



DSTouch Oscilloscope User Guide

V0.99

Revision History

Revision history:

Date (YY/MM/DD)	Version	Description
2023/05/23	V0.99	Added introduction to decoders and FFT.
2022/12/11	V0.98	Initial version.

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Chapter 1. Introduction

1.1 Overview

The DSTouch oscilloscope combines the high performance of a desktop oscilloscope with the touch screen experience of a smartphone. In terms of performance, it utilizes FPGA-based hardware waveform engine architecture, and a large storage depth based on DRAM. In terms of operation, it creatively designed a set of "single-finger touch" methods, simplifying all functions into 1-3 tap and swipe operations

Furthermore, the DSTouch oscilloscope is equipped with a built-in high-capacity lithium battery, making it an ideal palm-sized portable instrument

Main Features:

- FPGA-based hardware waveform engine, ensuring no lag and ultra-high refresh rate.
- DRAM-based large waveform buffer, with a maximum storage depth of up to 16Mpts.
- Dual-channel input, with a real-time sampling rate of up to 1GSa/s and a maximum bandwidth of up to 150MHz.
- 4.3-inch IPS capacitive touchscreen, providing a smooth UI experience and convenient control logic.
- Ultra-fast 1-second boot time, with one-click autoset of stable waveforms.
- Multiple global configuration files can be saved and easily loaded with a single click.
- Supports auto measurement of 20 parameters.
- Built-in signal generator.
- Supports adjustment of trigger sensitivity and hold-off time, meeting waveform capture requirements in various scenarios.
- Large-capacity lithium battery for extended battery life.
- Supports user-side firmware upgrade operations.
- Reserved rich function expansion interfaces.
- Supports on-the-fly switching between Chinese and English language interfaces.

1.2 Basic Operations

The DSTouch oscilloscope has a compact size that fits perfectly in the palm of your hand (129mmx77mmx20mm). The oscilloscope features a high screen-to-body ratio with a 4.3-inch IPS capacitive touch screen on the front. On the side of the device, essential function buttons are retained, including the power button on the left and the "Run/Stop" and "Auto" buttons at the top.

While ensuring its compactness, DSTouch uses the standard BNC interface commonly found in desktop oscilloscopes. This enables the direct use of all standard probes with the DSTouch, ensuring stable and reliable signal connections without compromising performance and stability due to its size. In addition to the input channels, the DSTouch also integrates a signal generator function, with waveforms being output externally via the MCX interface.

The DSTouch's USB port serves not only as a regular charging port but also allows for connections to a PC for firmware upgrades or exporting various configurations and waveform screenshot files stored in the oscilloscope. The DSTouch has also reserved multiple extend interface options through extend modules to meet diverse measurement and debugging requirements in different scenarios.

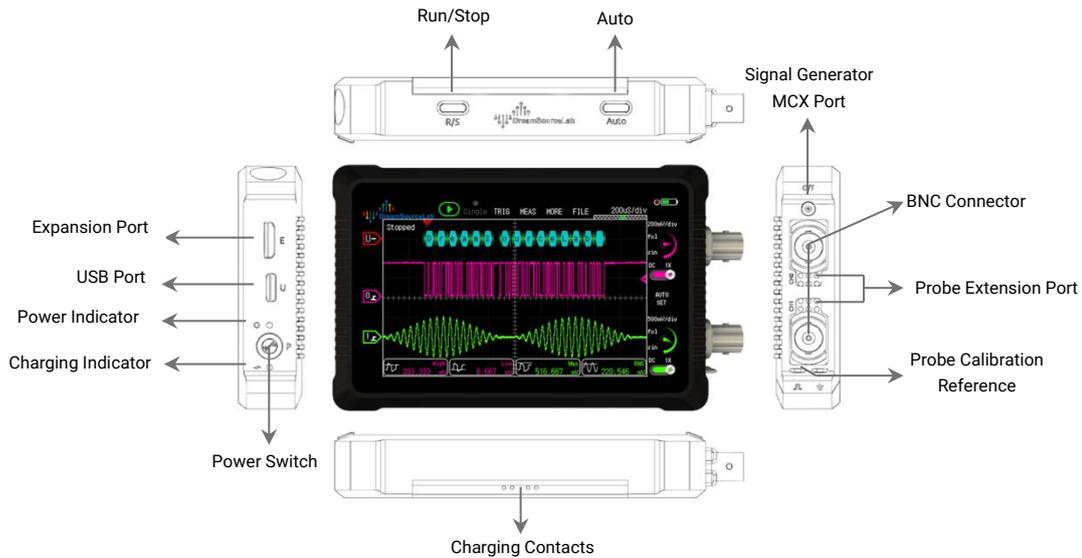


Figure 1-1

1.2.1 Power On/Off

The DSTouch oscilloscope provides a "Long-Press Power On/Off" and "Touch-Controlled Shutdown" to prevent accidental power toggling. In the power-off state, a 1-second long press of the power button turns the device on, while in the power-on state, a long press of 3 seconds or more shuts it down.

- **Button Power On/Off:**

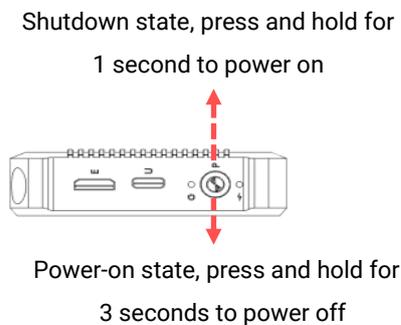


Figure 1-2

1.2.2 Charging

The DSTouch oscilloscope is equipped with a built-in high-capacity lithium battery that can be charged through the USB port located on the left side of the device. The charging input supports a maximum of 5V/2A. It is important to ensure that the input voltage during charging does not exceed 5V, as higher voltages may damage the instrument.

The DSTouch oscilloscope supports "Charge while using" functionality and features intelligent power distribution to ensure that measurements are not affected during the charging process. In extreme cases, such as battery damage, the DSTouch can also operate independently through external power supply.

During regular charging, the charging indicator light on the left side of the instrument remains a constant

red color. Once the charging is complete, the indicator light turns off. If the indicator light keeps flashing, it indicates a charging malfunction.

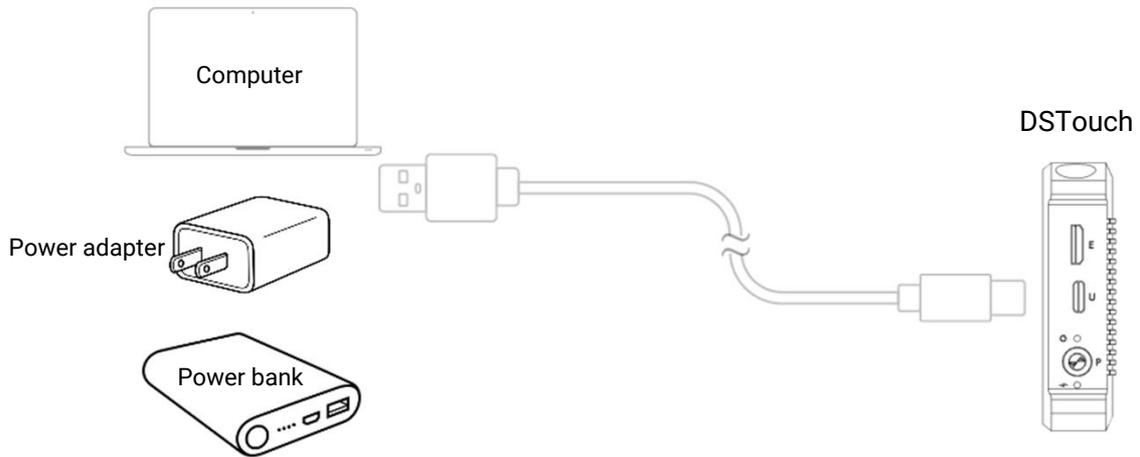


Figure 1-3

1.2.3 User Interface

With the single-finger touch interface, the DSTouch oscilloscope allows users to effortlessly perform all measurement operations. Through optimization of interaction, traditional multi-step operations on conventional oscilloscopes can now be accomplished within just 1-3 touch gestures on this device.

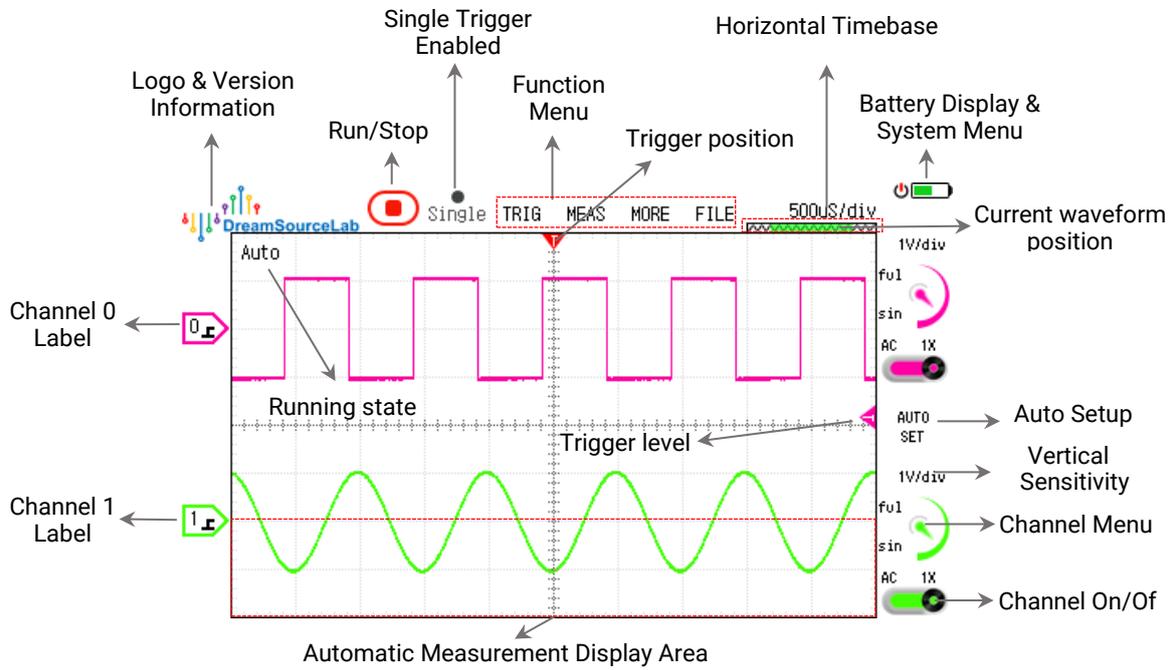


Figure 1-4

1.2.4 Run/Stop

As the most frequently used feature, the DSTouch oscilloscope provides two methods for running and stopping waveform acquisition: physical buttons and touch buttons.

• **Button Run/Stop:**

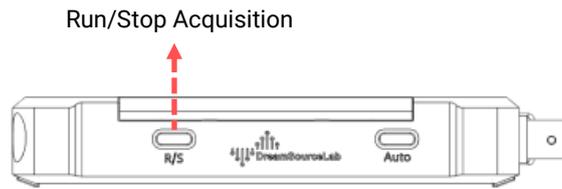


Figure 1-5

• **Touch Run/Stop:**

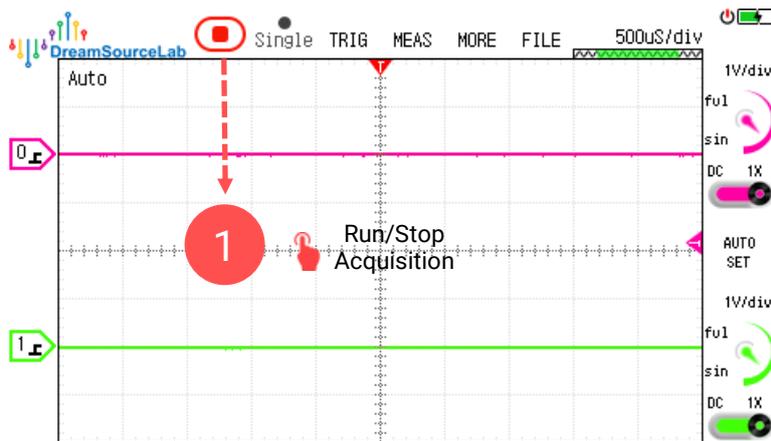


Figure 1-6

1.2.5 Autoset

The DSTouch oscilloscope offers both a physical "Auto" button and touch-controlled buttons to facilitate autoset. When the user has not actively selected any channel, the autoset program will start detecting enabled channels, beginning from Channel 0. It will then automatically designate the channel that first detects a waveform transition as the active channel for autoset.

Alternatively, users can manually specify a channel for autoset by simply selecting the corresponding channel as shown in Figure 1-8 and then initiating the autoset.

• **Button Auto:**



Figure 1-7

• **Touch Auto:**

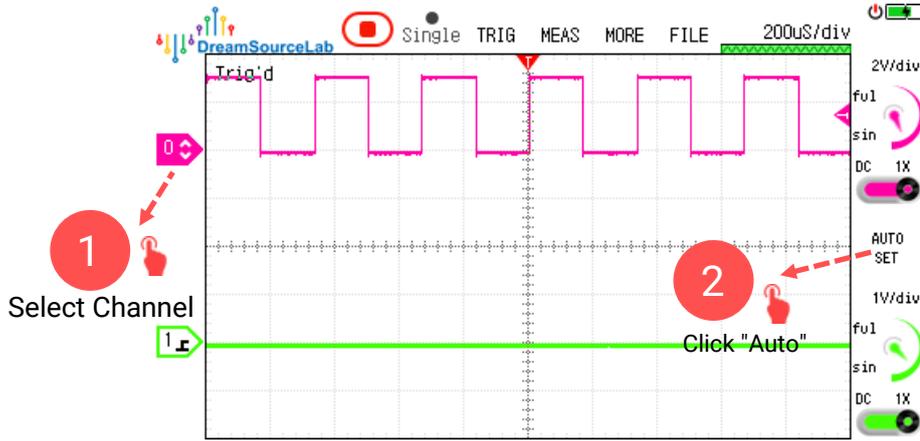


Figure 1-8

1.3 Probe Compensation

When using some probes such as 10X/100X attenuated probes, it is essential to ensure the oscilloscope's input capacitance matches the probe's compensation capacitance to correctly measure AC signal waveforms. Before the initial use of a specific probe on a new oscilloscope, it is necessary to adjust the probe's compensation capacitance. The specific adjustment method is as follows:

- 1) Set the switch on the probe to 10X (or other desired attenuation setting) and connect it to the desired channel of the oscilloscope. Connect the probe signal terminal to the probe compensation reference signal (1KHz square wave), and the ground clip to the oscilloscope's ground terminal. Enable only the target channel on the oscilloscope, and then click "Run" to initiate the Auto automatic setup.

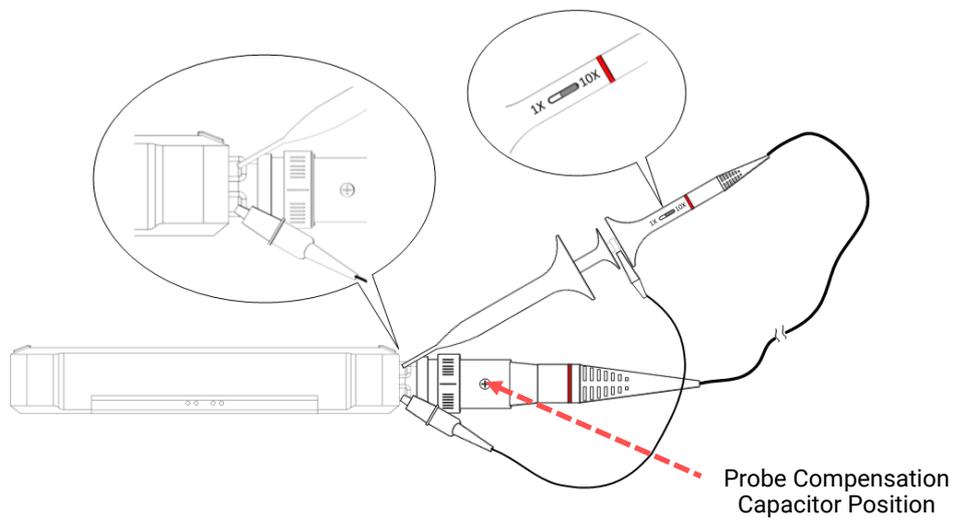


Figure 1-9

- 2) The captured waveform on the oscilloscope is shown in Figure 1-10. If the waveform is found to be improperly compensated, you can use the non-metallic adjustment tool to adjust the probe's variable capacitance. Make adjustments until the waveform matches the correctly compensated waveform in the center.

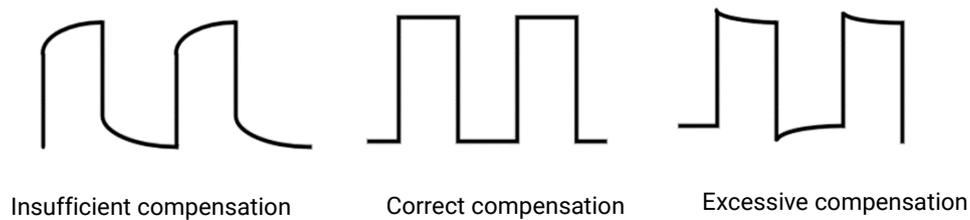


Figure 1-10

1.4 Measure Signals

1.4.1 Probe Settings

The DSTouch oscilloscope comes equipped with a standard BNC interface, making it compatible with various types of BNC probes. To accommodate different probe attenuation ratios, the DSTouch oscilloscope offers attenuation adaptation settings ranging from 0.1X to 1000X (in 1-2-5 steps).

Users need to select the right probe ratio based on the actual attenuation ratio of the currently connected probe, and then oscilloscope will show accurate measurement results.

For example, as shown in Figure 1-11, when using a 10X probe, simply set the probe ratio to 10X in the UI settings.

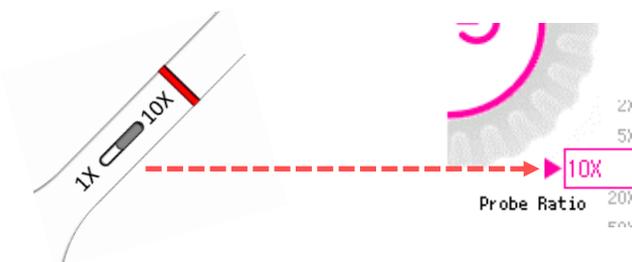


Figure 1-11

Except the single-ended passive probes, users can also use differential probes for measuring differential signals. Additionally, users have the option to employ current probes for testing current signals. The DSTouch oscilloscope supports the switching between voltage and current display.

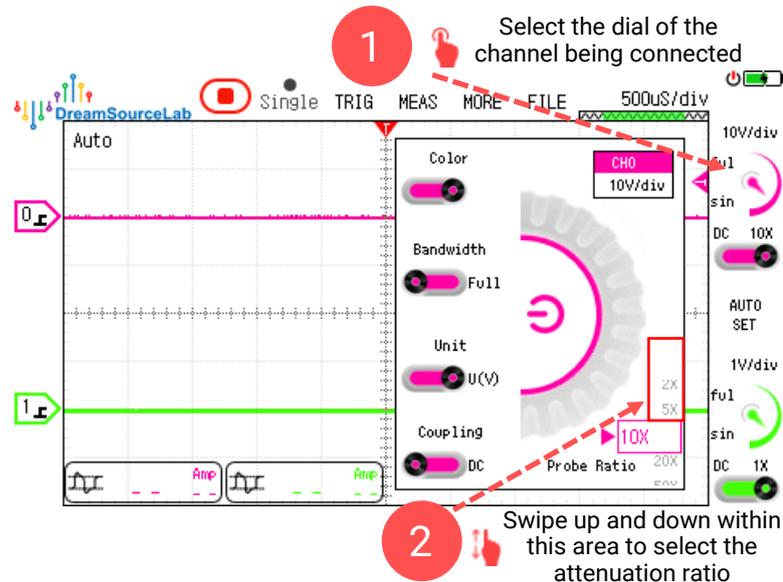


Figure 1-12

1.4.2 Connection

When measuring signals, it is crucial to ensure that the reference ground of the measured signal is connected as closely as possible to the oscilloscope probe's ground terminal. As the DSTouch oscilloscope is powered by a battery, it offers greater flexibility in grounding compared to desktop oscilloscopes that rely on mains power. When not connected to the mains for charging, the DSTouch oscilloscope functions as a handheld device. Its ground terminal can follow the reference potential of the measured system without concerns about short circuits between different ground potentials, thus avoiding any potential damage to equipment or instruments.

Certainly, this does not mean that the ground terminal can be connected arbitrarily. For example, when using a single-ended probe for measurements, it is recommended to connect the ground terminal to a voltage-stable reference plane and avoid connecting it to a reference point with high noise or continuous voltage fluctuations. This reduces interference with the oscilloscope itself and ensures more accurate measurement results. If the measured system cannot find a reliable reference plane, it is recommended to use a differential probe for measurements.

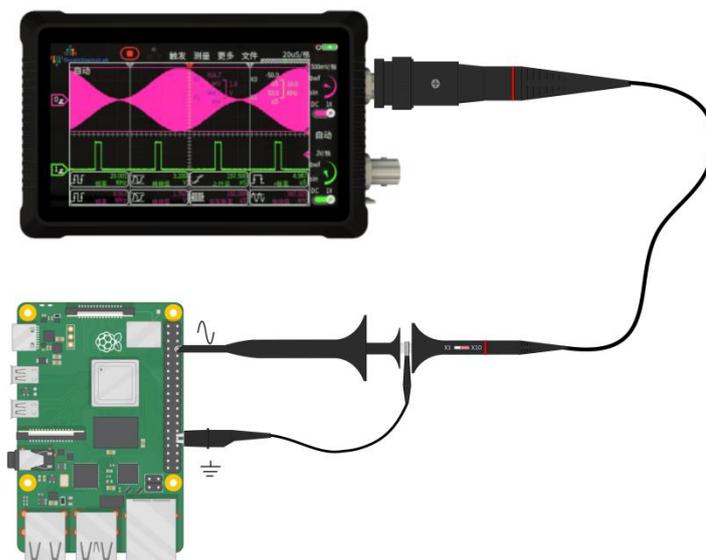


Figure 1-13

1.4.3 Grounding

There are mainly two ways to ground the probe: one is by using a clip, and the other is through a ground spring. The main difference between these two methods lies in the size of the loop area formed between the signal and the ground terminal. The larger the loop area, the more spatial electromagnetic waves pass through it, making the signal more susceptible to interference when entering the oscilloscope.

As shown in Figure 1-14, when using a ground spring, the loop area formed between the signal and the ground terminal is much smaller compared to the one formed when using a clip.

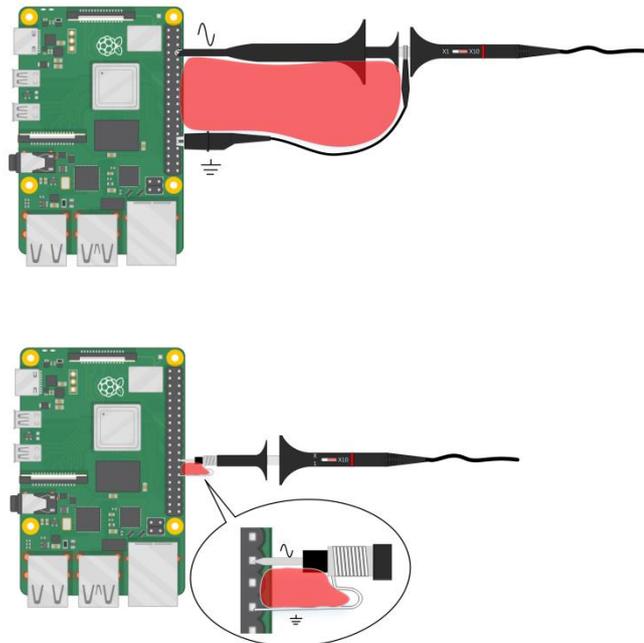


Figure 1-14

Figure 1-15 shows the waveform obtained when the grounding is done properly, indicating a clean and accurate signal measurement. On the other hand, Figure 1-16 illustrates a typical waveform when the ground loop area is too large, causing the measured signal to be interfered with and resulting in distorted or noisy measurements.

