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Chapter 1: Safe Precautions

The following precautions described herein must be observed during the use of this instrument. If the instrument is used in a manner not specified in this manual, the protection provided by the instrument may be impaired. ZHIYUAN Electronics assumes no liability for the customer's failure to comply with these requirements.

1.1 General Precautions

In order to avoid injury to operators and damage to the instrument or the devices connected with the instrument, make sure to comply with the precautions below.

Use correct power cord

Only the dedicated power cord allowed by the country where the instrument is used can be used. Power cord specifications in mainland: $3 \times 0.75\text{mm}^2$, $\Phi 6.3$, IEC 6022753, L=1500mm. It is used with three-pin plug and has passed CCC certification.

Ground the instrument

The instrument must remain grounded through the protective grounding wire of its power cord. In order to avoid electric shock, make sure the power cord ground wire is properly connected with protective earth terminal before connecting any input and output terminal of the instrument.

Connect probe correctly

The probe's ground lead is at ground potential. Do not connect it to a high voltage.

Check all ratings before use the instrument

In order to avoid fire and high current impulse, please check all ratings and instructions of the instrument before use the instrument. For the detail information about all ratings, please refer to the related user manual.

Use appropriate over voltage protection

In order to avoid the electric shock to operators, make sure an over voltage (such as the voltage caused by thunderstorm) will not occur.

Do not operate the instrument when the chassis is open

Do not operate the instrument when the chassis is open.

Use the specified power fuse

If the power fuse is necessary to be changed, please return the instrument back to the factory. The power fuse complied with the specification of this product (Class T, rated current: 2A, rated voltage: 240V) will be replaced by the maintainer from ZHIYUAN Electronics.

Avoid exposed circuitry

When the instrument is switched on, do not touch the exposed connections and components.

Avoid electric shock

Power cord should be inserted into a socket with ground protection on the wall or within visible area. The socket cannot be used in the over current situation.

When any fault occurs during the use of instrument

When there may be a fault during the use of instrument, please do not remove the screw of the handle to prevent scratching. If the product has any problem, please stop operating the instrument immediately and contact ZHIYUAN Electronics in time. ZHIYUAN Electronics will send engineers to inspect, maintain and adjust it or replace parts.

Keep instrument ventilated

Inadequate ventilation will cause instrument temperature increase, which may result in damage to the instrument. Please inspect vent and fan constantly to keep the instrument ventilated.

Do not use the instrument in a wet environment

In order to avoid the risk of short circuit and electric shock, do not operate the instrument in a wet environment.

Do not use the instrument in an explosive environment

In order to avoid instrument damage or personal injury, do not operate the instrument in an explosive environment.

Keep instrument surface clean and dry

To prevent dust or moisture in the air affecting instrument performance, please clean and dry the surface of instrument.

Electrostatic protection

Static electricity will cause damage to the instrument. The instrument should be tested in the anti-static area. The internal and external conductors of cables should be connected to ground to discharge the static electricity before they are connected to the instrument.

Transportation safety

To avoid damage to the parts (such as keys, knobs or interfaces on the panel) due to falling of instrument during transportation, please note transportation safety.

The way to use the handle

To ensure the safety of the oscilloscope during use and handling of the oscilloscope, please follow the method of using the handle. As shown below.



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1.2 Warning signs and meanings










CAUTION



CAUTION symbol indicates a hazard. Improper handling or execution in a specified process, operation and so on can lead to loss of important data or damage to the

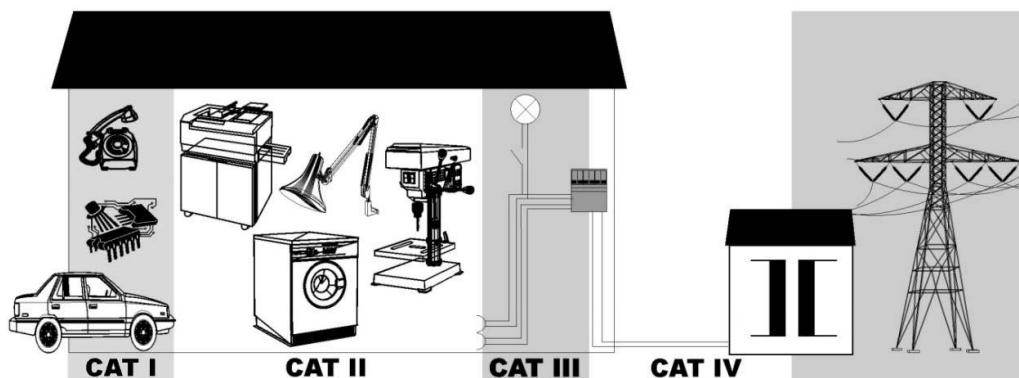
instrument. Please completely read and fully understand the related notes before continuing operation.

The following table lists signs that may be used by the instrument.

	Safety Warning		Probe Compensation Ground		Probe Compensation Input
	Power ON/OFF		USB Port		40 years of use, recyclable
	Do not throw the used battery into garbage bin.		CE Certification		
 All inputs 1MΩ~16pF 300V Max CAT I			Each channel has 1MΩ/50Ω input resistor and 16pF input capacitor. All inputs are 300Vrms CAT I, i.e., their maximum voltage should not be greater than 300V RMS.		
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 100-240V~,50-60Hz,100W MAX Fuse:250V,T2AL </div>			~: Alternating current		

(2) Measurement category introduction:

Measurement category includes CAT I, CATII, CATIII and CATIV. The main introduction is shown below.



Measurement category	Measurement category display	Description	Note
I/O	CAT I	It is applicable to measure for the circuit not directly connected with main power supply	Measured for the circuit which is not supplied by main power supply or by main supply especially with internal protection.
II	CAT II	It is applicable to measure for circuits directly connected to the low-voltage device	Measured for household appliances, portable tools and other similar devices.
III	CAT III	It is applicable to measure for building facilities	Measured for the output socket, industrial device and other devices of the distribution board, circuit breaker and wirings include cable, busbar wire, junction box, switch and fixed facilities, such as those stationary motors permanently attached to fixed facilities.
IV	CAT IV	It is applicable to measure for the terminal of the low-voltage facilities	Measured for primary over current protection devices and ripple control units.

Notes: The CAT I result is measured for the circuit not directly connected with main power supply. For example, a circuit is not supplied by main power supply or by main supply especially with internal protection. In the latter case, the transient stress is variable. Therefore, users should know the tolerant transient stress of device.

WARNING



WARNING symbol indicates serious danger. Improper handling or execution in a specified process, operation and so on can lead to serious or fatal injury to the users. Please completely read and fully understand the related notes before continuing operation.

