

SDS7000A Series Digital Storage Oscilloscope



Quick Start
EN01A



SIGLENT TECHNOLOGIES CO.,LTD

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General Safety Summary

Carefully read the following safety precautions to avoid any personal injury or damage to the instrument and any products connected to it. To avoid potential hazards, please use the instrument as specified.

Use the Proper Power Cord

Only the power cord designed for the instrument and authorized by local government regulations should be used.

Ground the Instrument

The instrument is grounded through the protective earth conductor of the power cord. To avoid electric shock, please make certain the instrument is grounded correctly before connecting its input or output terminals.

Connect the Signal Cable Correctly

The potential of the signal cable ground is equal to the earth ground. Do not connect the signal wire to a high voltage.

Look Over All Terminal Ratings

To avoid fire or electric shock, please look over all ratings and sign instructions of the instrument. Before connecting the instrument, please read the manual carefully to gain more information about the ratings.

Use Proper Overvoltage Protection

Make sure that no overvoltage (such as that caused by a thunderstorm) can reach the product, or else the operator might be exposed to the danger of electrical shock.

Electrostatic Prevention

Operate in an electrostatic-protected area environment to avoid damages induced by static discharge. Always ground both the internal and external conductors of the cable to release a static charge before connecting.

Maintain Adequate Ventilation

Inadequate ventilation may cause an increase in temperature, which may eventually damage the instrument. Maintain suitable ventilation and inspect the fan and intake regularly.

Avoid Exposed Circuits and Components

Do not touch exposed contacts or components when the instrument's power is on.

Use Only the Specified Fuse

Do Not Operate Without Covers

Do not operate the instrument with covers or panels removed.

Safety Terms and Symbols

Terms used in this product. These terms may appear in the product:

- DANGER** Indicates direct injury or hazards that may happen.
WARNING Indicates potential injury or hazards that may happen.
CAUTION Indicates potential damage to the instrument or other property that may happen.

Symbols used in this product. These symbols may appear on the product:



Hazardous
Voltage



Warning



Protective
Earth Ground



Earth Ground



Power Switch

General Care and Cleaning

Care:

Do not store or leave the instrument in direct sunshine for extended periods.

To avoid damage to the instrument or probes, please do not expose them to fog, liquid, or solvents.

Cleaning:

Please perform the following steps to clean the instrument and probes.

1. Disconnect the instrument from all power sources and then clean it with a soft damp cloth.
2. Clean the loose dust on the outside of the instrument and probe with a soft cloth. When cleaning the LCD, take care to avoid scratching it.

To avoid damage to the surface of the instrument and probe, please do not use any corrosive liquid or chemical cleansers.

Make sure that the instrument is completely dry before restarting it to avoid potential short circuits or personal injury.

General Inspection

- **Inspect the shipping container**

Keep the original shipping container and cushioning material until the contents of the shipment have been completely checked and the instrument has passed both electrical and mechanical tests.

The consigner or carrier will be responsible for damages to the instrument resulting from shipment.

SIGLENT will not provide free maintenance or replacement if the instrument has been damaged in shipment.

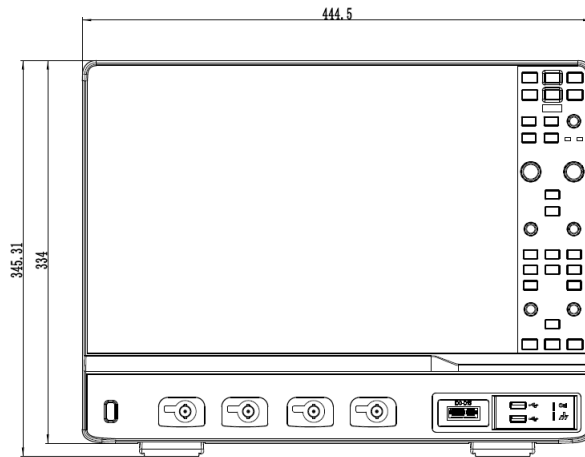
- **Inspect the instrument**

If there are instruments found damaged, defective, or have failed any electrical and / or mechanical tests, please contact SIGLENT.

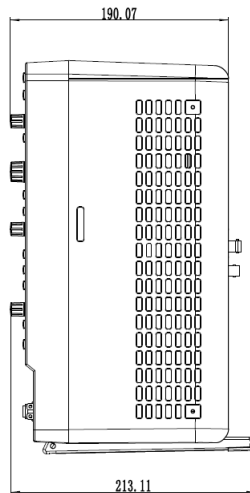
- **Check the accessories**

Please check the accessories according to the packing list. If the accessories are incomplete or damaged, please contact your SIGLENT sales representative.

