen(defaultRM, instrResourceString, VI_NULL, VI_NULL, instrsesn)
If (status < VI_SUCCESS) Then
    resultTxt.Text = "Cannot open a session to the device " + CStr(i + 1)
GoTo NextFind
EndIf

' At this point we now have a session open to the USB TMC instrument.
' We will now use the viWrite function to send the device the string "*IDN?",
' asking for the device's identification.
status = viWrite(instrsesn, "*IDN?", 5, retCount)
If (status < VI_SUCCESS) Then
    resultTxt.Text = "Error writing to the device."
    status = viClose(instrsesn)
GoTo NextFind
EndIf

' Now we will attempt to read back a response from the device to
' the identification query that was sent.  We will use the viRead
' function to acquire the data.
' After the data has been read the response is displayed.
status = viRead(instrsesn, Buffer, MAX_CNT, retCount)
If (status < VI_SUCCESS) Then
    resultTxt.Text = "Error reading a response from the device." + CStr(i + 1)
Else
    resultTxt.Text = "Read from device: " + CStr(i + 1) + " " + Buffer
EndIf
    status = viClose(instrsesn)
Next i

' Now we will close the session to the instrument using
' viClose. This operation frees all system resources.
status = viClose(defaultRM)
usbtmc_test = 0
EndFunction
```

b) TCP/IP Example

```
PrivateFunction tcp_ip_test(ByVal ip AsString) AsLong
Dim outputBuffer AsString * VI_FIND_BUFLEN
Dim defaultRM AsLong
```

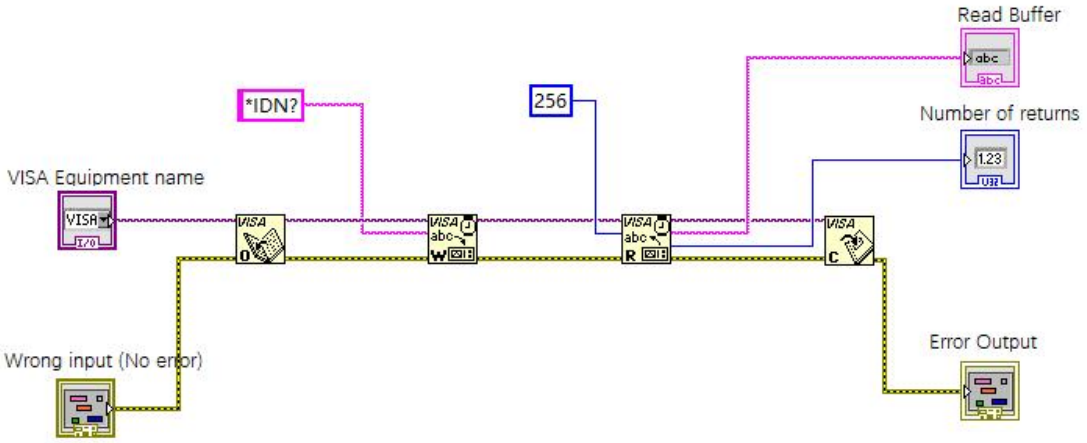
```
    Dim instrsesn AsLong
    Dim status AsLong
    Dim count AsLong

    ' First we will need to open the default resource manager.
    status = viOpenDefaultRM(defaultRM)
    If (status < VI_SUCCESS) Then
        resultTxt.Text = "Could not open a session to the VISA Resource Manager!"
        tcp_ip_test = status
    ExitFunction
    EndIf