1.3 Measurement Category

ZDS3000/4000 series oscilloscope can be measured in CAT I, and the maximum input voltage must be kept in the range of CAT I 300Vrms.

WARNING



ZDS3000/4000 series oscilloscopes are only used in the specified measurement

category.

1.4 Instrument Placement

CAUTION



The instrument placement location should meet following conditions:

- Do not install the instrument in the place in direct sunlight, near heat sources, strong magnetic field sources, high voltage equipment or power lines, and where an excessive amount of soot, steam, dust or corrosive gas is present, and where there is water, oil or chemical.
- The instrument should be placed on a flat, even surface; otherwise the measurement precision may be impaired.
- Good ventilation. In order to ensure good ventilation inside the instrument, there are cooling holes in real panel to avoid high internal temperature; please make sure the air inlet and vent of the product keep the air flow freely. When using the oscilloscope on the work bench, please leave at least 10cm gaps on the top, back and both sides of instrument.
- Protection impairment if used in a manner not specified by the manufacturer.
- Not to position the equipment so that it is difficult to operate the disconnecting device.

Warning: *Inadequate ventilation may cause temperature increase inside the instrument, thereby causing the damage to product. Please inspect vent and fan constantly to keep the instrument ventilated.*

1.5 Maintenance and Cleaning

Maintenance

Do not place the instrument in a place exposed to direct sunlight for a long time.

Cleaning

Please clean the instrument as follows:

- Cut off power supply.
- Use a damp but not dripping soft cloth (with a mild detergent or water) to wipe the dust outside the instrument. When clean LCD screen, be careful not to scuff the transparent LCD protective screen.

WARNING



Before the product is powered on, make sure that the product is dry to avoid unnecessary accidents caused by leaving some moisture.

Chapter 2: Product Introduction

2.1 Main Features of 4-channel ZDS3000/4000 Oscilloscopes

- 200MHz, 350MHz, 500MHz bandwidth, 4GSa/s sampling rate.
- Equipped with 512Mpts mass memory depth.
- Equipped with 13 kinds of basic trigger, 30 kinds of protocol trigger and 36 kinds of protocol decoding.
- Equipped with 1Mwfm/s waveform refresh rate.
- 4Mpts FFT analysis function.
- Dual ZOOM waveforms zoom function. Comparing and analyzing for the details of several waveforms by using two ZOOM windows simultaneously.
- 51 kinds of true parameters measurement and statistics. Through FPGA full hardware parallel processing, waveforms in full memory depth can be measured based on the original sampling point.
- Waveform search function. It supports multiple search criteria, such as edge, pulse width, runt, rising/falling time, period/frequency, and duty cycle. Combined with “Dual ZOOM” and “Large Knob” function, you can quickly view and locate abnormal signals.
- Waveform play function. In ZOOM mode, use the waveform play function to quickly browse the whole waveform signal, trends, etc.
- Analysis function. ZDS3000/4000 4-channel oscilloscope comes with power analysis function, segmented storage function, FIR hardware filtering function and Wave Analyze waveform comprehensive analysis software functions, etc. It can help analyze the waveform signal and locate the problem quickly.
- 9-inch TFT color touch screen with 800×480 resolution. It has optimized 256 gray levels display.
- Support USB Host, USB Device, LAN and VGA interface as well as SCPI, which provide rich communication interfaces for secondary programming control.

2.2 Panel Introduction

2.2.1 Front Panel/Rear Panel Description

ZDS3000/4000 series oscilloscope with a touch screen can be operated by using full-screen touch, and it is easy to operate. Take the ZDS4054 Plus digital oscilloscope as an example. The front panel of ZDS4054 Plus digital oscilloscope is shown in Figure 2-1, including buttons/knobs and I/O interface, and their functions are described in Table 2-1.

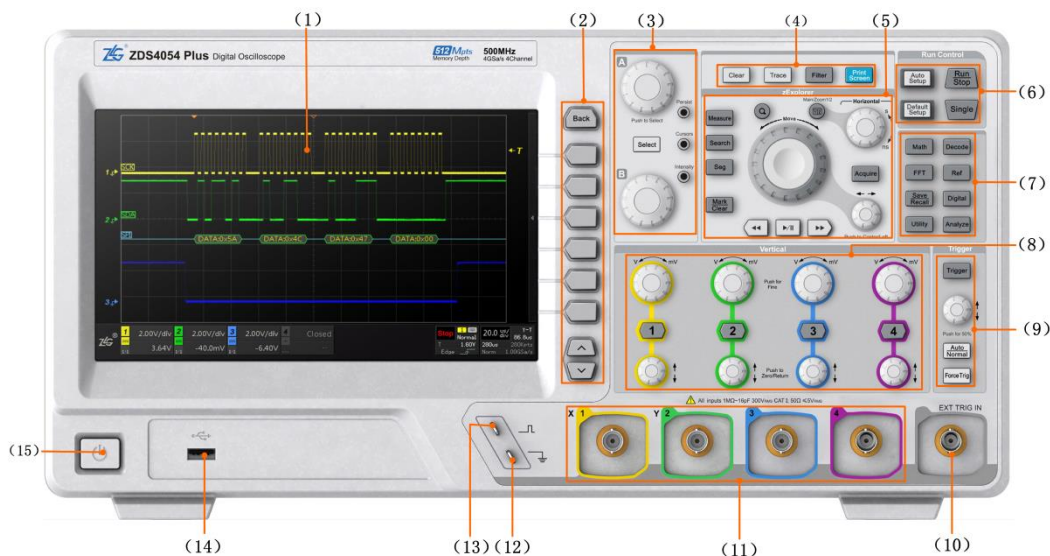


Figure 2-1: The front panel of ZDS4054 Plus oscilloscope

Table 2-1: Front Panel Function Introduction

No.	Name	Description	Use Introduction
(1)	LCD	LCD with touch screen.	9-inch color display screen.
(2)	Menu function keys	These keys perform operations of the menus in the display.	Long press the soft keys to pop-up the explanation of the options in menu selection.
(3)	Multifunctional knobs	These knobs are mainly used for the selection and adjustment of the menu, cursor, waveform brightness and afterglow time, as well as the adjustment of MATH and REF waveform.	The knobs can be turned clockwise or counterclockwise. Knob A and knob B mainly perform menu selection, or Knob A performs fine tune and Knob B performs coarse tune.
(4)	Shortcut function keys	These keys are mainly used to perform One-key clearing, One-key persistence, One-key capture and FIR hardware filtering function.	Belongs to the key operation. Long press the soft keys to pop-up the explanation of the options in menu selection.
(5)	Waveform detection area	Waveform detection area is mainly used for waveform measurement, search, waveform marker, waveform scaling and segment storage function; The horizontal control area is used for the adjustment of the horizontal time base of the waveform/zoom window, and the adjustment of the horizontal offset of the waveform /zoom window	In the zoom status, it is used for the adjustment of the zoom window and waveform by the large knob and horizontal knob. The knobs can be turned clockwise or counterclockwise. The large knob can adjust time base, and the small knob can adjust horizontal offset.

