



**RIGOL**

# Ultra Station

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**User Guide**  
UGU04100-1110  
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# 1 Product Overview

Ultra Station software is a PC software for the function/arbitrary waveform generator. It is developed by RIGOL TECHNOLOGIES CO., LTD. (**RIGOL**) based on the RIGOL TAP platform. The software can be used to edit the arbitrary waveform. It supports the following products.

- DG1022Z, DG1032Z, and DG1062Z
- DG2052, DG2072, and DG2102
- DG4202, DG4162, DG4102, DG4062
- DG5071, DG5101, DG5251, DG5072, DG5102, DG5252, DG5351, DG5352, DG5252 Pro, DG5352 Pro, DG5502 Pro
- DG811, DG821, DG831, DG812, DG822, DG832, DG821 Pro, DG822 Pro, and DG852 Pro
- DG952, DG972, DG992, DG902 Pro, DG912 Pro, and DG922 Pro
- MSO5072, MSO5074, MSO5102, MSO5104, MSO5204, MSO5354, and MSO5152-E
- MSO7014, MSO7024, MSO7034, and MSO7054
- MSO8064, MSO8104, and MSO8204



## NOTE

For the MSO series, only those installed with the signal source option are supported by the Ultra Station software.

## 1.1 Installation Environment

### Hardware Configuration Requirements

- Internal Memory: 4 GB or higher (8 GB or higher is recommended.)
- Monitor: 1920x1080 screen resolution or higher.
- Intel® Core™ i3 and above processor
- Hard disk: 1 GB or higher

### Running Environment

- Microsoft Windows 7 SP1+, Windows 8, Windows 10, and Windows 11

- NI-VISA 5.4 or above download link (<https://dotnet.microsoft.com/en-us/download/dotnet/6.0>)
- Microsoft .NET 6.0 64-bit/32-bit
  - 64-bit download link: <https://dotnet.microsoft.com/en-us/download/dotnet/thank-you/runtime-desktop-6.0.29-windows-x64-installer>.
  - 32-bit download link: <https://dotnet.microsoft.com/en-us/download/dotnet/thank-you/runtime-desktop-6.0.29-windows-x86-installer>.

**NOTE**

If you want to install or run Microsoft .NET 6.0 on Microsoft Windows 7 SP1, additional dependencies are required.

- Microsoft Visual C++ 2015-2019 Redistributable 64-bit/32-bit
  - 64-bit download link: [https://aka.ms/vs/17/release/vc\\_redist.x64.exe](https://aka.ms/vs/17/release/vc_redist.x64.exe).
  - 32-bit download link: [https://aka.ms/vs/17/release/vc\\_redist.x86.exe](https://aka.ms/vs/17/release/vc_redist.x86.exe).
- KB3063858 64-bit/32-bit
  - 64-bit download link: <https://www.microsoft.com/en-us/download/details.aspx?id=47442>.
  - 32-bit download link: <https://www.microsoft.com/en-us/download/details.aspx?id=47409>.

## 1.2 Installation and Uninstallation

### Install Ultra Station

Double-click the "setup.exe" file of the Ultra Station software installation package to complete the installation according to the installation wizard.

### Uninstall Ultra Station

Click **Start** > **Control Panel** > **Programs and Features** > **Ultra Station** > **Uninstall**. Then a prompt message is displayed, requesting you to confirm the operation. Click **Yes** to start uninstalling the software.

## 1.3 To Launch the Software

Click **Start** > **RIGOL** > **Ultra Station** to launch the software. You can also double-click the software shortcut icon to launch the software.



## 1.4 Software Interface

The layout of the Ultra Station interface is shown below.

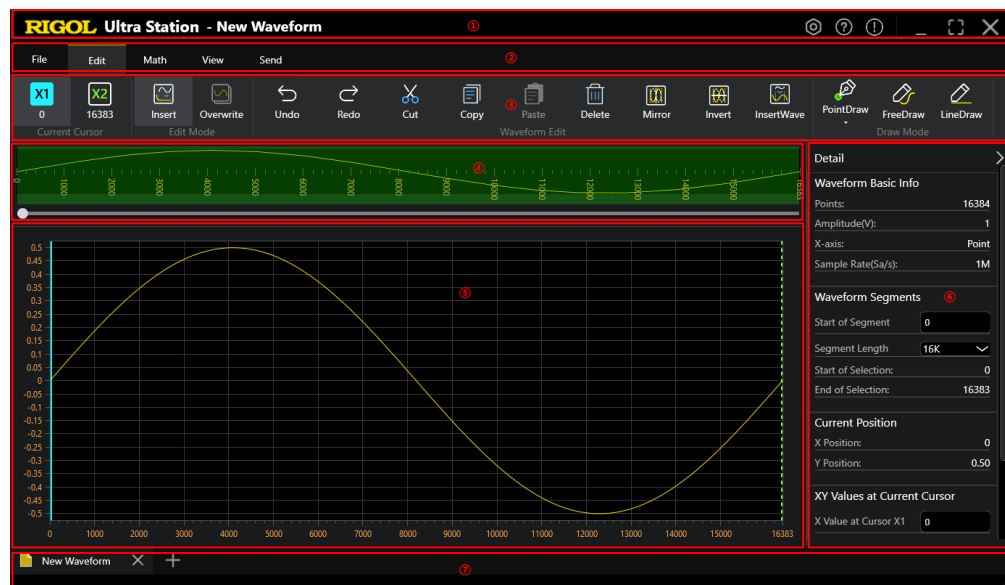



Figure 1.1 Ultra Station Main Interface

1. Title bar. It displays the RIGOL logo, interface name, settings, help, minimize window, maximize window, and close window button.

- **Settings:** Click on  to enter the setting interface. You can select the interface language (Chinese/English) and the background color of the interface (Black/White), as shown in the figure below.

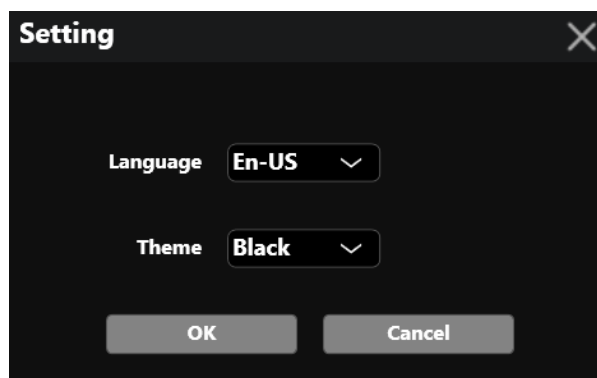
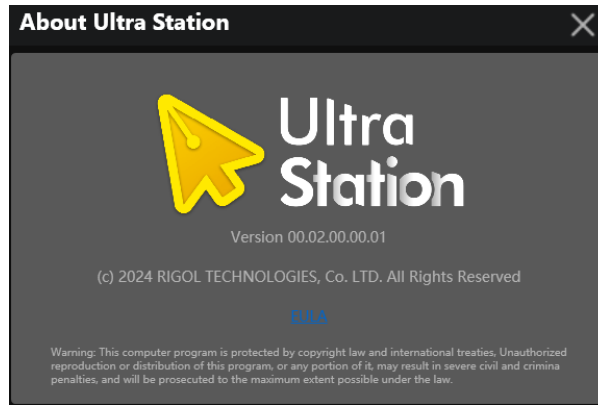





Figure 1.2 Interface Setting

- **About:** Click on  to display the software information.




**Figure 1.3 Software Version Information**


- **Minimize window:** Click on  to minimize the window.
- **Maximize window:** Click on  to maximize the window.
- **Close:** Click on  to close the window.

2. Menu display area. It displays the software menu, including File, Edit, Math, View, and Send.

3. Sub-menu display area. It displays the sub-menus of the specified main menu, such as Current Cursor, Edit Mode, Waveform Edit, and Draw Mode.

4. Waveform segment display area. It displays the current waveform segment and waveform coordinates information. Drag the scroll bar  or click on it to display the waveforms in segments.

5. Waveform segment zoom area. It displays the zoomed area of the specified

waveform segment covered in green patch. Drag the green patch , and the specified waveform segment covered by the green patch is displayed in the waveform segment zoom area.

6. Waveform detailed information display area. It displays the detailed information of the waveform.


#### **Waveform Basic Info**

- **Points:** indicate the number of points for the current waveform.

- **Amplitude(V):** indicates the amplitude of the original existing waveform.
- **X-axis:** indicates the type of the X-axis. It can be Point or Time.
- **Sample Rate(Sa/s):** indicates the sample rate of the current waveform.

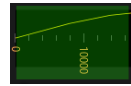
### Waveform Segments



- **Start of Segment:** indicates the start X-axis value of the specified waveform

segment. When dragging the scroll bar or clicking on the scroll bar  to select the specified waveform segment, the value of "Start of Segment" corresponds to the X-axis value of the specified waveform segment.

- **Segment Length:** indicates the number of points of each waveform segment.
- **Start of Selection:** indicates the start X-axis value of the specified waveform

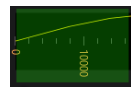
segment covered by the green patch . When dragging the green patch





, dragging the scroll bar or clicking on the scroll bar , the value of "Start of Selection" changes and corresponds to the X-axis value of the start position of specified waveform segment covered by the green patch.

- **End of Selection:** indicates the end X-axis value of the specified waveform

segment covered by the green patch . When dragging the green patch



, dragging the scroll bar or clicking on the scroll bar , the value of "End of Selection" changes and corresponds to the X-axis value of the end position of specified waveform segment covered by the green patch.

### Current Mouse Position

- **X Position:** displays the X-axis position of the current mouse cursor.
- **Y Position:** displays the Y-axis position of the current mouse cursor.



**XY Values at Current Cursor:** displays the X values and Y values at Cursor X1




and Cursor X2




respectively. Input a specified value into the input field

of **X Value at Cursor X1** and **X Value at Cursor X2**,  and  will be moved to the specified position.

- **X Value at Cursor X1:** displays the X-axis value of the crossing point between

the waveform and Cursor X1 . You can also input a value into the input field of **X Value at Cursor X1** to locate Cursor X1 to a specified position.

- **Y Value at Cursor X1:** displays the Y-axis value of the crossing point between

the waveform and Cursor X1 . You can also input a value into the input

field of **Y Value at Cursor X1**, and a new waveform point will be added to the original waveform. Its Y-axis value is the Y value you set and X-axis value is



where the Cursor X1 resides.

- **X Value at Cursor X2**: displays the X-axis value of the crossing point between



the waveform and Cursor X2. You can also input a value into the input

field of **X Value at Cursor X2** to locate Cursor X2 to a specified position.