Mechanical Dimensions



Front View



Side View

Panel Introduction



Front Panel

1. Analog Input Connectors
2. Digital Input Connector
3. USB 3.0 Host Ports. Connect to USB storage devices for data transfer or USB mouse / keyboard for control
4. Probe Compensation / Ground Terminal
5. Touch Screen Display
6. Knobs and buttons
7. Power Standby Button
8. Supporting Legs

Back Panel

1. AC Power Input and Power Switch
2. 10 MHz Reference Input
3. 10 MHz Reference Output
4. Built-in AWG Output
5. Auxiliary Out. Outputs the trigger indicator. When Mask Test is enabled, outputs the pass / fail signal
6. Ext Trigger Input
7. OCXO Module (Assembled and calibrated in factory only)
8. USB 2.0 Device. Connect with a PC for remote control
9. Handle



Side Panel

1. 2x 1000M LAN Ports
2. 4x USB Host 3.1 Gen 1 Ports
3. DP 1.2 Video output
4. HDMI 1.4 Video output
5. COM. Only used for internal debug
6. DVI-D Video output
7. Audio Line In , Line Out , Mic In

Quick Start

Connecting to Power Supply

The standard power supply for the instrument is 100 ~ 240 V, 50 / 60 Hz. Please use the power cord provided with the instrument to connect it to AC power.

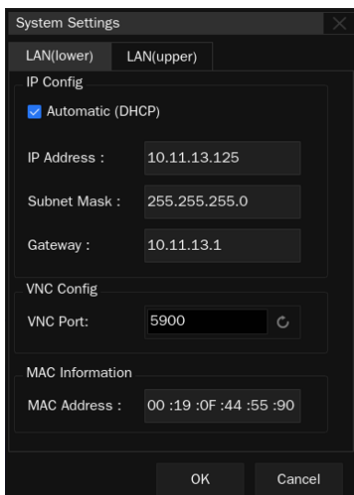
Connecting to an External Display


The instrument supports to copy or extend display to an external monitor via the HDMI, DP or DVI-D output on the side panel. Follow the steps below to set the external display to Duplicate or Extend mode.



Connecting to a LAN

Connect the 1000M LAN port to the LAN using a cable.



Perform **Utility** > **Menu** > **I/O** > **LAN Config** , or click the  icon in the lower right corner of the display to set the LAN. The LAN Config dialog box is shown on the left.

After Connecting to the LAN successfully, the instrument can be remotely controlled by WebServer or by sending SCPI commands via NI-VISA, Telnet, or Socket.

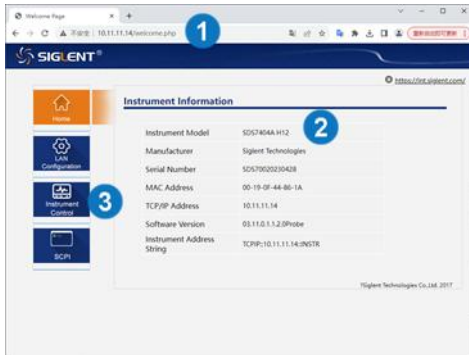
Reference Input and Output

The device can use the internal 10 MHz clock or an external 10 MHz clock from the 10 MHz In port as the reference. The reference is a square wave and can be output from the 10 MHz Out port for synchronizing other instruments. To set the reference clock by following the steps:

Utility > **Menu** > **I/O** > **Clock Source** .

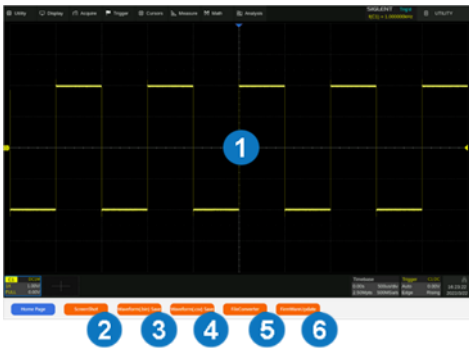
WebServer

A built-in web server provides an approach to interact with the oscilloscope by a web browser. It doesn't require any additional software to be installed on the computer. Set the IP address of the oscilloscope in the browser address bar, and then the user can browse and control the oscilloscope on the web.



1. Input the IP address of the instrument
2. Instrument information
3. Click here to recall the instrument control interface


Below is the instrument control interface over WebServer:

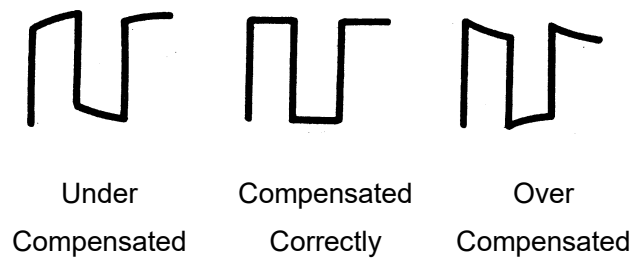


1. Display and control area of the instrument. The display in this area is a copy of the instrument display. Using the mouse to operate in the area is equivalent to directly operating on the display of the instrument
2. Click here to perform a screenshot
3. Click here to save the waveform data as a bin file and download it to the local computer
4. Click here to save the waveform data as a CSV file and download it to the local computer
5. Click here to download the mini-tool for converting binary files to CSV
6. Click here to perform a firmware upgrade

Probe Compensation

All oscilloscope passive probes should be properly compensated before their first use with the oscilloscope. A non-compensated or inadequately compensated probe may cause inaccurate measurement. The following steps illustrate the proper probe compensation procedure.