续上表

No.	Name	Description	Use Introduction
(6)	Run Control keys	These keys are used to start or stop data acquisition, set oscilloscope measurement automatically, and restore the oscilloscope's default settings.	Belongs to the key operation.
(7)	Multifunctional control area	The keys in this area are used to perform Decode, Digital, Math and Ref functions.	Belongs to the key operation.
(8)	Vertical control area	This area is used to offset and zoom waveforms vertically.	The knobs can be turned clockwise or counterclockwise. The large knob can adjust the vertical sensitivity, and the small knob can adjust the vertical offset.
(9)	Trigger control area	This area sets the triggering function.	The knobs can be turned clockwise or counterclockwise.
(10)	External trigger input	It is used to input external trigger signals. Note: The maximum input voltage is CAT I 300Vrms, CAT II 100 Vrms.	Connecting mode: Make the BNC female of the external interface connected with the BNC terminal of the oscilloscope. Turn the knob to right and lock it.
(11)	Analog channel input terminal	These inputs are connected with analog signals to be measured. Note: The maximum input voltage is CAT I 300Vrms.	Connecting mode: Make the BNC female of the probe connected with the BNC terminal of the oscilloscope. Turn the knob to right, and these two interfaces stuck means the connection is successful.
(12)	Probe compensation signal ground terminal	Ground terminal	Make the crocodile clip of the probe connected with ground terminal. It means the ground connection is successful.
(13)	Probe compensation signal output terminal	This terminal outputs a 1kHz, 3Vpp square wave signal.	Make the hook of the probe connected with the output terminal.
(14)	USB host port	This port is for connecting USB storage devices.	Make the standard A type USB directly plugged into the USB host port for use.
(15)	Power switch	Press once to switch power on; press again to switch power off.	Key operation.

Notes: All soft keys are lighted up when the instrument is turned on, and the keys become gray when the instrument is not in used.

Figure 2-2 shows the real panel of ZDS4054 Plus oscilloscope.

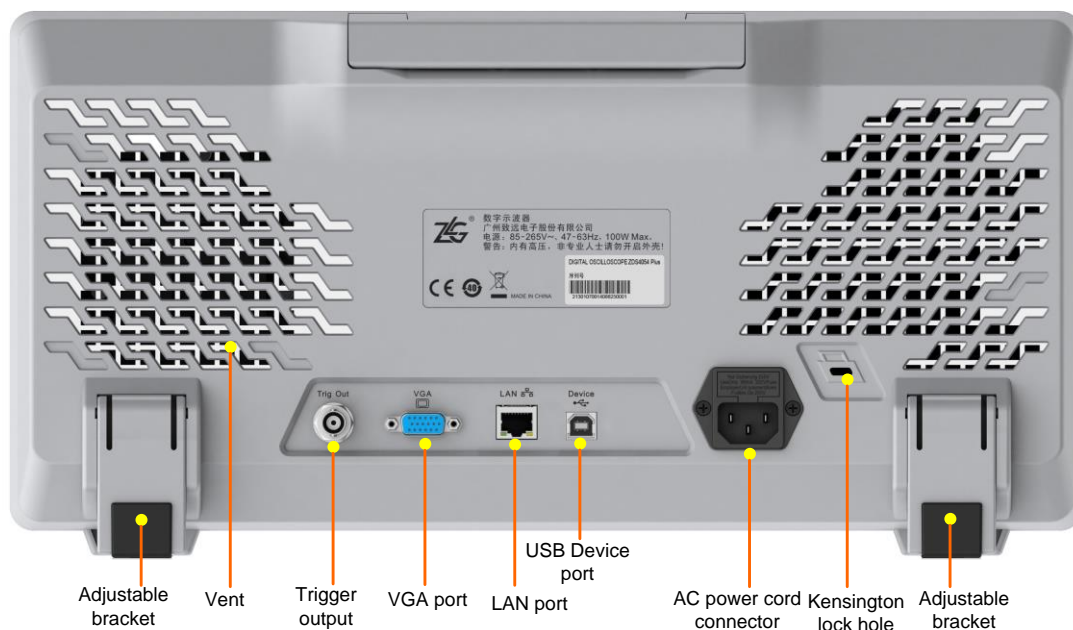


Figure 2-2: Real Panel of ZDS2024 Oscilloscope

Kensington lock: The oscilloscope can be locked on a fixed position by using Kensington lock as follows: insert the lock into the Kensington lock hole on the real panel, turn the key clockwise to lock the instrument, and then remove the key. Please note that do not insert any other things into the lock hole to prevent the instrument from damage.

Notes: *Adjustable bracket: Adjust the supporting feet appropriately and use them as the bracket to make the oscilloscope upward sloping, so as to leave the oscilloscope stableness for better operation and observing the display screen. Open the supporting feet outward to leave the oscilloscope sloping or close the feet inward to leave the oscilloscope upright.*

Trigger output: Make the BNC female interface connected with the trigger output interface. Then turn the knob clockwise. These two interfaces stuck means the connection is successful.

VGA interface: This interface can be used for the monitor externally.

LAN interface: Make the network cable interface connected with the LAN interface.

USB Device: Make the standard B type USB serial cable connected with the USB Device interface for use.

AC power jack: Make the power line which is complied with the provision connected with the power interface. (See "General Precautions").

Chapter 3: Function Description

3.1 zExplore Waveform Zoom

Large data storage can realize long-time waveform capture while maintaining a high sampling rate and the waveform is guaranteed not to be distorted. However, our purpose is not only to obtain waveforms without any distortion, but also use an oscilloscope to automatically and conveniently analyze the abnormality in waveforms, enabling users to locate abnormal signals within millions of waveforms without any effort.