- **Y Value at Cursor X2**: displays the Y-axis value of the crossing point between



the waveform and Cursor X2. You can also input a value into the input field of **Y Value at Cursor X2**, and a new waveform point will be added to the original waveform. Its Y-axis value is the Y value you set and X-axis value is



where the Cursor X2 resides.

Click on  to fold the detailed information display area. To show the details, click

on the Detail icon or  to unfold the area.

7. Waveform files opened. It displays the currently opened waveform files. You can click on the close icon of each file to close the existing file.

## 2 To Use the Software

This manual introduces the Ultra Station software from the following parts: File Management, To Create the Waveform, To Edit the Waveform, Waveform Calculation, Waveform View, and To Send the Waveforms.

### 2.1 File Management

File management includes creating, opening, saving, or saving as a waveform file. You can open the waveform files by clicking **Recently** to open the recent files or by clicking **Browse** to select the file from the specified path and open it. You can also close the file and exit the software.

#### Create a File

1. In *Figure 1.1*, click **File**. The sub-menus of **File** are displayed at the left part of the interface.

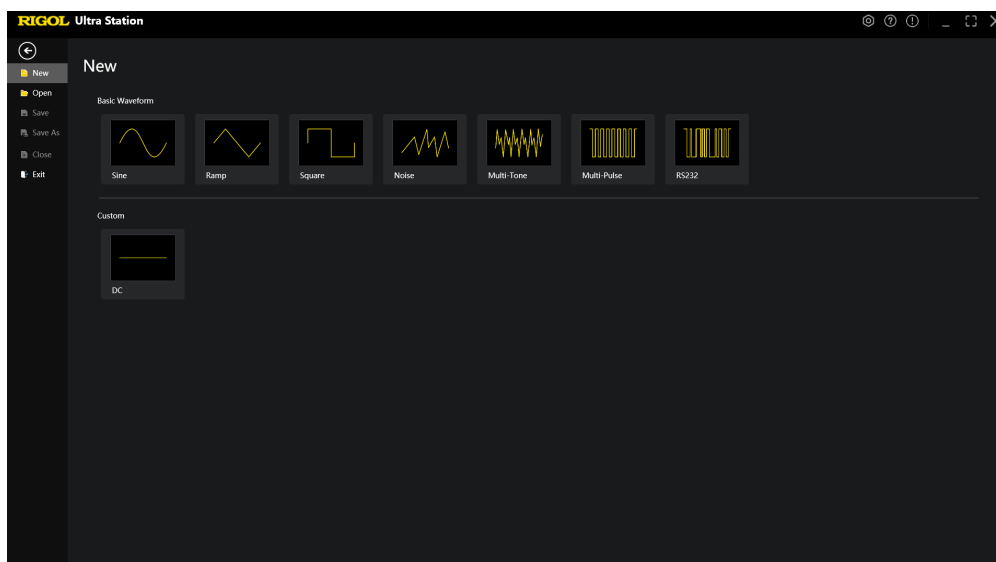


Figure 2.1 File Menu Interface

2. Click **New**, and then select a basic waveform from the built-in waveforms or click "Custom" to create a user-defined waveform (DC by default).
3. After selecting the specified waveform, you can set the waveform parameters such as frequency, amplitude, and etc.
4. After confirming the settings, click **OK**, and the new waveform file is created.

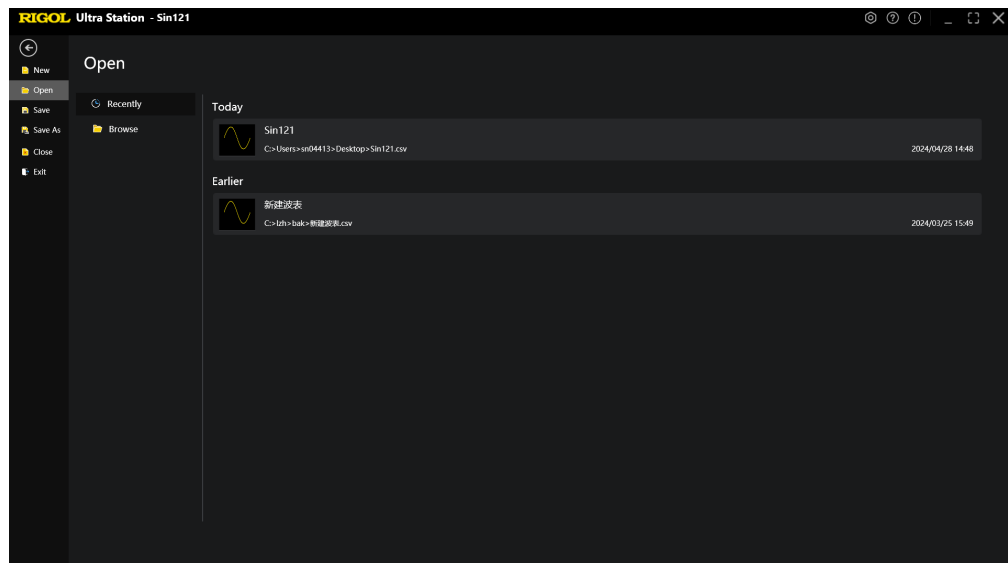
#### NOTE

For details about creating a file of different types of waveforms, refer to *To Create the Waveform*.



#### Open a File

1. In *Figure 2.1*, click **Open** to select the desired file from "Recently" or "Browse" menu.



**Figure 2.2 Open a File**

2. Click **Recently**, and the recently saved waveform files are displayed at the right section. Click to open the desired file.
3. Click **Browse**, and the default path is displayed. You can select the saved waveform file from the specified path and open it.

#### NOTE

Ultra Station supports opening four formats of files saved on this software. Besides, it also supports opening the saved waveform file suffixed with "\*.csv", and "\*.bin" which are saved on some oscilloscopes (DHO series, MSO series, and DS70000 series).

#### Save a File

1. After finishing editing the waveform, in *Figure 1.1*, click **File > Save**.
2. Then the path location is displayed for you to choose. Select the desired path and input the filename (if necessary), then click **Save** to save the file to the desired path.

#### NOTE

Ultra Station supports saving the waveform as a file suffixed with "\*.csv", "\*.txt", "\*.raf", and "\*.arb".

#### Save As

1. If you want to save the currently edited waveform file as a file with a specified format or save it to the specified path, click **Save As** in *Figure 2.1* to save the current waveform as a file suffixed with a specified format to a specified location.

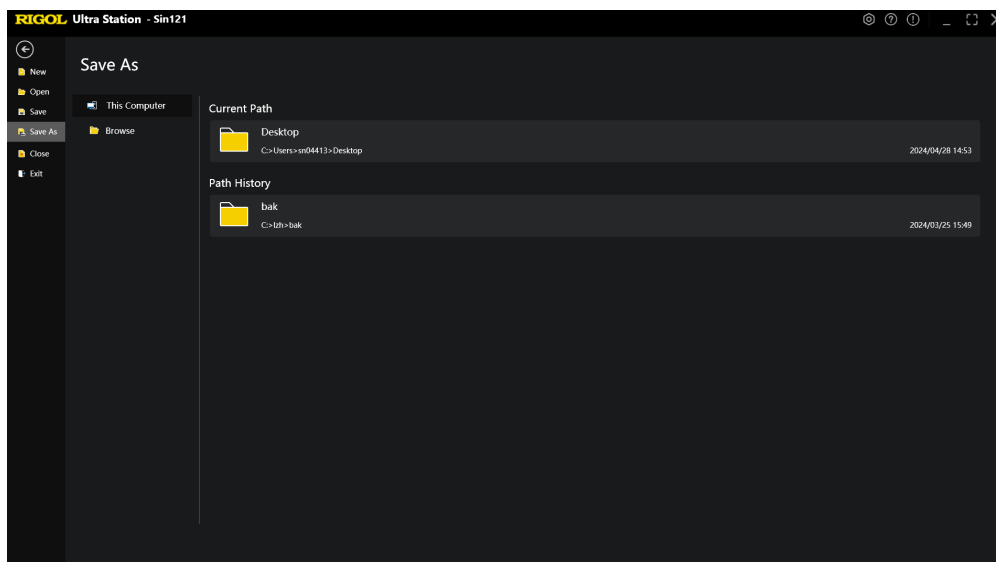


Figure 2.3 "Save As" Interface

2. You can save the file to the current path or history path. You can also click **Browse** to select the desired path to save the file.

Click **Close** to close the file management interface and go back to the main interface of the Ultra Station software.

Click **Exit** to exit the Ultra Station software.

## 2.2 To Create the Waveform

1. In *Figure 1.1*, click **File** > **New**. The available waveforms are displayed at the right part of the menu.

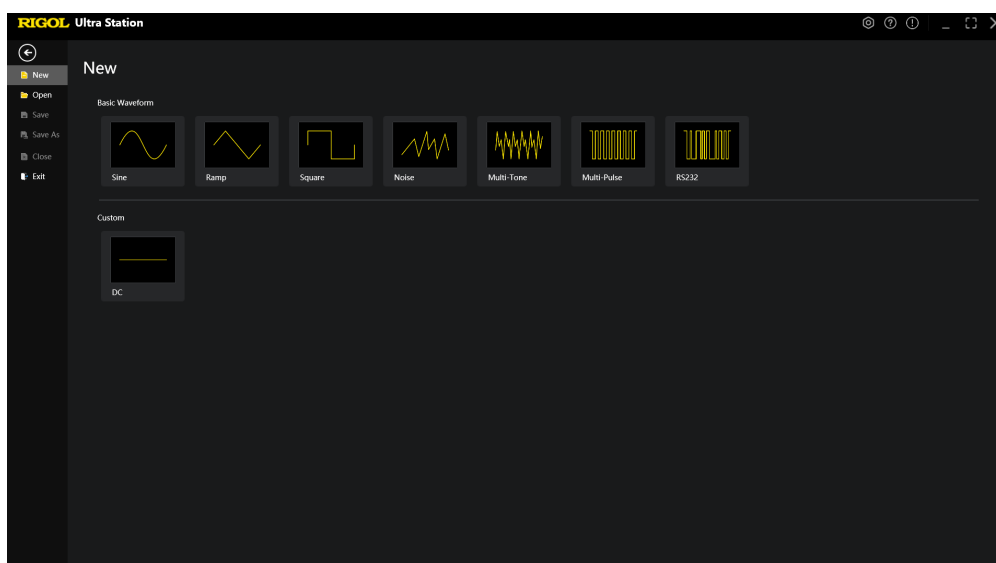


Figure 2.4 Waveform Selection Interface

2. Select the desired waveform from the available built-in basic waveforms or select a user-defined waveform. Then the waveform creation interface is displayed. You can set the waveform parameters and preview the created waveform.