    ' Now we will open a session via TCP/IP device
    status = viOpen(defaultRM, "TCPIP0::" + ip + "::inst0::INSTR", VI_LOAD_CONFIG, VI_NULL, instrsesn)
    If (status < VI_SUCCESS) Then
        resultTxt.Text = "An error occurred opening the session"
        viClose(defaultRM)
        tcp_ip_test = status
    ExitFunction
    EndIf
    status = viWrite(instrsesn, "*IDN?", 5, count)
    If (status < VI_SUCCESS) Then
        resultTxt.Text = "Error writing to the device."
    EndIf
        status = viRead(instrsesn, outputBuffer, VI_FIND_BUFLEN, count)
    If (status < VI_SUCCESS) Then
        resultTxt.Text = "Error reading a response from the device." + CStr(i + 1)
    Else
        resultTxt.Text = "read from device:" + outputBuffer
    EndIf
        status = viClose(instrsesn)
        status = viClose(defaultRM)
        tcp_ip_test = 0
EndFunction
```

LabVIEW Example

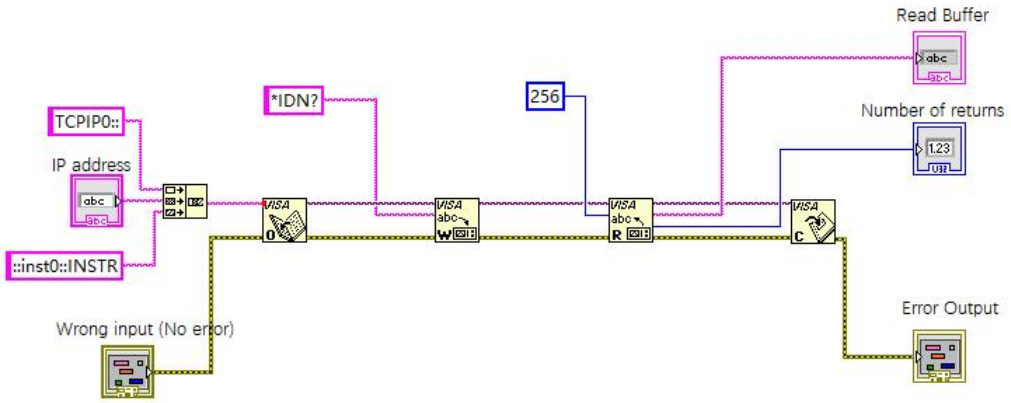
- Condition: Windows System & LabVIEW.
- Description: Access the device through the USBTMC and TCP/IP, and send "*IDN?" command in NI-VISA to check the device information.
- Steps

1. Open the LabVIEW software, and newly create a VI file.
2. Add the control, right-click the last interface, select and add the VISA resource name, input error, output error and some indicators.
3. Open the frame interface, right-click the VISA resource name, select and add the following functions in the VISA interface of popup menu: VISA Write, VISA Read, VISA Open, and VISA Close.
4. The VISA session of USBTMC device is opened by VI, writing "*IDN?" command to the device and reads back the response value. The VISA session will be closed by VI when the communication is finished, as

followings showed.



5. Communicating with device through the TCP/IP is similar to USBTMC, set the VISA writing and reading to be synchronous I/O, and the LabVIEW to be asynchronous I/O by default. Right-click the node, and select the "Synchronous I/O Mode>>Synchronous" in shortcut menu to write or read data synchronously, as followings showed.



MATLAB Example

- Condition: Windows System & MATLAB.
- Description: Access the device through the USBTMC and TCP/IP, and send "*IDN?" command in NI-VISA to check the device information.
- Steps

1. Open the MATLAB software, and click the File>>New>>Script in the Matlab interface to create a new M file.
2. Source Code

a) USBTMC Example

```
function usbtmc_test()
% This code demonstrates sending synchronous read & write commands
% to an USB Test & Measurement Class (USBTMC) instrument using
% NI-VISA

%Create a VISA-USB object connected to a USB instrument
vu = visa('ni','USB0::0x5345::0x1234::SN20220718::INSTR');

%Open the VISA object created
fopen(vu);

%Send the string "*IDN?",asking for the device's identification.
fprintf(vu,'*IDN?');

%Request the data

outputbuffer = fscanf(vu);
disp(outputbuffer);

%Close the VISA object
fclose(vu);
delete(vu);
clear vu;

end
```

b) TCP/IP Example

```
function tcp_ip_test()
% This code demonstrates sending synchronous read & write commands
% to an TCP/IP instrument using NI-VISA
%Create a VISA-TCPIP object connected to an instrument

%configured with IP address.
vt = visa('ni',['TCPIP0::','192.168.20.11','::inst0::INSTR']);

%Open the VISA object created

fopen(vt);

%Send the string "*IDN?",asking for the device's identification.
fprintf(vt,'*IDN?');

%Request the data
outputbuffer = fscanf(vt);
disp(outputbuffer);