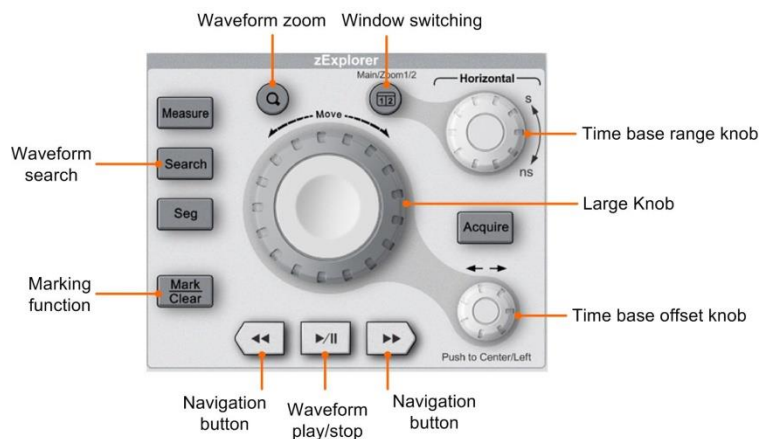


Figure 3-1: zExplore Panel

3.1.1 Waveform Zoom

The waveform zoom function can display not only the whole waveform but also the details of a waveform. ZDS3000/4000 series oscilloscope can use high-speed parallel processing capability of powerful multi-chip FPGA array to realize the zoom mode in the case of real-time massive data response.

Press “Waveform Zoom” button to enter the waveform zoom interface, as shown in Figure 3-2.

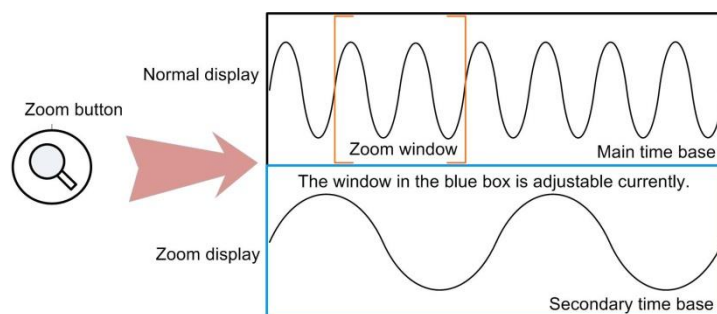


Figure 3-2: Waveform zoom

The display screen is divided into two parts. The upper half part is the normal display view, also called main time base; and the lower half part is the zoom display view, also called secondary time base, which is a magnified display of the specified area of a waveform in the normal display view.

(1) Single ZOOM and dual ZOOM mode

ZDS3000/4000 series oscilloscope provides single/dual zoom window modes. It can simultaneously display two zoom window views and analyze the details of different part of a waveform.

Press [Acquire] to enter the horizontal time base interface. If [Dual ZOOM] is “OFF”, then enter the single ZOOM display shown in Figure 3-3; if [Dual ZOOM] is “ON”, then enter the dual ZOOM display shown in Figure 3-4. After entering the zoom mode, press the "Window Switching" button to switch the adjustable window. The window within the blue box is selected, and the horizontal time-base or offset adjustment can be performed for the waveform in this window.

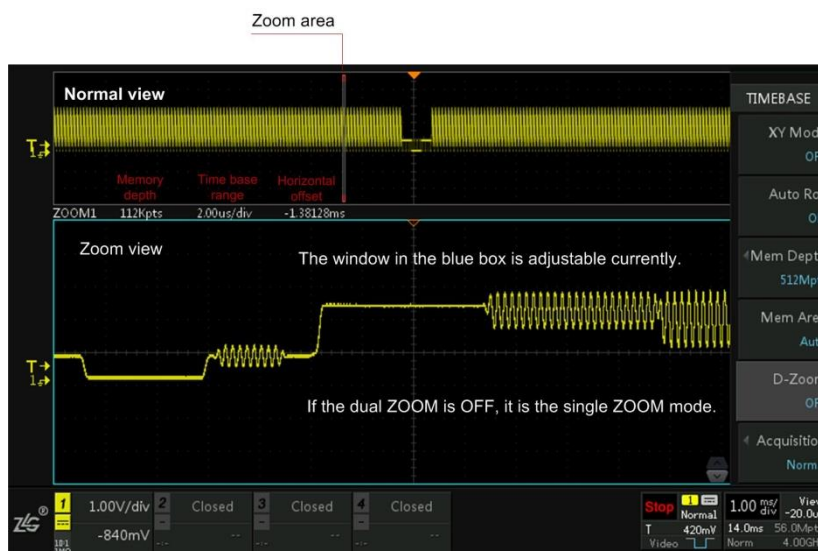


Figure 3-3: Single ZOOM mode



Figure 3-4: Dual ZOOM mode

(2) Horizontal time-base adjustment of a waveform in the zoom mode

The waveform selected in the “blue” box is adjusted after entering the zoom mode. If the normal view mode is selected, users can expand or compress the waveform in the horizontal direction; if the zoom view mode is selected, users can adjust the size of zoom window to view the waveform details.

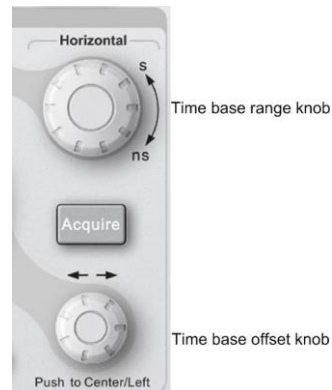


Figure 3-5: Horizontal control area

(3) Waveform translation in the zoom mode

The large knob and time base offset knob are used to adjust the offset of main time base waveform or secondary time base zoom window so that user can observe the waveforms at different positions, as shown in Figure 3-6.

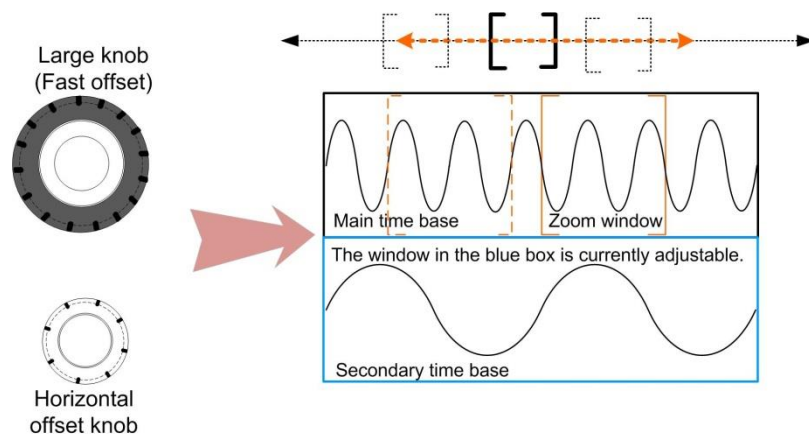


Figure 3-6: Waveform/zoom window translation

The large knob is used to quickly move main time base waveforms and secondary time base zoom windows. The wider the range of the large knob is turned, the faster the zoom window moves. The horizontal offset knob is used to slowly move main time base waveforms and secondary time base zoom windows.