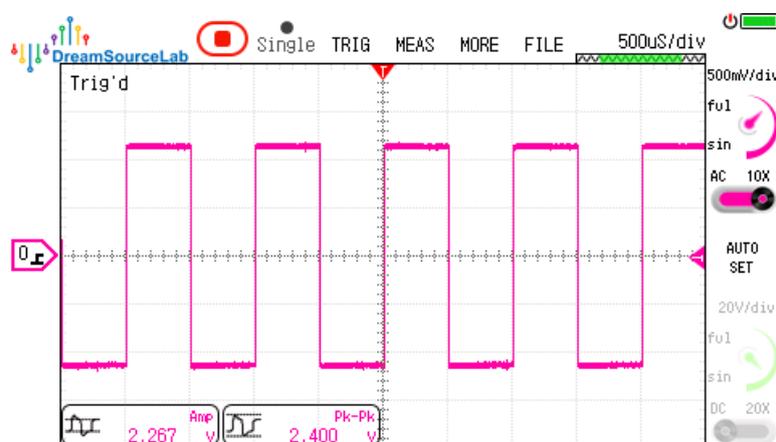


Figure 1-15

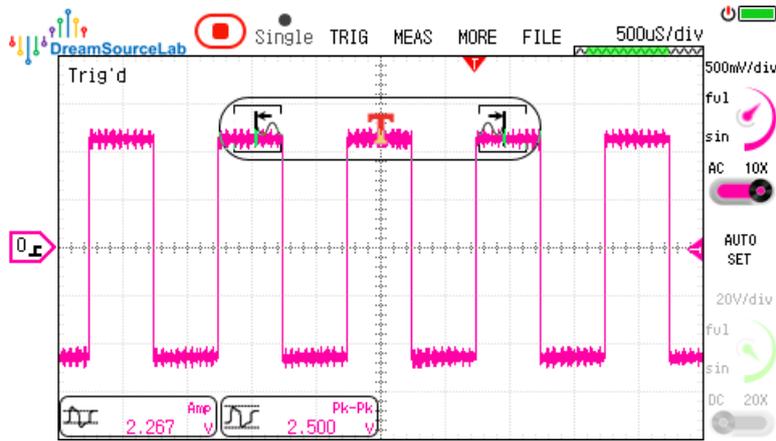


Figure 1-16

1.5 Precautions

1.5.1 Measurement Range

The measurement range of an oscilloscope refers to the maximum observable signal range at a fixed probe attenuation ratio. The vertical sensitivity range of the DSTouch oscilloscope is 10mV/div to 5V/div, with a total of 8 divisions in the vertical direction. When using a 1X probe, the measurement range is -20V to +20V with a 0V offset. By adjusting the vertical offset setting, the measurement range can be changed to 0V to +40V or -40V to 0V. The maximum peak-to-peak voltage measurable with a 1X probe is 40V.

When using a 10X probe, the measurement range with a 0V offset is extends to -200V to +200V. This is because the 10X probe attenuates the input signal by 10 times before it is fed into the oscilloscope. Similarly, when using a 100X probe, the measurement range with a 0V offset becomes -2KV to +2KV.

1.5.2 Withstand Voltage Range

The voltage withstand range of an oscilloscope refers to the input voltage range that the oscilloscope's input terminals (excluding the probe) can withstand without causing damage to the oscilloscope itself. The DSTouch oscilloscope has a voltage withstand range of -200V to +200V (peak-to-peak). This means that when using a 1X probe to input voltage within the range of -200V to +200V or using a 10X probe to input voltage within the range of -2000V to +2000V, the oscilloscope will not be damaged.

The voltage withstand range of the DSTouch oscilloscope is designed to be 10 times the measurement range under the same conditions. For common 1X and 10X adjustable probes, even if the wrong attenuation ratio is accidentally selected, as long as the input voltage is within the -200V to +200V range, there is no need to worry about damaging the oscilloscope.

For measuring high voltage signals (peak values exceeding $\pm 200V$), it is recommended to use 100X or higher high-voltage probes to ensure user safety. Alternatively, users can choose high-attenuation differential probes to eliminate the limitations of single-ended probe grounding.

1.5.3 Probe Limitations

The bandwidth of the probe itself can significantly impact the measurement performance. It is generally

recommended to choose a probe with a bandwidth greater than the oscilloscope's own bandwidth for high-frequency measurements to fully leverage the oscilloscope's capabilities. For common 1X and 10X adjustable probes, it is crucial to be aware that under the 1X setting, the probe's own bandwidth is typically only around 6MHz, making it suitable for observing low-frequency small signals like power supply ripples. Please refrain from using a 1X probe for high-frequency signals.

For example, when measuring high-frequency digital signals ranging from 0V to 3.3V, a high-bandwidth 10X probe should be used with the vertical sensitivity set to 1V/div for optimal results.

Chapter 2. Operation

The portability of the DSTouch oscilloscope is not only reflected in its appearance and size but also in its optimized user interface. DSTouch has defined a complete set of "single-finger touch" operation methods. All functions are simplified to 1-3 steps of tapping and sliding, eliminating the need to search for buttons and menus, making it more convenient for users to perform quick measurements, debugging, and problem localization challenges.

2.1 Horizontal System

The oscilloscope's horizontal system controls all variables related to the time domain during the data acquisition process. These variables include the horizontal timebase, mode, position, interpolation, and storage depth, among others.

2.1.1 Timebase

The horizontal timebase directly determines the duration of the waveform that the oscilloscope can observe. For example, with a timebase of 1 μ s/div, a 10-division horizontal direction on the oscilloscope represents a time window of 10 μ s; when the timebase is set to 1s/div, the observation window represents 10s of time. To observe waveforms of different frequencies, an appropriate horizontal timebase needs to be set.

The three main parameters that determine the oscilloscope's waveform acquisition process, namely acquisition duration, storage depth, and sampling rate, must satisfy the following equation:

$$\text{Storage Depth} \geq \text{Sampling Rate} * \text{Acquisition Duration}$$

In the implementation of the oscilloscope, the waveform storage space is limited by the hardware storage depth for each acquisition. The acquisition duration is determined by the user-set horizontal timebase. Therefore, when the user changes the horizontal timebase, the oscilloscope automatically selects the maximum available sampling rate as the current actual sampling rate based on the equation above. This principle also illustrates how the storage depth affects the real performance of an oscilloscope.

$$\text{Sampling Rate} \leq \frac{\text{Storage Depth}}{\text{Acquisition Duration}}$$

The DSTouch oscilloscope offers various methods to adjust the horizontal timebase. The simplest way requires just one click. In the default state of the oscilloscope, clicking on the upper or lower half of the waveform area on the screen allows for single-step increase/decrease of the horizontal timebase (in 1-2-5 steps). The specific operation process is shown in Figure 2-1.

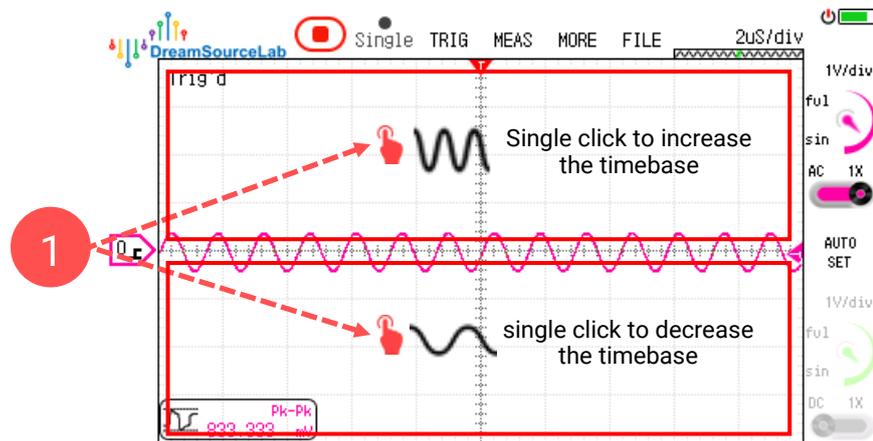


Figure 2-1

When you need to use other adjustment methods, you can click on the horizontal timebase menu located in the top right corner of the screen. This action will reveal a scroll wheel on the left side of the screen, indicating that you have entered the horizontal timebase adjustment mode.

Slide Adjustment: You can quickly change the timebase by sliding up or down in the scroll wheel area or the waveform area. Sliding upwards increases the timebase, while sliding downwards decreases it. The scroll wheel area also supports inertia setting, which means that when you slide your finger quickly on the scroll wheel, it will rapidly adjust the timebase to the maximum/minimum value through inertia. After performing a sliding operation, a single click will stop the inertia operation of the scroll wheel. Refer to Figure 2-2 for a visual representation of this process.

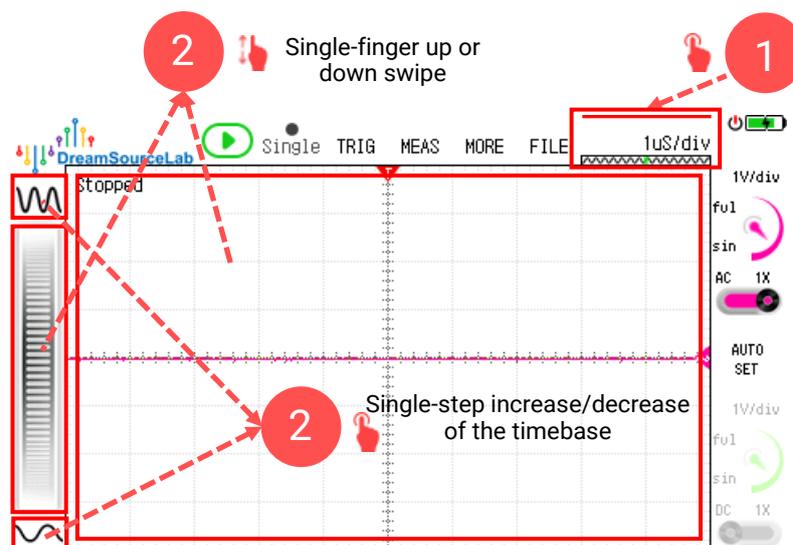


Figure 2-2

Single-step adjustment: Above and below the scroll wheel, there are buttons that allow for single-step timebase adjustment. Clicking the upper button increases the timebase by one step, and clicking the lower button decreases the timebase by one step.

2.1.2 Roll

The normal display mode of an oscilloscope is commonly referred to as Y-T mode, where the vertical axis (Y) represents voltage, and the horizontal axis (T) represents time. The default acquisition and display process is based on one frame of waveform as a fundamental unit. It can be simplified as follows: the oscilloscope acquires one frame of waveform, processes it through the processing unit, and displays it on the screen. It then proceeds to acquire the next waveform and repeats the process. When the horizontal timebase is relatively

small, the time taken to acquire one frame of waveform is very short, allowing us to observe dynamic changing waveforms on the oscilloscope.

However, when users set a larger horizontal timebase, the time taken to acquire one frame of waveform may become quite long. For example, when the timebase is set to 1s/div, it takes 10 seconds to acquire one frame of waveform. If displayed in Y-T mode, we would only see one frame of waveform every 10 seconds. Therefore, in situations where a large timebase is set, it is more convenient to use the ROLL mode to observe the waveform. As shown in Figure 2-3, in roll mode, the waveform is dynamically displayed on the screen as time progresses, without waiting for one frame to be filled before displaying it. When the waveform fills the entire window, it will scroll from right to left, continuously displaying the most recently acquired waveform on the right side.

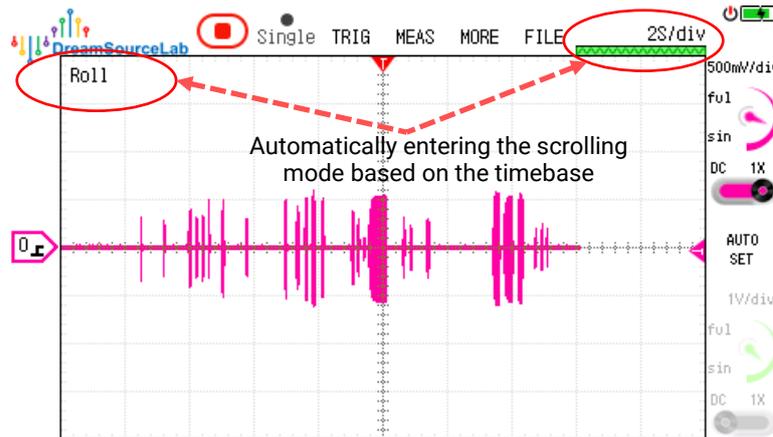


Figure 2-3

The DSTouch oscilloscope will automatically switch between Y-T mode and roll mode based on the user's current horizontal timebase settings. When the timebase is $< 50\text{ms/div}$, it operates in Y-T mode. When the timebase is $\geq 50\text{ms/div}$, it automatically enters scroll mode.

If the "Auto" trigger is set, Y-T mode will prioritize displaying waveforms that meet the trigger conditions. Only when there is no triggered waveform, it will automatically display the current waveform. In roll mode with "Auto" trigger, it will continuously display the current waveform without considering the trigger conditions.

If you need to force trigger the display in roll mode, you can set the trigger type to "Normal." This will return the waveform display to Y-T mode, capturing waveforms that meet the trigger conditions and displaying them on the screen after acquiring at least one frame of waveform.

2.1.3 Horizontal Position

The DSTouch oscilloscope supports ultra-long storage depth, allowing users to capture waveforms and then zoom in, observe, and locate any part of the entire storage depth after the acquisition has stopped. By moving the current display window, the DSTouch oscilloscope can position any sampling point from the entire storage depth at the center of the waveform window. Coupled with the horizontal timebase scaling operation, users can observe any sampling point position waveform at any desired zoom level. The relationship between the horizontal window position and the waveform of the entire storage depth is illustrated as follows.

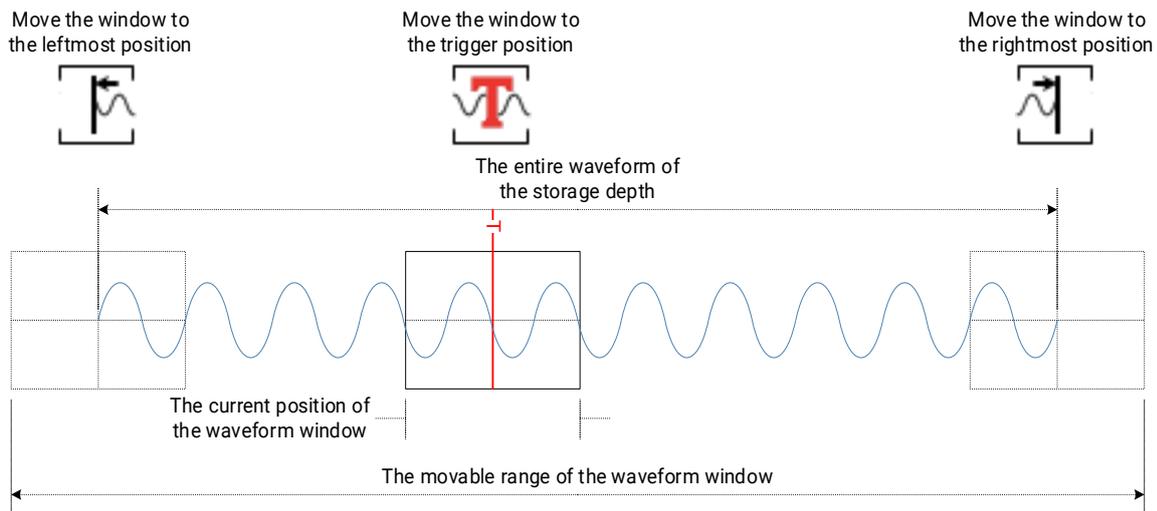


Figure 2-4

The DSTouch oscilloscope's interface includes a simple graphical representation of the relationship between the display window and the storage depth. A long bar below the horizontal timebase represents the entire stored waveform, with the green portion indicating the current position of the waveform window. The specific method for moving the waveform window is as follows:

Single-finger swipe: In the default display mode, simply swipe left or right with a single finger on the waveform window to move the position of the horizontal window. When combined with the single-tap zoom function for the timebase in this mode, it becomes very convenient to locate any waveform within the storage depth, enabling users to zoom in and observe specific regions of the waveform.

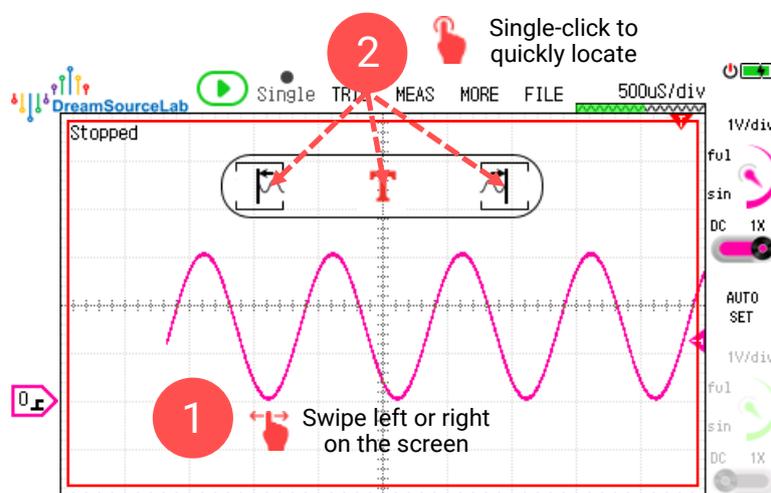


Figure 2-5

Quick positioning: While sliding the horizontal window position, three quick buttons will appear above the window. From left to right, these buttons allow users to quickly position the waveform to the far-left, trigger position, or far-right of the display window's center position.

2.1.4 Storage Depth

The storage depth of conventional oscilloscopes is generally a fixed value, limited by the hardware memory's maximum capacity. In contrast, the DSTouch oscilloscope provides a large hardware storage depth and also allows users to set the storage depth at the software level, emulating different oscilloscopes with varying storage depths to better accommodate diverse waveform observation needs.

Reducing the storage depth drastically reduces the amount of data the oscilloscope needs to process, while it may also lower the effective sampling rate under certain horizontal timebase settings. The process of changing the storage depth settings on the DSTouch oscilloscope is illustrated in Figure 2-6.

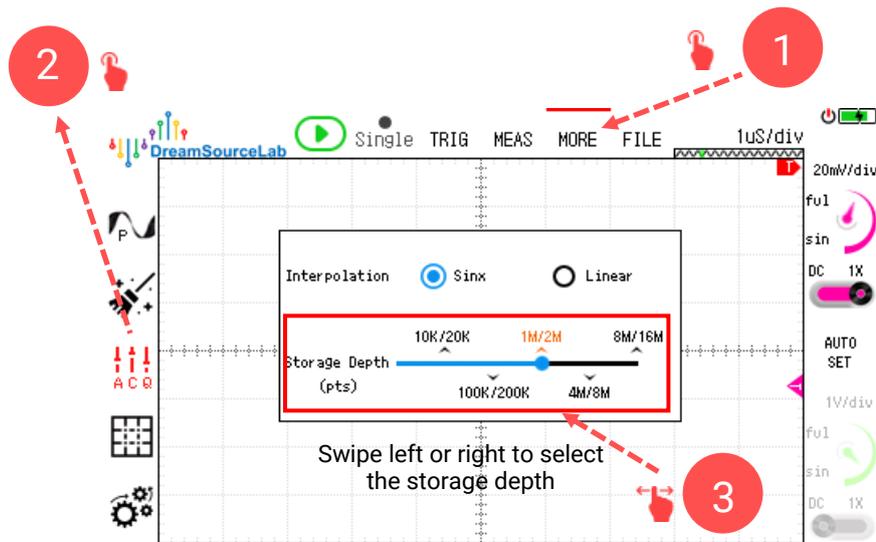


Figure 2-6

2.1.5 Interpolation

The DSTouch oscilloscope provides two different waveform interpolation algorithms. The linear interpolation method connects the sampled points with straight lines, making it more suitable for reconstructing signals with sharp edges, and is ideal for observing square wave signals. The sine interpolation method, on the other hand, reconstructs the sampled points using sine wave signals, which is more suitable for observing sinusoidal signals. Considering the frequency response characteristics of electrical signal transmission in the real world, most signals better conform to sinusoidal characteristics, making the sine interpolation method more widely used.

As shown in Figure 2-7, you can switch between different interpolation algorithms by selecting the corresponding radio button in the settings window.

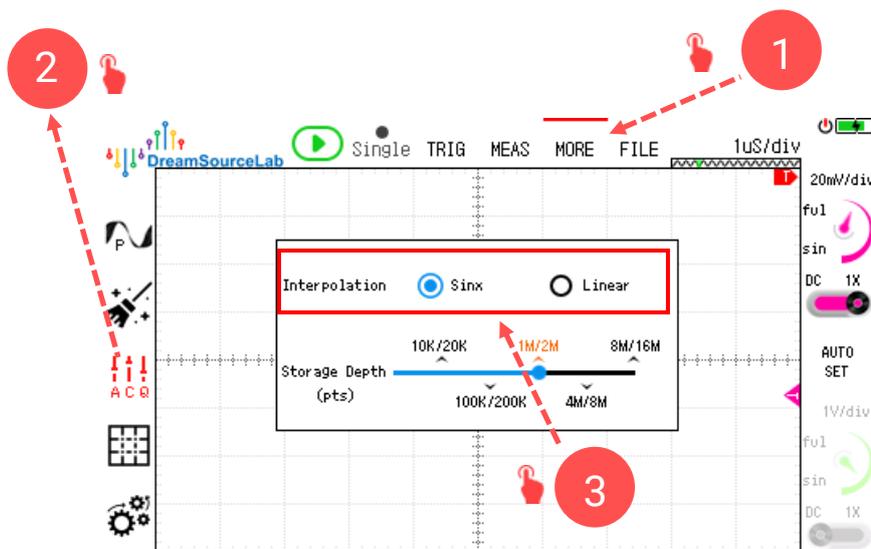


Figure 2-7

2.2 Vertical System

The vertical system of the oscilloscope mainly controls and sets parameters related to the channels.

2.2.1 Channel Settings

The DSTouch oscilloscope is designed with separate operating interfaces for each channel. As shown in Figure 2-8, you can click on the respective channel to open the corresponding channel's settings window.

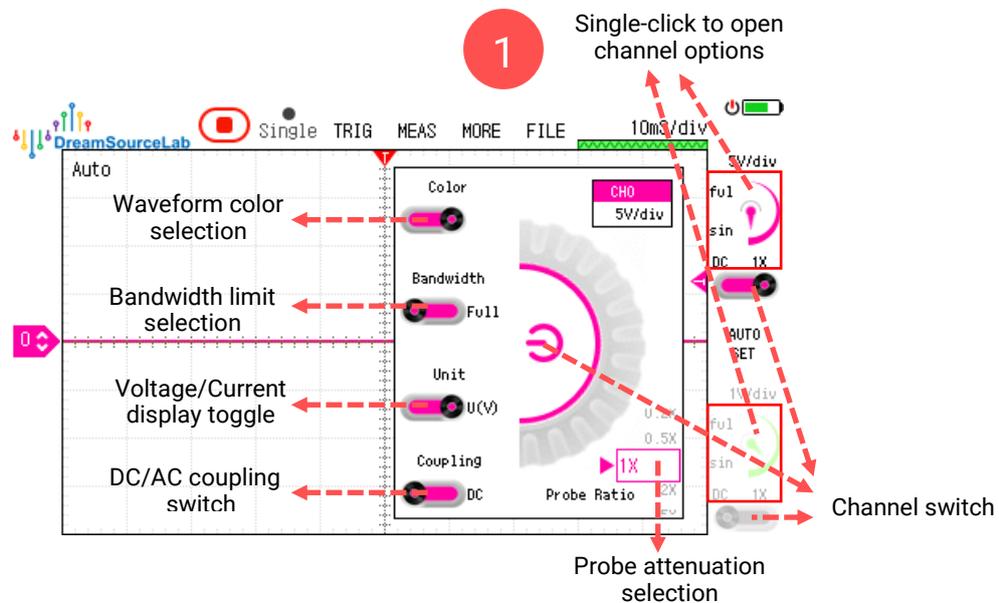


Figure 2-8

Channel On/Off: In the default state, you can directly click the toggle button below the channel to on/off the corresponding channel. Alternatively, you can open the channel settings window first and then click the central toggle button to switch the channel status.