1. Use the probe to connect the CH1 Input Terminal and the Compensation Signal Output Terminal  on the front panel. Connect the ground alligator clip of the probe to the “Ground Terminal” under the compensation signal output terminal.
2. Check the displayed waveforms and compare them with the following figure.



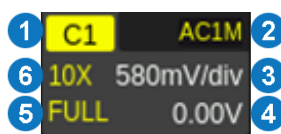
3. Use a nonmetallic flat-head screwdriver to adjust the low-frequency compensation adjustment hole on the probe until the waveform matches the “ Compensated Correctly ” waveform above.

User Interface



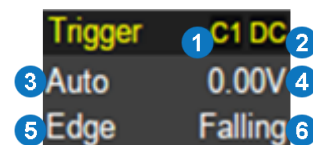
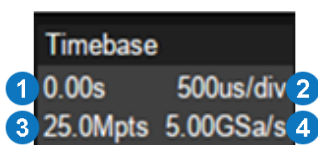
1. Menu Bar
2. Grid Area displays the waveform traces. Traces can be moved by dragging them
3. Channel descriptor boxes include analog channels (C1~C4) , zoom traces (Z1~Z4) , math traces (F1-F4) , Memory traces (M1~M4) and digital channels (D). They show the parameters of the corresponding traces. Clicking the boxes creates a dialog box
4. Timebase and Trigger Descriptor Boxes show the parameters of timebase and trigger respectively. Clicking the boxes creates a dialog box
5. Dialog Box is the main area to select the parameters for a chosen specific function
6. Trigger Delay Indicator locates where the trigger is on the horizontal axis
7. Trigger Level Indicator locates where the trigger is on the vertical axis
8. Cursors show where measurement points have been set

Channel Descriptor Box



1. Channel Index
2. Coupling and Input Impedance
3. Vertical Scale
4. Vertical Offset
5. Bandwidth Information
6. Probe Attenuation Factor

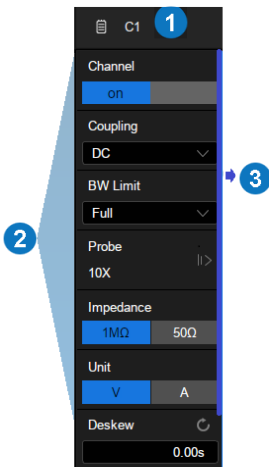
Timebase and Trigger Descriptor Boxes



- | | | | |
|------------------|--------------------------------|-------------------|------------------|
| 1. Trigger delay | 2. Horizontal scale (timebase) | 1. Trigger source | 2. coupling |
| 3. # Samples | 4. Sample Rate | 3. Trigger mode | 4. Trigger level |
| | | 5. Trigger type | 6. Trigger slope |

Dialog Box

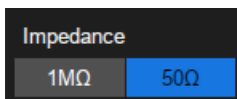
The dialog box on the right side of the screen is the main area for setting the parameters of the selected function.



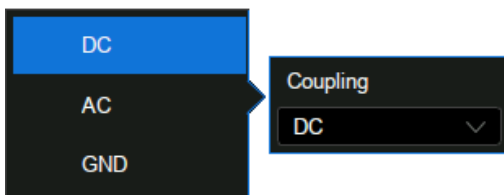
1. Title bar. Clicking the bar can hide the dialog box, and clicking again can open the dialog box.
2. Parameter setting area.
3. Scroll bar. When parameters are more than the displayed range, the blue scrollbar will be displayed. By sliding the dialog area up and down, it can scroll to the area not displayed.

To Set Parameters

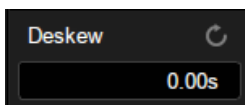
Several different ways are provided to set parameters:



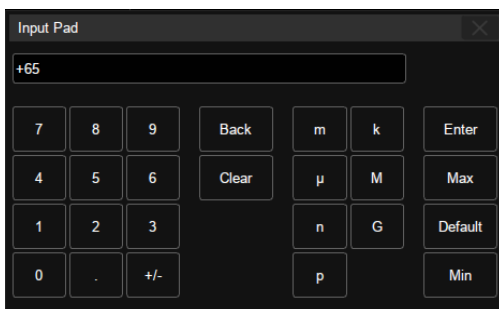
Switch -- Sets parameters with two states, such as to enable or disable a function. Click the switch region to change from one state to the other.



List -- Sets parameters with more than two options, such as the coupling mode of channels. Click the parameter region, and then select the expected option from the pop-up list.