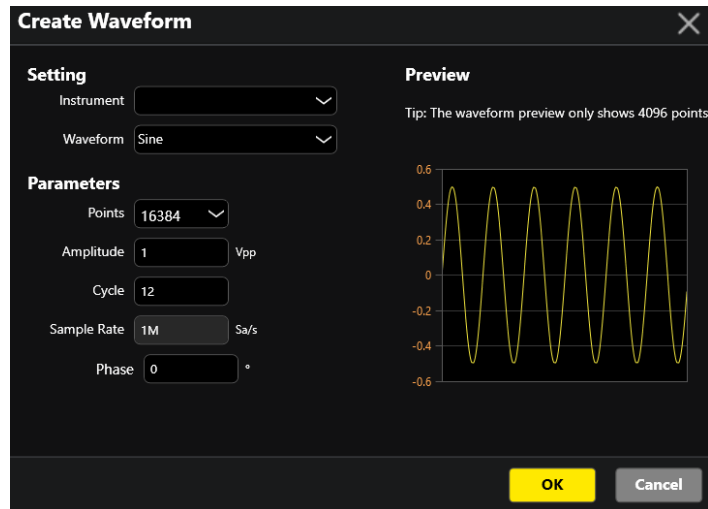


Figure 2.5 Waveform Creation Interface

3. Select the desired instrument and the waveform type.
  - a. **Instrument:** selects the desired instrument.
  - b. **Waveform:** selects the desired waveform to be created from the drop-down list. After selecting the desired waveform to be created, set its relevant parameters.

For the parameter settings of the specified created waveform, refer to detailed descriptions of the following waveform type.

- *Sine*
- *Square*
- *Ramp*
- *Noise*
- *DC*
- *RS232*
- *Multi-Pulse*
- *Multi-Tone*



4. After completing the parameters for the new waveforms, you can preview the created waveform in the Preview section at the right part of the interface and modify the relevant parameters in the Parameter section at the left part if necessary.
5. After confirming the settings, click **OK**, and the new waveform is created.

## 2.2.1 Sine

In the "Create Waveform" interface, select the desired instrument from the drop-down list of **Instrument**, then click the drop-down button of **Waveform** to select **Sine**. The Sine waveform is displayed in the preview section. You can set the parameters of Sine waveform at the left section of the current interface.

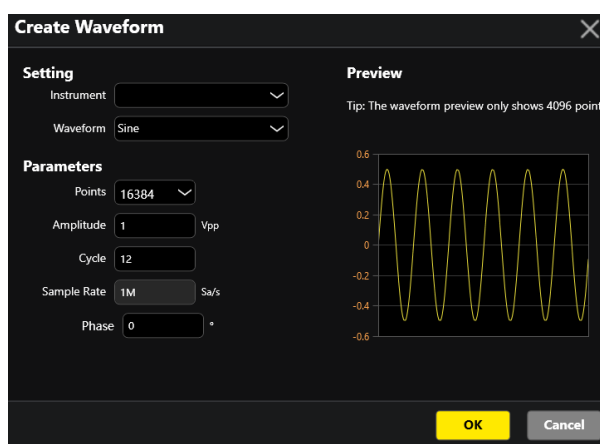


Figure 2.6 Create the Sine Waveform

**Points:** sets the number of waveform points for the Sine waveform. It's an integer, ranging from 8 to max. value (determined by the selected instrument model). Click the drop-down button of **Points** to select the desired points for the Sine waveform of the specified instrument.

**Amplitude:** sets the amplitude of the created Sine waveform. Its range is from 0.02 Vpp to max. value (determined by the selected instrument model), accurate to two decimal places.

**Cycle:** sets the number of cycles for the new Sine waveform. It's an integer, ranging from 1 to (Points/8).

**Sample Rate:** sets the sample rate of the new Sine waveform. It is an integer ranging from 1,000 to max. value (determined by the selected instrument model).

**Phase:** sets the phase of the new Sine waveform. Its range is from 0° to 359.99°, accurate to two decimal places.

## 2.2.2 Square

In the "Create Waveform" interface, select the desired instrument from the drop-down list of **Instrument**, then click the drop-down button of **Waveform** to select **Square**. The Square waveform is displayed in the preview section. You can set the parameters of Square waveform at the left section of the current interface.

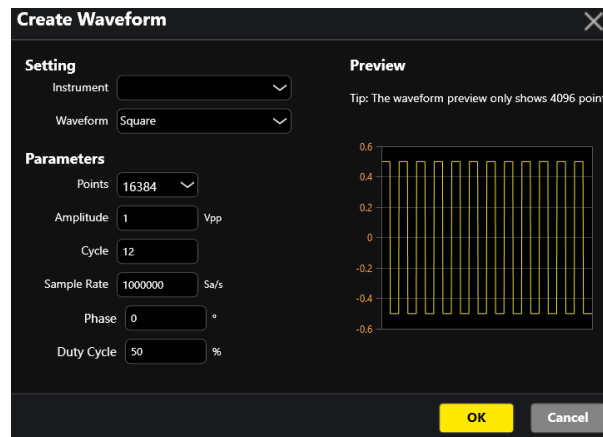


Figure 2.7 Create the Square Waveform

**Points:** sets the number of waveform points for the Square waveform. It's an integer, ranging from 8 to max. value (determined by the selected instrument model). Click the drop-down button of **Points** to select the desired points for the Square waveform of the specified instrument.

**Amplitude:** sets the amplitude for the created Square waveform. Its range is from 0.02 Vpp to max. value (determined by the selected instrument model), accurate to two decimal places.

**Cycle:** sets the number of cycles for the new Square waveform. It's an integer, ranging from 1 to (Points/8).

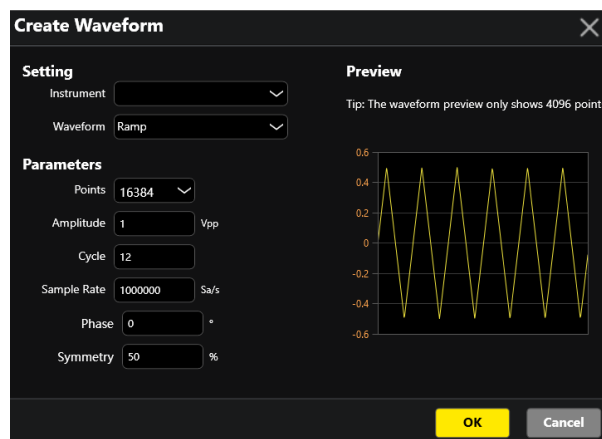
**Sample Rate:** sets the sample rate of the new Square waveform. It is an integer ranging from 1,000 to max. value (determined by the selected instrument model).

**Phase:** sets the phase of the new Square waveform. Its range is from 0° to 359.99°, accurate to two decimal places.

**Duty Cycle:** sets the duty cycle of the new Square waveform. It is defined as the percentage that high level takes up in the whole period. Its range is from 20% to 80%. By default, it is 50%.

## 2.2.3 Ramp

In the "Create Waveform" interface, select the desired instrument from the drop-down list of **Instrument**, then click the drop-down button of **Waveform** to select **Ramp**. The Ramp waveform is displayed in the preview section. You can set the parameters of Ramp waveform at the left section of the current interface.



**Figure 2.8 Create the Ramp Waveform**

**Points:** sets the number of waveform points for the Ramp waveform. It's an integer, ranging from 8 to max. value (determined by the selected instrument model). Click the drop-down button of **Points** to select the desired points for the Ramp waveform of the specified instrument.

**Amplitude:** sets the amplitude of the created Ramp waveform. Its range is from 0.02 Vpp to max. value (determined by the selected instrument model), accurate to two decimal places.

**Cycle:** sets the number of cycles for the new Ramp waveform. It's an integer, ranging from 1 to (Points/8).

**Sample Rate:** sets the sample rate of the new Ramp waveform. It is an integer ranging from 1,000 to max. value (determined by the selected instrument model).

**Phase:** sets the phase of the new Square waveform. Its range is from 0° to 359.99°, accurate to two decimal places.

**Symmetry:** sets the symmetry of the Ramp waveform. It is defined as the percentage that the rising period of the ramp takes up in the whole period. Its range is from 0% to 100%.

## 2.2.4 Noise

In the "Create Waveform" interface, select the desired instrument from the drop-down list of **Instrument**, then click the drop-down button of **Waveform** to select **Noise**. The Noise waveform is displayed in the preview section. You can set the parameters of the Noise waveform at the left section of the current interface.

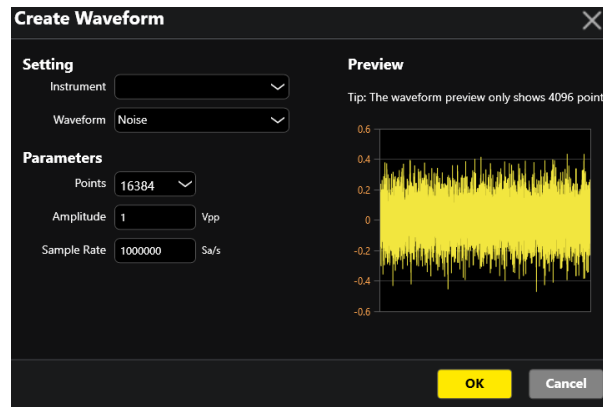


Figure 2.9 Create the Noise Waveform

**Points:** sets the number of waveform points for the Noise waveform. It's an integer, ranging from 8 to max. value (determined by the selected instrument model). Click the drop-down button of **Points** to select the desired points for the Noise waveform of the specified instrument.

**Amplitude:** sets the amplitude of the created Noise waveform. Its range is from 0.02 Vpp to max. value (determined by the selected instrument model), accurate to two decimal places.

**Sample Rate:** sets the sample rate of the Noise waveform. It is an integer ranging from 1,000 to max. value (determined by the selected instrument model).

## 2.2.5 DC

In the "Create Waveform" interface, select the desired instrument from the drop-down list of **Instrument**, then click the drop-down button of **Waveform** to select **DC**. The DC waveform is displayed in the preview section. You can set the parameters of DC waveform at the left section of the current interface.