Color: It supports channel waveform color settings to better distinguish or highlight signals from different channels.

Bandwidth: You can switch between 20MHz bandwidth limit and full bandwidth. If you want to reduce signal noise or observe low-frequency signals, you can use the bandwidth limit.

Units: It supports switching between voltage and current units to match the type of probe being used.

Coupling: You can switch between AC and DC coupling modes.

Probe Ratio: It supports selecting different probe ratios to match different probe attenuations.

2.2.2 Vertical Sensitivity

Vertical sensitivity determines the range and accuracy of the oscilloscope in the vertical direction, and its specific value represents how much voltage/current one grid in the vertical direction represents. To achieve more accurate measurements, and within the range, the vertical sensitivity should be set to make the measured signal occupy more vertical grids. For example, when measuring a +3V sine wave signal, a vertical sensitivity of 1V/Div is a better choice compared to 5V/Div. The vertical sensitivity of the DSTouch oscilloscope uses a "1-2-5" step scale, and the specific setting method is as follows:

Quick Operation: Click the vertical sensitivity label of the corresponding channel to select the channel you want to set. Once selected, the label starts to flash. At this time, you can change the vertical sensitivity of the corresponding channel by sliding up and down within the waveform area. Alternatively, you can also click on the

upper/lower half of the waveform area to incrementally decrease/increase the vertical sensitivity, as shown in Figure 2-9.

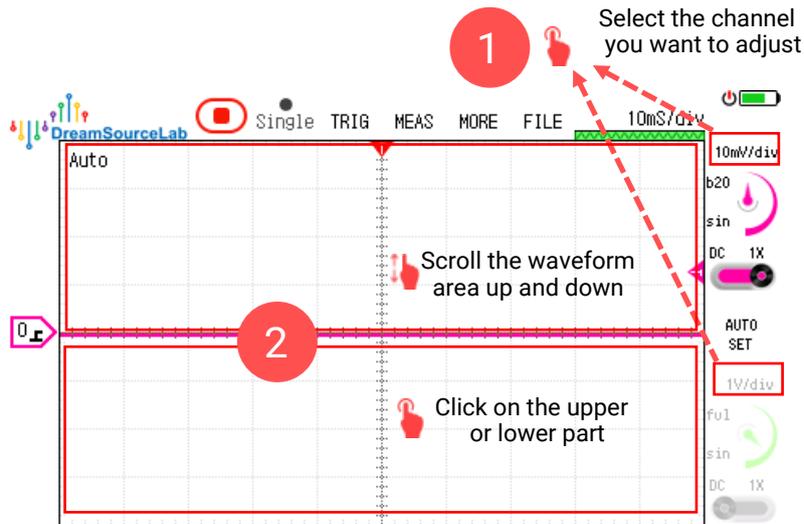


Figure 2-9

Regular Operation: The first step is to click on the corresponding channel to open the channel options. Then, click on the top/bottom area of the scroll wheel to incrementally decrease/increase the vertical sensitivity. Alternatively, you can directly slide the scroll wheel to set the vertical sensitivity. Additionally, the scroll wheel is designed with inertia, so if you need to quickly set it to the maximum/minimum, simply flick the scroll wheel quickly. The specific operations are shown in Figure 2-10.

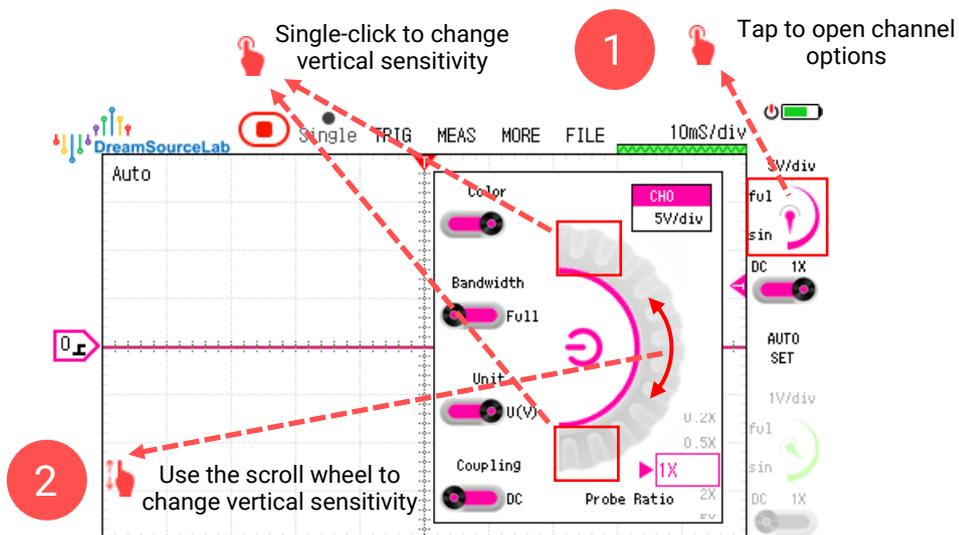


Figure 2-10

Probe Ratio: In addition to setting the vertical sensitivity of the oscilloscope itself, adjusting the probe ratio will also change the actual vertical sensitivity of the oscilloscope. To obtain accurate measurement results, it is essential to ensure that the actual probe attenuation matches the setting on the oscilloscope. The DSTouch oscilloscope provides a wide range of probe ratio options (0.1X ~ 1000X, 1-2-5 increments). The specific adjustment method is shown in Figure 2-11, simply slide up or down in the probe ratio area to change the probe ratio.

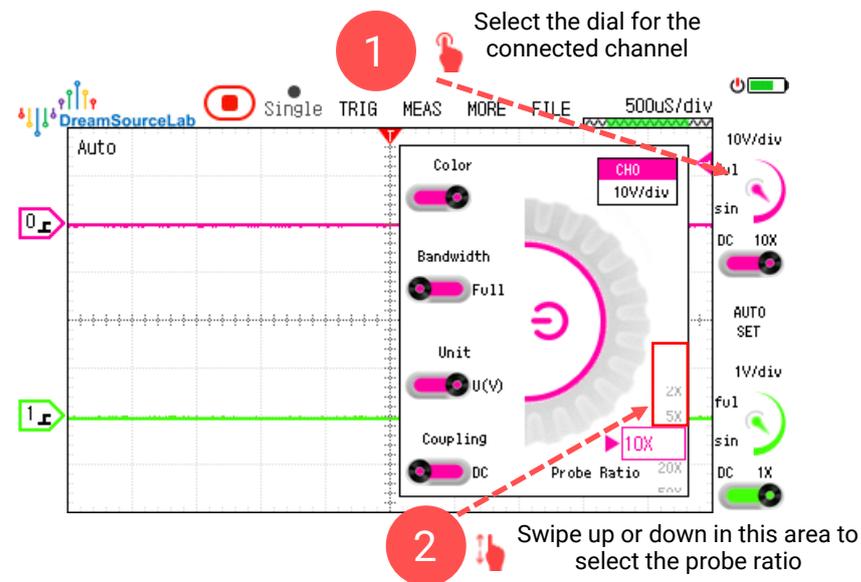


Figure 2-11

2.2.3 Vertical Offset

The vertical offset allows you to change the reference ground level within the vertical range of the oscilloscope. When the channel label is positioned in the middle of the oscilloscope, it indicates that the vertical offset is also at the middle position of the range, and the oscilloscope can measure a completely symmetrical range of positive and negative voltages. For example, with a vertical sensitivity of 5V per division, when the channel label is in the middle, the measurement range of DSTouch oscilloscope is -20V to +20V; when the channel label is at the top of the screen, the range becomes -40V to 0V.

During operation, moving the channel label will change the vertical offset of the channel. If the operation is paused, moving the channel label will only change the display position of the waveform within the display window. The specific method to move the channel label is as follows:

Standard Operation: Click to select the channel label, and the label will be filled with the channel color, indicating that the channel is selected. Now, you can slide up or down in the waveform area to change the channel offset. The operation is shown in Figure 2-12.

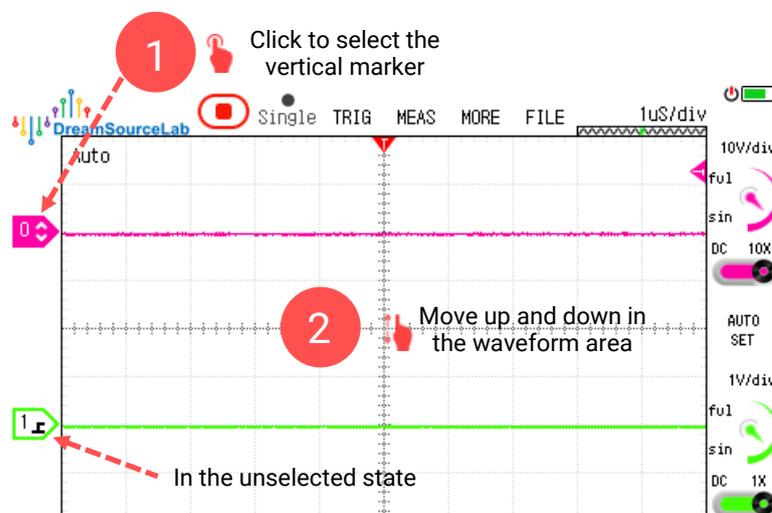


Figure 2-12

Quick Positioning: When we want to quickly set the vertical offset to specific positions, such as the center

of the screen, the upper center of the screen, or the lower center of the screen, we can use the quick buttons that appear on the left side of the waveform area while moving the channel label. Simply click on the desired quick button to set the vertical offset to the corresponding position. The specific operation is shown in Figure 2-13.

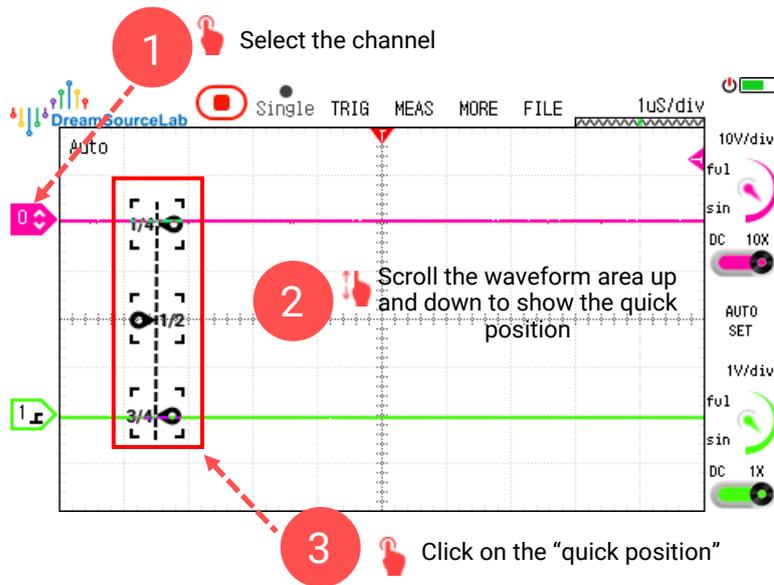


Figure 2-13

AC/DC coupling can also change the vertical offset of the waveform. When the measured signal, as shown in Figure 2-14, contains both AC and DC components, and you are only interested in the AC part but cannot zoom in on the waveform to the appropriate position, you can set AC coupling to remove the DC component. As shown in Figure 2-15, this allows for a better observation and amplification of the AC waveform.

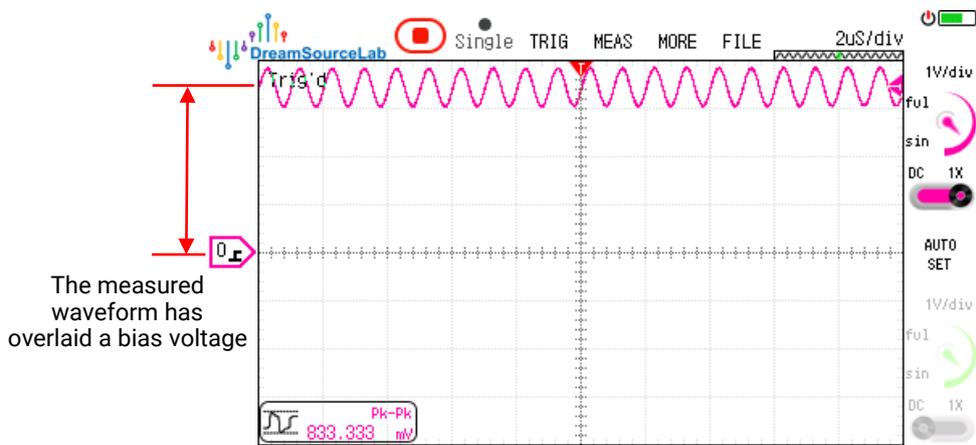


Figure 2-14

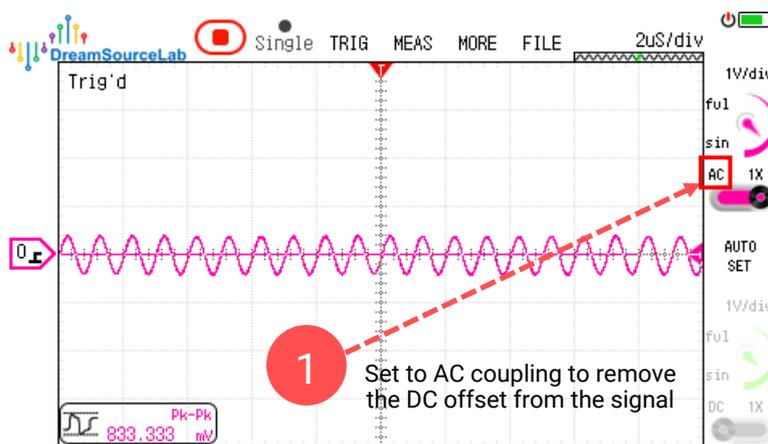


Figure 2-15

2.3 Trigger system

When the trigger system is not functioning, the oscilloscope's operation can be simplified as follows: it continuously acquires signals and fills the storage depth, then displays the collected waveforms on the screen, and repeats the process for the next acquisition. Due to the fast update rate of the oscilloscope, thousands of waveform frames can be captured and displayed within a second. Without any relationship or constraint between waveform frames, the displayed result appears as chaotic overlapping waveforms, making it impossible to observe stable waveform images.

The triggering system aligns waveform frames by placing the points that meet the trigger conditions at fixed positions within the storage depth. This alignment helps us observe stable waveform images. The description of trigger conditions and the setting of trigger positions are crucial for a triggering system. The DSTouch oscilloscope implements hardware-level waveform triggering, significantly reducing trigger latency while ensuring that no valid trigger signals are missed. It offers multiple trigger options, such as trigger mode, type, sensitivity, and hold-off time, as well as complete adjustment of the trigger position from 0% to 100%.

2.3.1 Trigger Position

By adjusting the trigger position, you can set at which point in the storage depth the waveform that meets the trigger condition will appear. This allows you to decide whether you need to observe more of the waveform before the trigger event (trigger position > 50%) or more of the waveform after the trigger event (trigger position < 50%). The relationship between trigger position and storage depth is illustrated in Figure 2-16.

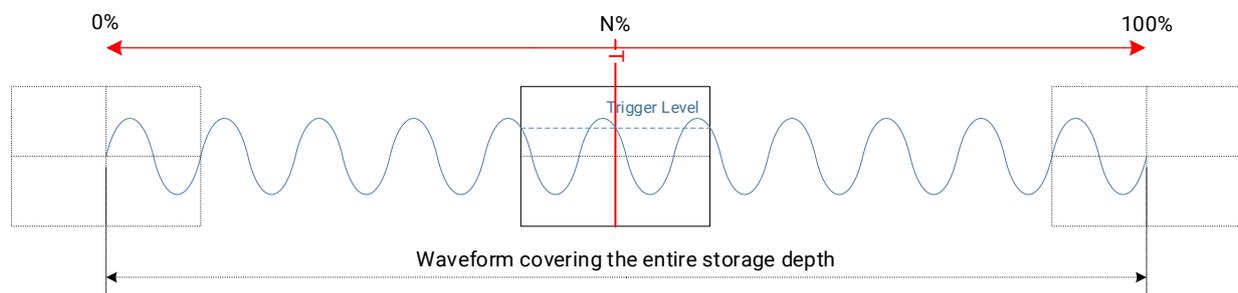


Figure 2-16

On the DSTouch oscilloscope, clicking on the "Trigger" option in the menu bar allows you to access the trigger settings, including the ability to set the trigger position. The specific steps for setting the trigger position are shown in Figure 2-17.

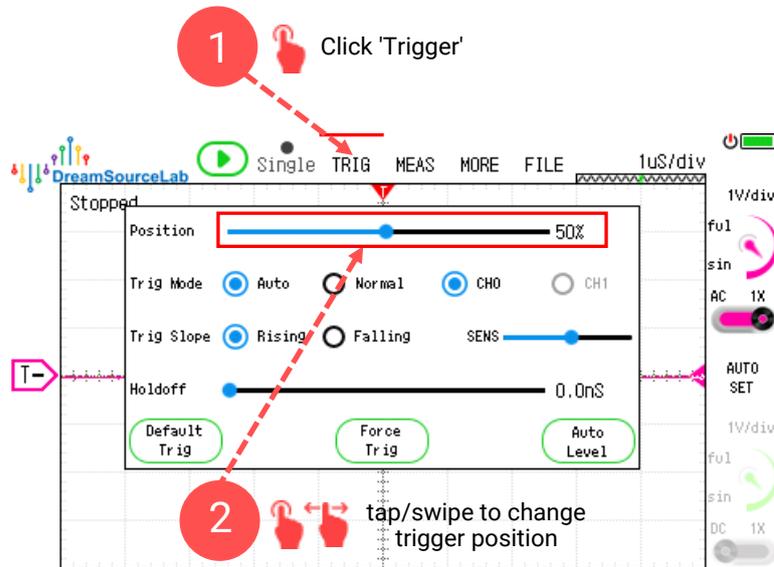


Figure 2-17

2.3.2 Trigger Level

The trigger level is a crucial parameter in the trigger settings that determines the vertical position of the triggered waveform. For the most commonly used edge trigger, when the input signal crosses the trigger level region from low to high (rising edge) or from high to low (falling edge), the waveform is considered to meet the trigger condition. As the DSTouch oscilloscope supports adjustable trigger sensitivity, the trigger level is not represented as a single value but rather as a voltage range, which effectively reduces false triggering. For details on adjusting trigger sensitivity, refer to section 2.3.6.

The DSTouch oscilloscope allows for convenient adjustment of the trigger level in its default state. The process is illustrated in Figure 2-18. When not selected, the trigger level is indicated by a triangle marked "T" on the right side of the waveform window. By clicking on the trigger level area in the rightmost two grid spaces, the trigger level can be selected. The specific trigger level value and a blinking trigger line will be displayed, and the trigger level can be adjusted by sliding up or down within the waveform area.

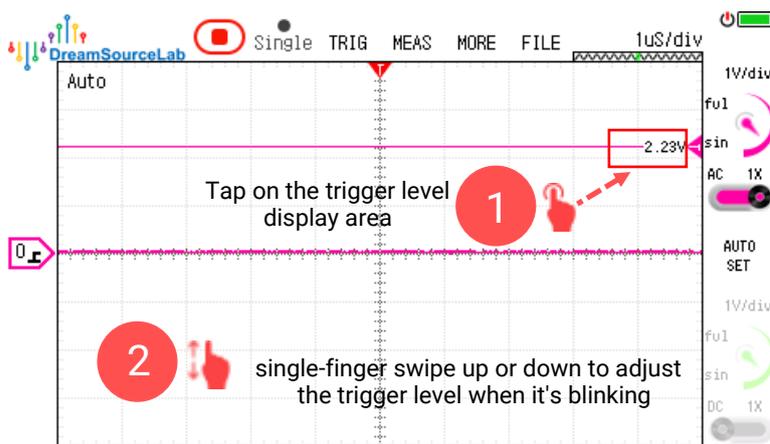


Figure 2-18

After entering the trigger options, you can also adjust the trigger level. The specific method is shown in Figure 2-19. Once you access the trigger options window, the left sidebar of the oscilloscope will display the current trigger level label. By clicking to select the trigger level label, you can then slide up or down in the left sidebar area to change the trigger level.

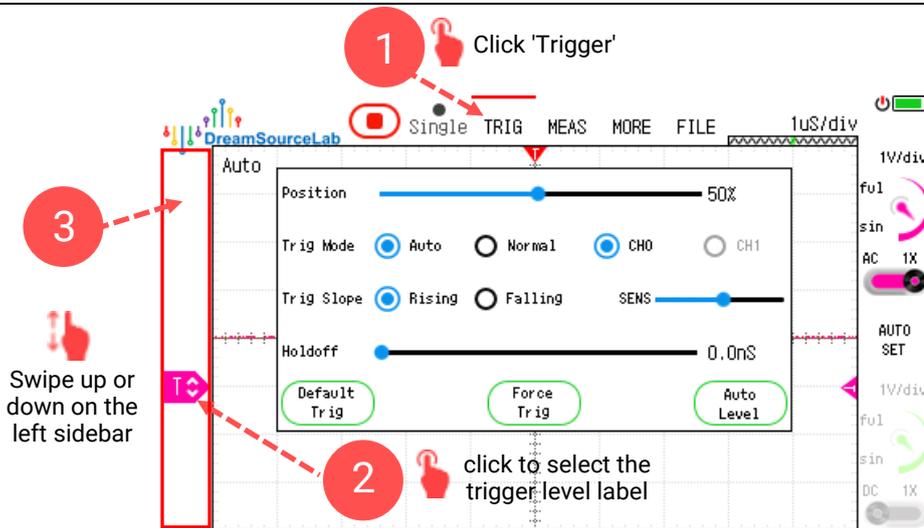


Figure 2-19

The trigger level is usually set in the middle of the high and low levels of the waveform under test, at a position where the change is relatively steep. When we are unsure about the specific information of the signal under test, we can use the "Auto" trigger and click "Auto Level" in the trigger options while in the running state. This will automatically set the trigger level in the middle of the maximum and minimum values of the current acquired waveform. The specific method is shown in Figure 2-20.

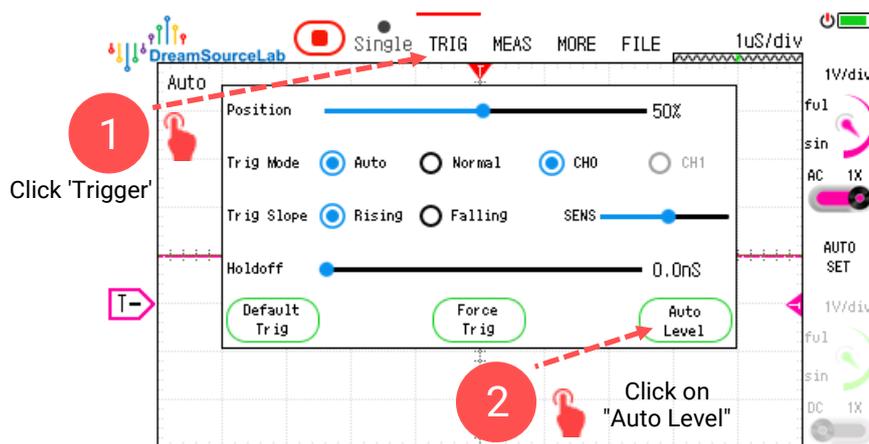


Figure 2-20

2.3.3 Trigger Modes

Trigger mode determines the strategy the oscilloscope uses to wait for the trigger condition. The DSTouch oscilloscope provides two trigger modes: "Auto" and "Normal," and their setup method are shown in Figure 2-21.

Auto Trigger: In auto trigger mode, the oscilloscope sets a waiting time. If no waveform meets the trigger condition within the specified time, the oscilloscope will automatically acquire and display the current waveform. If a trigger occurs during the waiting period, the oscilloscope will acquire and display the waveform according to the trigger settings. To distinguish between the two scenarios, the current status is displayed in the top-left corner of the waveform area. It shows "Auto" for an automatically acquired waveform and "Triggered" for a triggered waveform.

