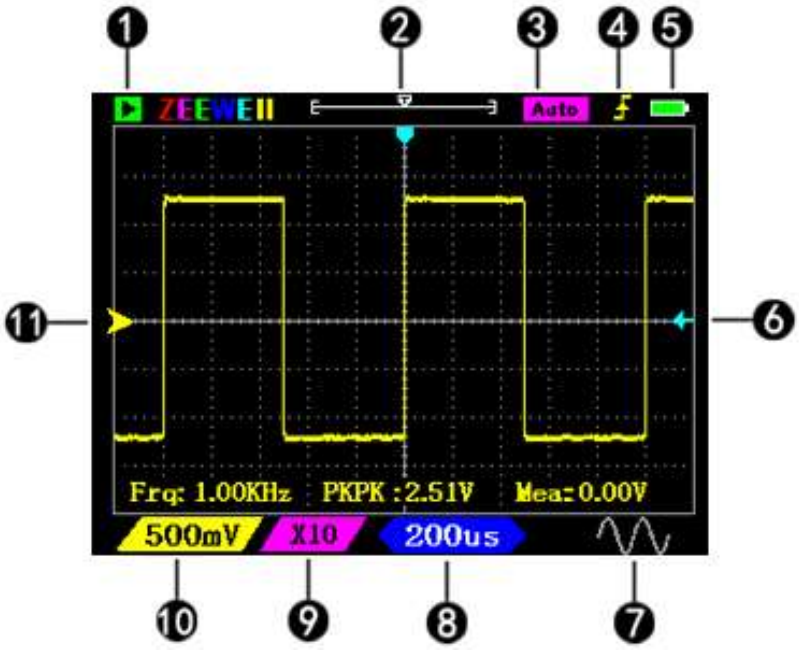
ZDS5020

DIGITAL OSCILLOSCOPE

User's Manual

Designed by ZEEWEII



① Green is the ‘Run’ state; Flashing cyan for waiting to trigger; Red is ‘Stop’.
② The horizontal line is the sample memory, and the box is the display area.
③ Auto indicates that the trigger mode is ‘Auto’. Normal indicates that the trigger mode is ‘Normal’.
④ Trigger edge: Rising edge trigger or falling edge trigger.
⑤ Battery level indication.
⑥ Trigger level position.
⑦ When the icon is gray, the signal generator is OFF.
⑧ Timebase: The time of a grid.
⑨ X1/X10 indicates probe attenuation, which should be set to match the probe. The purpose is to tell the oscilloscope what attenuated probe you used.
⑩ Vertical sensitivity: Indicates the voltage of a grid.
⑪. Zero arrow: The baseline position, where the vertical voltage is zero.

Buttons Function

1. Default function – Yellow text

OK **Auto**	1. When the menu opens, as the OK button. 2. as an "Auto" button
Run/Stop	Run / Stop
Menu	Open/close the menu, (press the mV/V keys to switch menus)
Shift	Select the function of the “white” text above. for example "Save" / "50%" .
Single	Single trigger
▲	Move up the waveform/cursor
▼	Move down the waveform/ cursor
◄	Move left the waveform/ cursor
►	Move right the waveform/ cursor
mV/V	Adjust vertical sensitivity (voltage of one grid)
s/ns	Adjust the time base (the time of one grid)
Power	Long press the power button to power on/off

2. Second function – White text(Shift + other buttons)

50%	The waveform returns to the center
X1X10	Probe attenuation (which tells the oscilloscope what probe attenuation you are using)
Zoom	Enter [Zoom] mode
Ref	Latches the current waveform as a reference
Save	Save a screenshot of the waveform
View	Enter the image viewing page
||	Enable horizontal cursor
==	Enable vertical cursor
▲	Move up the trigger level
▼	Move down the trigger level

More:

Trigger level: The default trigger level is automatic adjustment, if you need to adjust it manually, you need to set the trigger level to "Manual" in the menu, then you can adjust the trigger level position (Press the **Shift** button first, then press the up and down keys to move the trigger level).