%Close the VISA object
fclose(vt);
delete(vt);
```

```
clear vt;

End
```

Python Example

- Condition: Windows System & Python3.8 & PyVISA 1.11.0.
- Description: Access the device through the USBTMC and TCP/IP, and send "*IDN?" command in the NI-VISA to check the device information.
- Steps

1. Firstly install the Python, then open its script compiling software, and create a new test.py file.
2. Install PyVISA through the pip install PyVISA command, please refer to https://pyvisa.readthedocs.io/en/latest/ if any questions.
3. Source Code

a) USBTMC Example

```
import pyvisa
rm = pyvisa.ResourceManager()
rm.list_resources()
my_instrument = rm.open_resource('USB0::0x5345::0x1234::SN20220718::INSTR')
print(my_instrument.query('*IDN?'))
```

b) TCP/TP Example

```
import pyvisa
rm = pyvisa.ResourceManager()
rm.list_resources()
my_instrument = rm.open_resource('TCPIP0::192.168.20.11::inst0::INSTR')
print(my_instrument.query('*IDN?'))
```

Programming Applications

Sine Wave Configuration

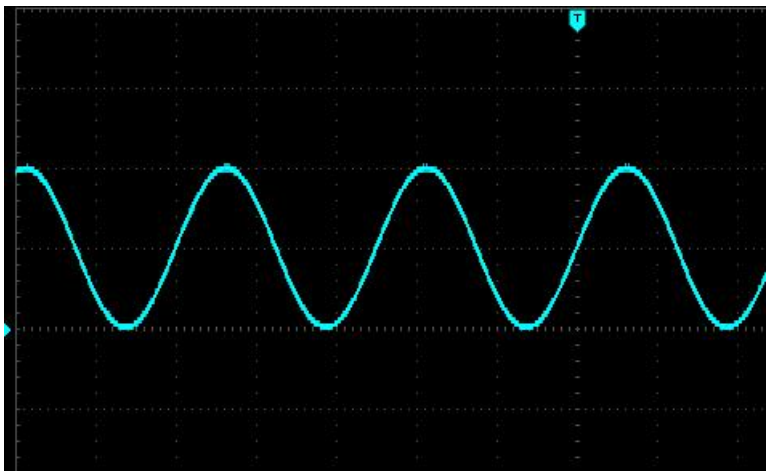
In this page, we will introduce how to configure the sine function.

Description

The sine wave has amplitude, offset, and phase relative to the synchronization pulse, and its amplitude and offset can be set by high and low voltage.

Example

The following waves can be set by the SCPI command series, and the high level and low level can be used to replace :CHANnel1:BASE:AMPLitude and :CHANnel1:BASE:OFFSet.



The above sine wave can be generated by following commands.

:CHANnel1:MODe CONTinue
:CHANnel1:BASE:WAVe SINe
:CHANnel1:BASE:FREQuency 2000
:CHANnel1:BASE:HIGH 2
:CHANnel1:BASE:LOW 0
:CHANnel1:BASE:PHAse 20
:CHANnel1:OUTPut ON

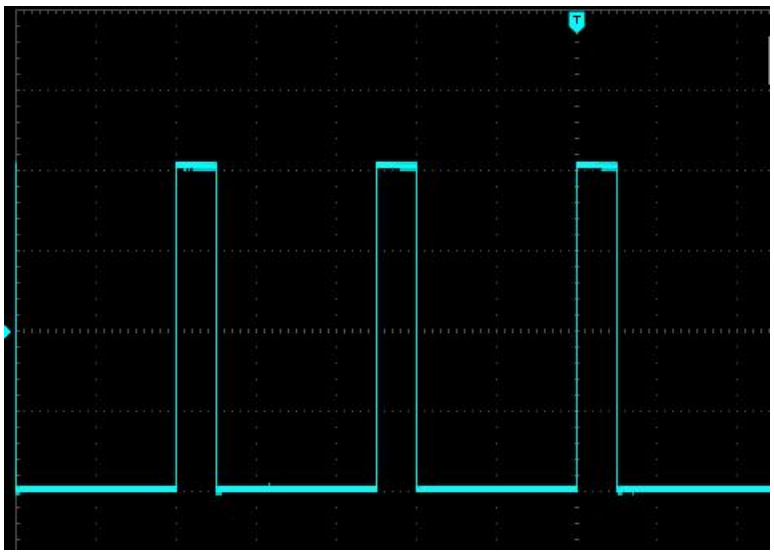
Square Wave Configuration

Description

The square wave has amplitude, offset, and phase relative to the synchronization pulse, and also with duty ratio and cycle. Its amplitude and offset can be set by high and low voltage.

Example

The following waves can be set by the SCPI command series.



The above square wave can be generated by following commands.