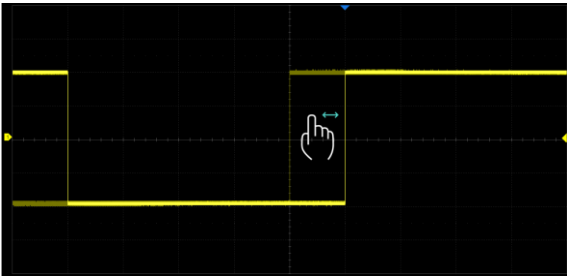
Virtual Keypad -- Sets parameters with a numerical value. Click the parameter region, and the parameter can be adjusted by rolling the mouse wheel; click the region again, then the virtual keypad appears.



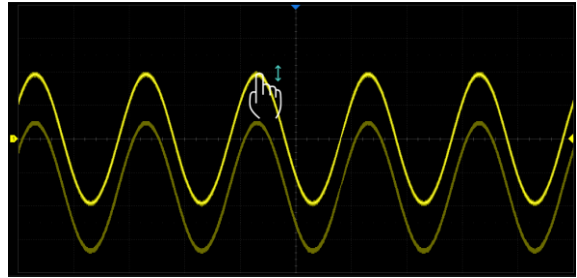
To use the operation of setting “deskew” of the channel as an example: If the expected value is 65 ns, input “65” on the virtual keypad, and then choose the unit **n** to complete the operation. On the virtual keypad, clicking the button **Max** , **Min** , and **Default** quickly sets the parameter to its maximum, minimum and default values.

Touch Gestures and Mouse Control

Waveforms, cursors, and trigger levels can be adjusted by touch gestures or the mouse quickly.



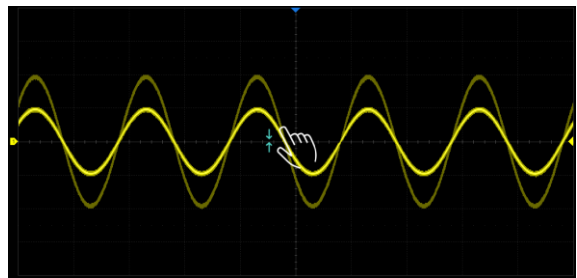
Drag the waveform left and right to move it on the horizontal axis



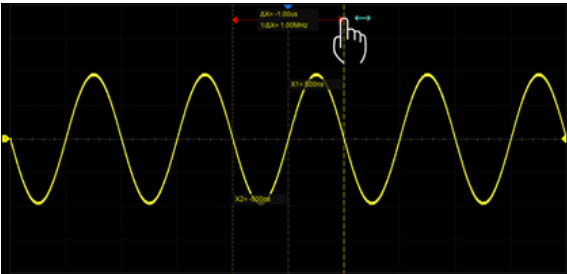
Drag the waveform up and down to move it on the vertical axis



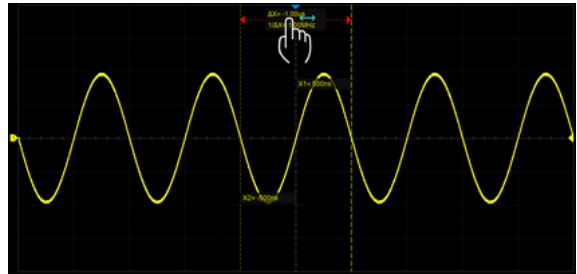
Pinch and spread the waveform horizontally to re-scale the timebase



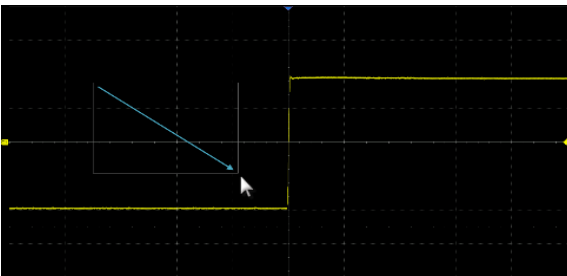
Pinch and spread the waveform vertically to re-scale the vertical gain



Click and drag the cursor to move it




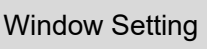
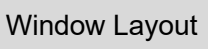

Click and drag the cursor information region to move the pair of cursors simultaneously





Draw a rectangular box to create a zone or a histogram region. At the beginning of the gesture keep the angle close to 45° so it can be recognized as the drawing box gesture

Setting Multi-Window

This instrument supports display up to 9 windows at once. The window layouts include: Auto, 2x1, 4x1, 1x2, 2x2, 4x2 and 3x3. Follow the one of the set of steps below to set Multi-Window:

1.  >  >  .
2. Directly select the layout on the  drop-out menu.
3. Right-click mouse on the display, and then select the layout on the pop-up dialog box.

Window  is always the main window in the multi-window matrix. The fast traces with high waveform update rate can only be displayed in the main window. The other traces except for Zoom traces can also be displayed in the main window. Window  will be used to display Zoom traces. The Zoomed fast traces can only be displayed in this window. The other Zoom traces (ZF1~ZF4 , ZM1~ZM4) can also be displayed in it.