(4) Waveform play/pause

When the memory depth is large, much waveform data can be recorded, but the whole waveform signal may not be observed completely. However, user can press the “Waveform play/pause” button of ZDS3000/4000 series oscilloscope to automatically play and move the secondary time base waveform in the zoom mode, as shown in Figure 3-7.

- Turn the “large knob” to adjust the play speed of waveform. Faster and wider

range the large knob is turned, faster the waveform is played. The speed can reach its maximum value.

- Reversely turn the “large knob” to change the play direction of waveform. When the zoom window moves to the left, the waveform passes through the window from left to right, and users will observe the waveform moves to the right in the secondary time base; on the contrary, the waveform moves to the left.
- Press the navigation button with the same direction as the secondary time base waveform play to increase the waveform play speed. The more times the button is pressed, the faster the waveform is played. Press the backward navigation button to decrease the waveform play speed. The more times the button is pressed, the slower the waveform is played. When the speed is reduced to 0, the waveform will be played in the opposite direction.
- Press the “Waveform play/pause” button again to stop the movement of waveform temporarily.

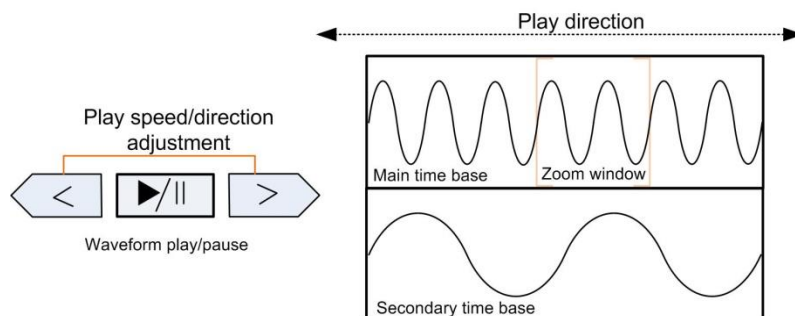


Figure 3-7: Waveform play/pause

3.1.2 Search and marking

The “search” function can quickly find the interested waveform signals and then mark them automatically for user to view these signals later conveniently. It provides many search conditions, including edge, pulse width, rising/falling time, cycle, frequency, duty cycle, runt, etc.

The “marking” function divides into manual marking and automatic marking. It can mark the position of interested waveform in the sampled waveforms and quickly locate the abnormal signal.

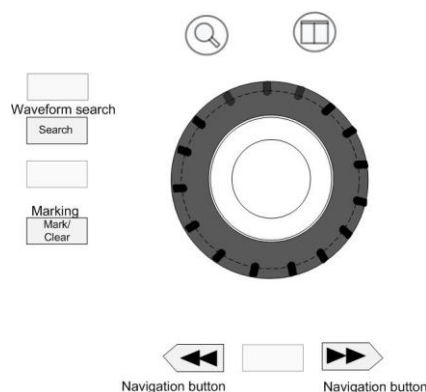


Figure 3-8: Waveform search/marking

When using the manual marking function, users can press [Mark/Clear] button at the position of the interested waveform to mark it, and then press this button again to delete the marking. Press the left or right navigation button to jump from one marking position to the other.

3.2 Real-time digital filter

The FIR digital filter is a filter that responds to any finite length input, and also known as non-recursive filter. It features strict linear phase-frequency characteristic while guaranteeing arbitrary amplitude - frequency characteristics. Meanwhile, its impulse response is of finite duration. The low-pass filtering can be performed against a signal through setting the cut-off frequency. Note, only ZDS4000 Plus oscilloscope supports it.

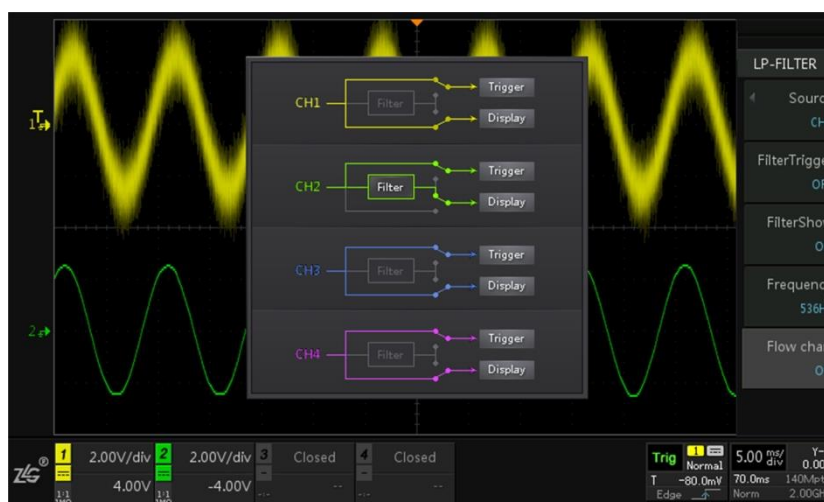


Figure 3-9: Noise filter settings

3.3 Segmented storage function

The segmented storage is triggered several times in the process of acquisition, and the sampled data for each trigger are stored in the individual segment of storage space.

There is no waveform appearing in the signal for a long time, and then the waveform appears along with interference, as shown in Figure 3-10. In order to facilitate analysis and save storage space, the segmented storage is used to record each section of waveform under triggering conditions. After the waveform is captured, users can use the left and right navigation buttons to perform abnormality analysis and processing for each section of waveform.

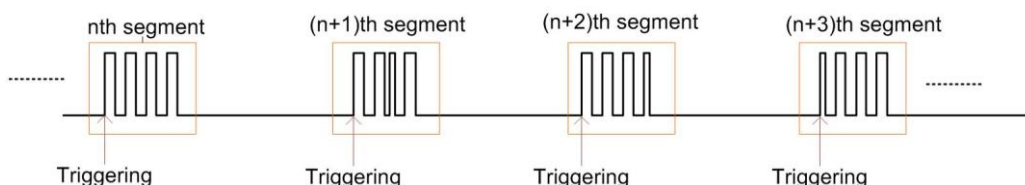


Figure 3-10: Segmented storage application

The total memory depth is divided into n segments, as shown in Figure 3-11. The first segment is used for display, and the second segment begins to be used for storage, that is, the sampled data is stored in the second segment when the first triggering occurs; after the second segment is full, the first triggering ends and users should wait for the arrival of the second triggering; and then the sampled data is stored into the third segment when the second triggering occurs; and so on.