RTAuto: Long press “Auto”key, RTAuto appears in the upper right corner of the screen, indicating real-time automatic adjustment. When the probe is connected, the oscilloscope automatically adjusts the range in real time. Press any key to exit.

6-Digital Frequency meter: Open the [menu], switch to [Disp] page, then press the “Run/Stop” button.

1 Safety Precautions

- **High voltage. The x10 range of the probe measures up to 220V. An x100 probe is required for overreach.**
- **Probe attenuation. Before measuring voltages greater than 40V, switch the probe to the X10 position.**
- **Charge. The charging voltage is 5V, use a computer or mobile phone charger.**
- **When measuring high-voltage or non-isolated circuits, it cannot be used while charging (powered by a built-in battery).**

2 Quick start instructions

2.1 Power

Long press the power button for 2s to turn on/off.

When the battery is dead, use the USB cable to connect to the 5V adapter for charging, and the max charging current is about 0.5A. The LED lights up red when charging, and turns green when fully charged.

2.2 Auto

After the probe is connected to the signal, press the [Auto] button, and the oscilloscope will automatically detect the signal and adjust the range. If there is no waveform, the probe may not be connected correctly, or there may be no signal at the connection (you can use a multimeter to determine if there is a voltage).

2.3 Vertical Sensitivity and Time base

Manual adjustment: “mV”/ “V” buttons scale the waveform vertically. The “s”/ “ns” button scales the waveform horizontally.

The vertical sensitivity indicates the voltage of a grid in the vertical direction, and it is adjusted by the mV and V buttons to adapt to different voltages.

The time base represents the time of a grid horizontally. It is adjusted by the s and ns buttons to accommodate different frequencies.

2.4 Test built-in signal generator

1. Connect the probe to the generator output pin. 2. Press the [Menu] key and then press [mV] to open the generator interface, press the “Run/Stop” key to change the generator to the [ON] state. Press the “s/ns” key to switch waveforms. Press the “Single” key to reset to 1.00Khz. 3. Press “menu” to exit the interface.

4. After pressing the “Auto” key, you can see the waveform of the generator.

2.5 Frequency meter and Pulse counter

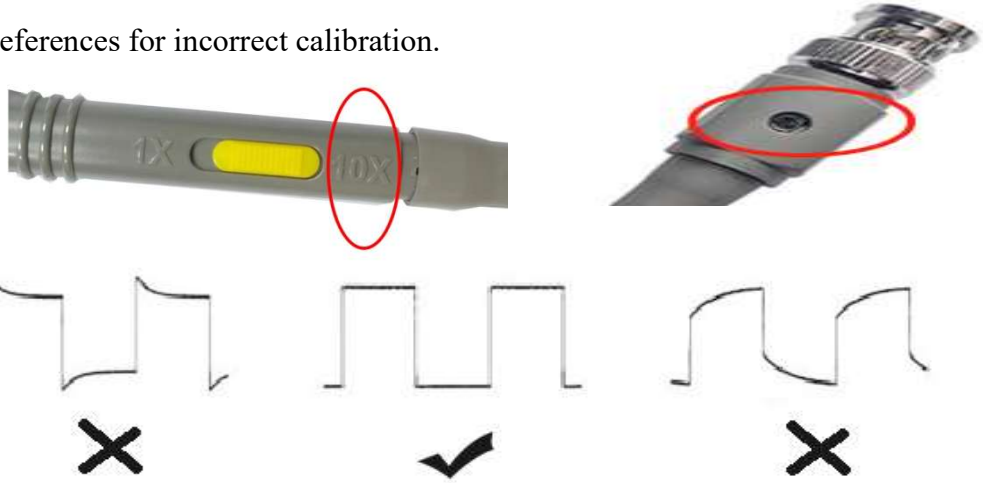
Open the [menu], switch to [Disp] page, and press the “Run/Stop” button. You can turn on the frequency meter or counter

Note that after turn on the counter, you need to manually adjust the trigger level, If the pulse crosses the trigger level, the counter will be incremented by 1. (**Shift**+🡅/🡇 to move the trigger level).