:CHANnel1:MODe CONTinue
:CHANnel1:BASE:WAVe SQUare
:CHANnel1:BASE:FREQuency 40000
:CHANnel1:BASE:AMPLitude 2
:CHANnel1:BASE:OFFSet 0
:CHANnel1:BASE:PHAse 90
:CHANnel1:BASE:DUTY 20
:CHANnel1:OUTPut ON

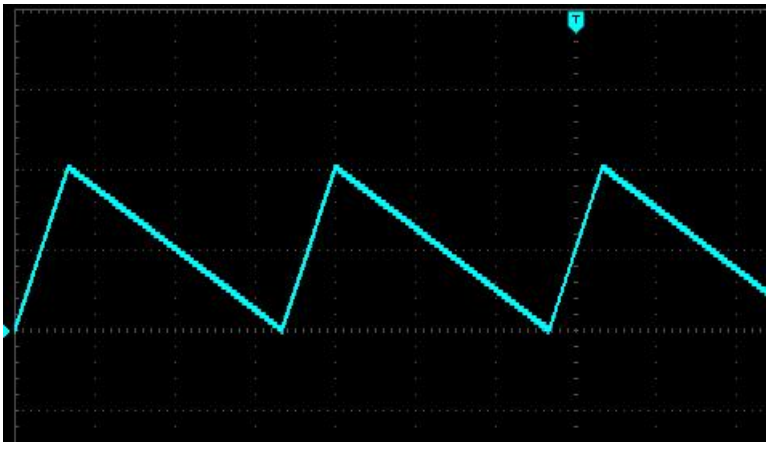
Sawtooth Wave Configuration

Description

The sawtooth wave has amplitude, offset, and phase relative to the synchronization pulse. Its symmetry can be used to create ramp wave and other waves. Its amplitude and offset can be set by high and low voltage.

Example

The following waves can be set by the SCPI command series, and the high level and low level can be used to replace :CHANnel1:BASE:AMPLitude and :CHANnel1:BASE:OFFSet.



The above sawtooth wave can be generated by following commands.

:CHANnel1:MODe CONTinue
:CHANnel1:BASE:WAVe RAMP
:CHANnel1:BASE:FREQuency 30000
:CHANnel1:BASE:HIGH 2
:CHANnel1:BASE:LOW 0
:CHANnel1:BASE:PHAse 90
:CHANnel1:RAMP:SYMMetry 20
:CHANnel1:OUTPut ON

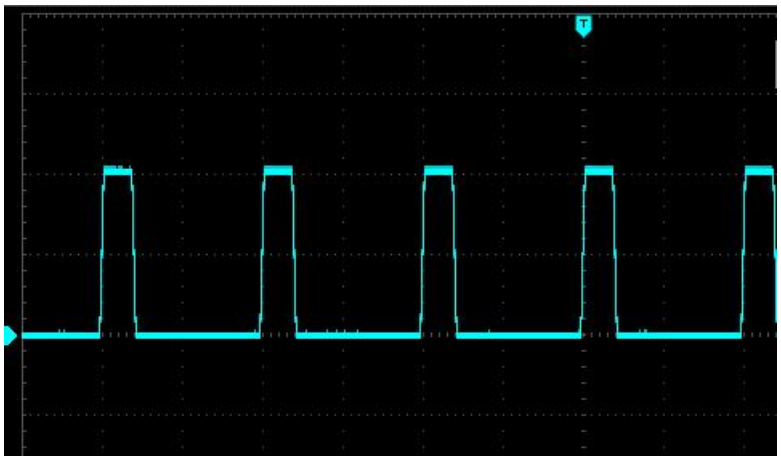
Pulse Wave Configuration

Description

The pulse wave has amplitude, offset, and phase relative to the synchronization pulse. It also adds edge slope and duty ratio (or pulse width). Its amplitude and offset can be set by high and low voltage.

Example

The following waves can be set by the SCPI command series, and the high level and low level can be used to replace :CHANnel1:BASE:AMPLitude and :CHANnel1:BASE:OFFSet.



The above pulse wave can be generated by following commands.

:CHANnel1:MODe CONTinue
:CHANnel1:BASE:WAVe PULSe
:CHANnel1:BASE:FREQuency 100000
:CHANnel1:BASE:HIGH 2
:CHANnel1:BASE:LOW 0
:CHANnel1:BASE:PHAse 270
:CHANnel1:BASE:DUTY 20
:CHANnel1:PULSe:RISe 0.0000002
:CHANnel1:PULSe:FALL 0.0000002
:CHANnel1:OUTPut ON

Arbitrary Wave Configuration

In this page, we will introduce how to configure arbitrary wave.

Description

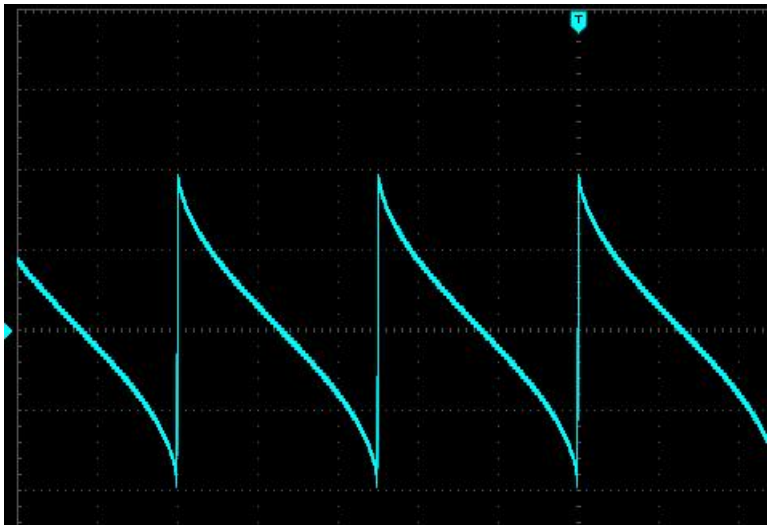
The arbitrary wave has frequency, amplitude, offset and phase, and also adds modes and wave files.

Example

The built-in arbitrary wave can be loaded and modified by the following codes.