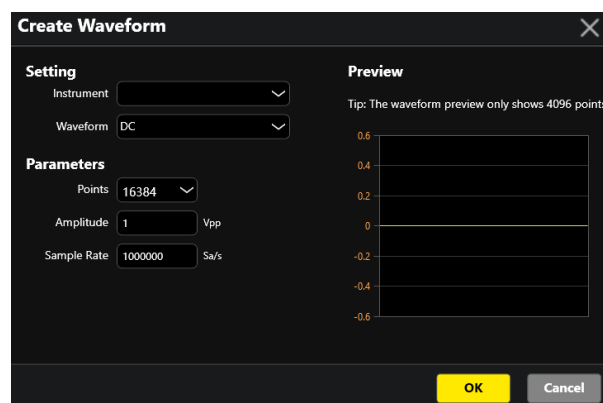


Figure 2.10 Create the DC Waveform

**Points:** sets the number of waveform points for the DC waveform. It's an integer, ranging from 8 to max. value (determined by the selected instrument model). Click

the drop-down button of **Points** to select the desired points for the DC waveform of the specified instrument.

**Amplitude:** sets the amplitude of the created DC waveform. Its range is from 0.02 Vpp to max. value (determined by the selected instrument model), accurate to two decimal places.

**Sample Rate:** sets the sample rate of the DC waveform. It is an integer ranging from 1,000 to max. value (determined by the selected instrument model).

## 2.2.6 RS232

In the "Create Waveform" interface, select the desired instrument from the drop-down list of **Instrument**, then click the drop-down button of **Waveform** to select **RS232**. The RS232 waveform is displayed in the preview section. You can set the parameters of RS232 waveform at the left section of the current interface.

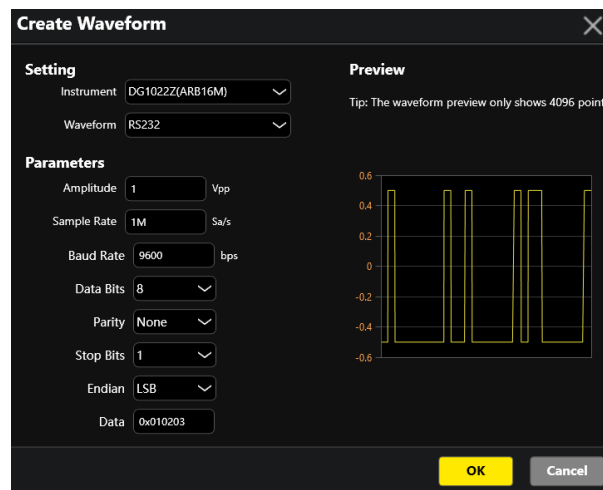


Figure 2.11 Create the RS232 Waveform

**Amplitude:** sets the amplitude of the created RS232 waveform. Its range is from 0.02 Vpp to max. value (determined by the selected instrument model), accurate to two decimal places.

**Sample Rate:** sets the sample rate of the created RS232 waveform. It is an integer ranging from 1,000 to max. value (determined by the selected instrument model).

**Baud Rate:** sets the baud rate of data transmission. It's an integer, ranging from 500 to (sample rate/2).

**Data Bits:** sets the number of data bits transmitted in RS232. It can be set to 5, 6, 7, or 8.

**Parity:** set the parity of RS232 waveform to "Odd", "Even", or "None".

**Stop Bits:** sets the stop bits of RS232 waveform. It can be set to 1, 1.5, or 2.

**Endian:** sets the transmission sequence of RS232 waveform. It can be set to "LSB" and "MSB". LSB (Least Significant Bit) indicates that the lowest bit of data is transmitted first; MSB (Most Significant Bit) indicates that the highest bit of data is transmitted first.

**Data:** sets the data of the RS232 waveform. It is in Hex format, with "0x" being added ahead of the Hex format.

## 2.2.7 Multi-Pulse

In the "Create Waveform" interface, click the drop-down button of **Waveform** to select **Multi-Pulse**. The Multi-Pulse waveform is displayed in the preview section. You can set the parameters of Multi-Pulse waveforms at the left section of the current interface.

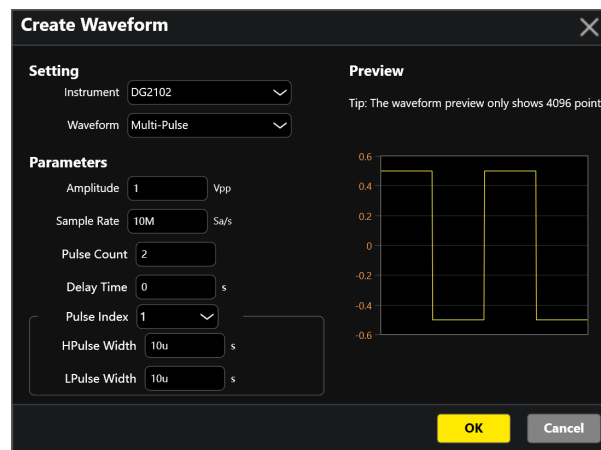


Figure 2.12 Create the Multi-Pulse Waveform

**Amplitude:** sets the amplitude of the new waveform. Its range is from 0.02 to max. amplitude (determined by the selected instrument model), accurate to two decimal places.

**Sample Rate:** sets the sample rate of the new multi-pulse waveform. Its range is from 1,000 to max. sample rate (determined by the selected instrument model).

**Pulse Count:** indicates the number of the pulses contained for the new multi-pulse waveforms. It's an integer, ranging from 2 to 30.

**Delay Time:** indicates the time interval between the pulses. It ranges from 0 to 1 s, accurate to 9 decimal places.

**Pulse Index:** specifies the pulse number. You can select the specified pulse for the parameter setting.

**HPulse Width:** indicates the high-level pulse width. When a specified pulse number is selected, set it for the specified pulse. The min. value is 1/sample rate (expressed in s). The sum of the HPulse width and LPulse width of all the pulses shall not be greater than (max. waveform points/sample rate (expressed in s)), accurate to 9 decimal

places. The max. number of the waveform points is determined by the currently selected instrument model.

**LPulse Width:** indicates the low-level pulse width. When a specified pulse number is selected, set it for the specified pulse. The min. value is 1/sample rate (expressed in s). The sum of the HPulse width and LPulse width of all the pulses shall not be greater than (max. waveform points/sample rate (expressed in s)), accurate to 9 decimal places. The max. number of the waveform points is determined by the currently selected instrument model.

## 2.2.8 Multi-Tone

In the "Create Waveform" interface, click the drop-down button of **Waveform** to select **Multi-Tone**. The multi-tone waveform is displayed in the preview section. You can set the parameters of multi-tone waveform at the left section of the current interface.

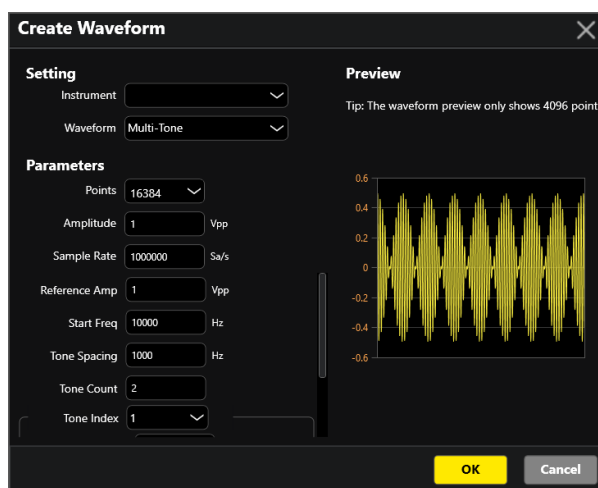


Figure 2.13 Create the Multi-Tone Waveform

**Points:** sets the number of waveform points of the new multi-tone waveform. It is an integer, ranging from 8 to max. points (determined by the selected instrument model).

**Amplitude:** sets the amplitude of the new multi-tone waveform. Its range is from 0.02 to max. amplitude (determined by the selected instrument model), accurate to two decimal places.

**Sample Rate:** sets the sample rate of the new multi-tone waveform. Its range is from 1,000 to max. sample rate (determined by the selected instrument model).

**Reference Amp:** indicates the amplitude of each sine waveform of the multi-tone waveform.

**Start Freq:** indicates the start frequency of the new multi-tone waveform. Its range is from 400 to  $<(\text{sample rate}/2.5)$ , accurate to 6 decimal places.

**Tone Spacing:** indicates the spacing between the adjacent frequencies of the new multi-tone signal. Its range is from 1,000 to 50 M.

**Tone Count:** indicates the number of the tones. It's an integer, ranging from 1 to 30.

**Tone Index:** specifies the tone number. You can select the specified tone for the parameter setting.

**Gain:** specifies the magnification times for the selected tone. Its range is from 0 to -20 dB.

**Phase:** indicates the start phase (start point of the waveform) of the selected tone. The default unit is degree (°). Its range is from 0° to 359.99°, accurate to two decimal places.

**Status:** sets the status of the selected tone. 0 indicates that the selected tone is invalid; 1 indicates that the selected tone is valid.



## 2.3 To Edit the Waveform

Ultra Station allows you to cut, copy, paste, delete, mirror, invert, insert, and overwrite waveforms. It supports point, free, and line drawing of waveforms.

### 2.3.1 Cursor

#### Cursor Position



Click on  to activate Cursor 1 (X1, in blue); click on  to activate Cursor 2 (X2, in green). When the cursor is selected, the selected cursor turns out to be a solid line whereas the not selected one becomes a dotted line. Select the cursor and drag it to any position.

The waveforms specified by Cursor 1 (X1) and Cursor 2 (X2) are the current existing waveforms. When you insert a specified type of waveforms, the waveforms will be inserted between the two cursors and the original waveforms will be moved towards right in sequence.

### 2.3.2 Edit Mode



Ultra Station provides two waveform editing modes: Insert  and Overwrite





**Insert:** inserts the specified types of waveforms into the range specified by X1 and X2. The original waveforms will be moved towards right horizontally. The new waveforms to be inserted will start from X1 or X2 whichever is smaller.

**Overwrite:** overwrites the original waveforms specified by X1 and X2 with the specified types of waveforms you set. The new waveforms to overwrite the original ones will start from X1 or X2 whichever is smaller.

### 2.3.3 Wave Edit

Click **Edit**, and the sub-menus are displayed. Refer to *File Management* to open the waveforms to be edited.