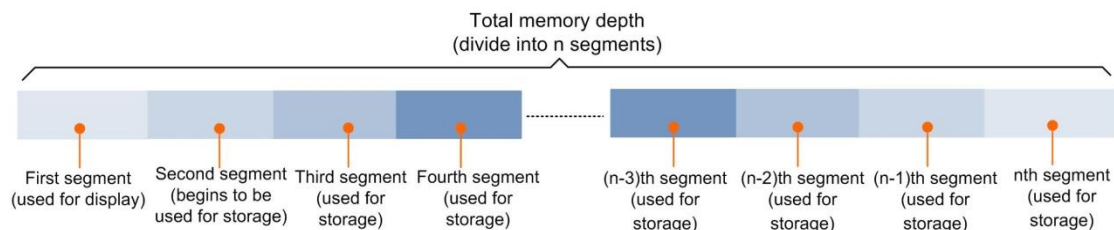


Figure 3-11: Segmented storage structure diagram

Take the ZDS4054Plus oscilloscope for example; its total memory depth is 512Mpts. The number of allocated segments is calculated as follows:

$$N=512 * 1024 * 1024 / (\text{the current storage capacity is rounded to the nth power of } 2) - 1.$$

3.4 Waveform search

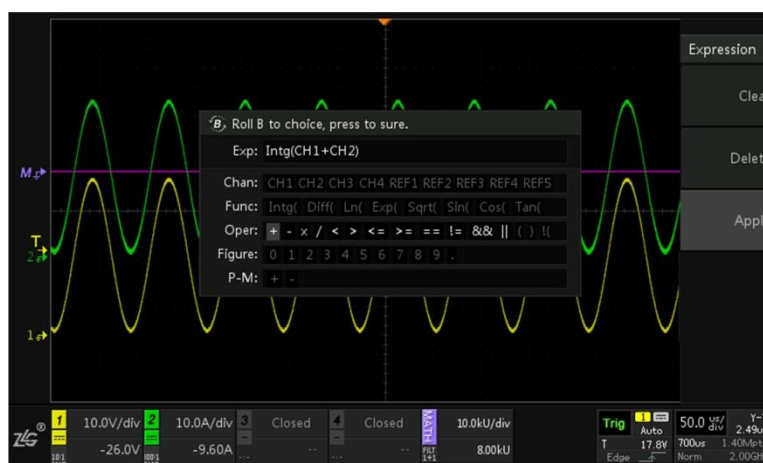
ZDS3000/4000 series oscilloscope has powerful real-time hardware search function. It provides many waveform search modes, including edge, pulse width, cycle, frequency, rising/falling time, duty cycle and runt, and sets the measuring modes in detail, such as greater than, less than, within the range and outside the range. ZDS3000/4000 is also able to quickly locate the interested signal, greatly improving the efficiency of abnormal signal measuring and analyzing.



Figure 3-12: Waveform search

3.5 Mathematic operation

ZDS3000/4000 series four-channel oscilloscope can perform various mathematic operations for the waveform of each channel, such as basic operations, trends and advanced operations. Advanced operations include multiple expression operations, which is a combination of basic operators, logical operators, function operators, etc. It is an integrated operation, mainly including differential, integral, logarithmic, exponential, trigonometric functions, logical relations and other operation methods. Users can define the operation method and operation type of an operation expression.



3.6 Parameter measurement

ZDS3000/4000 series oscilloscope has powerful parameter measurement and statistics function. It uses full hardware to accelerate processing, can analyze all original (non-sampling) sample points on the whole screen, and perform the measurement and statistics of 51 parameters simultaneously. The processing speed is extremely fast.



Figure 3-13: Automatic measurement interface

3.7 Cursor Measurement

Users can use the cursor measurement function to measure the X axis values (such as time) and Y axis values (such as voltage) of selected waveforms. There are two pairs of measurement cursors: X-type cursor or Y-type cursor. The X-type cursor is generally used to measure time parameters and Y-type cursor is generally used to measure voltage parameters, as shown in Figure 3-14.

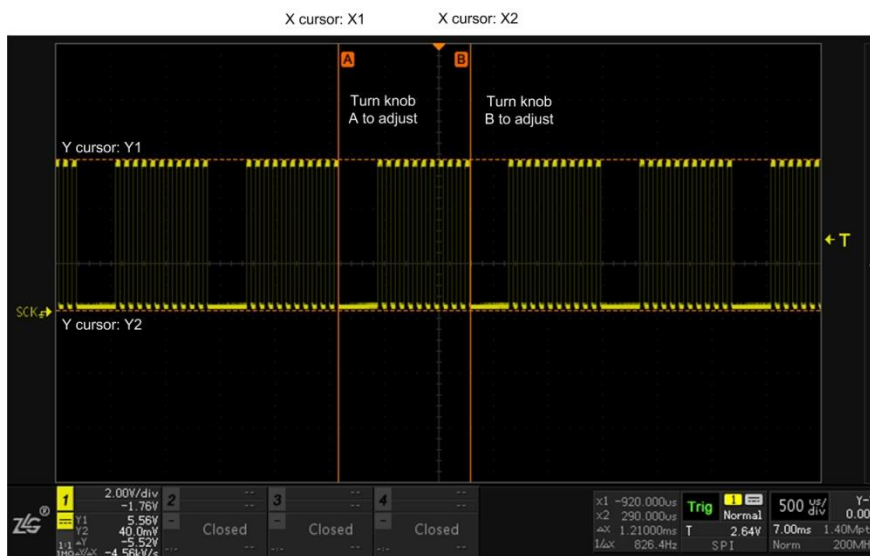


Figure 3-14: X-type cursor and Y-type cursor

3.8 FFT Function

Users can use FFT function to compute the Fast Fourier Transform. It is used to find crosstalk problems, locate distortion problems caused by the non-linearity of amplifier in the analog waveform, or adjust the analog filter.



Figure 3-15: FFT interface view

3.9 Protocol Decoding

Users can easily find the communication error, debug hardware and accelerate the development progress through this function, as shown in Figure 3-16. ZDS3000/4000 series oscilloscope can perform 36 protocols decoding for the input signals of 4 analog channels (CH1-CH2-CH3-CH4), including UART, SPI, I²C, CAN-FD, CAN, FlexRay, USB, Wiegand, LIN and other commonly used protocols.