Normal Trigger: In normal trigger mode, the oscilloscope continuously waits for the trigger condition to be met. If no waveform meets the trigger condition, the current waveform display will not be updated, and the status "Waiting for Trigger" is displayed in the top-left corner of the waveform area. Once the trigger condition is met, the oscilloscope acquires and displays the waveform based on the trigger settings.

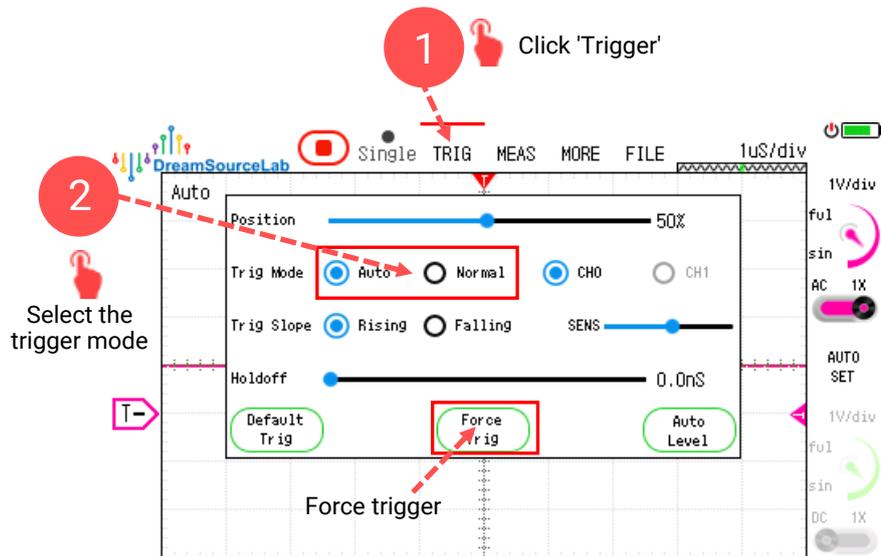


Figure 2-21

In normal trigger mode, if the waveform continuously fails to meet the trigger condition, resulting in no waveform displayed in the waveform area, you can use the "Force Trigger" option. This temporarily ignores the trigger condition and immediately acquires and displays the current waveform for observation or adjustment of the trigger condition based on the waveform.

2.3.4 Trigger Source

The DSTouch oscilloscope allows setting the trigger source to any currently enabled channel, and the setup method is shown in Figure 2-22.

When only one channel is enabled, the trigger source will automatically be set to the currently enabled channel. If the previously set trigger source channel has its channel enable disabled due to other operations, the trigger source will automatically be set to another channel that remains enabled.

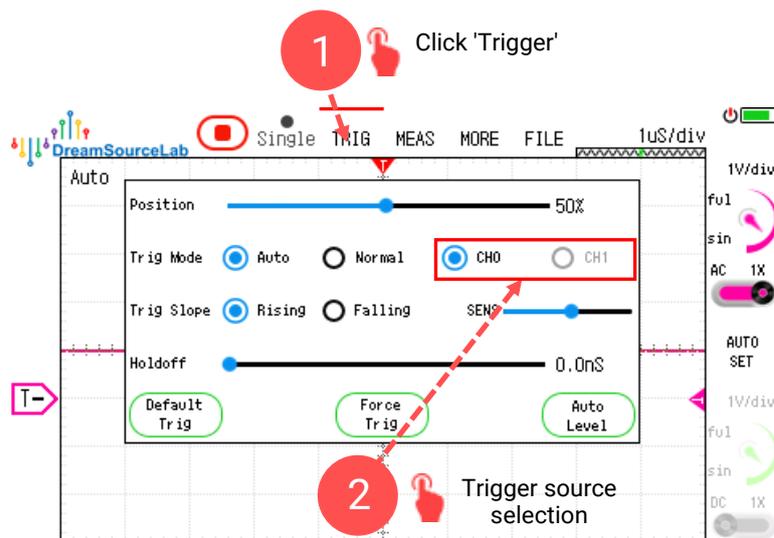


Figure 2-22

2.3.5 Trigger Type

The DSTouch oscilloscope provides two trigger types: "Rising Edge" and "Falling Edge," and their setup methods are shown in Figure 2-23.

Rising Edge Trigger: When the measured signal crosses the trigger level from below to above, it triggers a rising edge event.

Falling Edge Trigger: When the measured signal crosses the trigger level from above to below, it triggers a falling edge event.

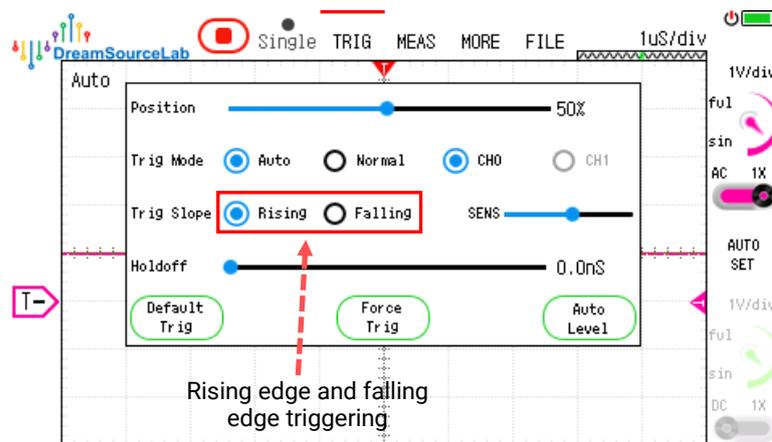


Figure 2-23

2.3.6 Sensitivity

If the trigger level is set to a single voltage value, jitter in the vicinity of the trigger level can cause multiple trigger conditions, leading to unstable trigger positions and resulting in the waveform horizontally jittering back and forth, making it difficult to observe the stable triggered waveform. To stabilize triggering on waveform edges, the DSTouch oscilloscope applies hysteresis comparison to the trigger level, effectively filtering out the influence of signal glitches on triggering. Additionally, it provides a setting for the hysteresis range, which is referred to as the trigger sensitivity in the trigger options.

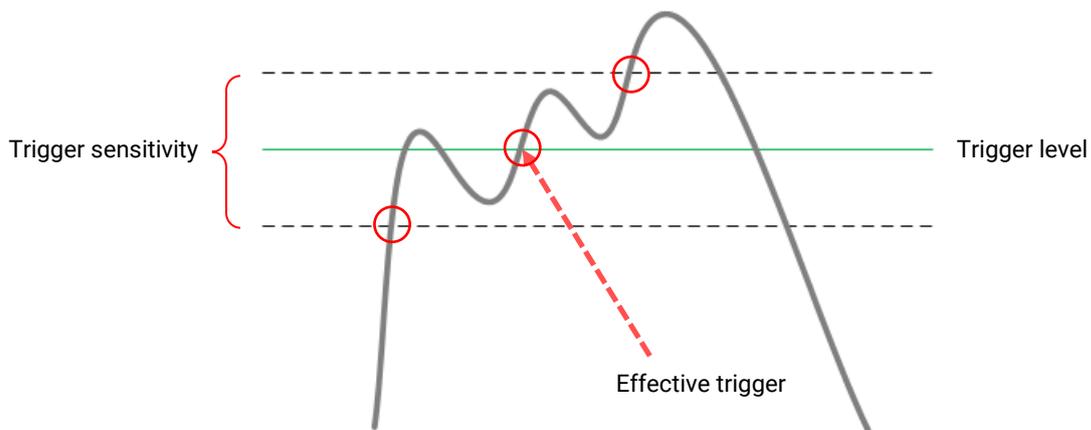


Figure 2-24

The specific setup for trigger sensitivity is shown in Figure 2-25. When the dot is set to the leftmost position of the slider, it indicates that the trigger hysteresis height is 0, meaning there is no hysteresis effect, and any voltage changes at the trigger level's two ends may trigger the oscilloscope. When the dot is set to the rightmost position of the slider, it represents the maximum trigger hysteresis range, and the waveform will trigger only when it entirely crosses the entire hysteresis range, effectively filtering out the influence of excessive noise on triggering.

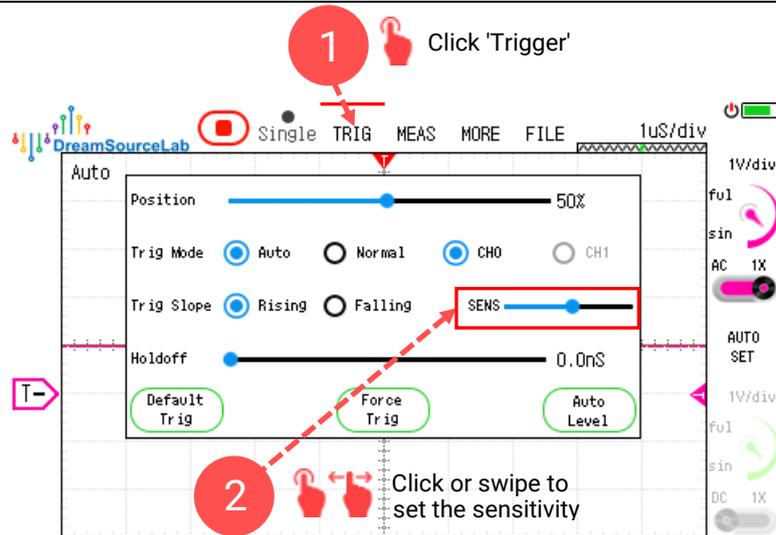


Figure 2-25

2.3.7 Trigger Holdoff

Trigger holdoff allows you to set a duration during which the oscilloscope disables triggering after each trigger event. Once the set duration has elapsed, the trigger functionality is re-enabled. This feature is essential for observing burst signals frequently encountered in real-world signal transmissions. Without trigger holdoff, it would be challenging to observe such signals stably on the oscilloscope. The basic principle of trigger holdoff is illustrated in Figure 2-26.

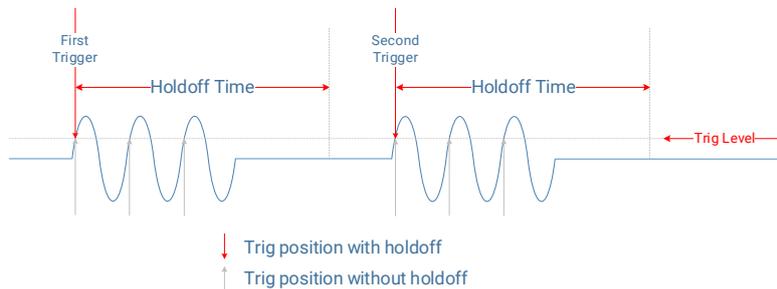


Figure 2-26

If every rising edge in each transition period shown in Figure 2-26 triggers the oscilloscope, each trigger point in each frame of the waveform can be any of these rising edges. As a result, these random trigger points would be superimposed on the screen, making it impossible to observe a stable burst signal, as shown in Figure 2-27.

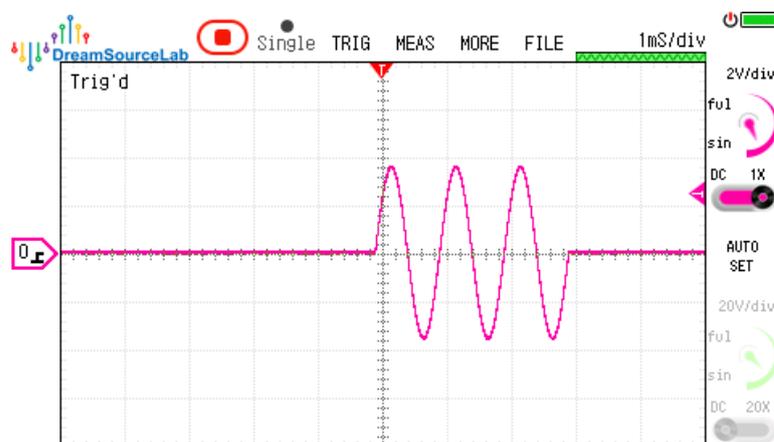


Figure 2-27

The setup method for trigger holdoff in the DSTouch oscilloscope is shown in Figure 2-28.

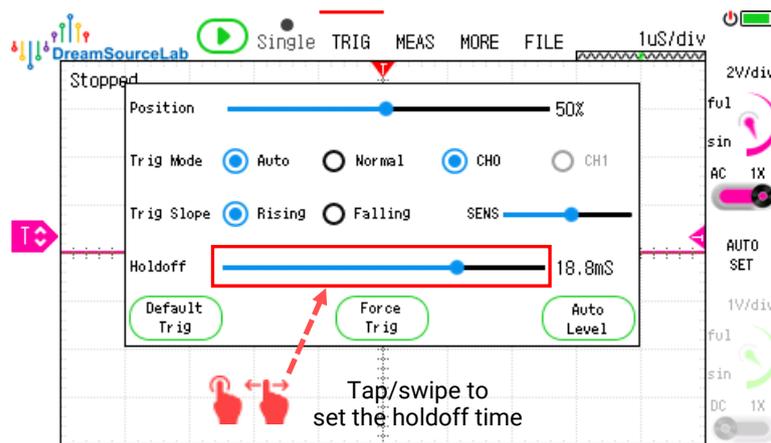


Figure 2-28

2.4 Single Acquisition

The DSTouch oscilloscope supports two modes of single acquisition, and the method to set single acquisition is shown in Figure 2-29. Select the "Single" option and click "Run". Similar to real-time acquisition, single acquisition also comes in two trigger types: "Auto" trigger and "Normal" trigger. It is important to note that some oscilloscopes only support "Single Normal" trigger. To achieve compatibility, the DSTouch oscilloscope also defaults to the "Normal" trigger mode during single acquisition. If auto trigger is desired, it can be manually configured.

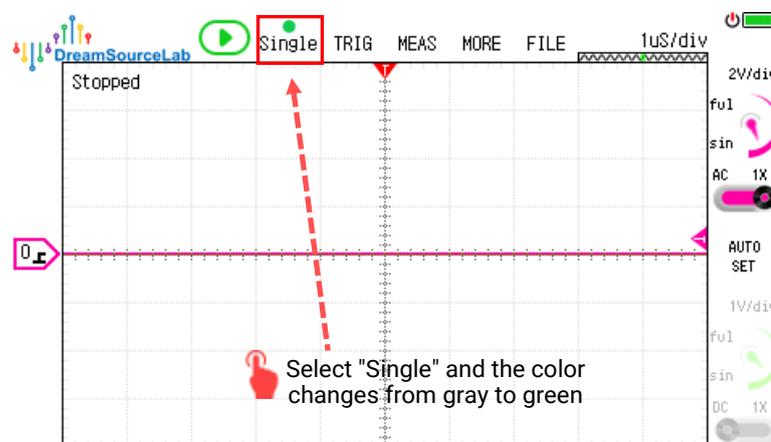


Figure 2-29

Single Auto Trigger: In this mode, the oscilloscope will acquire and display the current waveform once based on the current settings. After the acquisition is complete, it will automatically stop. This process does not depend on whether the trigger condition is met; it will automatically perform acquisition and display.

Single Normal Trigger: Similar to real-time normal trigger, in this mode, the oscilloscope will trigger and acquire data once based on the trigger conditions. However, unlike real-time normal trigger, single normal trigger stops the acquisition after the first trigger event and displays the waveform of the last trigger event. To perform another trigger, you need to click the "Stop/Run" button again.

2.5 Quick Menu

Considering the single-hand grip scenario, the DSTouch oscilloscope has designed a quick menu operation

to allow fast switching between the three main settings: horizontal timebase, vertical sensitivity, and trigger level. This enables users to quickly set the three most important parameters of the oscilloscope with one hand, making the entire measurement process smoother and more convenient.

Auto: Long-press the blank area on the left sidebar with one finger to bring up the quick menu. Then, click on "Auto" in the center of the rotary knob, and the oscilloscope will automatically adjust the vertical sensitivity, horizontal timebase, trigger level, and other parameters based on the acquired waveform. The specific method is shown in Figure 2-30.

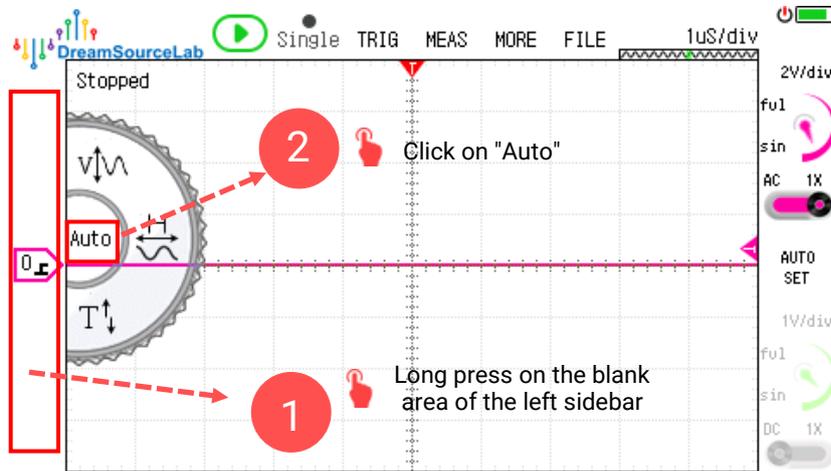


Figure 2-30

Vertical Sensitivity: Long-press the blank area on the left sidebar with one finger to bring up the quick menu. Click on the vertical direction label on the rotary knob to select the channel for adjusting the vertical sensitivity. The selected channel label will start blinking, and then you can adjust the vertical sensitivity of that channel by sliding up and down within the waveform area. The specific method is shown in Figure 2-31.

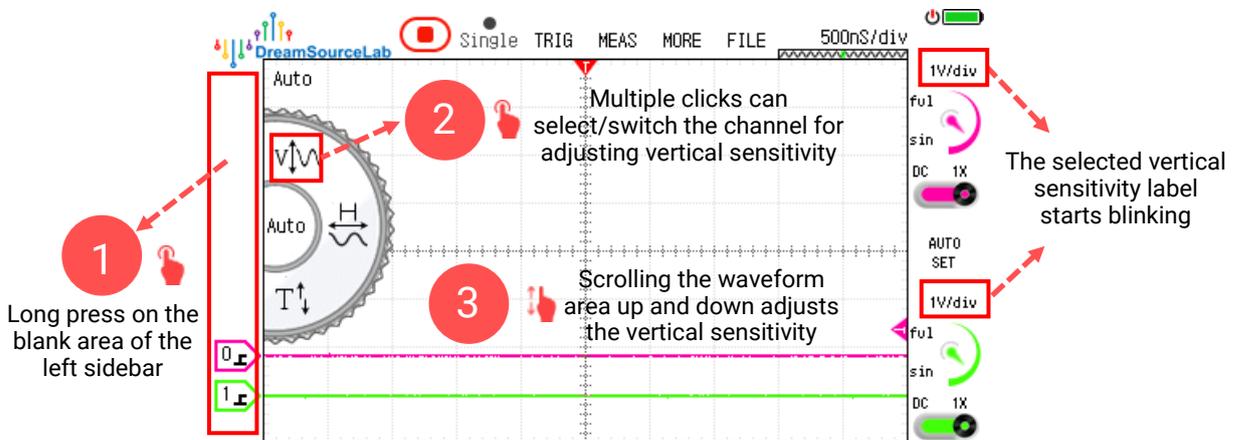


Figure 2-31

Horizontal Timebase: Long-press the blank area on the left sidebar with one finger to bring up the quick menu. Click on the horizontal direction label on the rotary knob to enter the horizontal timebase adjustment mode. In this mode, you can adjust the horizontal timebase by sliding up and down within the waveform area. The specific method is shown in Figure 2-32.

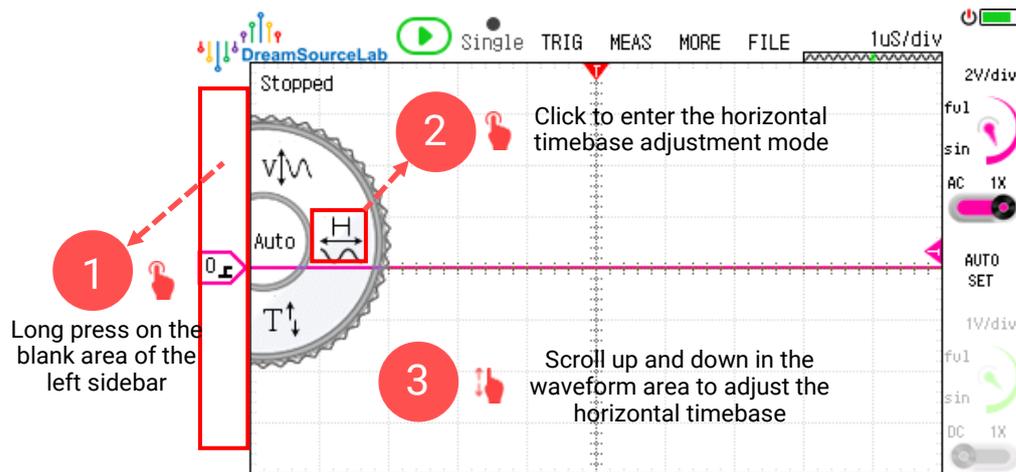


Figure 2-32

Trigger Level: Long-press the blank area on the left sidebar with one finger to bring up the quick menu. Click on the "T" trigger label at the bottom of the rotary knob to perform trigger level selection and trigger channel switching. When the trigger level scale line blinks, you can adjust the trigger level by sliding up and down within the waveform area. The specific method is shown in Figure 2-33.

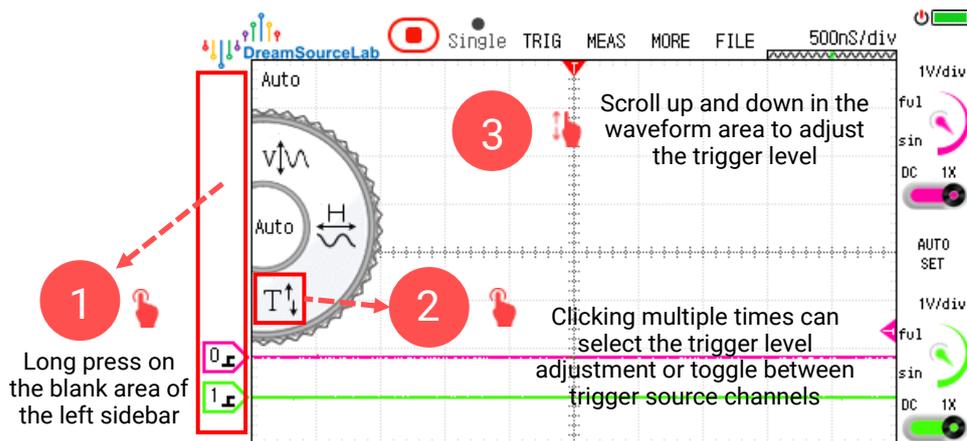


Figure 2-33

2.6 Auto Measurements

The DSTouch oscilloscope supports 20 types of automatic measurements. With just 2-3 light taps/clicks, you can easily add or delete automatic measurement options. The window can display up to 8 automatic measurement options simultaneously. Each measurement option can be customized to select any enabled channel and any parameter for display and observation. All automatic measurements in the DSTouch oscilloscope are based on the waveforms currently displayed in the window. If there are multiple measurement values, the average value will be displayed. When zooming or moving the waveform, all automatic measurement results will automatically update based on the changes in the displayed waveform.

The automatic measurement parameters can be divided into vertical voltage parameters and horizontal time parameters.

2.6.1 Vertical Measurements

Maximum Voltage (Max): The voltage value from the highest point of the waveform to the Ground (reference level).

Minimum Voltage (Min): The voltage value from the lowest point of the waveform to the Ground (reference level).

Peak-to-Peak Value (Pk-Pk): The difference between the maximum and minimum voltage of the waveform.

High Level (High): The voltage value with the highest occurrence in the upper part of the waveform.

Low Level (Low): The voltage value with the highest occurrence in the lower part of the waveform.

Amplitude (Amp): The difference between the high level and low level of the waveform.

+Overshoot (+Over): The ratio of the difference between the maximum voltage and the high level to the waveform amplitude.