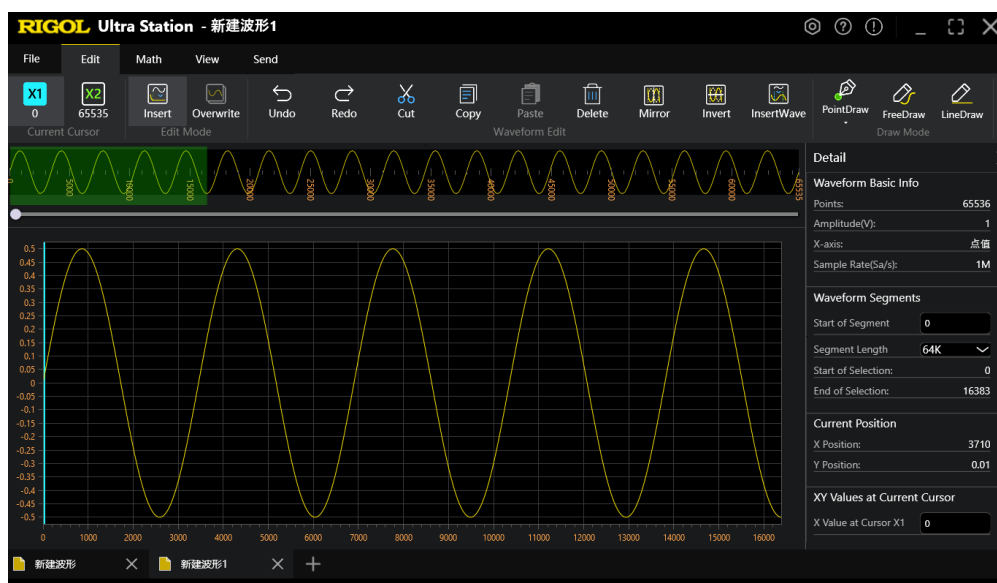









Figure 2.14 Waveform Editing Interface

#### Copy and Paste the Waveform



1. Click on  to enter the waveform insertion mode. Click on  to enter the waveform overwriting mode.
2. Move the current cursor  and  to specify the range of the selected waveform to be copied.
3. Click on  to copy the specified segment of the waveform.



4. Move the cursor  or  to specify the desired position where you want to


 paste the waveform. Click on  to paste the copied specified waveform to this position. The copied waveform will be pasted to the location specified by X1 and X2 in Insert edit mode. The original waveform in the range specified by X1 and X2 will be moved towards right. In Overwrite edit mode, the copied waveform will be pasted to overwrite the original waveform located between X1 and X2.



5. After completing the operation, click **File > Save** (or **Save As**) to save the current operation and save it to a desired location as a file.



### Cut and Paste the Waveform

1. Click on  to enter the waveform insertion mode. Click on  to enter the waveform overwriting mode.

2. Move the current cursor  and  to specify the range of the selected waveform to be cut.



3. Click on  to cut the selected waveform segment.

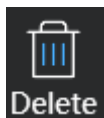
4. Move the current cursor  and  to the desired position where you want

 to paste the waveform. Click on  to paste the specified waveform to this position. The cut waveform will be pasted to the location specified by X1 and X2 in Insert edit mode. The original waveform in the range specified by X1 and X2 will be moved towards right. In Overwrite edit mode, the cut waveform will be pasted to overwrite the original waveform located between X1 and X2.

5. After completing the operation, click **File** > **Save** (or **Save As**) to save the current operation and save it to a desired location as a file.



### Delete the Waveform

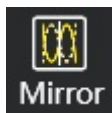
1. Move the current cursor  and  to specify the range of the waveform to be deleted.



2. Click on **Delete** to delete the specified segment of the waveform.
3. After completing the operation, click **File** > **Save** (or **Save As**) to save the current operation and save it to a desired location as a file.



### Mirror the Waveform

1. Move the current cursor  and  to specify the range of the selected waveform to be mirrored.



2. Click on **Mirror** to mirror the specified segment of the waveform. The selected waveform will make a symmetry along the center of the vertical axis.
3. After completing the operation, click **File** > **Save** (or **Save As**) to save the current operation and save it to a desired location as a file.

### Invert the Waveform

1. Move the current cursor  and  to specify the range of the selected waveform to be inverted.



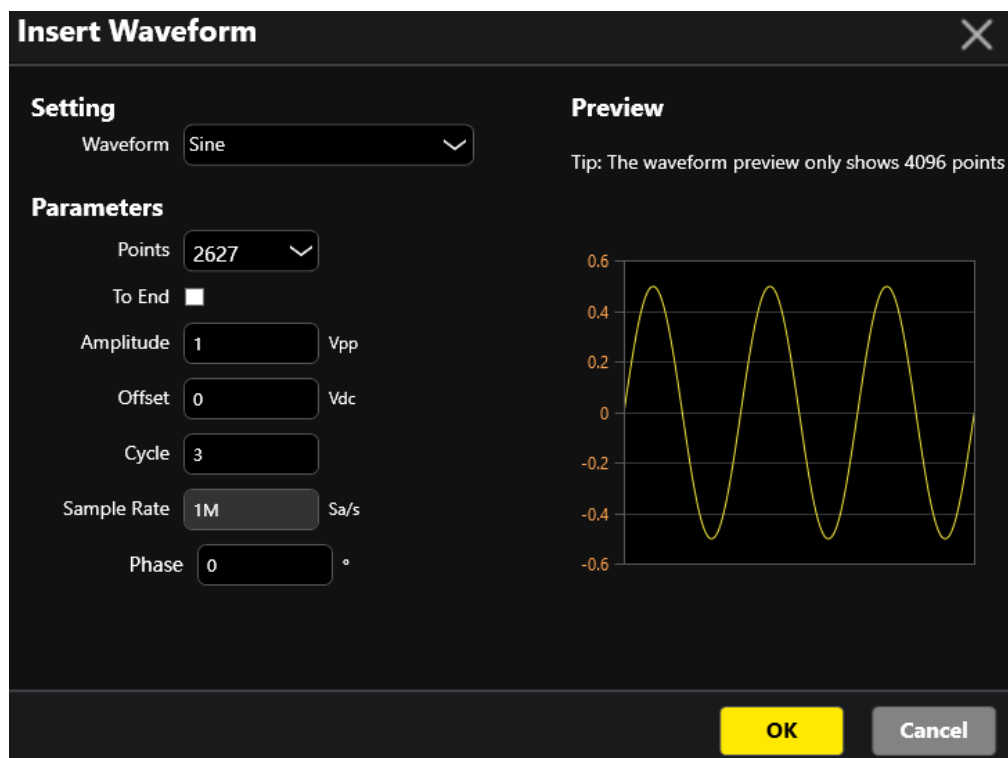
2. Click on **Invert** to invert the specified segment of the waveform. The selected waveform will be inverted along the center of the horizontal axis.

3. After completing the operation, click **File** > **Save** (or **Save As**) to save the current operation and save it to a desired location as a file.

### Insert the Waveform



1. In *Figure 2.14*, click on **Insert** > **InsertWave** to insert the desired waveform into the range specified by X1 and X2.



**Figure 2.15 "Insert Waveform" Interface**

2. **Waveform:** selects the desired waveform to be inserted from the drop-down list of **Waveform**.
3. **Parameters:** sets the parameters of the inserted waveform. The available waveforms to be inserted include the following. Click on the specified topic below to learn more about parameter settings for the specified waveform type.
  - *To Insert the Sine Waveform*
  - *To Insert the Square Waveform*
  - *To Insert the Ramp Waveform*

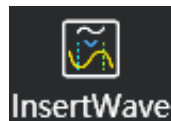
- *To Insert the Noise Waveform*
- *To Insert the DC Signal Waveform*
- *To Insert the RS232 Waveform*
- *To Insert the Multi-Pulse Waveform*
- *To Insert the Multi-Tone Waveform*

**4. Preview:** displays the preview of waveforms to be inserted.

**5.** After completing the settings, click **OK**, and the waveform is inserted. The original waveform between X1 and X2 will be moved towards right in sequence.

**6.** After completing the operation, click **File > Save** (or **Save As**) to save the current operation and save it to a desired location as a file.

#### Overwrite the Waveform



**1.** In *Figure 2.14*, click on **Overwrite** > **InsertWave** to insert the desired waveform into the range specified by X1 and X2 to overwrite the original waveform, as shown in *Figure 2.15*.

**2. Waveform:** selects the desired waveform to overwrite the original waveform from the drop-down list of **Waveform**.

**3. Parameters:** sets the parameters of the inserted waveform.

For detailed parameter settings, refer to relevant descriptions in "**Insert the Waveform**" section above.

**4. Preview:** displays the preview of waveforms to be inserted to overwrite the original waveform.

**5.** After completing the settings, click **OK**, then the original waveform specified between X1 and X2 is overwritten by the inserted waveform.

**6.** After completing the operation, click **File > Save** (or **Save As**) to save the current operation and save it to a desired location.

## Redo and Undo Operation



Click on **Undo** to undo the last operations. At most, last five operations can be undone.

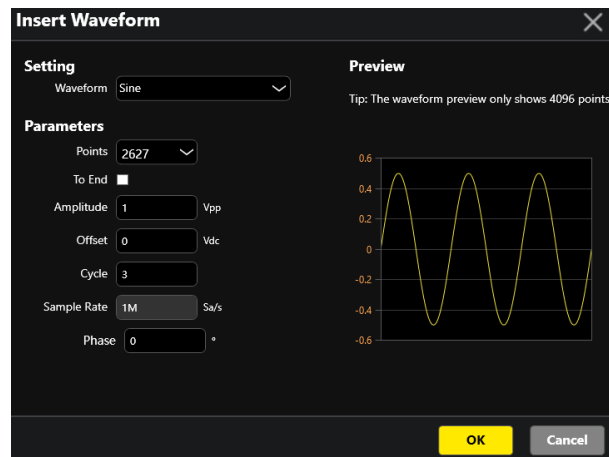


Click on **Redo** to redo the last undo operations. At most, last five undo operations can be recovered.

### 2.3.3.1

#### To Insert the Sine Waveform

In the "Insert Waveform" interface, click the drop-down button of **Waveform** to select **Sine**. The Sine waveform is displayed in the preview section. You can set the parameters of Sine waveform at the left section of the current interface.



**Figure 2.16 Insert the Sine Waveform**

**Points:** sets the number of waveform points for the inserted Sine waveform. The range is from 1 to the max. number of the original existing waveform points.

**To End:** When you check the checkbox of "To End", the input field of **Points** is automatically filled with the max. number of waveform points of the original existing waveform.

**Amplitude:** sets the amplitude of the inserted Sine waveform. Its range is from 0.02 Vpp to the amplitude of the original existing waveform, no more than two decimal places.