3 Probes

3.1 Probe calibration

1. Switch the probe to **X10**.
2. Connect the probe to a **1KHz square wave** with an amplitude of about 2V-3V. You can use the built-in generator.
3. Let the waveform is displayed stably at a suitable position on the screen.
4. Use a screwdriver to rotate the adjustable capacitor on the probe until you get the waveform in the middle of the figure below. The left and right waveforms below are references for incorrect calibration.



3.2 Probe bandwidth

Because the 1X probe has a large input capacitance, the bandwidth of the 1X is usually within 5MHz; while the bandwidth of the 10X is the standard bandwidth of the probe.

3.3 Use tips

3.3.1 Large input capacitance

Because the probe 1X has a large input capacitance (usually more than 100 pf), it is not suitable for measuring some capacitively sensitive circuits. For example, when measuring a passive crystal of MCU, the large capacitor may cause the crystal to fail to vibrate. As for the output of a high-speed op amp, a capacitive load may cause the op amp to overshoot or oscillate. For circuits with large capacitances that are not suitable for measurement, please use 10X. The input capacitance of the 10X is usually several pf.

3.3.2 Measuring high voltage

The oscilloscope's measurement voltage range is -40V ~ + 40V (80Vpp). Please use the 10X probe to attenuate the signal by 10 times beyond this range. The measurable voltage range of 10X range is 220V. Please note that you must first switch the probe to the 10X position before connecting the high voltage signal, otherwise the high voltage may break down the internal circuit of the oscilloscope.

3.3.3 High bandwidth

Because the 1X probe has a large input capacitance, the bandwidth of the probe 1X is usually within 5MHz, so please use the 10X position when the measured signal bandwidth is greater than 5M.

Summary: **10X is usually used in most applications.**

4 Vertical system

4.1 Vertical sensitivity

Oscilloscope vertical sensitivity refers to the voltage represented by **a grid** in the vertical direction of the screen. There are 8 divisions in the vertical direction of the oscilloscope. You can estimate the amplitude of the signal by observing how many divisions the waveform occupies on the screen. For example, if the vertical sensitivity is 1.00v/div, and the signal occupies 3 grids on the screen, you can know that the amplitude of the signal is 3V.

The scope's vertical sensitivity range is 10mV / div ~ 10V / div (1X probe). In the oscilloscope button panel, the keys for adjusting the vertical sensitivity are '**mV**' and '**V**' button. Pressing the 'mV' button decreases the vertical sensitivity, which is used to measure signals with smaller voltage amplitude. Press the 'V' button to increase the vertical sensitivity for measuring signals with larger voltage amplitudes.

5 Horizontal system

5.1 Time base

The time base refers to the time represented by each grid in the horizontal direction on the oscilloscope screen. There are 12 grids in the horizontal direction of the oscilloscope. The sampling time that can be observed on the screen = " time base" * 12.The user can estimate the signal period by observing how many grids a waveform period occupies. For example, the current time base is 500us, and one cycle of the signal occupies 2 grids,so the signal period is 1ms (1KHz).

The oscilloscope time base range is 5ns ~ 10s. The buttons for adjusting the time base in the oscilloscope button panel are '**ns**' and '**s**' button.， When observing high-frequency signals, you should press the 'ns' button to decrease the time base. When observing low-frequency signals, you should press the 's' button Increase the base.The time base in the figure is 200us/div.

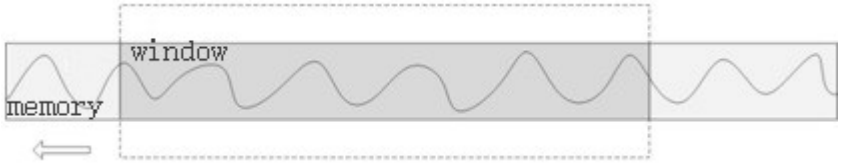
What you need to know is that the sampling process of the oscilloscope is:

"Sampling">>"Processing" >> "Display"

When adjusted to a large time base, the screen waveform refresh will be slow due to the longer time taken by the oscilloscope to sample the waveform.