-Overshoot (-Over): The ratio of the difference between the minimum voltage and the low level to the waveform amplitude.

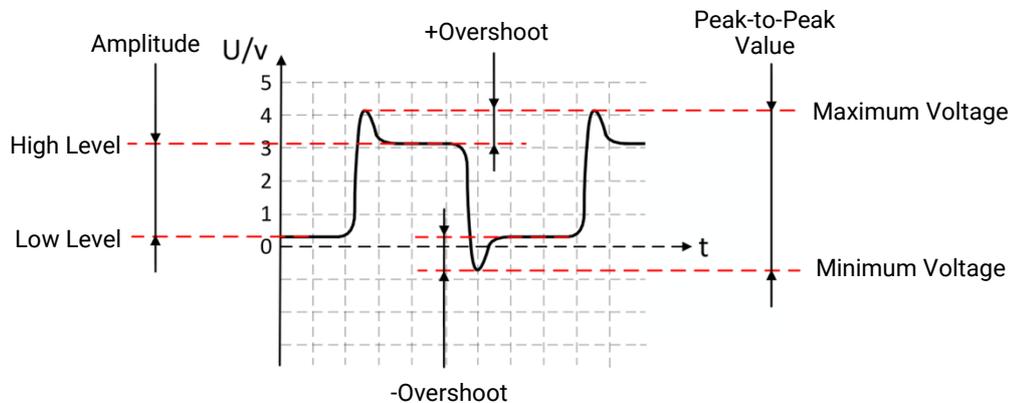


Figure 2-34

Root Mean Square (RMS): The root mean square value of the voltage of all sampling points in the waveform display window.

$$\bar{x} = \sqrt{\frac{\sum_{i=1}^n x_i^2}{n}}$$

Mean: The average voltage value of all sampling points in the waveform display window.

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

2.6.2 Horizontal Measurements

Rise Time (Rise): The time it takes for the waveform amplitude to rise from 10% to 90%.

Fall Time (Fall): The time it takes for the waveform amplitude to fall from 90% to 10%.

Positive Pulse Width (+Pulse): The pulse width of the positive pulse at 50% amplitude.

Negative Pulse Width (-Pulse): The pulse width of the negative pulse at 50% amplitude.

Burst Pulse Width (Burst): The burst width of all pulses at 50% amplitude within the display window.

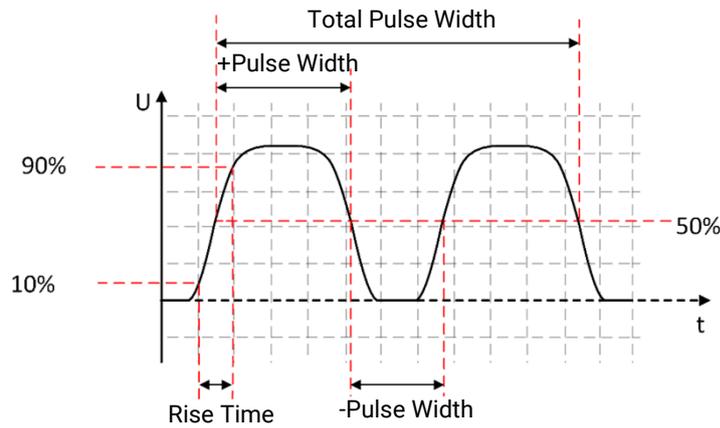


Figure 2-35

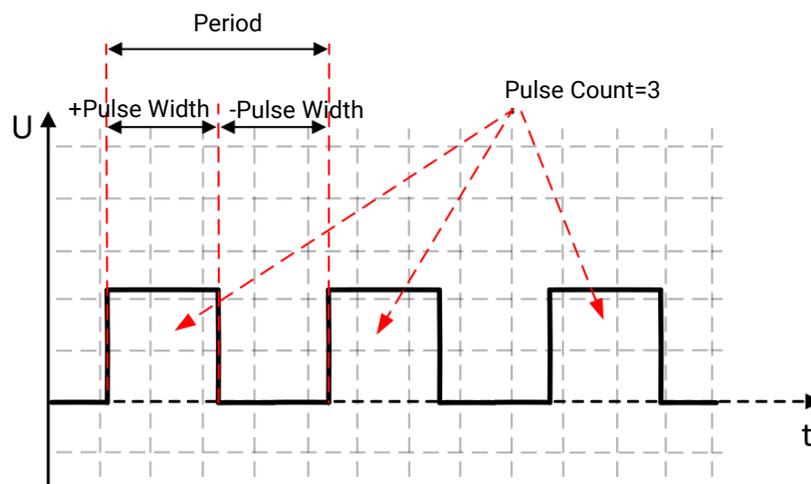
Frequency (Freq): The number of periodic changes in the waveform within one unit of time.

Period (Period): The time interval between repeated appearances of the signal, which is the reciprocal of the frequency.

Pulse Count (PCnt): The number of positive pulses in the waveform.

Positive Duty Cycle (+Duty): The ratio of the positive pulse width to the period.

Negative Duty Cycle (-Duty): The ratio of the negative pulse width to the period.



Positive Duty Cycle = $\frac{+Pulse\ Width}{Period}$
 Negative Duty Cycle = $\frac{-Pulse\ Width}{Period}$

Figure 2-36

2.6.3 Add/Delete Measurements

To add or delete auto measurement items in the DSTouch oscilloscope, follow the method shown in Figure 2-37.

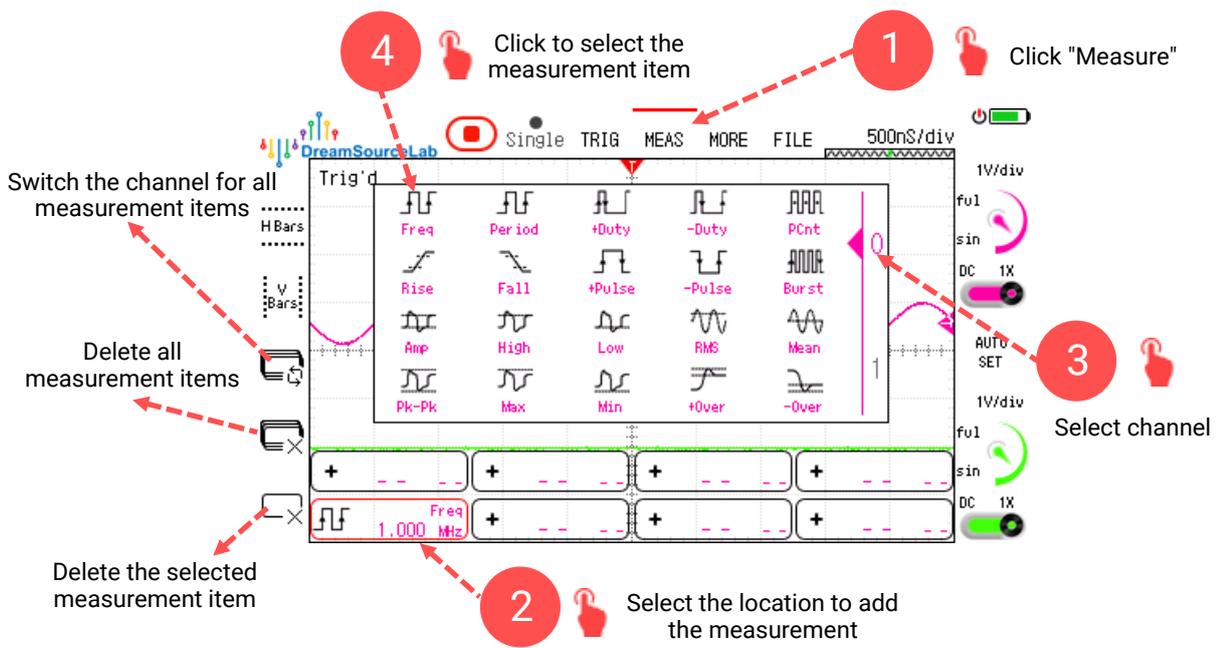


Figure 2-37

2.7 Cursor Measurement

In addition to auto measurements, the DSTouch oscilloscope also provides vertical and horizontal cursor measurements. The "H Bars" cursor is displayed as a horizontal line to measure voltage values, and the "V Bars" cursor is displayed as a vertical line to measure time values. By sliding with a single finger, you can conveniently measure time differences and voltage differences. Figure 2-38 shows the display and position of the two types of cursor measurements.

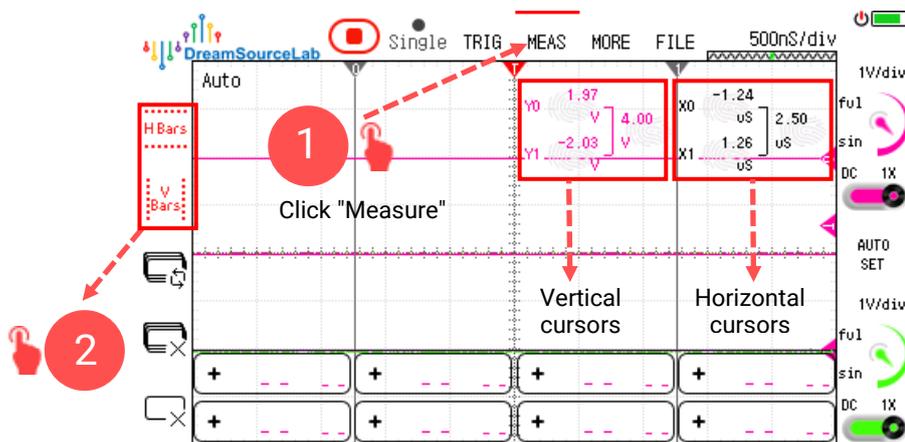


Figure 2-38

2.7.1 H Bars

The "H Bars" can be used to measure the voltage difference between two sampling points in the waveform. It consists of Y0 and Y1 cursors and the measurement display result. After selecting the cursors, you can move them up and down to the measurement position. The measurement result displays the voltage value of each cursor and the voltage difference between the two cursors. Different channels can also be selected for measurement.



Figure 2-39

2.7.2 V Bars

The "V Bars" can be used to measure time parameters between two horizontal positions. It consists of X0 and X1 cursors and the measurement display result. Clicking on the cursors allows you to move them to the desired measurement position. The measurement result shows the time positions of both X0 and X1 cursors, as well as their time difference. The time difference can also be displayed as the corresponding frequency. For example, if the time span between X0 and X1 is 1ms, the converted frequency will be 1kHz.

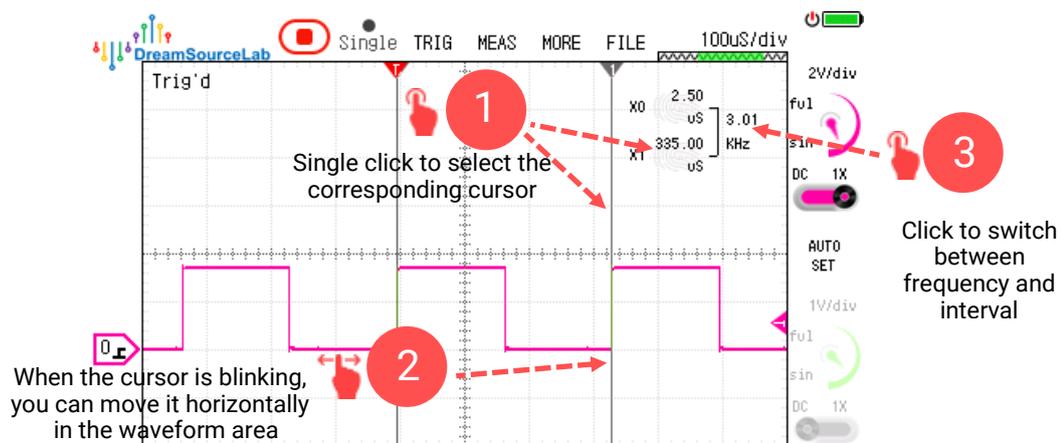


Figure 2-40

2.8 Display

2.8.1 X-Y Mode

The X-Y mode uses the sampled values of two channels as X and Y coordinates, creating a graphical pattern on the screen called a Lissajous figure. To enter X-Y mode in the DSTouch oscilloscope, follow the steps shown in Figure 2-41.

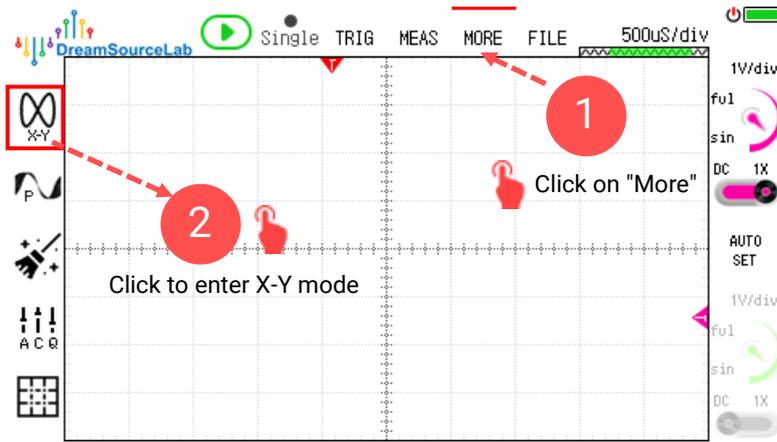


Figure 2-41

In X-Y mode, at least two enabled channels are required. You can choose the correspondence between channels and coordinates. Channel 0 can be selected as X and Channel 1 as Y, or vice versa. The interface and display effect of X-Y mode are shown in Figure 2-42.

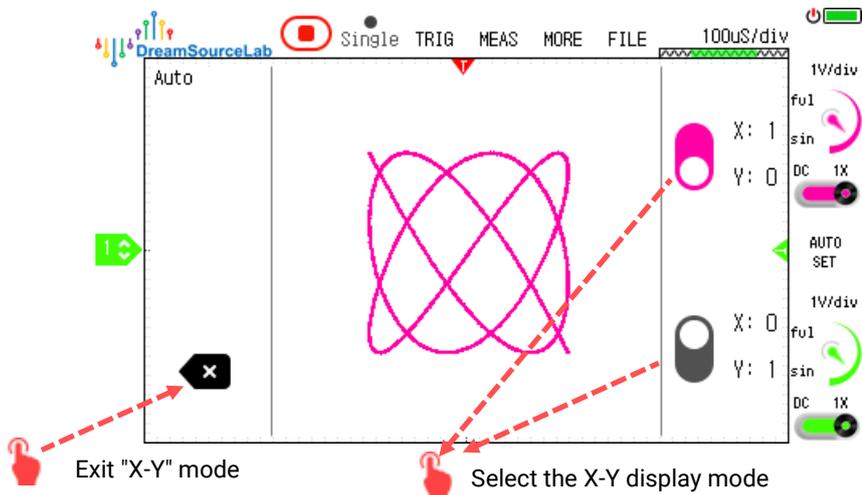


Figure 2-42

2.8.2 Persistence Mode

The DSTouch oscilloscope supports persistence mode, which allows all captured waveforms to leave traces on the screen. Historical waveforms and current waveforms can be distinguished by color difference. Persistence mode has many applications, for example, stable triggered waveforms may sometimes have anomalies, but these signals may be transient and not easily observable by the naked eye. Using persistence mode allows all waveforms to remain on the screen, making it easier to observe any anomalies. Additionally, persistence mode can be useful for observing signal noise and jitter.

To enter the persistence mode in the DSTouch oscilloscope, follow the steps shown in Figure 2-43.

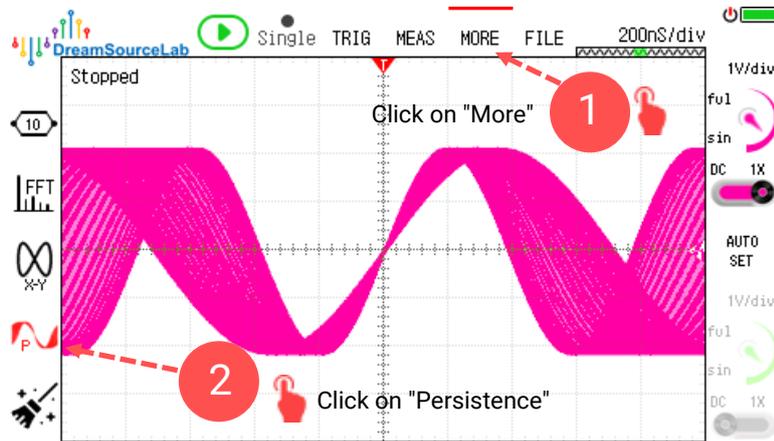


Figure 2-43

2.8.3 Clear Screen

When you need to clear the displayed waveforms on the screen, you can use this function. Additionally, this function can also be used in conjunction with the persistence mode.

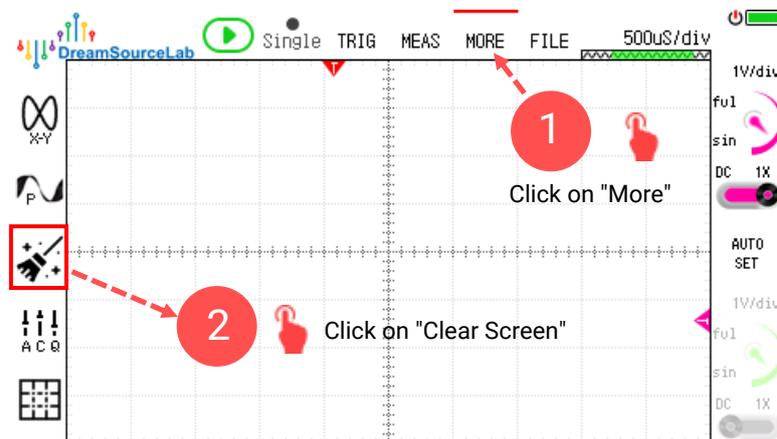


Figure 2-44

2.8.4 Grid Lines

As shown in Figure 2-45, the DSTouch oscilloscope provides four types of waveform display backgrounds for users to choose from: grid + cross, grid only, cross only, and no grid.

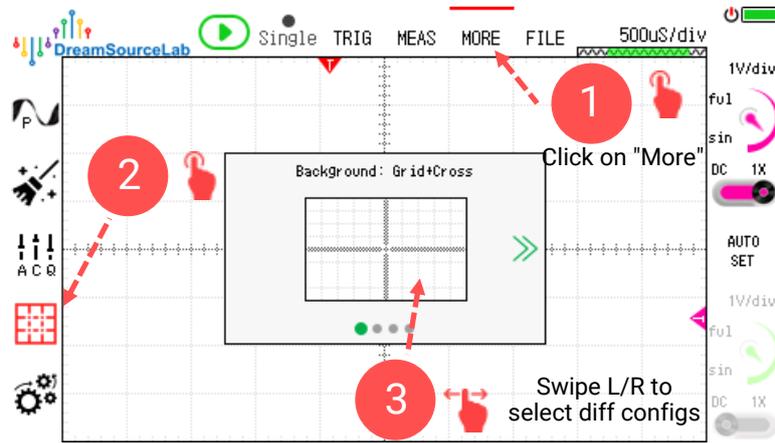


Figure 2-45

2.9 Calibration

The DSTouch oscilloscope provides two waveform calibration features: "Auto Calibration" and "Amplitude Fine-Tuning."

Auto calibration can correct the impact of environmental factors on channel offset. If there are significant changes in the oscilloscope's operating environment (such as temperature, humidity, etc.), or if you notice significant offset in the zero point position, it is recommended to perform auto calibration again. In general, frequent calibration is not required during regular use.

The amplitude fine-tuning function eliminates the hassle of periodic factory calibration for users. For users with the necessary conditions, they can perform amplitude calibration on the oscilloscope through the amplitude fine-tuning feature.

To enter the calibration mode, follow the steps shown in Figure 2-46. Then, in the pop-up window (Figure 2-47), select the specific calibration method.

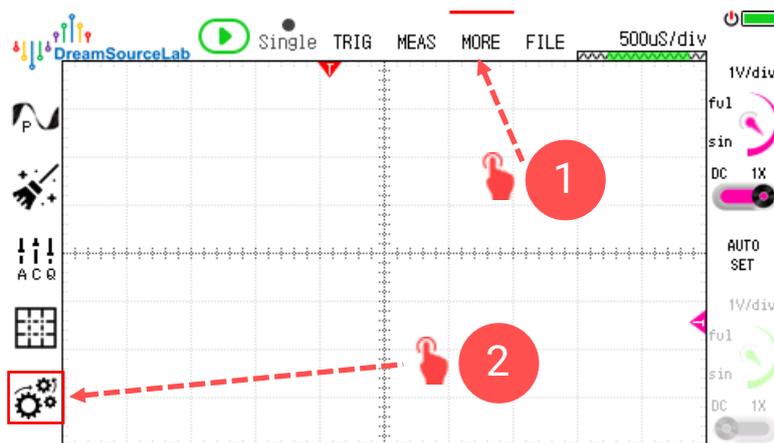


Figure 2-46

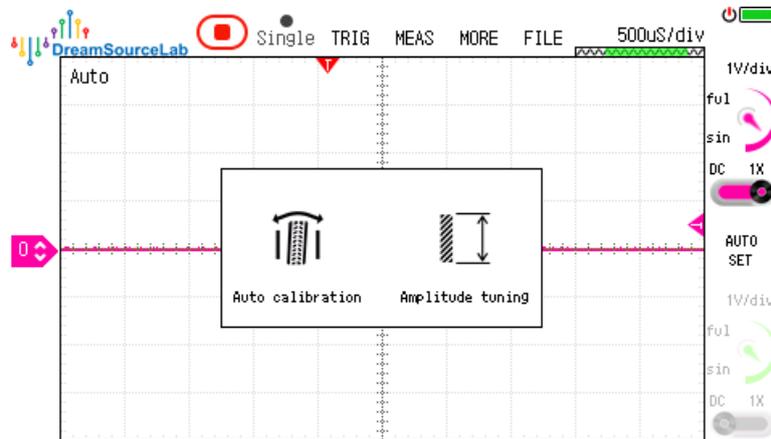


Figure 2-47

Auto Calibration: The auto calibration does not require manual intervention. Ensure that no probes are connected to the oscilloscope before starting the auto calibration. During the auto calibration, which normally takes 1-2 minutes, the oscilloscope will automatically complete the calibration. After the process is finished, you can save the calibration results, and these parameters will be automatically loaded on the next boot. If any issues arise during the auto calibration, corresponding error messages will be displayed. You can exit the auto calibration process immediately by clicking the "Exit" button. The auto calibration process is illustrated in Figure 2-48.

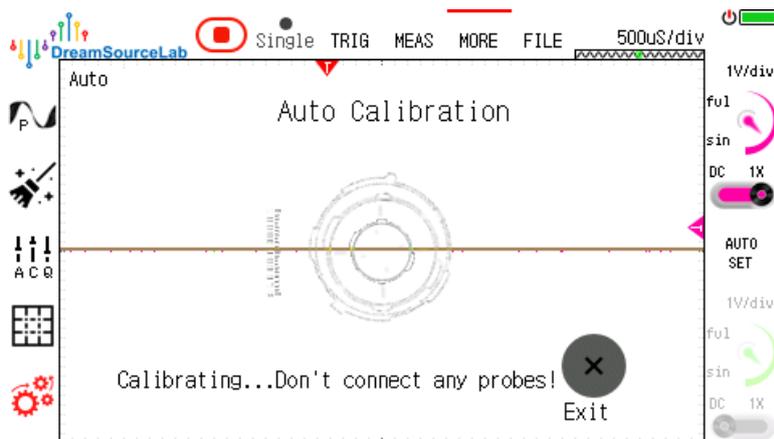


Figure 2-48

Amplitude Fine-Tuning: The amplitude fine-tuning feature allows users to calibrate the amplitude of the oscilloscope. This process is relatively complex and requires user involvement. By default, the DSTouch oscilloscope already performs amplitude calibration during its factory calibration, so it is recommended not to change the default settings of amplitude fine-tuning unless necessary.