The instrument is able to automatically allocate a trace to a window according to the window layout and traces activated. If the user want to adjust the mapping relationship between a trace and a window, simply drag the Channel Descriptor Box of the trace to the destination window, as the right figure above shown. In this figure F2 is originally shown in window (4,1), to drag its channel descriptor box to window (4,2) will have the trace shown in window (4,2).

Every window has three icons on the top-right corner:




Perform a screenshot of the window



Full-screen mode. If the window has been in full-screen mode, the icon will become . At this time click it to retore to window mode



Floating mode. If the window has been in floating mode, the icon will become . At this time click it to retore to fixed mode. A floating window can be dragged to any location in the display, including the extended display.

Front Panel



The front panel is designed to operate the basic functions without having to open the software menu. Most of the front panel controls duplicate functionality available through the touch screen display but the operation is more quickly achieved.



Push to switch between Run mode and Stop mode. The button is light in green in Run mode, and red in Stop mode



Automatically sets the waveform to adapt the display according to its frequency and amplitude



Resets the oscilloscope to the default configuration



Clears the data or displays in multiple sweeps, including display persistence, measurement statistics, average sweeps, and Pass/Fail statistics



Enables or disables the touch screen. When it is lighted the functionality is enabled



Press the button to recall the **Display** dialog box. The second press turns on Persist and lights the button. Press the button again to turn off Persist



Rotate the universal knob to set the value of the activated parameter, or to move the selected cursor. The default function is to adjust the waveform intensity



All the knobs on the front panel are multi-function. They can be pushed as well as rotated. Pushing a knob quickly recalls a specific function, which is indicated by the silkscreen near the knob.

Choosing the Language

Utility > Menu > System settings > Language .

Basic Operations

Turn On / Disable a Channel

From the Front Panel

Push the channel button (1-4, Digital, Math, Ref) to turn on the corresponding channel. Its channel descriptor box and dialog box will appear on the display. If a channel is already on but not activated, push the button to activate it. If a channel is already on and activated, push the same button again to disable the channel.

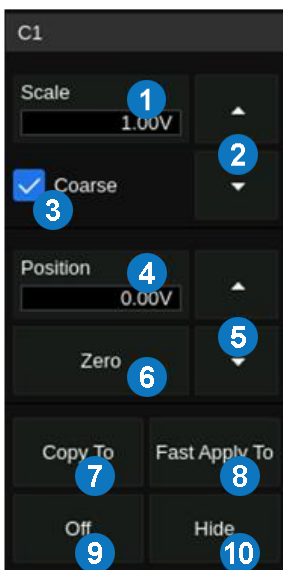
From the Touch Screen

Click the **+** button and then select the expected channel to turn it on, and its channel descriptor box and the dialog box will appear on the display. Click the channel descriptor box and then click the **Off** button to disable it.

Vertical System

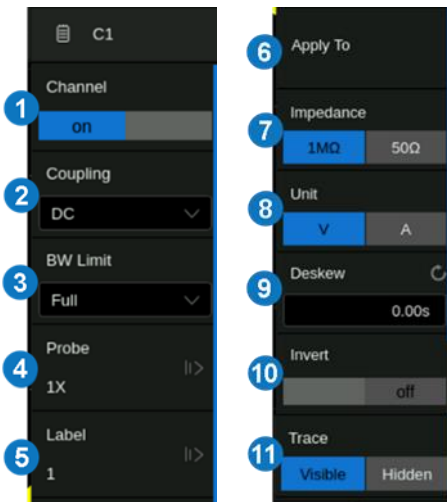
Channel Setup

Click the channel descriptor box, a quick dialog will pop up. Vertical scale and offset can also be set from this dialog box.



1. Click the region to set the vertical scale with the mouse wheel or virtual keypad
2. ▲ to increase the vertical scale and ▼ to decrease
3. Check to coarsely adjust the vertical scale and uncheck to enable fine adjustment
4. Click the region to set the offset with the mouse wheel or virtual keypad
5. ▲ to increase the offset and ▼ to decrease
6. Set the offset to zero
7. Copy the setting of the current channel to another channel
8. Quickly select the current channel as the source of a specified operation (Trigger, FFT, Measure, Cursor, Search, DVM, and Counter)
9. Disable the channel
10. Hide the trace

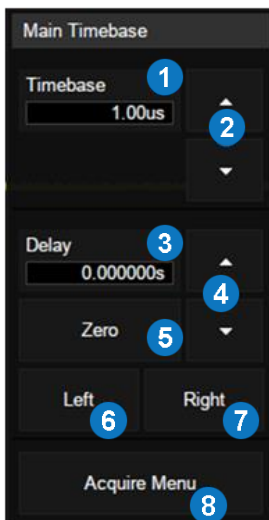
Activating a channel in the quick dialog of the channel recalls the channel dialog box, displaying more parameters:



1. Turn channel on/off
2. Coupling (DC, AC, or GND)
3. Bandwidth limit (Full, 200 MHz, or 20 MHz)
4. Probe attenuation (1X, 10X, 100X or custom)
5. Set the label text. Click to recall the label setting.
Users can customize the text and display of the label
6. Quickly apply a specified operation (Cursor, Measure, FFT, Search, DVM, Histogram, and Mask Test) to the current channel
7. Impedance
8. Units for the channel
9. Deskew
10. Enable/disable invert
11. Trace visible/hidden

Horizontal System

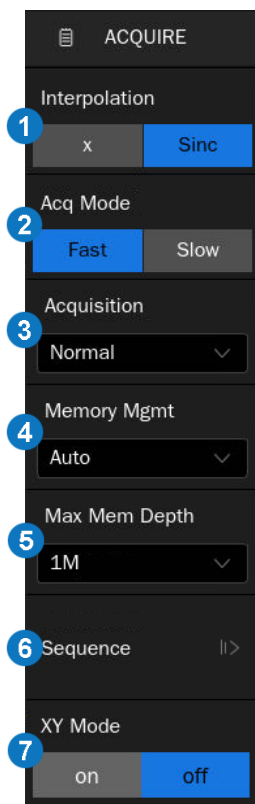
Click the timebase descriptor box to display a quick dialog box. Timebase and Trigger Delay can also be set in this dialog box.



1. Set the horizontal scale (timebase) by the virtual keypad
2. ▲ to increase and ▼ to decrease the horizontal scale
3. Set the trigger delay by the virtual keypad
4. ▲ to increase and ▼ to decrease the trigger delay
5. Set the trigger delay to zero
6. Set the trigger point to the left part of the screen
7. Set the trigger point to the right part of the screen
8. Open the Acquire dialog box

Acquisition System

Click **Acquire Menu** on the quick menu of the timebase settings, or click the menu bar **Acquire** > **Menu** to recall the Acquire dialog box on the right side.



1. Select the interpolation mode
2. Select the Acq mode
3. Select the acquisition mode
(Normal / Peak / Average / Hi-Res)
4. Select the Memory Management mode
(Auto, Fixed Sample Rate, and Fixed Memory)
5. Select the maximum memory depth
6. Enter the sequence menu
7. XY mode on/off

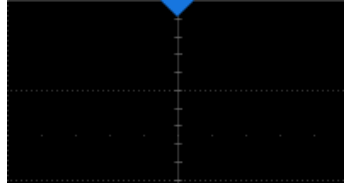
Trigger

The trigger system supports multiple powerful triggering modes including serial bus triggering. Refer to the User Manual for more details.

Indicators Relative to Trigger



Trigger level Indicator

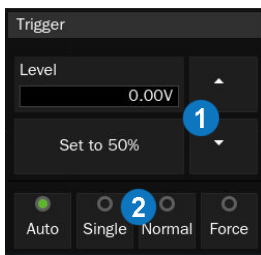


Horizontal 0 position Indicator



Horizontal position (offscreen) Indicator

Click the Trigger Descriptor Box, the pop-up dialog box is shown as below. Trigger level and trigger mode can be set in the dialog box:



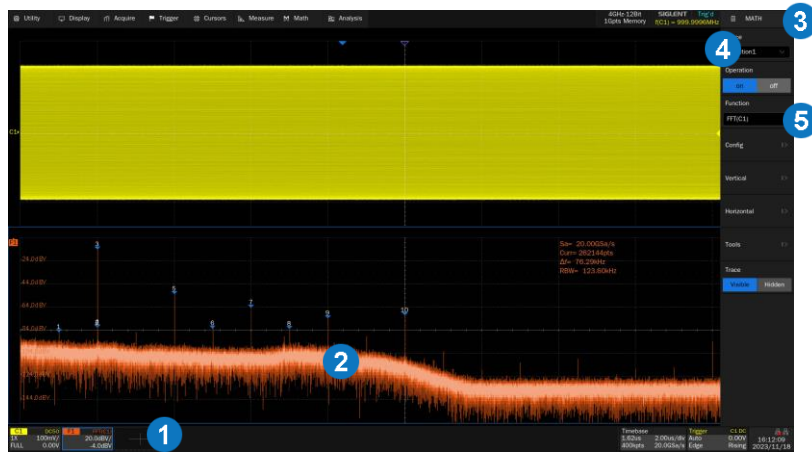
1. Trigger level setting region. It can also be set by the "Level" knob on the front panel
2. Trigger level setting region, in which the "Auto" mode can be also set by pressing the button on the front panel. This is similar with the "Single" mode and "Normal" mode.

Below is the introduction of the Trigger dialog box on the right.