5.2 Horizontally moving waveform

In the stop mode, the user can move the waveform left and right.



6 Trigger system

About trigger

The oscilloscope will capture a frame of waveform only after the waveform meets the pre-set conditions. This action of capturing the waveform according to the conditions is the trigger.

What does trigger do?

1. Trigger can stabilize the waveform on the screen.
2. Capture the segment of the waveform you want to observe.

The trigger supported by the oscilloscope is edge trigger, including rising edge trigger and falling edge trigger.

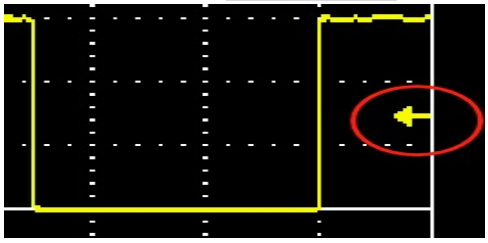
6.1 Trigger level

In the edge trigger mode, the trigger condition appears only when the waveform crosses up or down the trigger level.

The trigger level is automatically adjusted by default. Here's **how to adjust manually**:

a. In Menu-> Trigger, change "Trigger Level" to "Manual".

b. Press the “Shift” key, then press the up and down keys to move the trigger level.



The arrow circled above is the trigger level position, and when the edge of the square wave in the above figure passes upwards through the position of this arrow, a trigger is formed (the waveform only forms a trigger when it crosses the trigger level up or down).

6.2 Trigger Mode

Trigger mode: “auto”, “normal”, “Single”. Automatic triggering is more commonly used. The normal trigger will not refresh the screen when there is no waveform, suitable for measuring some pulse signals that come occasionally, etc., and refresh the waveform once in a pulse. The single-trigger procedure is described in 7.2 below.

7 Operation Guide

7.1 50%

The role of 50% is to quickly return to the center, including zero point offset, trigger position, trigger level will quickly return to the middle position with one button, operation method: Shift->50%.

7.2 Single trigger

Suitable for sporadic single pulse capture.

A single trigger is when the single button is pressed, and the oscilloscope samples a frame of waveform and then stops. That is, only one frame of waveform is taken per press. It is important to note that this sampling must be triggered, if it is not triggered, the upper left corner of the oscilloscope flashes "||", and the sampling is not completed until there is a waveform trigger. To cancel a single trigger, click "Stop" button to stop.

Procedure:

1.Probe connect the signal first.

2. mV/V set the voltage sensitivity, s/ns set the time base.

3. Set the trigger level to "manual" and adjust the trigger level (press Func+up/down to move trigger leve).

4. Press the “Func” key then press “OK” key.

5. The oscilloscope waits for the signal to arrive, and once a waveform crosses the trigger level, the oscilloscope completes a sample and then stops.

7.3 Screenshot

Shift-> Save button to capture the current screen.

7.4 View images

After pressing the Shift key, then press the View key to enter the Image View window. In this window, the user can delete or browse historical screenshots.

Click the “RunStop” button to delete the current screenshots.

Click the "ok" button to zoom in on the waveform. After zooming in, click "ok" to return to the homepage.

Click the " Menu" button to return to the oscilloscope window.

7.5 Signal generator

Click the "**Menu”,** then **“mV**" button to call up the window of the signal generator, The signal amplitude is 3V, the maximum frequency of the sine wave is 5Mhz, and the other waves are 1Mhz.

Click the " Stop" button to turn on/off the signal generator output.

Click the "Single" button to reset the number to: 1.00Khz, 50%

Click the "s" or "ns" keys to switch the waveform type: sine wave, square wave, triangle wave, etc.

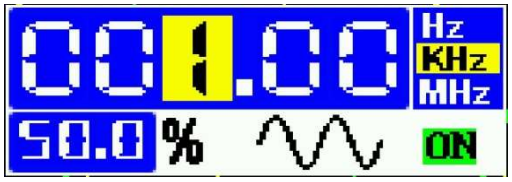
Click "Menu" to exit.

Square wave can adjust the duty cycle, other waveforms do not work.