For amplitude fine-tuning, you need to connect a more precise DC or fixed-frequency square wave reference signal. Assuming you need to adjust Channel 0, first ensure that only Channel 0 is enabled and the oscilloscope is running. Then open the amplitude fine-tuning window and compare the measured value with the actual reference signal. If they do not match, you can adjust the "Gain Adjustment" slider to make the measured value match the actual reference signal's amplitude. Next, enable all other channels and adjust the "Single/Double Difference" slider to make the amplitude of Channel 0 match the actual reference signal's amplitude again. After completing the amplitude fine-tuning for Channel 0, you can save the results. If you need to adjust other channels, repeat the above steps accordingly.

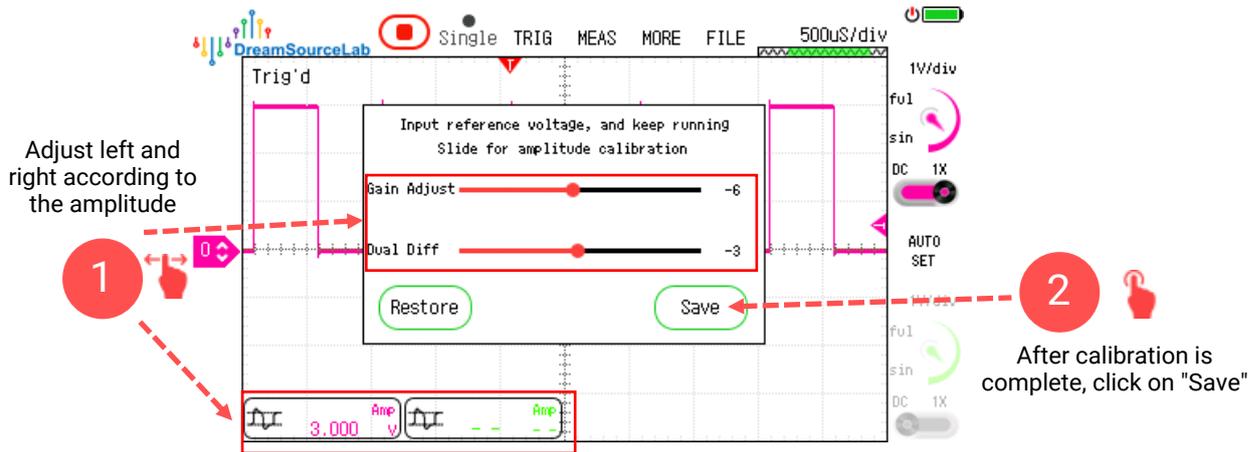


Figure 2-49

2.10 Signal Generator

The DSTouch oscilloscope features an independent signal generator function that can output various types of custom waveforms, such as sine waves, square waves, triangle waves and sawtooth waves. The output interface of the signal generator is a standard MCX female connector, as shown in Figure 2-50.

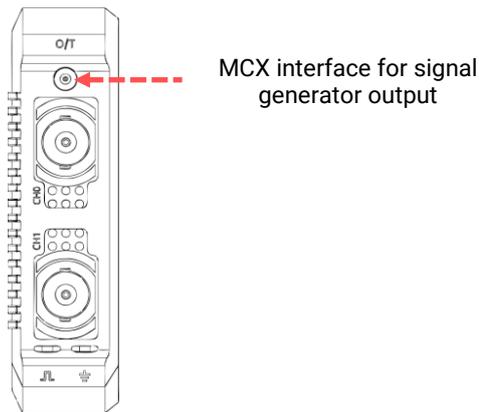


Figure 2-50

2.10.1 Run/Stop

To start or stop the signal generator, follow the steps in Figure 2-51. Click the "Run" button in the options window, and when the button turns red, it indicates that the signal generator is outputting the currently set waveform. The signal generator will automatically turn off after shutting down, and you need to manually turn it on again during the next power-on.

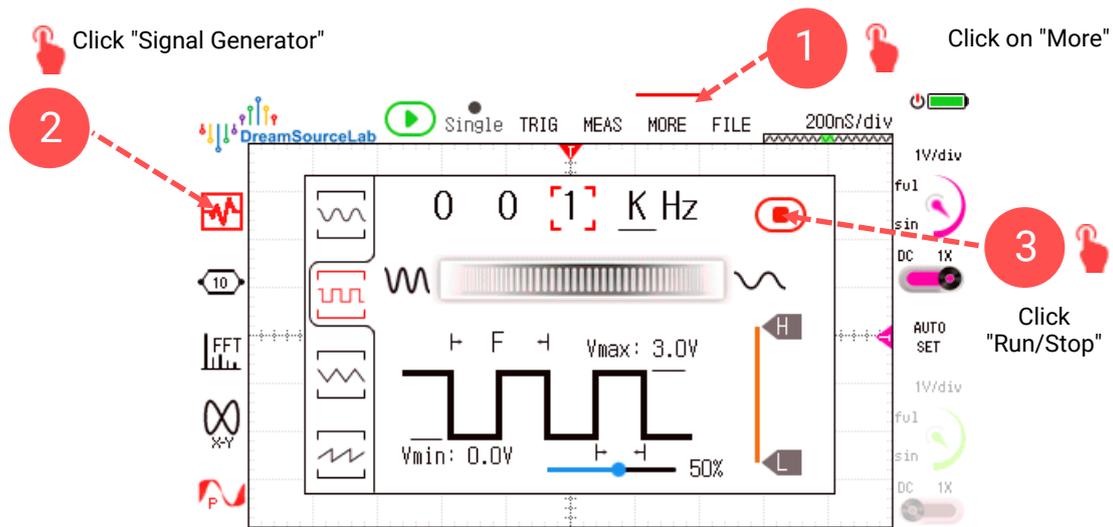


Figure 2-51

2.10.2 Frequency

To set the signal frequency, follow the steps in Figure 2-52. The frequency unit can be quickly switched by clicking on it.

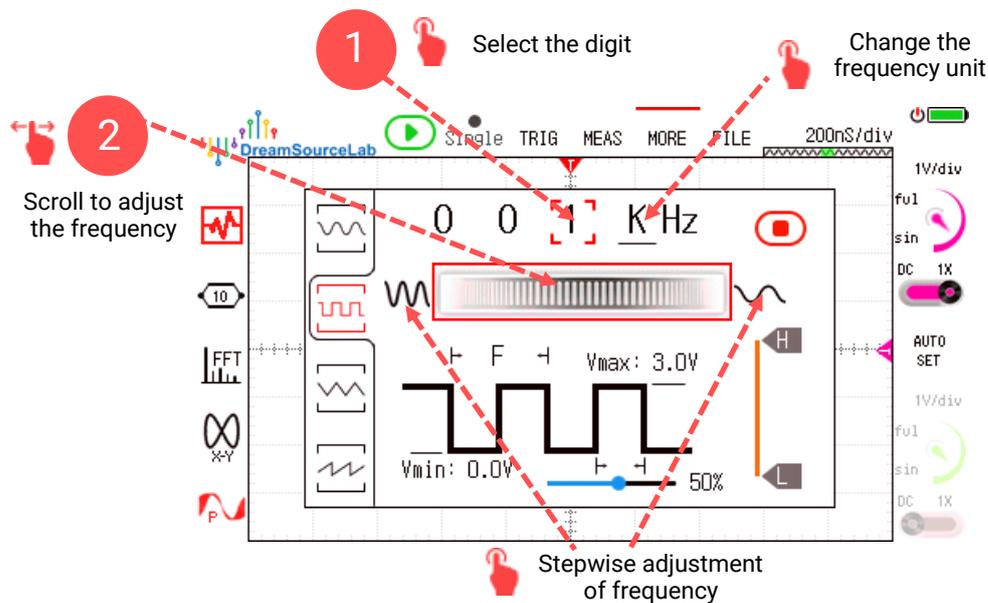


Figure 2-52

2.10.3 Amplitude

The signal amplitude can be adjusted using the method shown in Figure 2-53. Before adjusting, you need to select the corresponding high/low-level label, and then slide up or down the entire window to adjust the amplitude.

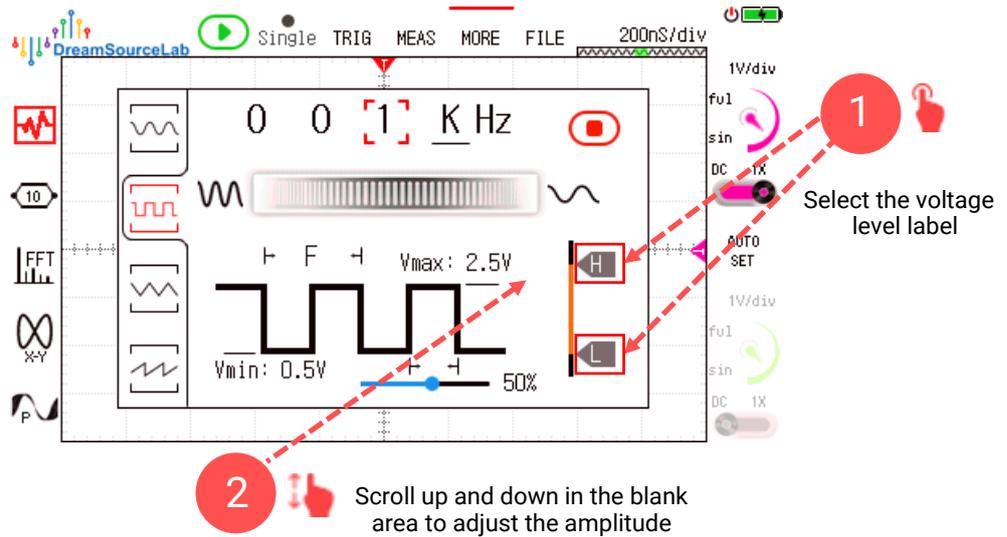


Figure 2-53

2.10.4 Signal Type

Selecting the signal type is shown in Figure 2-54. If you choose a square wave, you can also adjust the duty cycle of the square wave.

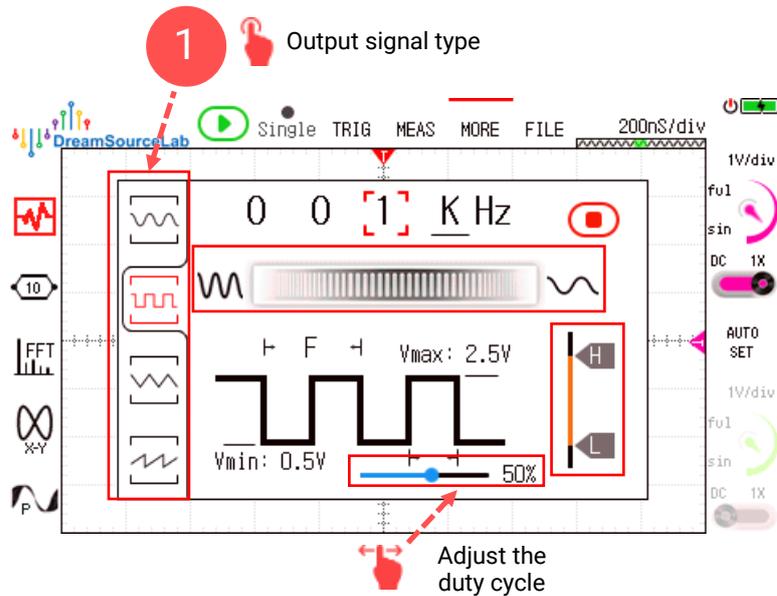


Figure 2-54

2.11 Protocol Decoders

The DSTouch oscilloscope has a built-in protocol decoder function that allows users to easily decode the captured signals. Currently, the DSTouch oscilloscope provides decoding for three protocols: UART, I2C, and SPI.

2.11.1 Add/Delete Decoder

Add: To add a decoder, follow the steps in Figure 2-55. Click on "More," then select "Decoder" from the menu

on the left side, and choose the corresponding protocol. After setting the parameters for the decoder, click "OK." It's essential to note that different protocols have different parameter settings, so users need to refer to the specific protocol specification for configuration.

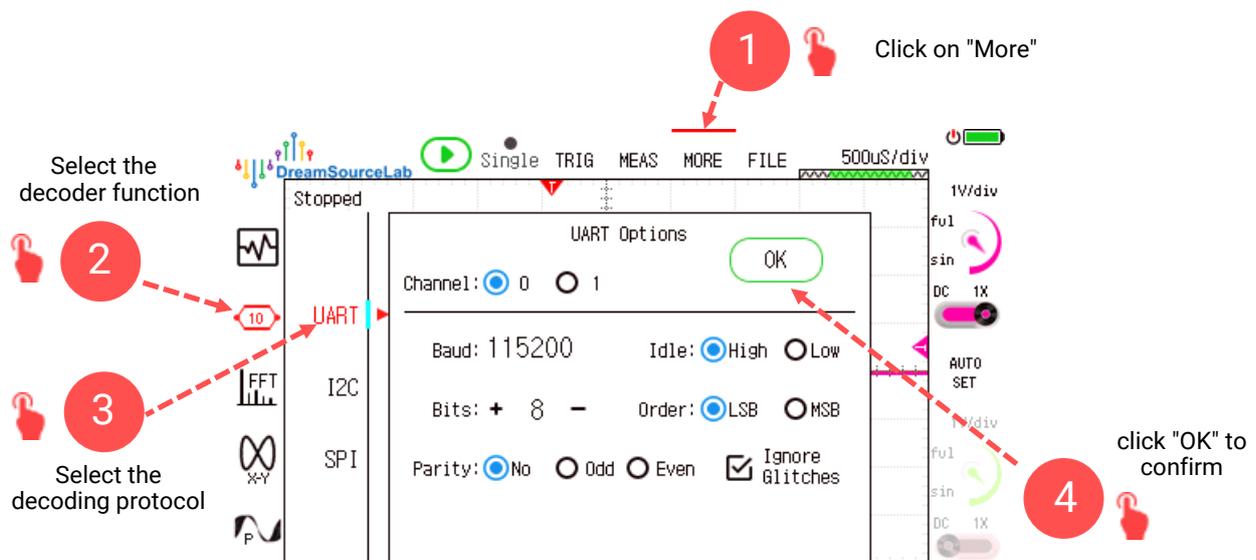


Figure 2-55

Delete: To delete a decoder, click on "More," then select "Decoder" from the menu on the left side, and uncheck the decoder you want to remove. Once done, go back to the waveform window, and the decoder will be deleted.

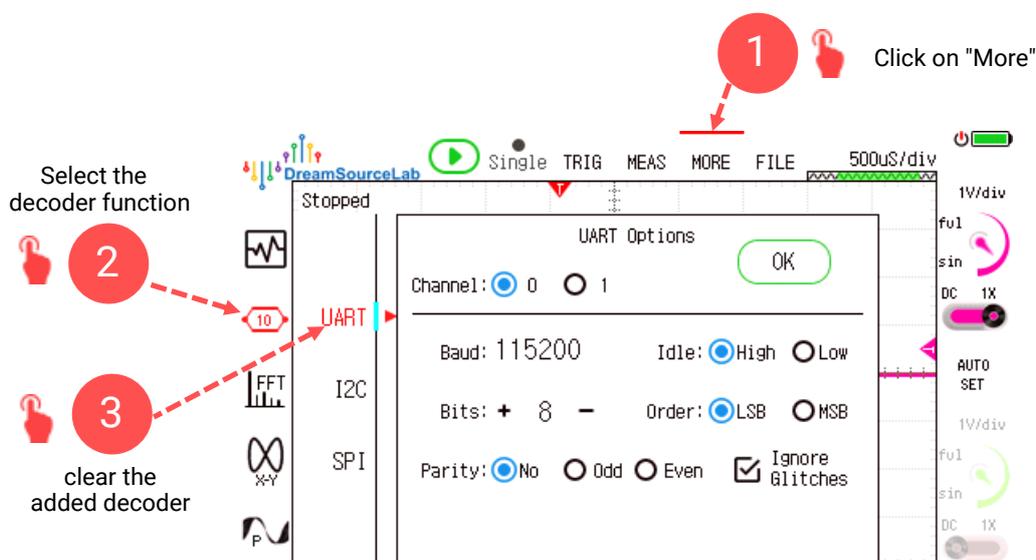


Figure 2-56

2.11.2 Decoder Results

In the waveform display interface and during the running state, the decoder results will be continuously updated. However, due to the large depth of the DSTouch oscilloscope, it is not feasible to globally decode every frame of the waveform in real-time to achieve real-time signal tracking. Therefore, when the waveform data is large, the decoder only processes the beginning part of the waveform.

Real-time update: The decoding is performed after the waveform acquisition stops, and the results are updated in real-time as the waveform display window changes. For example, in the stopped state, moving the waveform to the beginning or the end will update the decoding results accordingly. This method allows decoding

of the initial part of the waveform without being overwhelmed by the large data volume.

Zoom-only: After acquiring the waveform and stopping, the decoding results will remain in zoom-only mode, and moving the waveform left or right will not update the decoding results in real-time.

The display format of the decoded data can be set to Decimal, Hex, or ASCII. After enabling the decoder, click on the decoder label, and in the pop-up decoding options interface, you can set the decoding mode in the stopped state and the data display format.

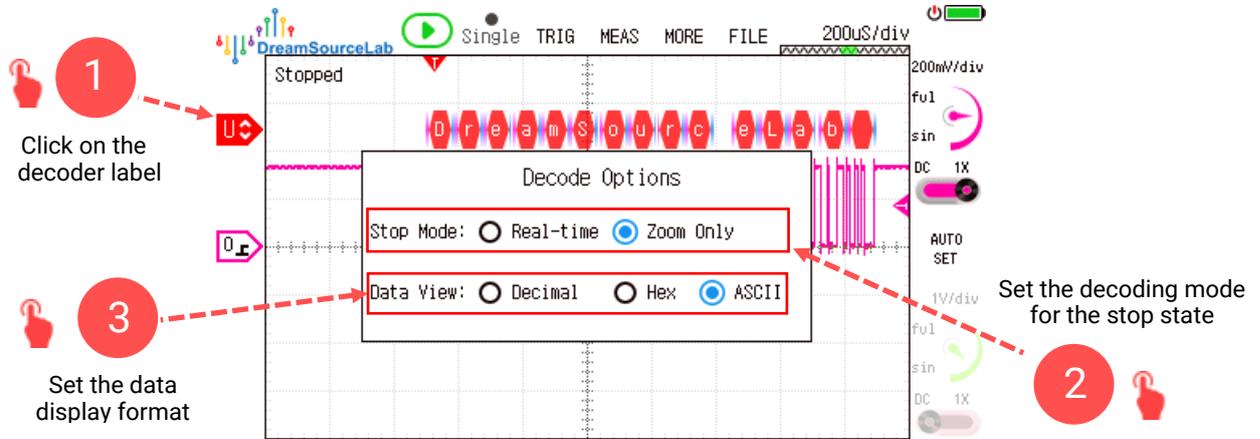


Figure 2-57

The position of the decoder display can be adjusted by moving it up or down in the left sidebar after enabling the decoder.

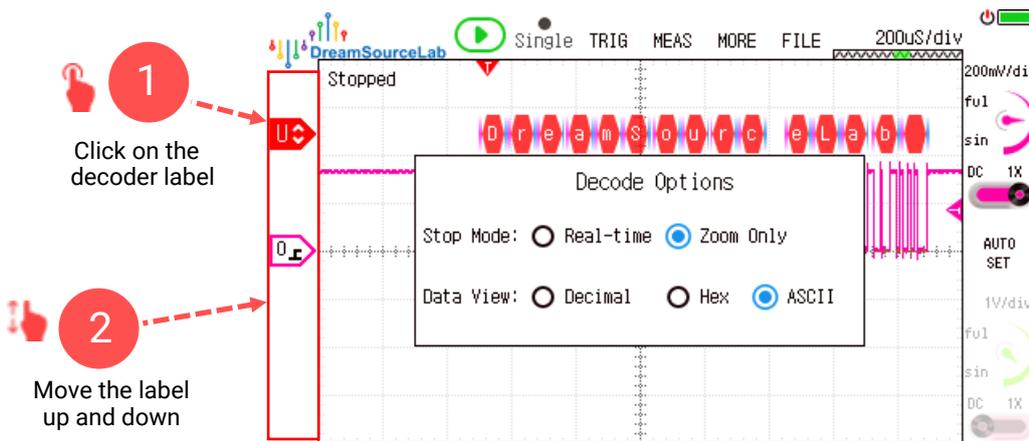


Figure 2-58

2.12 FFT

The DSTouch oscilloscope is equipped with an FFT (Fast Fourier Transform) function, which allows users to perform frequency spectrum analysis on input signals to better understand the frequency components and spectral characteristics of the signals.

2.12.1 Parameter Settings

To enable FFT, follow the steps in Figure 2-59. Click on "More," then select the FFT icon from the menu on the left side, and click on "Enable" to confirm. Additionally, the FFT function provides some parameters for flexible use.

Channel selection: Users can choose which channel to perform FFT analysis.

Window function: The window function is a mathematical function applied to the input signal to reduce spectral leakage and improve spectral resolution. The DSTouch oscilloscope offers five window function types: Rectangle, Hanning, Hamming, Flat Top, and Blackman. Selecting an appropriate window function can enhance the accuracy of frequency spectrum analysis.

Y-axis display mode: Set the Y-axis display mode, which supports both dB and linear modes.

DC Display: Set whether to display the DC component in the spectrum analysis results.

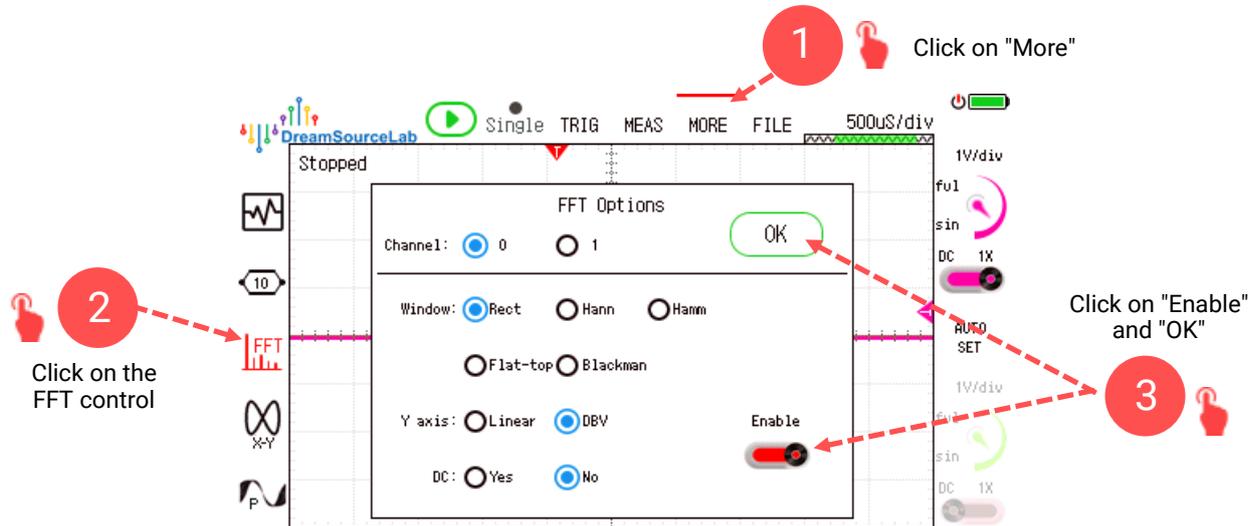


Figure 2-59

2.12.2 Center Frequency

The center frequency setting in the DSTouch oscilloscope refers to selecting which frequency to set as the center of the spectrum graph during frequency spectrum analysis. By adjusting the center frequency, users can better observe and analyze signals within specific frequency ranges.

To set the center frequency, follow the steps in Figure 2-60. Click on the FFT label in the left sidebar, then click on the unit for setting the center frequency, and finally, slide to adjust the center frequency.