```
:CHANnel1:MODe CONTinue
:CHANnel1:BASE:WAVe ARB
:CHANnel1:ARB:MODe DDS
:CHANnel1:BASE:ARB INTernal,"ACos.bsv"
:CHANnel1:BASE:FREQuency 200000
:CHANnel1:BASE:AMPLitude 2
:CHANnel1:BASE:OFFSet 0
:CHANnel1:BASE:PHAse 90
:CHANnel1:OUTPut ON
```

The waves generated by the commands are as followings.



Appendix 1：<key> List

Key	Function	LED Light
Wave	Wave Type	
Mode	Output Mode	√
Utility	System	
Symbol	Number Symbol	
Dot	Number Dot	
NUM0	NUMBER 0	
NUM1	NUMBER 1	
NUM2	NUMBER 2	
NUM3	NUMBER 3	
NUM4	NUMBER 4	
NUM5	NUMBER 5	
NUM6	NUMBER 6	
NUM7	NUMBER 7	
NUM8	NUMBER 8	
NUM9	NUMBER 9	
Up	UP	
Down	DOWN	
Left	LEFT	
Right	RIGHT	
OK	OK	
CH1	CHANNEL 1	√
CH2	CHANNEL 2	√
F1	First Menu Item	
F2	Second Menu Item	
F3	Third Menu Item	
F4	Fourth Menu Item	
F5	Fifth Menu Item	
F6	Sixth Menu Item	

Appendix 2：IEEE 488.2 Binary Data Format

DATA is the data stream, and others are ASCII characters, as followings showed: <#812345678 + DATA + \n>

Start（1Byte）	Bit Width（1Byte）	Total Data Length（Byte Bit Width）	DATA（n Byte）	End（1Byte）
#	x	xxxxxxxx	.....	\n