Note:

1.To avoid signal crosstalk to the scope, the generator will not work when the vertical sensitivity is set to minimum (20mV & square / sawtooth).

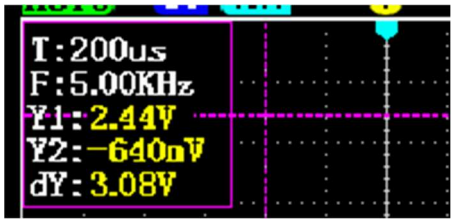
2.There may be little jitter in the square wave(when the frequency is higher than 500K).



7.6 Cursor

Press the “Shift” key then press "s" key to turn the horizontal cursor on/off.

Press the “Shift” key then press "ns"key to turn the vertical cursor on/off.



Press the left and right arrow keys directly to move the horizontal cursor 1.

Press the **Shift** key, then press the left and right arrow keys to move the horizontal **cursor 2**. The same goes for vertical cursors.

For vertical cursors, Y1: The voltage at the dashed line above. Y2: The voltage at the dashed line below. dY=Y1-Y2, which is the voltage difference between the two dashed lines.

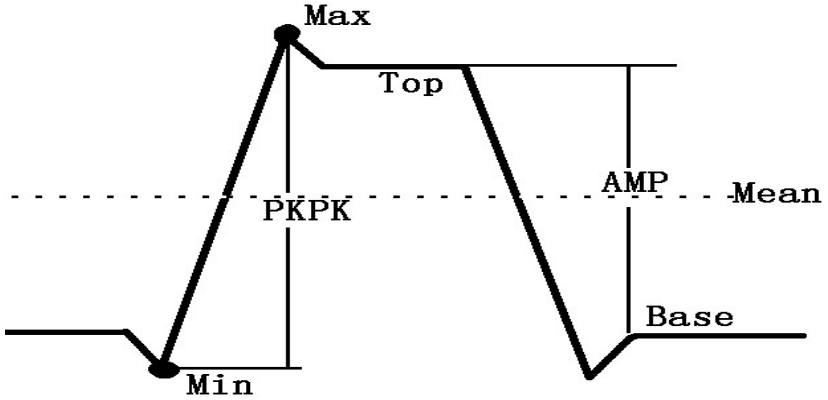
8 Menu introduction

Once the menu is open, press the “mV” or “V” button to switch menus.

8.1 Measurement

There are 14 measurement options available, as shown below:

Frequency, Peak-to-Peak, Duty cycle, Amplitude, RMS, Average, Period, +Pulse width, -Pulse width, Max, Min,Top, Base, -Duty cycle.



The difference between peak-to-peak and amplitude(AMP) is shown in the figure above.

8.2 Trigger

There are 3 options in the trigger menu: “Trigger Mode” ,“Trigger Type” , “Trigger level”.

Trigger Mode can be selected from "Auto" and "Normal".

For “**Auto**” mode, if a waveform trigger is detected, the waveform will be used for triggering. At this time, the waveform can be displayed stably. If the oscilloscope cannot detect the trigger condition, it will automatically force the trigger to display the waveform, but because there is no suitable trigger condition, the waveform will not be displayed steadily.

For “**Normal**” mode, The oscilloscope will not refresh the display until there is a waveform trigger. Therefore, in this mode, the screen waveform may not refresh or there is no waveform. It is suitable for measuring discontinuous waveforms and requires users to adjust the trigger level in advance.

Trigger type includes rising and falling edges. Rising edge trigger means that the waveform crosses the trigger level line upward, and a trigger condition occurs.

Trigger level include " Auto-adjust " and "manual".

"Auto" is suitable for trigger mode = auto, the oscilloscope detects the waveform in real time and automatically adjusts the trigger level.

"Manual" When the “single” is used or the trigger mode is "Normal", the

"Manual" option should be used. Under this option, the trigger level can be manually adjusted by the user.

8.3 Display

“**Persistence**” is to make the historical waveform remain on the screen for a while and then disappear. Optional persistence options are: None, 1s, Infinite. When Infinity is selected, the waveforms that have appeared on the screen will remain forever and will not disappear.