**Offset:** sets the DC offset for the inserted Sine waveform. Its range is related to the amplitude setting of the inserted waveform and the amplitude of the original existing waveform. Its value ranges from  $-(\text{amplitude of the original existing waveform} - \text{currently set amplitude of the inserted waveform})/2$  to  $+(\text{amplitude of the original existing waveform} - \text{currently set amplitude of the inserted waveform})/2$ .

the original existing waveform - currently set amplitude of the inserted waveform)/2, no more than two decimal places.

**Cycle:** sets the number of cycles for the inserted Sine waveform. It's an integer, ranging from 1 to (Points/8).

**Sample Rate:** same as the sample rate of the original existing waveform and cannot be modified.

**Phase:** sets the phase of the inserted Sine waveform. Its range is from 0° to 359.99°, accurate to two decimal places.

### 2.3.3.2

#### To Insert the Square Waveform

In the "Insert Waveform" interface, click the drop-down button of **Waveform** to select **Square**. The Square waveform to be inserted is displayed in the preview section. You can set the parameters of Square waveform at the left section of the current interface.

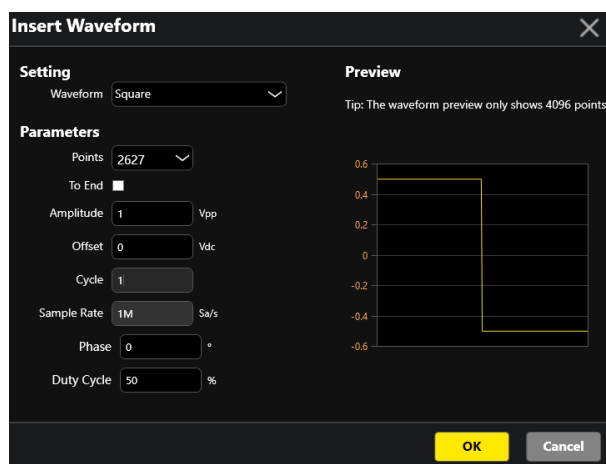


Figure 2.17 Insert the Square Waveform

**Points:** sets the number of waveform points for the inserted Square waveform. The range is from 1 to the max. number of the original existing waveform points.

**To End:** When you check the checkbox of "To End", the input field of **Points** is automatically filled with the max. number of waveform points of the original existing waveform.

**Amplitude:** sets the amplitude of the inserted Square waveform. Its range is from 0.02 Vpp to the amplitude of the original existing waveform, no more than two decimal places.

**Offset:** sets the DC offset for the inserted Square waveform. Its range is related to the amplitude setting of the inserted waveform and the amplitude of the original existing waveform. Its value ranges from -(amplitude of the original existing waveform - currently set amplitude of the inserted waveform)/2 to +(amplitude of

the original existing waveform - currently set amplitude of the inserted waveform)/2, no more than two decimal places.

**Cycle:** sets the number of cycles for the inserted Square waveform. It's an integer, ranging from 1 to (Points/8).

**Sample Rate:** same as the sample rate of the original existing waveform and cannot be modified.

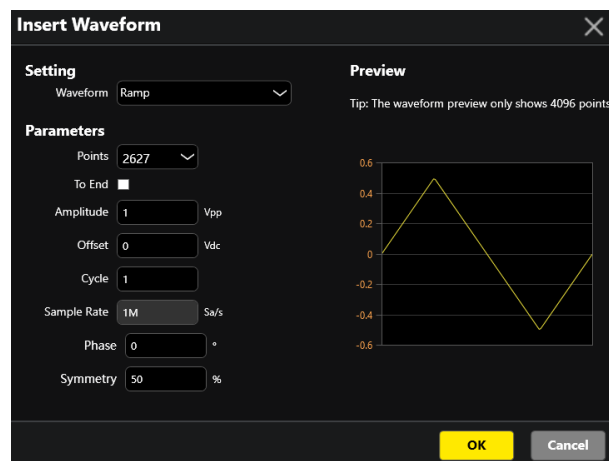
**Phase:** sets the phase of the inserted Square waveform. Its range is from 0° to 359.99°, accurate to two decimal places.

**Duty Cycle:** sets the duty cycle of the inserted Square waveform. It is defined as the percentage that high level takes up in the whole period. Its range is from 20% to 80%. By default, it is 50%.

### 2.3.3.3

#### To Insert the Ramp Waveform

In the "Insert Waveform" interface, click the drop-down button of **Waveform** to select **Ramp**. The Ramp waveform is displayed in the preview section. You can set the parameters of Ramp waveform at the left section of the current interface.



**Figure 2.18 Insert the Ramp Waveform**

**Points:** sets the number of waveform points for the inserted Ramp waveform. The range is from 1 to the max. number of the original existing waveform points.

**To End:** When you check the checkbox of "To End", the input field of **Points** is automatically filled with the max. number of waveform points of the original existing waveform.

**Amplitude:** sets the amplitude of the inserted Ramp waveform. Its range is from 0.02 Vpp to the amplitude of the original existing waveform.

**Offset:** sets the DC offset for the inserted Ramp waveform. Its range is related to the amplitude setting of the inserted waveform and the amplitude of the original existing waveform. Its value ranges from -(amplitude of the original existing



waveform - currently set amplitude of the inserted waveform)/2 to +(amplitude of the original existing waveform - currently set amplitude of the inserted waveform)/2.

**Cycle:** sets the number of cycles for the inserted Ramp waveform. It's an integer, ranging from 1 to (Points/8).

**Sample Rate:** same as the sample rate of the original existing waveform and cannot be modified.

**Phase:** sets the phase of the inserted Ramp waveform. Its range is from 0° to 359.99°, accurate to two decimal places.

**Symmetry:** sets the symmetry of the inserted Ramp waveform. It is defined as the percentage that the rising period of the ramp takes up in the whole period. Its range is from 0% to 100%.

#### 2.3.3.4 To Insert the Noise Waveform

In the "Insert Waveform" interface, click the drop-down button of **Waveform** to select **Noise**. The Noise waveform is displayed in the preview section. You can set the parameters of the Noise waveform at the left section of the current interface.

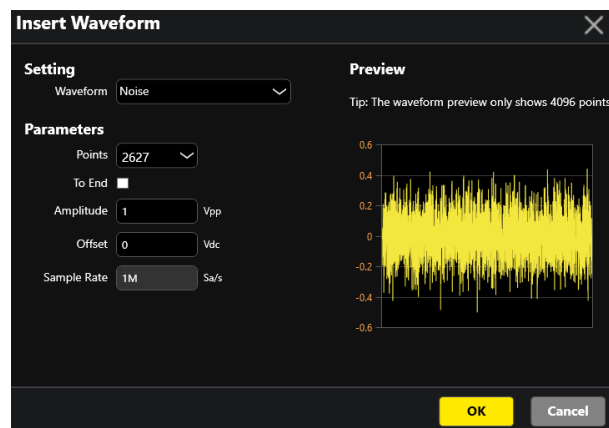


Figure 2.19 Insert the Noise Waveform

**Points:** sets the number of waveform points for the inserted Noise waveform. The range is from 1 to the max. number of the original existing waveform points.

**To End:** When you check the checkbox of "To End", the input field of **Points** is automatically filled with the max. number of waveform points of the original existing waveform.

**Amplitude:** sets the amplitude of the inserted Noise waveform. Its range is from 0.02 Vpp to the amplitude of the original existing waveform.

**Offset:** sets the DC offset for the inserted Noise waveform. Its range is related to the amplitude setting of the inserted waveform and the amplitude of the original existing waveform. Its value ranges from -(amplitude of the original existing

waveform - currently set amplitude of the inserted waveform)/2 to +(amplitude of the original existing waveform - currently set amplitude of the inserted waveform)/2.

**Sample Rate:** same as the sample rate of the original existing waveform and cannot be modified.

### 2.3.3.5 To Insert the DC Signal Waveform

In the "Insert Waveform" interface, click the drop-down button of **Waveform** to select **DC**. The DC signal waveform is displayed in the preview section. You can set the parameters of DC signal waveform at the left section of the current interface.

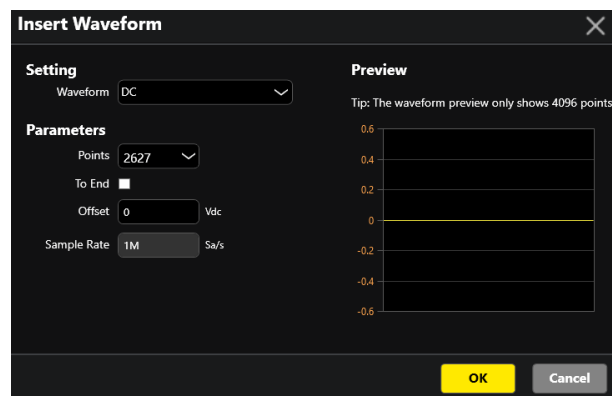


Figure 2.20 Insert the DC Signal Waveform

**Points:** sets the number of waveform points for the inserted DC waveform. The range is from 1 to the max. number of the original existing waveform points.

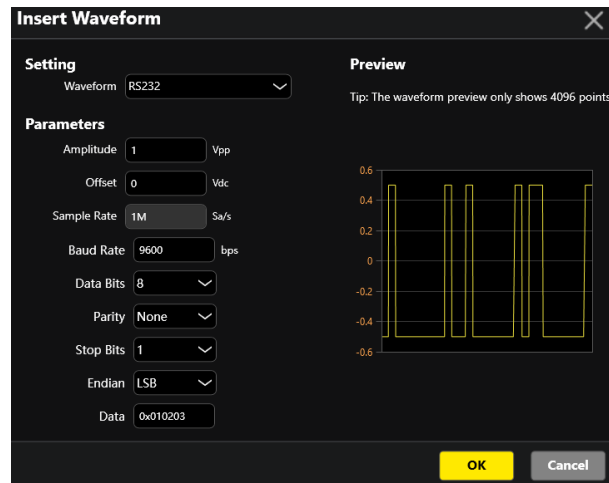
**To End:** When you check the checkbox of "To End", the input field of **Points** is automatically filled with the max. number of points of the original existing waveform.

**Offset:** sets the DC offset for the inserted DC signal waveform. Its range is related to the amplitude setting of the inserted waveform and the amplitude of the original existing waveform. Its value ranges from -(amplitude of the original existing waveform - currently set amplitude of the inserted waveform)/2 to +(amplitude of the original existing waveform - currently set amplitude of the inserted waveform)/2.