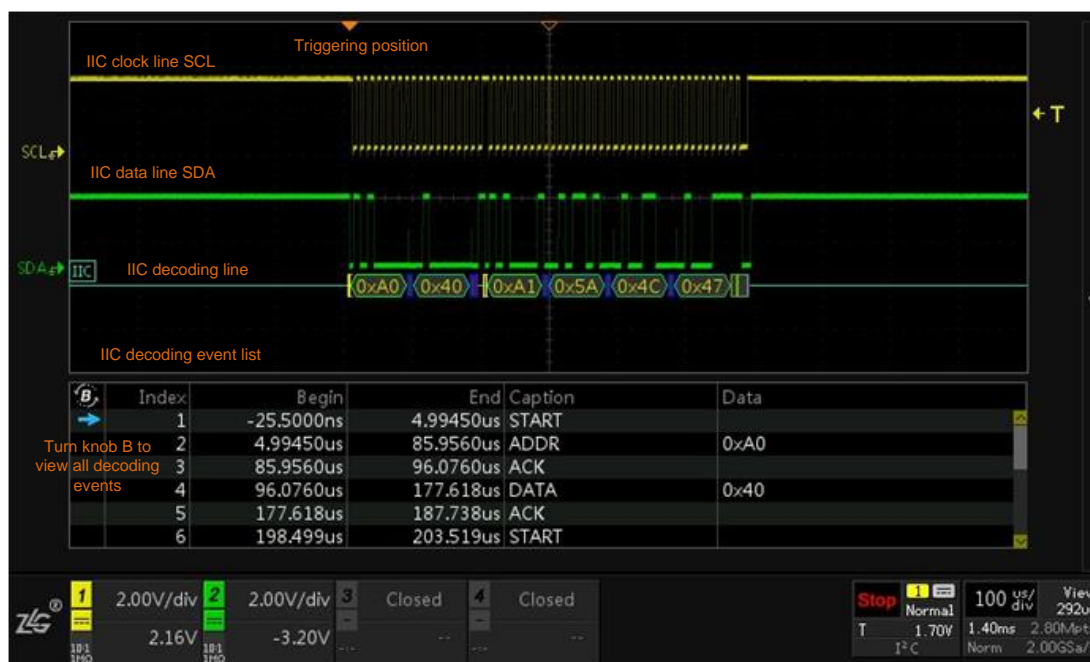


Figure 3-16: Decoding function (ZDS3000/4000 Plus oscilloscopes)

Chapter 4: Technical Parameters for ZDS3000/4000 Series Oscilloscope

All parameters can be guaranteed, but the oscilloscope must be operated continuously under the operating temperature for more than 30 minutes.

4.1 Vertical System

Figure 4-1: The analog channel of vertical system

Characteristics	Description		
	ZDS4054 Plus/ ZDS4054/ ZDS3054 Plus/ ZDS3054	ZDS4034Plus/ ZDS4034/ ZDS3034Plus/ ZDS3034	ZDS4024 Plus/ ZDS4024 / ZDS3024 Plus/ ZDS3024
Number of channels	4	4	4
Analog bandwidth (-3dB)	500MHz	350MHz	200MHz
Calculated rising time	≤0.7ns	≤1ns	≤1.75ns
Vertical resolution	8 bit		
Bandwidth limit	20MHz、OFF		
Input coupling	DC、AC、GND		
Input impedance	1MΩ ± 1% 16pF ± 4pF 50 Ω±1.5%		
Input sensitivity range	2mV/div ~ 10V/div, 1-2-5 stepping		
Maximum Input Voltage (1MΩ)	CAT I 300Vrms		
DC Gain accuracy	2 mV/div ~5 mV/div : ±3% full scale 10 mV/div ~ 10 V/div : ±2% full scale		
DC Offset accuracy	-2V≤ offset value ≤2V : ±0.1 div±2 mV ±2% offset value offset value >2V, offset value <-2V: ±0.1 div±2 mV ±3% offset value		
Interchannel isolation	>40dB		
Low-frequency response (AC coupling, -3dB)	≤5Hz		
Offset range	2mV/div~ 50mV/div: ±2V 100mV/div ~ 10V/div: ±40V		
Dynamic range	Screen center ±6div		
Probe attenuation coefficient	0.1x~1000x, 1-2-5 stepping		

4.2 Horizontal System

Figure 4-2: The analog channel of horizontal system

Characteristics	ZDS3000/4000 Series Models	
Time range	10ns/div ~1Ks/div, 1-2-5 stepping	
Time base accuracy	25ppm ± 5ppm/year (ageing)	
Waveform refresh rate	ZDS4024 Plus / ZDS4034 Plus / ZDS4054 Plus	1000,000wfms/s ^[Note] ;
	ZDS4054 / ZDS4034/ ZDS4024/ ZDS3054 Plus / ZDS3034 Plus / ZDS3024 Plus/ ZDS3054 / ZDS3034/ ZDS3024	330,000wfms/s ^[Note]
Delay range	Pretrigger: ≤Memory depth; post trigger: 40ms -- 2000s	
Time base mode	Y-T、X-Y、ROLL	

Notes: Single-channel, point display mode, 10ns/div time base range, automatic memory depth, the input signal is greater than 5MHz.

4.3 Sampling System

Figure 4-3: Acquisition mode

Mode	Description	
Sampling mode	Real-time sampling	
Maximum sampling rate	Per channel 4GSa/s	
Memory depth	ZDS4024 Plus/ ZDS4034 Plus/ ZDS4054Plus	Single channel: 1.4Kpts, 14Kpts, 140Kpts, 1.4Mpts, 14Mpts, 28Mpts, 56Mpts, 128Mpts, 256Mpts, 384Mpts, 512Mpts Multiple channels: fixed depth, 1.4Kpts, 14Kpts, 140Kpts, 1.4Mpts, 14Mpts, 28Mpts, 56Mpts, 128Mpts, 256Mpts
	ZDS4024/ ZDS4034 /ZDS4054/ ZDS3024 Plus/ ZDS3024/ ZDS3034 Plus/ ZDS3034/ ZDS3054 Plus/ ZDS3054	Single channel: 1.4Kpts, 14Kpts, 140Kpts, 1.4Mpts, 14Mpts, 28Mpts, 56Mpts, 125Mpts, 250Mpts Multiple channels: fixed depth, 14Kpts, 140Kpts, 1.4Mpts, 14Mpts, 28Mpts, 70Mpts, 125Mpts
Peak detection	The sampling spikes of all scan rates are narrowed to 1 ns.	
Average	Includes 2 to 65536 waveforms averagely.	

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Mode	Description
High resolution	Reduces random noise and increases vertical resolution in real time averagely. 9bit: Sampling rate $\leq 500\text{MSa/s}$ 10bit: Sampling rate $\leq 125\text{MSa/s}$ 11bit: Sampling rate $\leq 25\text{MSa/s}$ 12bit: Sampling rate $\leq 5\text{MSa/s}$
Scroll	Scrolls the waveform from right to left on the screen, and the time base range is greater than or equal to 50ms/div .