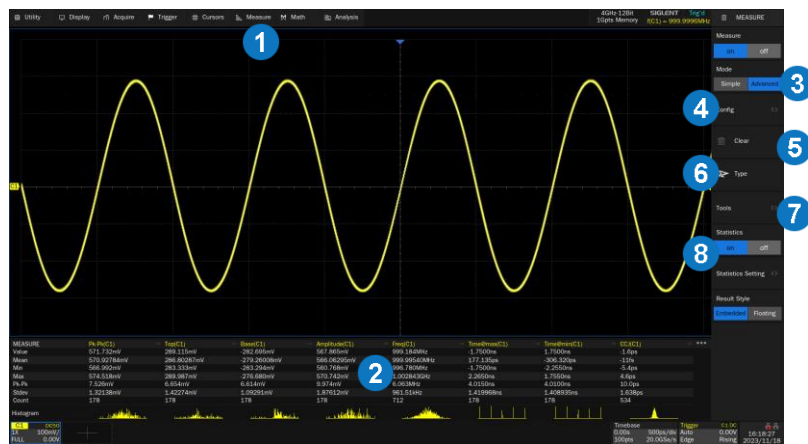
1. Select trigger type
2. Select the trigger source
3. Select the trigger slope (When the trigger type is "Edge", "Slope" and other specific types)
4. Set holdoff (None / Time / Events)
5. Set trigger coupling mode (DC / AC / LF Reject / HF Reject)
6. Enable / disable Noise Rejection. When Noise Reject is on, the trigger hysteresis is increased, so the noise immunity of the trigger circuit is better. As a compromise, the trigger sensitivity degrades
7. Set the Zone Trigger

Math



1. Click **+** > **Math** > **Fx** to create a math trace and open math setup dialog box **3**
2. Math trace
3. Math setup dialog box
4. Selects the trace (F1 ~ F4)
5. Selects the operator and source (C1~C4, Z1~Z4, F1~F4, M1~M4)

Measure & Statistics

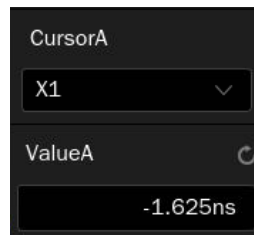


1. Click **Measure** > **Menu** to open the measure setup dialog box
2. Measurement parameters and statistics display area
3. Set the mode of measure: Simple or Advanced. "Simple" shows the specified basic measurement parameters of the selected channel. In "Advanced" mode, the measurement parameters can be added one by one as needed
4. Measure configuration: amplitude strategy, threshold, and display mode
5. Clear all the selected measurements
6. Select measurement parameters and source
7. Tools including Trend, Track, and Measure Cursor
8. Turn on or off statistics

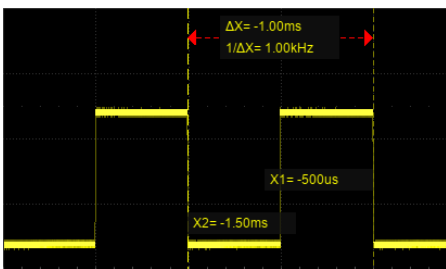
Cursors

Cursors set measurement points on the Vertical or Horizontal axis of a trace (or both). For more information please refer to the User Manual.

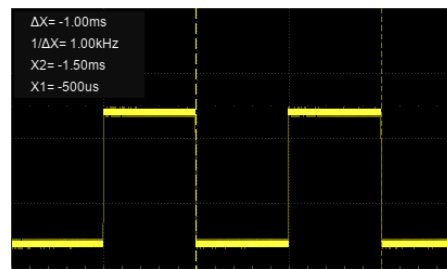
The cursors can be moved by touch gestures and mouse, or by the A and B knobs on the front panel. Cursor A is used to move X1/Y1, and cursor B is used to move X2/Y2. Gesture is quick but not precise, while knob is precise but not quick. It is recommended to combine gesture and knob: to use gesture to finish coarse move, and then use the knobs to finish fine move. If the user needs the cursor to precisely locate to a value, use the “Value” dialog box to directly input the value of the location.



The display mode of cursors



Following mode



Fixed mode

Memory Traces

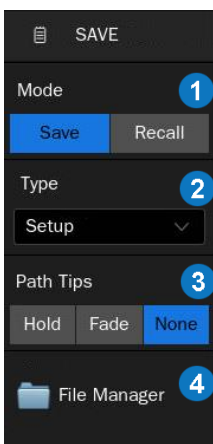
Analog channels, zoom, math, memory waveforms, and waveforms in files can be imported to available memory waveforms (M1 / M2 / M3 / M4) and displayed on the screen for comparison with the current waveforms. Differing from reference traces which are displayed data, the memory traces are in the format of raw data, which can be used as the source of Math and Decoding functions and can provide more accurate measurements than a reference waveform. Click **+** at the bottom and select **M1 ~ M4** to set a memory trace.