**Sample Rate:** same as the sample rate of the original existing waveform and cannot be modified.

### 2.3.3.6 To Insert the RS232 Waveform

In the "Insert Waveform" interface, click the drop-down button of **Waveform** to select **RS232**. The RS232 waveform is displayed in the preview section. You can set the parameters of RS232 waveform at the left section of the current interface.



**Figure 2.21 Insert the RS232 Waveform**

**Amplitude:** sets the amplitude of the inserted RS232 waveform. Its range is from 0.02 Vpp to the amplitude of the original existing waveform.

**Offset:** sets the DC offset for the inserted RS232 waveform. Its range is related to the amplitude setting of the inserted waveform and the amplitude of the original existing waveform. Its value ranges from  $-(\text{amplitude of the original existing waveform} - \text{currently set amplitude of the inserted waveform})/2$  to  $+(\text{amplitude of the original existing waveform} - \text{currently set amplitude of the inserted waveform})/2$ .

**Sample Rate:** same as the sample rate of the original existing waveform and cannot be modified.

**Baud Rate:** sets the baud rate of data transmission.

**Data Bits:** sets the number of data bits transmitted in RS232. It can be set to 5, 6, 7, or 8.

**Parity:** sets the parity of RS232 waveform to "Odd", "Even", or "None".

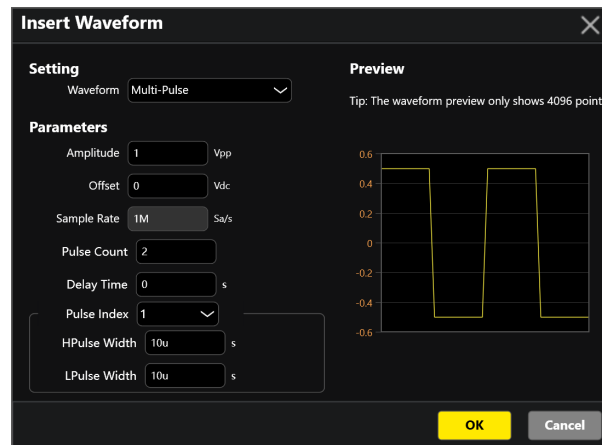
**Stop Bits:** sets the stop bits of RS232 waveform. It can be set to 1, 1.5, or 2.

**Endian:** sets the transmission sequence of RS232 waveform. It can be set to "LSB" and "MSB". LSB (Least Significant Bit) indicates that the lowest bit of data is transmitted first; MSB (Most Significant Bit) indicates that the highest bit of data is transmitted first.

**Data:** sets the data of RS232 waveform.

### 2.3.3.7 To Insert the Multi-Pulse Waveform

In the "Insert Waveform" interface, click the drop-down button of **Waveform** to select **Multi-Pulse**. The Multi-Pulse waveform is displayed in the preview section. You can set the parameters of Multi-Pulse waveforms at the left section of the current interface.



**Figure 2.22 Insert the Multi-Pulse Waveform**

**Amplitude:** sets the amplitude of the multi-pulse waveform. Its range is from 0.02 Vpp to the amplitude of the current existing waveform.

**Offset:** sets the offset for the inserted multi-pulse waveform. Its range is related to the amplitude setting of the inserted waveform and the amplitude of the original existing waveform. Its value ranges from  $-(\text{amplitude of the original existing waveform} - \text{currently set amplitude of the inserted waveform})/2$  to  $+(\text{amplitude of the original existing waveform} - \text{currently set amplitude of the inserted waveform})/2$ .

**Sample Rate:** same as the sample rate of the original waveform and cannot be modified.

**Pulse Count:** indicates the number of the pulses. It's an integer, ranging from 2 to 30.

**Delay Time:** indicates the time interval between the pulses. It ranges from 0 to 1 s, accurate to 9 decimal places.

**Pulse Index:** specifies the pulse number. You can select the specified pulse for the parameter setting.

**HPulse Width:** indicates the high-level pulse width. When a specified pulse number is selected, set it for the specified pulse. The min. value is  $1/\text{sample rate}$  (expressed in s). The sum of the HPulse width and LPulse width of all the pulses shall not be greater than  $(\text{max. waveform points}/\text{sample rate (expressed in s)})$ , accurate to 9 decimal places.

**LPulse Width:** indicates the low-level pulse width. When a specified pulse number is selected, set it for the specified pulse. The min. value is  $1/\text{sample rate}$  (expressed in s). The sum of the HPulse width and LPulse width of all the pulses shall not be greater than  $(\text{max. waveform points}/\text{sample rate (expressed in s)})$ , accurate to 9 decimal places.

### 2.3.3.8 To Insert the Multi-Tone Waveform

In the "Insert Waveform" interface, click the drop-down button of **Waveform** to select **Multi-Tone**. The multi-tone waveform is displayed in the preview section. You can set the parameters of multi-tone waveform at the left section of the current interface.

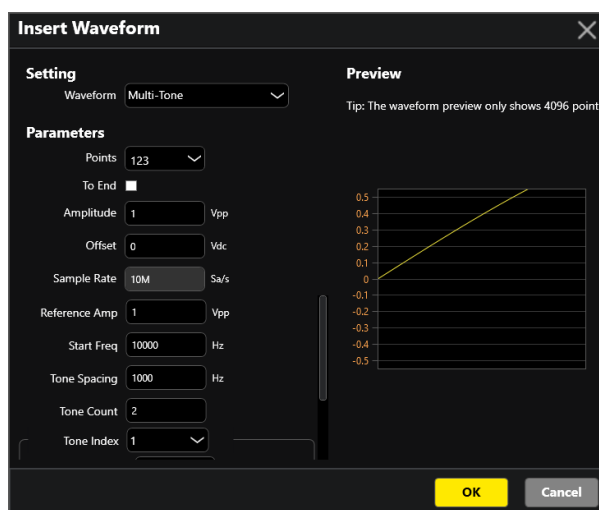


Figure 2.23 Insert the Multi-Tone Waveform

**Points:** sets the number of waveform points for the inserted multi-tone waveform. The range is from 1 to the max. number of the original existing waveform points.

**To End:** When you check the checkbox of "To End", the input field of **Points** is automatically filled with the max. number of waveform points of the original existing waveform.

**Amplitude:** sets the amplitude of the inserted multi-tone waveform. Its range is from 0.02 Vpp to the amplitude set for the current existing waveform.

**Offset:** sets the offset for the inserted multi-tone waveform. Its range is related to the amplitude setting of the inserted waveform and the amplitude of the original existing waveform. Its value ranges from  $-(\text{amplitude of the original existing waveform} - \text{currently set amplitude of the inserted waveform})/2$  to  $+(\text{amplitude of the original existing waveform} - \text{currently set amplitude of the inserted waveform})/2$ .

**Sample Rate:** same as the sample rate of the original waveform and cannot be modified.

**Reference Amp:** indicates the amplitude of each sine waveform of the inserted multi-tone waveform.

**Start Freq:** Indicates the start frequency of the inserted multi-tone waveform. Its range is from 100 to  $<(\text{sample rate}/2)$ .

**Tone Spacing:** Indicates the spacing between the adjacent frequencies of the inserted multi-tone signal. Its range is from 1,000 to (stop frequency - start frequency)/(tone count). Wherein, max. stop frequency = sample rate/2.

**Tone Count:** indicates the number of the tones. It's an integer, ranging from 1 to 30.

**Tone Index:** specifies the tone number. You can select the specified tone for the parameter setting.

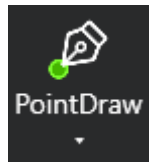
**Gain:** specifies the magnification times for the selected tone. Its range is from 0 to -20 dB.

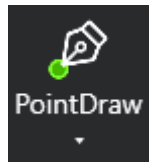
**Phase:** indicates the start phase (start point of the waveform) of the selected tone. The default unit is degree (°). Its range is from 0° to 359.99°, accurate to two decimal places.

**Status:** sets the status of the selected tone. 0 indicates that the selected tone is invalid; 1 indicates that the selected tone is valid.

## 2.3.4 Waveform Drawing Mode

### Point Drawing



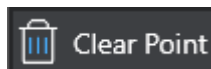
1. In *Figure 2.14*, click on  to start point drawing.
2. In the waveform editing area, click any place to leave points one by one, and the points will be connected together with the existing waveform to form the new waveform shape.

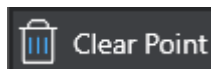
All the added points can be seen as green dots in the waveform editing area.



#### NOTE


The two adjacent points refer to the two points whose X-axis coordinate values are the closest.



3. Click on  to clear all the green dots that you have drawn.

### Free Drawing



1. In *Figure 2.14*, click on  to start free drawing.
2. Click any place of the waveform editing area and long press the left key of the mouse to drag the existing waveform to perform waveform drawing. Drag to any

place to make a free drawing. The new drawn segment will be linked with the existing waveform.

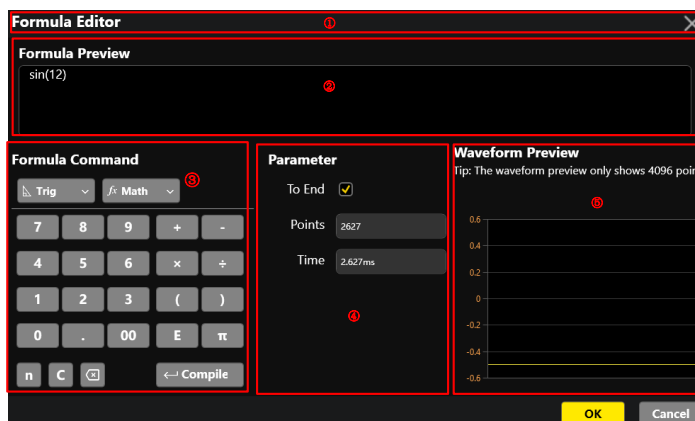
### Line Drawing



1. In *Figure 2.14*, click on **LineDraw** to start line drawing.
2. Click any place of the waveform editing area, and the line is drawn. The original waveform will be connected with the line you drawn to form a new waveform shape.

## 2.4 Waveform Calculation

In *Figure 1.1*, click **Math**, and the sub-menus of the math setting are displayed under the **Math** menu. Click **FormulaEdit**, and then the Formula Editor interface is displayed.