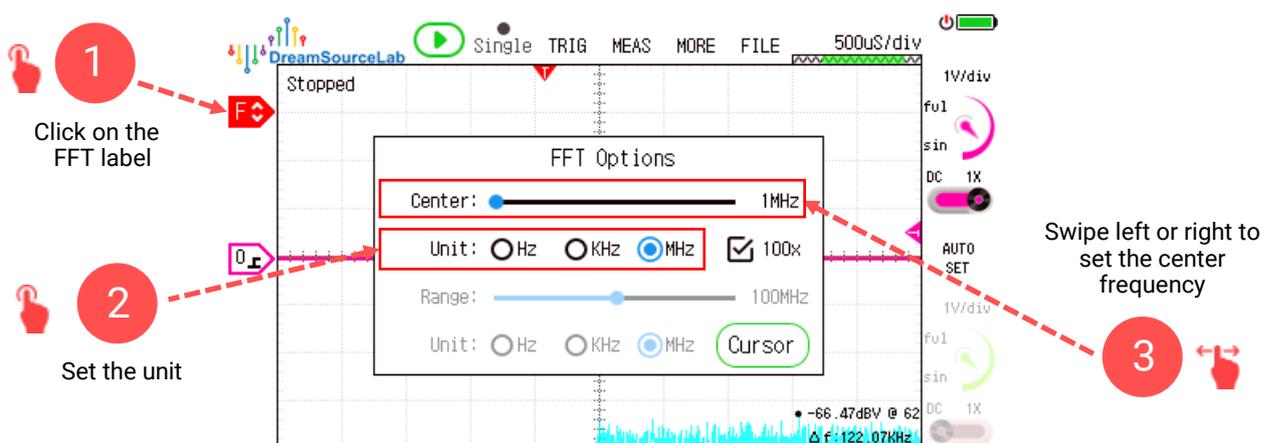


Figure 2-60

2.12.3 Frequency Range

The FFT frequency range in the DSTouch oscilloscope represents the frequency range along the X-axis line on the entire screen. It is used in conjunction with the center frequency to facilitate the analysis of signal details

within a specific frequency range.

The FFT frequency range in the DSTouch oscilloscope can be set in two ways:

Default frequency range: In the default range setting, the frequency range is 100 times the center frequency, and it changes accordingly when the center frequency is changed.

Manual range setting: To manually set the frequency range, follow the steps in Figure 2-61. Cancel the default range setting, then select the unit for the frequency range, and finally, slide to adjust the frequency range.

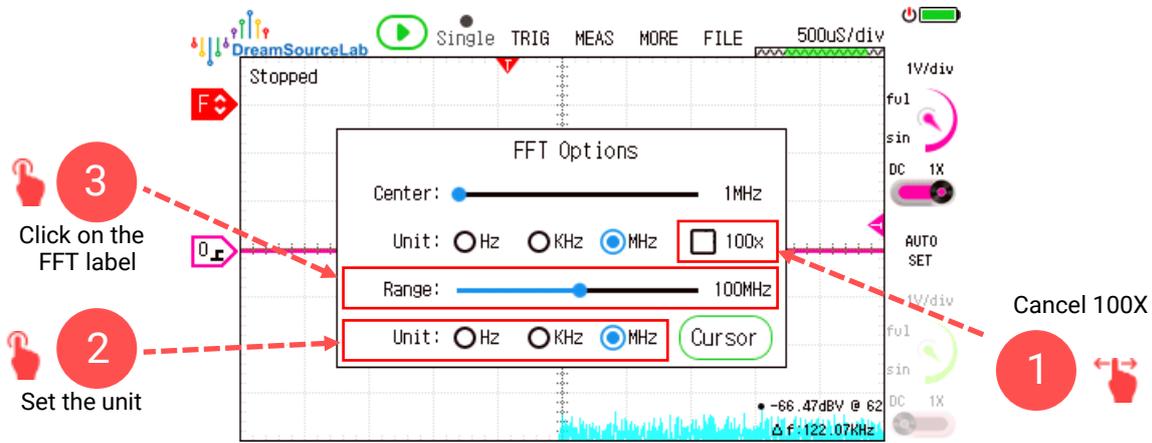


Figure 2-61

2.12.4 Spectrum Measurement

Auto measurement: The FFT function in the DSTouch oscilloscope auto measures the amplitude and frequency of the maximum frequency component (as shown in Figure 2-62), as well as the frequency resolution Δf of the current FFT waveform.

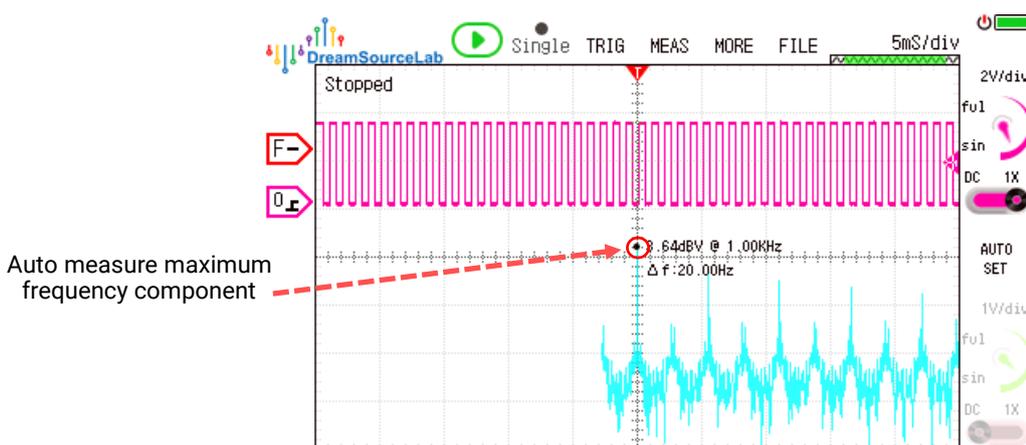


Figure 2-62

Manual cursor measurement: The FFT function in the DSTouch oscilloscope also supports manual cursor measurement. Click on the "Cursor" control in the center frequency setting interface, and frequency and amplitude cursors will appear on the waveform window. Move the cursors up and down to the desired measurement position to obtain the amplitude value (as shown in Figure 2-64). Similarly, move the cursors left and right to the desired measurement position to obtain the frequency (as shown in Figure 2-65).

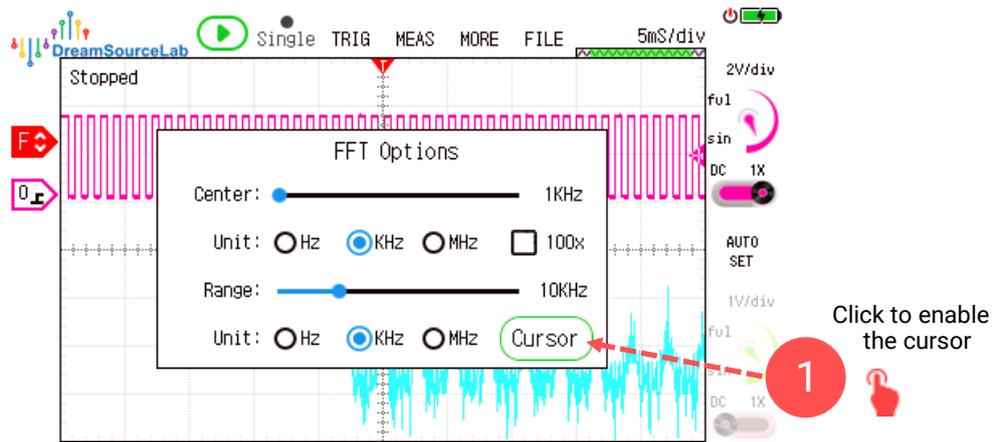


Figure 2-63

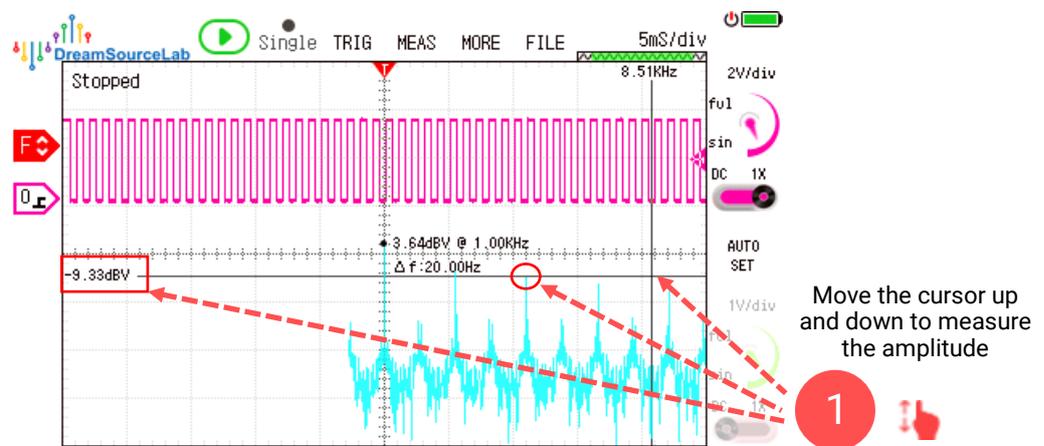


Figure 2-64

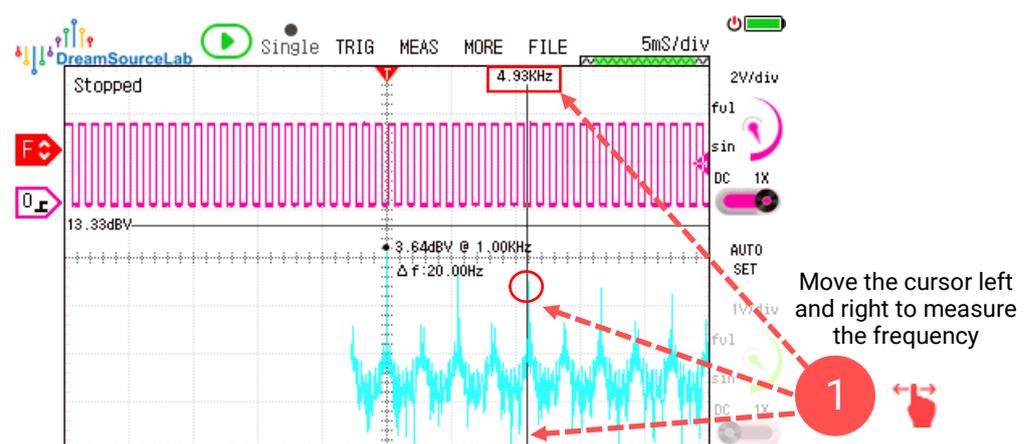


Figure 2-65

2.13 File

The DSTouch oscilloscope is equipped with an internal disk and supports a file system. It provides various file operations for users, including session save and load, screenshots, gallery browsing, acting as a USB flash drive, and firmware upgrade.

2.13.1 Sessions

The DSTouch oscilloscope offers up to 9 sessions, divided into 2 system sessions and 7 user sessions. Session files can be easily saved and loaded, eliminating the hassle of switching between different test scenarios and setting all parameters repeatedly.

Default Session: This is the system's default session. Loading this session will restore all user-set parameters (including measurements, horizontal timebase, vertical sensitivity, etc.) to their default values. It is useful when the user needs to quickly restore the oscilloscope to its initial state after accidentally setting the parameters incorrectly.

Last Session: This session saves the settings used in the last session before the oscilloscope was powered off. The oscilloscope automatically loads this session every time it is powered on, ensuring that the parameters from the previous session are retained.

User Sessions: Users can save their frequently used sessions for later use. For example, if a user frequently tests the ripple of a signal, they can save the session used for measuring the ripple. The saved session can be easily loaded for future ripple tests.

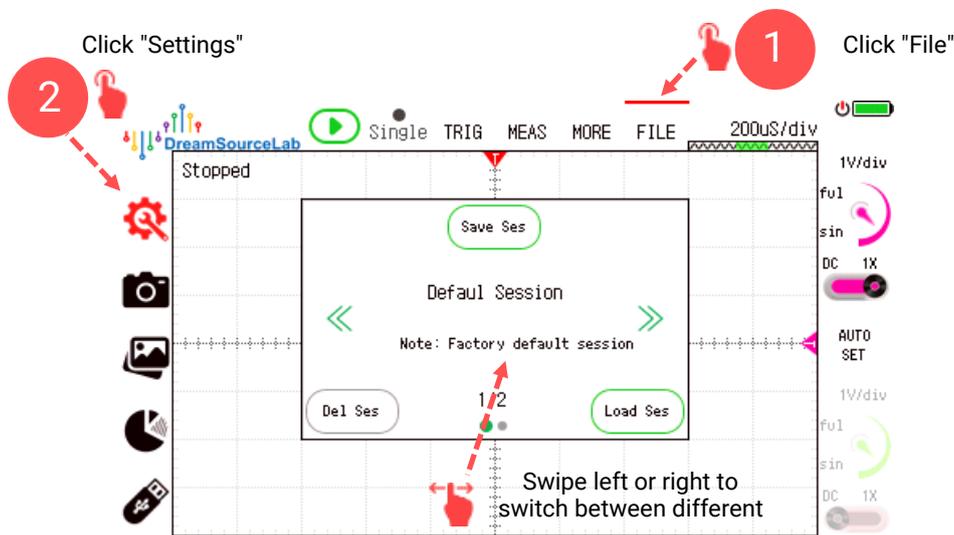


Figure 2-66

2.13.2 Screenshot and Gallery

The DSTouch oscilloscope provides a screenshot feature, as shown in Figure 2-67. Clicking on "Screenshot" allows the user to capture the entire screen, saving the current waveform as an image. Clicking on "Gallery" allows users to view all screenshots taken.

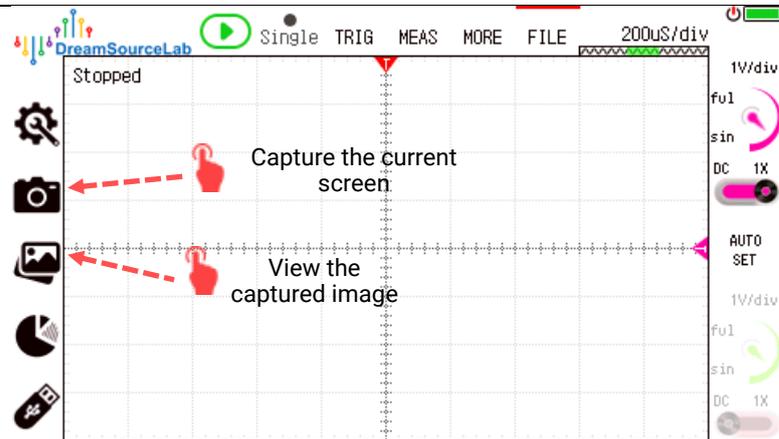


Figure 2-67

2.13.3 Disk Usage

The "Disk Usage" feature displays the distribution of disk space in the DSTouch oscilloscope. The disk is divided into four categories: System, Screenshot, Other, and Idle. Each category's space usage is represented by a different color, allowing users to intuitively see the space occupied by different types of files on the device, as shown in Figure 2-68.

2.13.4 USB Mode

USB Mode allows file sharing between the DSTouch oscilloscope and a PC. Users can copy session files and screenshot image from the oscilloscope to their computer, or drag new firmware from the computer to upgrade the oscilloscope's firmware.

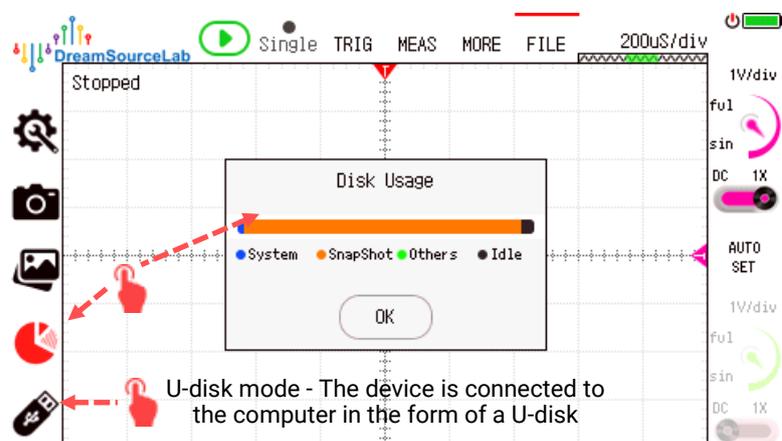


Figure 2-68

2.13.5 Disk Format

Disk format will erase all data on the internal disk, including session files and screenshot images, and reformat the disk. Format will permanently delete the data on the disk, so please proceed with caution. However, this format will not affect the normal operation of the DSTouch oscilloscope.

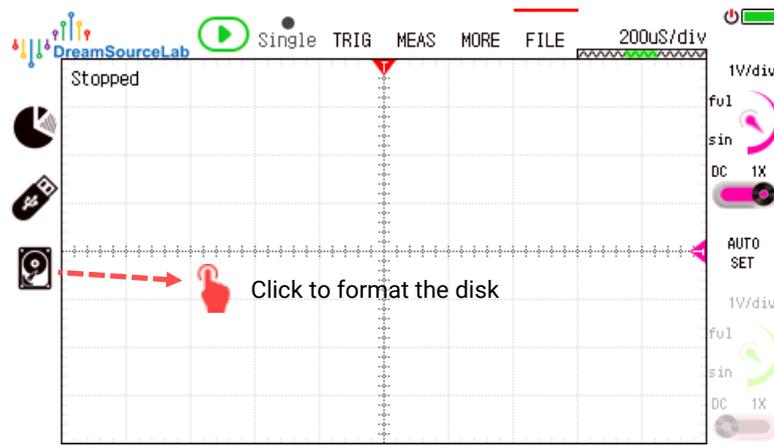


Figure 2-69

2.14 System Settings

2.14.1 Backlight and Sound

The DSTouch oscilloscope provides options to adjust the backlight brightness and sound effects. Both settings can be accessed through the battery icon in the top right corner of the screen, as shown in Figure 2-70.

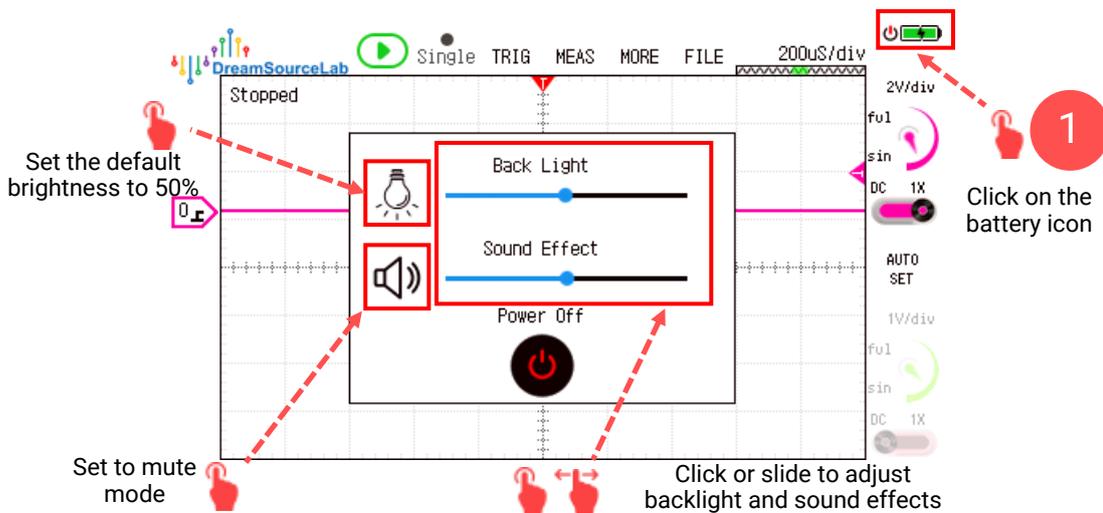


Figure 2-70

2.14.2 About

By default, click on the "DreamSourceLab" logo in the top left corner of the screen will display basic information about the device. This includes the device model, firmware version, architecture, basic parameters, and the unique serial number of the oscilloscope, as shown in Figure 2-71.

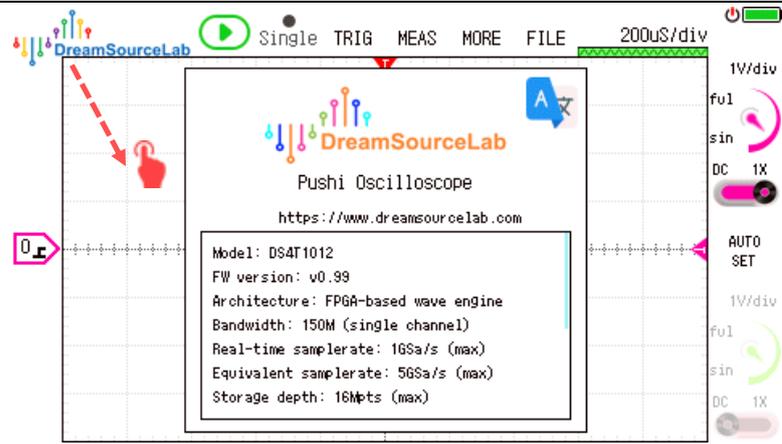


Figure 2-71

2.14.3 Language

The DSTouch oscilloscope supports two language options: Simplified Chinese and English.

To switch between the languages, click on the "DreamSourceLab" logo in the top left corner and then click on the language selection icon in the top right corner of the pop-up window. Choose the desired language from the language selection interface, and the user interface will switch to the selected language immediately, as shown in Figure 2-72.

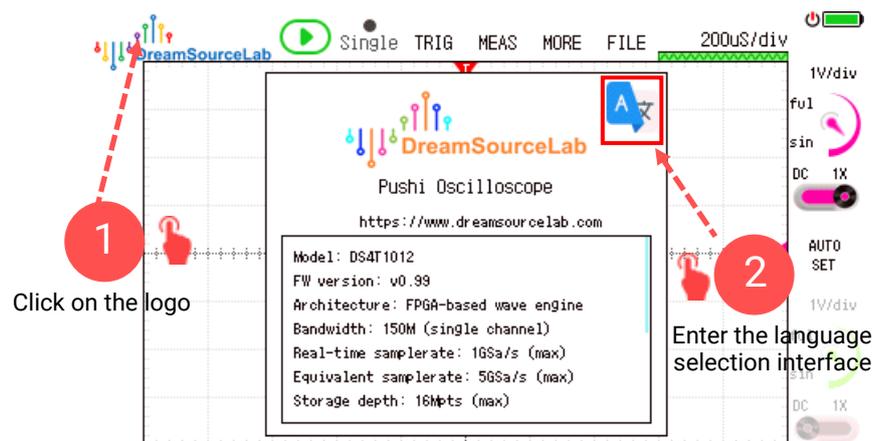


Figure 2-72

Chapter 3. Examples

3.1 Simple periodic signals

To measure a simple high-frequency periodic signal and display its frequency and peak-to-peak value, follow these steps:

3.1.1 Acquisition:

- ① Set the probe attenuation ratio to 10X on the oscilloscope, and ensure that the probe's attenuation ratio is also set to 10X in DSTouch.
- ② Connect Channel 0 probe to the test point.
- ③ Click "Run" and then press "Auto".

The oscilloscope will automatically adjust the waveform display to the optimal state. In this state, you can further adjust the horizontal and vertical systems to meet your observation requirements. The specific operations are shown in Figure 3-1.

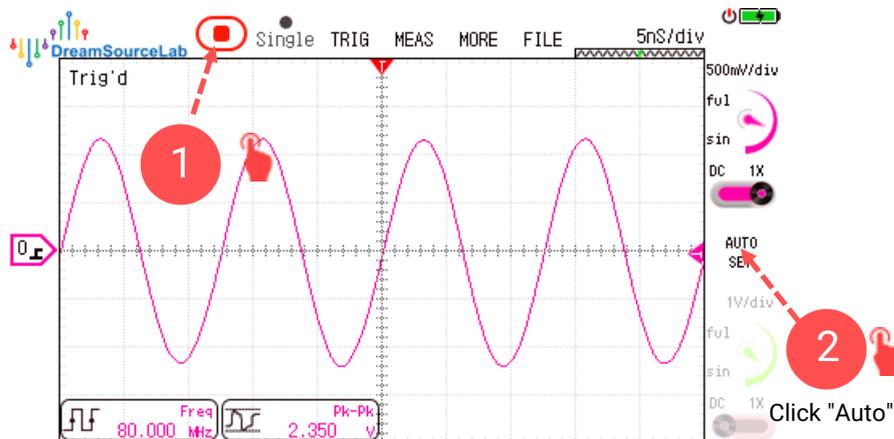


Figure 3-1

3.1.2 Measurement

- ① Click "MEAS" menu
- ② Select the position on the screen where you want the measurement parameters to be displayed.
- ③ Choose the measurement parameters "Frequency" and "Peak-to-Peak Value."