1. Select the location of the memory (M1 ~ M4)
2. Select the source (Channel / Zoom / Math / Memory / File)
3. Import the trace of the selected source in 2 to the memory location set in 1
4. Turn on or off the Memory
5. Set the label text of the memory trace
6. Set the vertical parameters of the memory trace
7. Set the horizontal parameters of the memory trace
8. Display the memory information, including source, vertical and horizontal parameters, sampling rate, and length

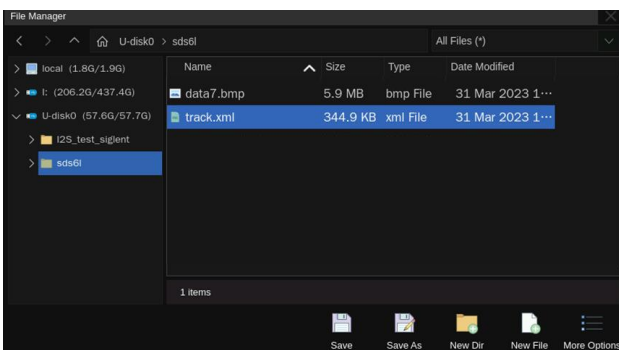
Save/Recall

Click **Utility** > **Save / Recall** to save / recall a setup, picture, waveform data or reference waveform.



1. Choose Save or Recall operation
2. Select the object type
3. Display mode of the save path tips
4. Recall the File Manager for further operations

File Manager and Quick Screenshot



Perform **Utility** > **Screenshot** or pressing the **Save** button (If the function of the button has been defined as “screenshot”) to capture the screen to a .bmp\ .jpg\ .png picture. The file will be saved in the path specified in the File Manager.

Calibration

The oscilloscope is calibrated at the factory before being shipped. The calibration is run at 23°C ($\pm 2^\circ\text{C}$) and is valid for temperatures $23 \pm 5^\circ\text{C}$. Within this temperature range, the oscilloscope will meet all specifications once warmed up.

Warm up the oscilloscope for at least 20 minutes before each use or before performing self-calibration. Specifications are not guaranteed during the warm-up period.

Whenever the oscilloscope is used in an environment outside $23 \pm 5^\circ\text{C}$, or when it has been more than one month since the previous self-calibration, manual calibration is recommended. To perform a self-calibration : Click **Utility** > **Menu** > **Maintenance** > **Self Calibration** .

Software Option

Installing a Software Option

Follow the steps below to install a software option (see the datasheet for details) after purchasing it and obtaining the Option Key:

1. **Utility** > **Menu** > **Software Options** .
2. Select the correct Option Type.
3. Input the option key in the text box.
4. Click **Install** and then restart the oscilloscope.

Advanced Analysis Features

The instrument integrates a number of advanced analysis features to help users quickly characterize or debug systems. These features can be accessed on the **Analysis** menu. The brief introduction of the features is below. For detailed description, refer to the user manual.

Eye Diagram	An eye diagram is an oscilloscope display in which a high-speed digital signal is repetitively sampled and applied to the vertical input, while the data rate is used to trigger the horizontal sweep. The combined effects of channel and dispersion can be evaluated from the Eye opening, width, and height. Mask test and Eye Measurements are included.
Jitter Analysis	Jitter analysis includes TIE data, jitter spectrum, DJ, PJ, and more. The various jitter components can be decomposed based on TIE data and analyzed in time and frequency domains.
Compliance Test	The supported protocols include USB and Ethernet. Refer to the data sheet for details.
Decode	The instrument supports automatic decode on serial bus protocols: I2C, SPI, UART, CAN, LIN, FlexRay, CAN FD, I2S, MIL-STD-1553B, SENT, USB2.0 and Manchester.
Power Analysis	Power analysis can help users quickly and easily analyze and debug switching power supply design. It automatically calculates Power Quality, Current Harmonics, Inrush Current, Switching Loss, Slew Rate, Modulation, Turn On/Turn Off, Transient Response, PSRR, Power Efficiency, Output Ripple, and SOA.
Bode Plot	This function provides a frequency response curve of the device-under-test as well as the interface for output sweep parameter control and data display settings.
Search	The instrument can search for the specified events in a frame. The location of the events is displayed with white triangle indicators. The Search function is based on hardware.
SignalScan	This is a software function similar to Search, but supporting a wider variety of events.
Navigate	Provides three navigation modes: Search Event, Time, and History Frame.
Mask Test	Users can create masks and define the mask shape used to evaluate Pass/Fail operations. An event violating the mask is defined as a failure and a pulse can be generated from the "Aux Out" port on the back panel. This is very useful to find and quantify anomalies in production tests or similar batch measurements.
Counter	The counter is used to measure the frequency and period of a signal or count the events happening within it. The counter is asynchronous to the acquisition system of the oscilloscope. It functions even if the acquisition of the oscilloscope is stopped.
Histogram	The instrument supports waveform histograms for observing probability distributions of the waveform in the specified region. The statistics can be performed in both horizontal and vertical directions.
DVM	The DVM (Digital Voltage Meter) function can be used to measure parameters such as DC and AC amplitudes. DVM is asynchronous to the acquisition system of the oscilloscope. Data sources for the DVM and the measurement function can be different.

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