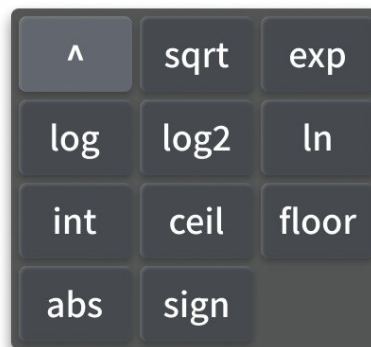
**Figure 2.24 Formula Editor Interface**

- ①: displays the interface name and the close button.
- ②: previews the formula you are editing or have edited.
- ③: displays the formula command. You can select the desired formula and input the number, operator, and function required for the formula. If you click 00, two zeros will be input.



**Figure 2.25 Trigonometric/Antitrigonometric/Hyperbolic Functions**

- **sin:** Sine function.
- **cos:** Cosine function.
- **tan:** Tangent function. It is abbreviated as tan or tg.
- **csc:** Cosecant function. It is abbreviated as csc or cosec.
- **sec:** Secant function.
- **cot:** Cotangent function. It is abbreviated as cot or ctg.
- **asin:** Arc sine function.
- **acos:** Arc cosine function.
- **atan:** Arc tangent function.
- **sinh:** Hyperbolic sine function.
- **cosh:** Hyperbolic cosine function.
- **tanh:** Hyperbolic tangent function.



**Figure 2.26 Math Function**



- **^**: Power function. For example,  $n^3$  indicates the 3rd power of  $n$ .
- **sqrt**: Square root.
- **exp**: Base-e exponential function.
- **log**: Base-10 logarithm function.
- **log2**: Base-2 logarithm function.
- **ln**: Base-e logarithm function.
- **int**: Rounds a number down to the nearest integer. For example, the formula `int(x)` rounds the number  $X$  down to the nearest integer.
- **ceil**: Rounds up to the nearest integer. The formula `ceil(x)` generates the smallest integral value that is greater than or equal to the specified decimal number.
- **floor**: Rounds down to the nearest integer. The formula `floor(x)` generates the largest integral value that is equal to or smaller than the specified decimal number.
- **abs**: Absolute value.
- **sign**: Sign function. The formula `sign(x)` returns a number that indicates the sign of  $x$ . When  $x > 0$ , `sign(x) = 1`; when  $x < 0$ , `sign(x) = -1`; when  $x = 0$ , `sign(x) = 0`.

After setting the formula, click **Compile** to generate the calculation results.

- ④: parameter setting area. You can set the waveform points, time, etc.
  - **Points**: sets the number of waveform points specified between  $X1$  and  $X2$  for the waveform operation. The range is from 0 to the number of waveform points specified between  $X1$  and  $X2$ .
  - **To End**: When you check the checkbox of "To End", the input field of **Points** is automatically filled with the max. number of waveform points specified between  $X1$  and  $X2$ .

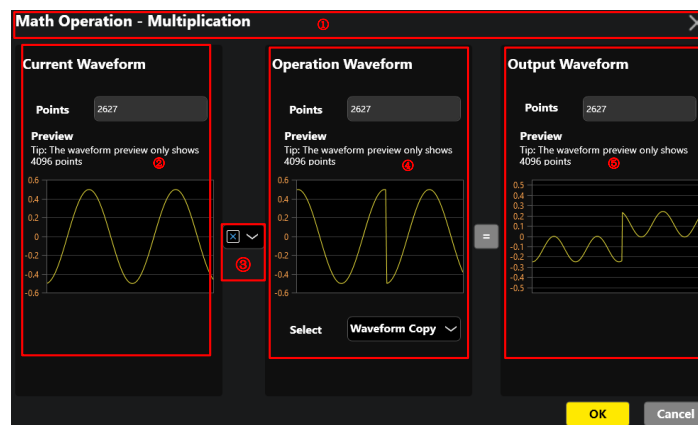
- **Time:** displays the X-axis value of the waveforms when the X-axis of the waveform is set to Time. It changes along with the value of **Points** automatically and cannot be set manually.
- ⑤: waveform preview area. In the formula command area, after setting the formula, click **Compile** to compile the formula. Then set the parameter. After that, you can preview the waveforms in the waveform preview area.

Click **OK** to confirm the settings.

### Multiply/Add/Subtract

In *Figure 1.1*, click **Math**, and the sub-menus of the math operation are displayed under the **Math** menu. Click on the specified math operator icon to enter the corresponding math operation interface.

The following section takes multiplication operation interface as an example to illustrate the function of each part.



**Figure 2.27 Multiplication Operation**

The following section takes multiplication operation interface as an example to illustrate the function of each part.

- ①: displays the interface name and the close button.
- ②: displays the current waveform setting and waveform preview.
- ③: displays the current operation type. Click the drop-down button of the operation type to select the desired type.

- ④: displays the operation waveform setting and waveform preview. You can select the desired waveform from the drop-down list of **Select** as the operation waveform.
- ⑤: displays the output waveform setting and preview of the waveforms that have undergone the specified math operation.


After setting, click **OK** to confirm the calculation. The calculated waveforms are output on the interface.

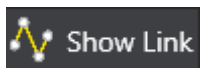
## 2.5 Waveform View

In *Figure 1.1*, click **View**, and the sub-menus of the view setting are displayed under the **View** menu.

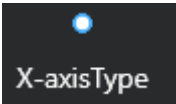




Figure 2.28 Waveform View Setting Interface

Click on  to select whether to show or hide the waveform line. Click on

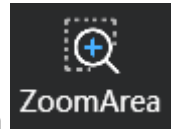


to show the line; click on  to hide the line.

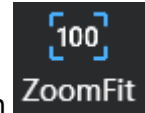
Click on  to set the type of the X-axis. When  is selected, X-axis represents the number of points. When  is selected, X-axis represents time.



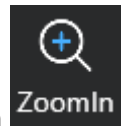
Click on **Grids** to select whether to show or hide the grids. When **Show** is selected, the grids are shown in the background. When **Hide** is selected, the grids are hidden.



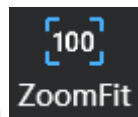
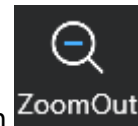
Click on **ZoomArea** and hold on to the left key of the mouse to drag the mouse



cursor to select the specified waveform area to be enlarged. Click on **ZoomFit** to restore the selected waveform to its original size.



Click on **ZoomIn** to zoom in the waveforms. Click on **ZoomOut** to restore its last



zoom operation. Click on **ZoomFit** to restore it to its original size. You can also roll the mouse wheel to zoom in or out the selected waveform.

## 2.6 To Send the Waveform

In *Figure 1.1*, click **Send**, and the sub-menu of the **Send** menu is displayed. Click



, and the "Send Waveform Data" interface is displayed.

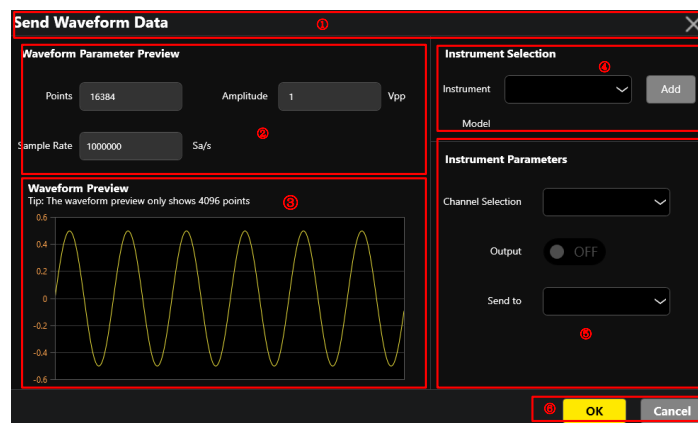


Figure 2.29 "Send Waveform Data" Interface

- ①: displays the interface name and the close button.
- ②: displays the current waveform parameter settings.
- ③: displays the waveform preview.
- ④: instrument selection area.

Click **Add** to enter the Add Instrument interface. You can add the LAN instrument.

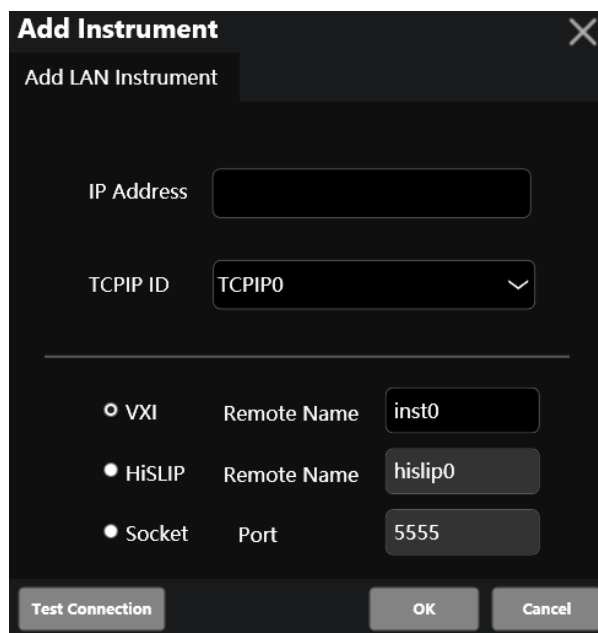


Figure 2.30 Add LAN Instrument

- **IP Address:** inputs the IP address of the instrument manually to which the waveform data are sent.
- **TCPIP ID:** selects the TCPIP ID.
- **Communication Protocol:** selects one of the three communication protocols: VXI, HiSLIP, and Socket. When you select "VXI" or "HiSLIP", you need to set **Remote Name**. When you select "Socket", you need to set the port number.
- After setting, click **Test Connection** to check whether the instrument is successfully connected. If yes, click **OK**, then the instrument is added to the LAN instrument resource list. If no, please check whether the IP address of the instrument that you input is correct.

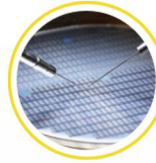
- ⑤: instrument parameter area. It displays the selected channel, enables or disables the output, the location where the waveform data are sent to.
- ⑥: operation confirmation area. After completing the settings, click **OK** to confirm the setting operation. Click **Cancel** to cancel the setting operation.

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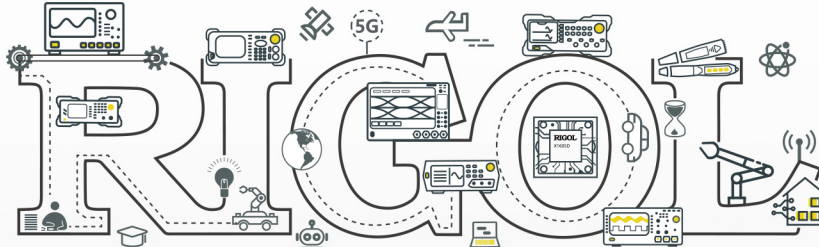
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