3.2 Power Supply Ripple

The power supply ripple can be considered as a small AC signal superimposed on a large DC bias voltage. If you directly observe the original signal, it may not be conducive to observing the small AC signal. To address this, you can use AC coupling to remove the DC bias and then observe the ripple.

① After connecting the DC voltage, adjust the horizontal timebase and vertical sensitivity so that the oscilloscope can display the DC voltage signal.

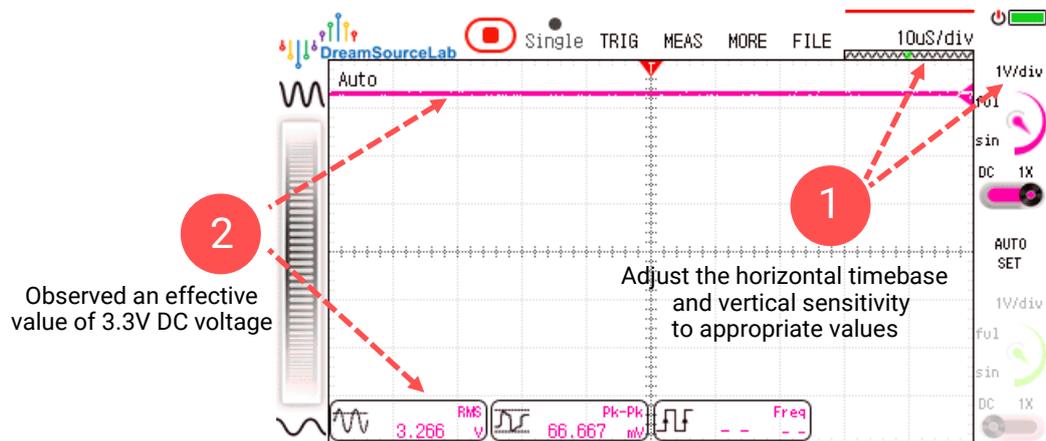


Figure 3-2

② Click on the channel options and set the coupling mode to "AC," and enable the 20MHz bandwidth limit.

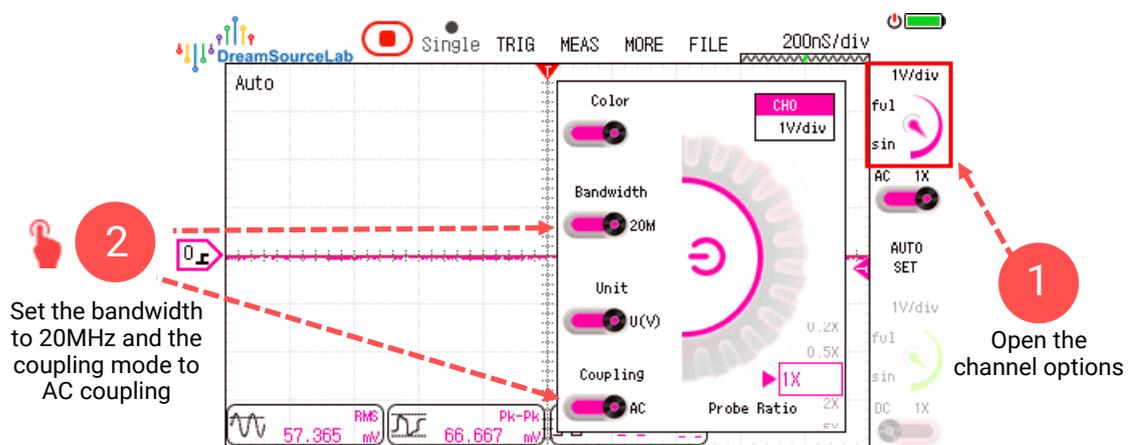


Figure 3-3

③ Adjust the horizontal timebase and vertical sensitivity again to observe the ripple, and add measurements such as peak-to-peak value to quantify the ripple.

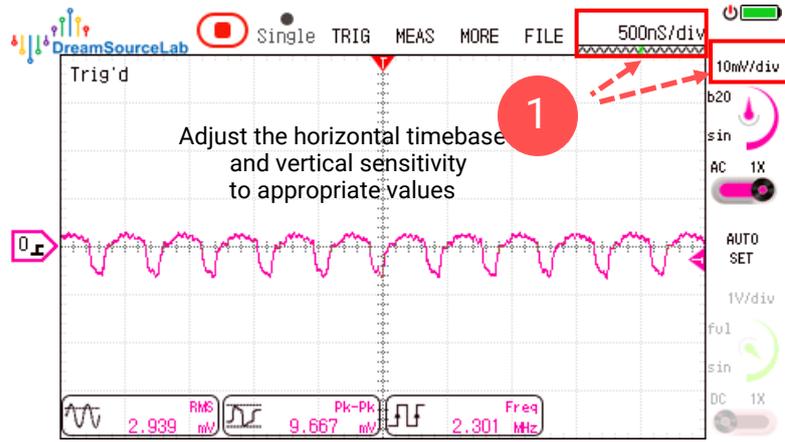


Figure 3-4

3.3 Crystal oscillator signal

To capture the oscillation process of a crystal oscillator, you need to use single trigger mode. Before using single trigger mode, it is recommended to first observe the frequency and amplitude of the signal to set appropriate trigger level, horizontal timebase, vertical sensitivity, and other parameters.

Here are the specific steps:

3.3.1 Basic Setup

- ① Turn on Channel 0 and adjust the vertical range to a suitable scale.
- ② Set the attenuation ratio of Channel 0 and the probe to 10X. Generally, the frequency of a crystal oscillator is not too low, and the probe at 10X setting has a higher bandwidth, so we set the probe to 10X.
- ③ Set the coupling mode to DC coupling.

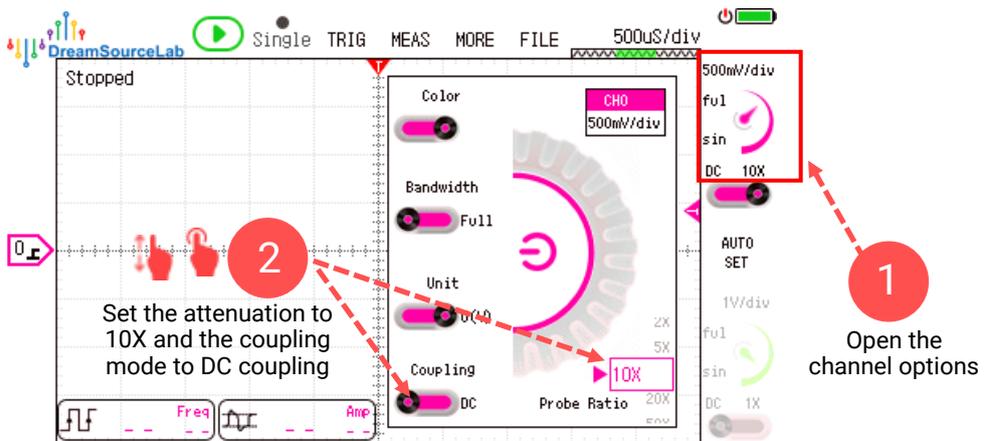


Figure 3-5

3.3.2 Trigger Setup

- ① Click on the "Trigger" menu.
- ② In the trigger setup interface, select Channel 0 and rising edge trigger, and set the trigger mode to Normal Trigger.
- ③ Adjust the trigger level to the appropriate position.
- ④ Check the "Single" acquisition in the menu.

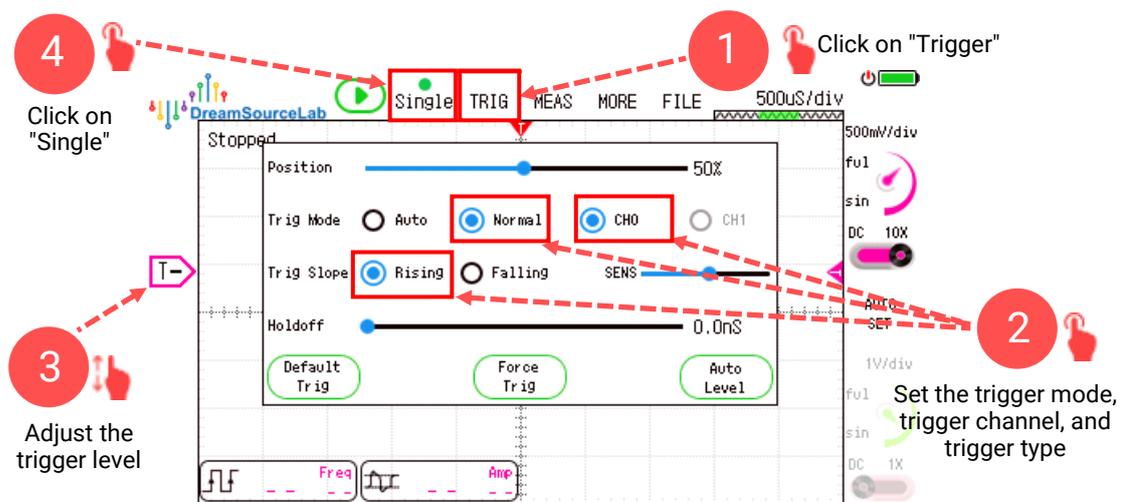


Figure 3-6

After completing the settings, click "Run." The oscilloscope will wait for the waveform that satisfies the trigger condition. Once triggered, the captured waveform will be displayed. At this point, you can perform operations such as moving or zooming on the waveform to observe specific details of the waveform.

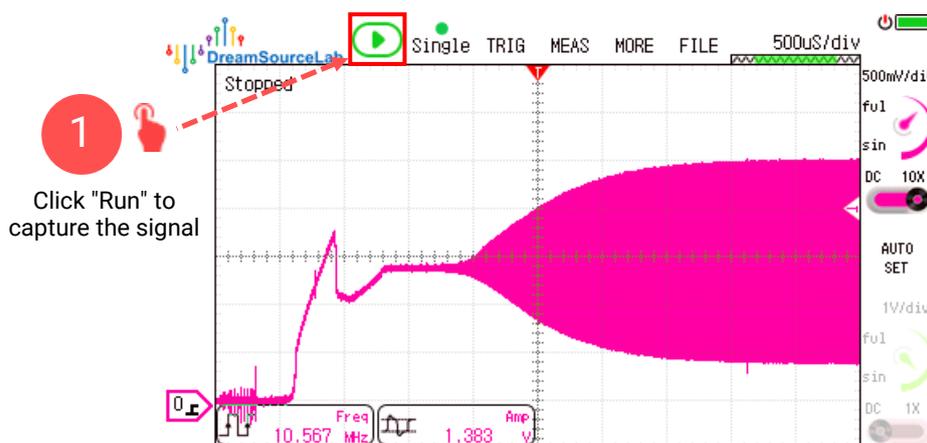


Figure 3-7

3.4 X-Y Function

The X-Y function allows you to view the phase difference between two channel signals. For example,

you can test the phase change of a signal after passing through a certain circuit network.

Here are the specific steps:

- ① Set the attenuation ratio of Channel 0 and Channel 1, as well as the probe attenuation ratio, to 1X.
- ② Connect the probe of Channel 0 to the input end of the circuit network, and connect the probe of Channel 1 to the output end of the circuit network.
- ③ Press the "Auto" button, and adjust the vertical sensitivity to make the amplitudes of the two signals roughly equal.
- ④ Select the "X-Y" mode under the "More" menu, and the display result will be shown as in Figure 3-8.

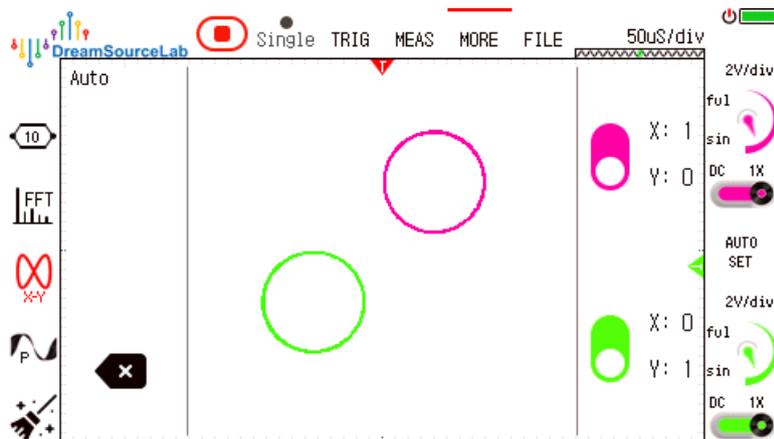


Figure 3-8

3.5 Amplitude Modulated (AM) Wave

To observe the details of the amplitude-modulated (AM) wave as specified in Figure 3-9 using an oscilloscope, you need to consider the oscilloscope's storage depth and the trigger hold-off time for stable waveform observation.

If you want to capture an undistorted 10MHz carrier signal at a timebase of 5ms/div, the real sampling rate should be greater than 100MSa/s. You can calculate that you need a storage depth greater than $5\text{ms} * 10 * 100\text{MSa/s} = 5\text{Mpts}$ to observe the true carrier waveform without distortion.

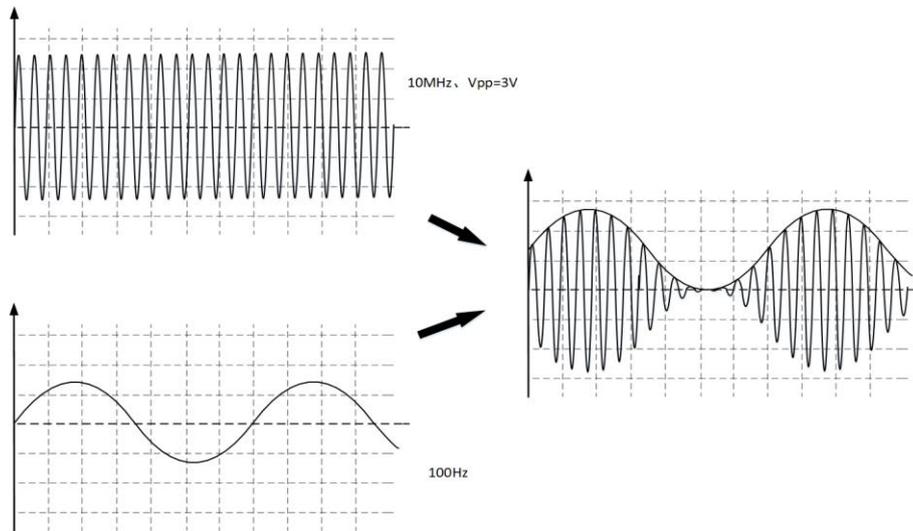


Figure 3-9

① Adjust the horizontal timebase and vertical sensitivity to display the waveform within an appropriate range.

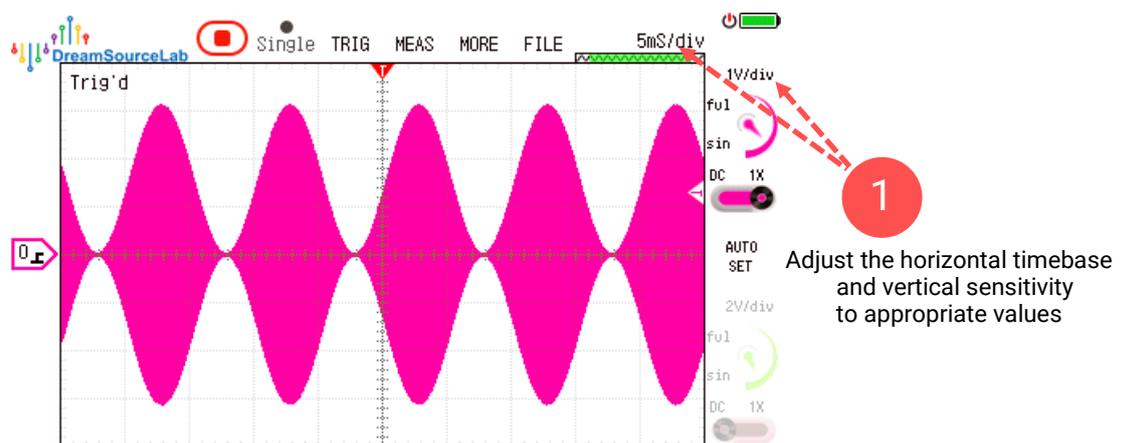


Figure 3-10

② Set the trigger level and trigger hold-off time to stabilize the waveform display. For this waveform, the time span for each wave peak is approximately 5.38ms after setting the trigger level. So, set the trigger hold-off time slightly greater than 5.38ms.

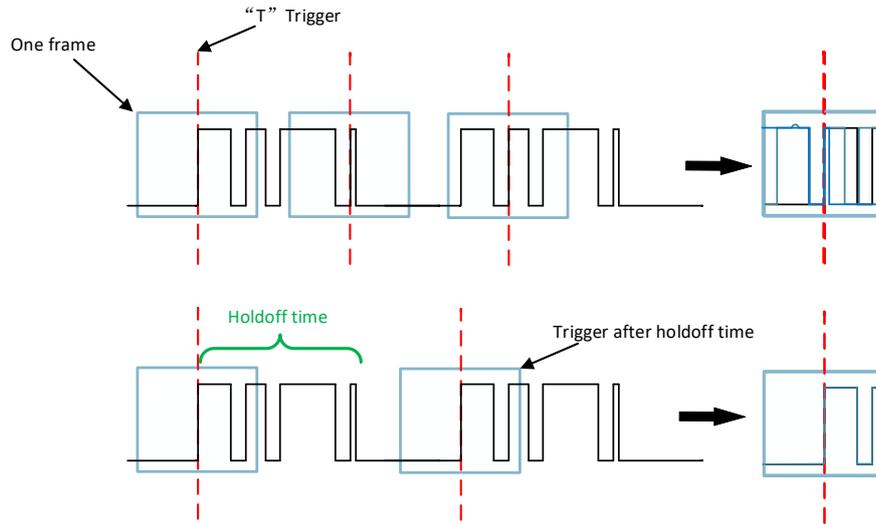


Figure 3-11

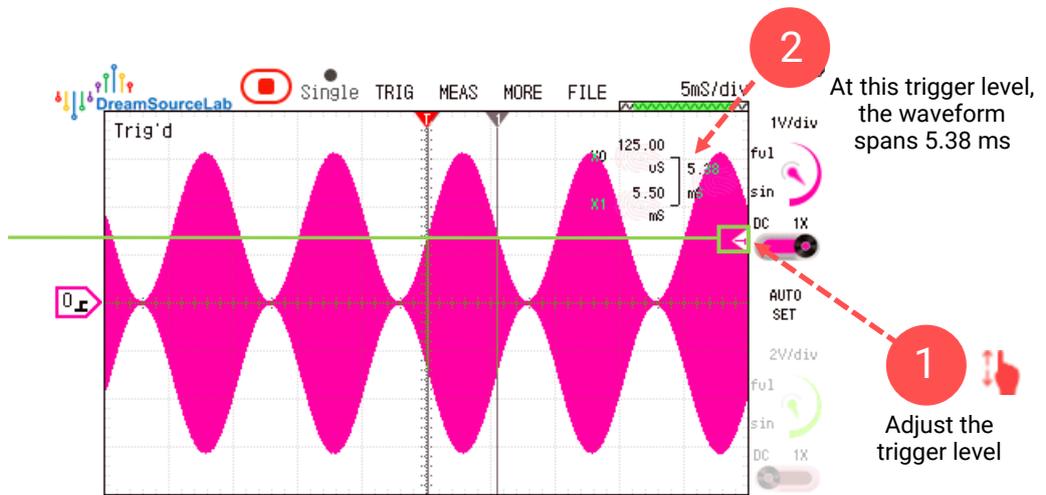


Figure 3-12

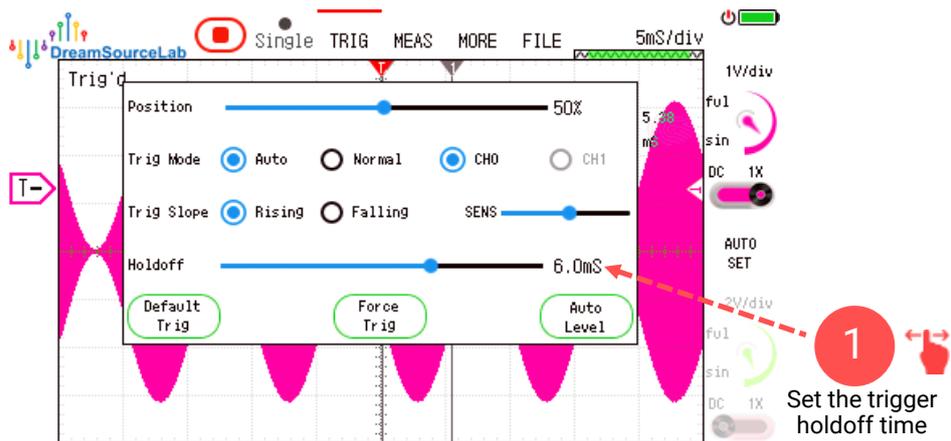


Figure 3-13

③ If you set the storage depth to 1M/2M, and then capture and zoom in to view the waveform, you will notice that the carrier signal is not a standard sine wave. This is because the storage depth is insufficient, resulting in inadequate real sampling rate.

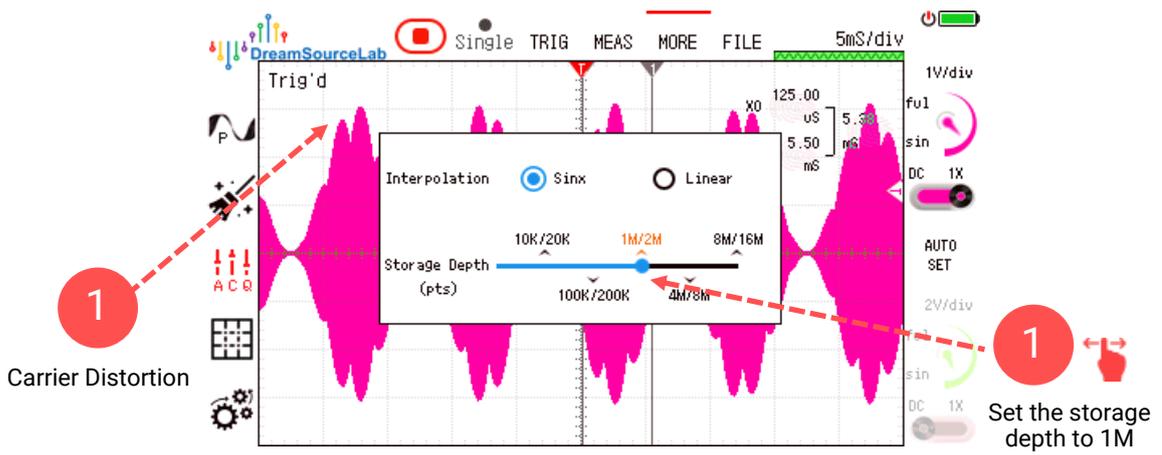


Figure 3-14

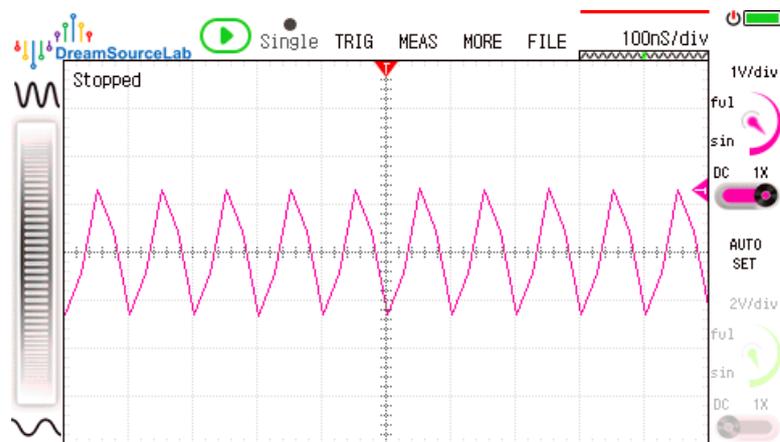


Figure 3-15

④ Increase the storage depth to 8M/16M, and then capture the waveform and zoom in to observe the correct carrier signal.



Figure 3-16