“**roll**” is to display the waveform while sampling. Only when the time base is greater than or equal to 200ms will the roll mode be entered. If roll is turned off, the waveform will be displayed after one screen is sampled, resulting in a long time before the screen is refreshed for large time base.

Roll mode does not support triggering, if you need to perform a single trigger(time base >= 200ms), please turn off roll mode.

8.4 Settings

In the first line, you can set "Auto shutdown(15 minutes)" and let the screen invert the color(white background).

“FFT”: fast Fourier transform calculation. The frequency cursor is supported, but the amplitude cursor is not supported.

The “Calib” option is used to calibrate the zero point of the oscilloscope. Self-calibration is required when there is a zero offset due to aging. Remove the probes before calibration.

Furthermore:

1. Keep this menu open, and long press "RunStop" to reset the oscilloscope settings.

2. Keep this menu open, and long press "S" to switch the background color of the measurement item

Parameters

Model	ZDS5020	Coupling	AC/DC
Channels	1	AUTO	Support
Screen size	2.8inch	Measurement	14 types
Bandwidth	20MHz	DC Offest	±5%
Sampling rate	50MSa/s	Freq_meter	10Hz ~ 5 MHz
Resolution	320*240	Screenshot	Support
Storage depth	64Kpts	Frequency	±0.01%
Rise time	<16ns	Pulse counter	Support
Impedance	1MΩ	FFT	Support
Time base	5ns – 10s	Generator vol	3V
Ver sensitivity	20mV/div-10V/div	Generator freq	1Hz – 1MHz
Max voltae	40Vpk（x1） 400Vpk（x10）	Shell size	hight*width* thickness 12 *8 *1.9cm
Trigger mode	Auto/Normal/Single	Language	CN/EN
Trigger type	rise/fall	Charger	TYPE-C / 5V
Display mode	YT / Roll	Built-in power	lithium battery
Persistence	None/1s / ∞	Weight	~130g

Q & A

0. I am a beginner, how do I reset the device to its initial state?

Answer: Open Menu->Set, and then long press the "RunStop" button to reset.

1. What is the difference between probe 1X and 10X?

Answer: The 1X does not attenuate the signal, and the 10X attenuates the signal amplitude by 10 times. When the measuring voltage is higher than 40V, 10X is used. In addition, the bandwidth of 1X file can only reach about 5M. So generally we usually use 10X, and use 1X when the measured signal amplitude is less than a few hundred millivolts. Note: If the probe test lead is set to 10X, it must be set to 10X in the menu. 1X is the same. That is to keep the two consistent! !

2.When the timeBase is >50ms, the waveform refresh becomes slower?

Answer: The time base of 50ms means the time of "one grid". There are 12 grids in the horizontal direction. The time to perform one sampling=50*12=600ms, so it is normal for the waveform refresh to be slow.

3.How to measure DC power voltage?

Answer: Please turn the switch at the top to the DC position first, and adjust the probe to the 10X position (the oscilloscope menu should also be set to the same 10X as the probe). Connect the probe to the power output terminal, and then click the [Auto] key. Pay attention to the "Mea" value.

4.How to measure 220V mains?

Answer: First remove the USB cable (isolation), then adjust the probe to the 10X position, adjust the vertical sensitivity to 100V, and adjust the time base to 10ms, and then connect the probe to the neutral wire and the live wire (be careful!).

6.How to measure main board communication signal or bus signal?

Answer: The probe is connected to the signal first. The coupling mode is set to DC, the probe is set to the X10 position (the menu should also be set to 10X), and then click the [Auto] button. If the correct waveform cannot be obtained, please manually click the [s]/[ns] button to adjust the time base.

7.How to measure power supply ripple?

Answer: Set the coupling mode to "AC" in the menu, and set the probe to the 1X position (the menu is also set to 1X). Adjust the time base to about 20us. First adjust the vertical sensitivity to 10mV. If the waveform exceeds the screen, click the [V] key to reduce it until all the ripples appear on the screen.