4.4 Trigger System

Figure 4-4: Trigger system

Characteristics	Description
Trigger Source	CH1, CH2, CH3, CH4, external trigger, power trigger
Trigger mode	Automatic, normal
Trigger coupling	DC, AC, high frequency rejection (50KHz), low frequency rejection (50KHz)
Trigger hold-off range	8ns ~ 34s
Trigger sensitivity	Internal: 0~1.5div, external: 300mV
Trigger level	Internal: $\pm 5\text{div}$ from the center of the screen, external: $\pm 5\text{V}$

4.5 Trigger Type

Figure 4-5: Trigger type

Model	Trigger Type	
	Basic Trigger	Protocol Trigger
ZDS4024Plus ZDS4034 Plus ZDS4054 Plus ZDS4024 ZDS4034 ZDS4054 ZDS3024Plus ZDS3034 Plus ZDS3054 Plus ZDS3024 ZDS3034 ZDS3054	Edge, Pulse, Runt, Setup/Hold, Delay, N th -Edge, Pattern, Time-out, Pos-Runt, Slope, Video, Alternative trigger, A-> B trigger	UART, I2C, SPI, CAN, CAN FD, USB, LIN, SD_SPI, SD_SD, Wiegand, FlexRay, DS18B20, PS/2, MDIO, DALI, HDQ, 1-Wire, IrDA, Manchester, Diff-Manche, Miller, 1553B, MVB, Modbus, ISO7816, WTB, SENT, MIPI_DSI, DHT11, SHT11

Figure 4-6: Basic trigger type description

Trigger Type Symbol	Description
Edge trigger	Includes rising edge trigger, falling edge trigger and rising/falling edge trigger. The edge will be triggered when reaches the trigger level.
Pulse trigger	The positive pulse or negative pulse is triggered at the specified pulse width time.
Slope trigger	Triggered when the pulse edge rate is faster/slower than the specified value.
Video trigger	Trigger on the specified line, random line, even field, odd field or random field of NTSC, PAL and SECAM video signals.
Runt trigger	Trigger when the pulse amplitude is greater than or less than the set value.
Pos-Runt trigger	Trigger when the pulse amplitude is greater than the normal amplitude.
Pattern trigger	The pattern types of two channels are high level, low level, ignore, rising edge and falling edge. The waveforms which meet the conditions will be triggered after setting.
Nth-Edge trigger	The signal is triggered at the Nth edge after idle.
Delay trigger	Triggered when the time difference between the specified edge of source A and the specified edge of source B satisfies the set delay time.
Time-out trigger	Triggered when the level duration is greater than the specified time value.
Setup/Hold trigger	Triggered when the time of data setup or hold is satisfied.
Alternative trigger	Selects whether a rising edge trigger or a falling edge trigger by the random function.
A-> B trigger	After the edge of channel A has elapsed, the edge of channel B start counting. Triggered when the counting reaches n.

4.6 Decoding Type

Figure 4-7: Protocol decoding type

Model	Protocol Type	Protocol Name
ZDS4024Plus ZDS4034 Plus ZDS4054 Plus ZDS4024 ZDS4034 ZDS4054 ZDS3024Plus ZDS3034 Plus ZDS3054 Plus ZDS3024 ZDS3034 ZDS3054	Automotive Electronics	CAN, LIN(LIN1.3, LIN2.0), FlexRay, MVB, CAN-FD, SENT, WTB
	IC interfaces	1-WIRE, I2C, SPI, UART, SPI_CS
	Computer peripherals	USB1.1, PS/2
	Wireless communication	Manchester, DiffManchester, WIEGAND, Miller, ISO7816
	Photoelectricity	DALI, MIPI-DSI
	Infrared	NEC Infrared transfer protocol analysis, Philips RC-5, Philips RC-6, IrDA
	Industrial automation	ModBus, RS485, RS232(485 and 232 use UART to decode)
	Sensor	DS18B20, SHT11, DHT11
	Video, audio	I2S, TDM
	Aviation	MIL-STD-1553B
	Power management	HDQ
	Storage	SD-SPI, SD-SD
	Other	MDIO

Figure 4-8: Decoding protocols information

Characteristics	Description
UART	There are 2-channel signals in UART protocol: TXD and RXD. UART (RS-232/422/485/UART) bus within the 10Mb/s can be triggered and decoded on the oscilloscope.
I2C	I2C protocol has 2-channel signals: SCL (clock line) and SDA (data line). I2C bus within 20Mb/s can be triggered and decoded on the oscilloscope.
SPI	SPI has SCK (clock line) and MOSI/MISO (data line), and there is no chip select line should be connected. SPI bus can be triggered and decoded within 20Mb/s.
Modbus	Modbus has one data source. Set its Baud rate, parity bits and transmission mode parameters within 10Mb/s to trigger and decode.
MIPI-DSI	MIPI-DSI has two data lines: D+ and D-. The start bit trigger, transmission mode and bus steering trigger can be used.

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Characteristics	Description
CAN	CAN protocol has three data types: CANH, CANL and CAN-DIFF. The start bit or all kinds of data frame trigger modes can be configured.
CAN-FD	CAN-FD protocol has three data types: CANH, CANL and CAN-DIFF. The normal Baud rate and FD Baud rate should be set and the start bit triggering and all kinds of data frame triggering can be configured.
LIN	LIN protocol support LIN1.1 and LIN1.3 version, LIN bus synchronization interval, synchronous field, specific ID, specific ID + specific data within the 1Mb/s can be triggered.
FlexRay	FlexRay has one data line TXD. FlexRay bus within 20Mb/s can be triggered in the TSS and frame ID.
SENT	SENT has one data source. The number of data pulses and the time slice width can be set and the synchronous field triggering and state field triggering can be used.
MVB	MVB has one data source. Its Baud rate can be set, and the MSD and SSD trigger mode can be decoded.
WTB	WTB has one data source. Its Baud rate and trigger mode can be set for decoding.
1553B	1553B has one data source. The start bit trigger and address trigger can be set.
ISO7816	ISO7816 has two sources, including reset source and data source. Its Baud rate can be adjusted, and the TS and RST trigger can be used for decoding.
TDM	TDM has three sources, including clock line, data line and chip select signal line.
IIS	IIS has three sources, including clock line, data line and channel source selection. The protocol format can choose IIS, Left and Right.
USB	USB has two sources, including D+ and D-. USB2.0 (low speed + full speed) bus output packet, input packet, start packet, setup packet, DATA0, DATA1, response packet, no response packet, stop packet, preamble packet, package synchronization and package terminator within 20Mb/s can be triggered. Each triggering mode can further specify the specific information of the corresponding packet, for example, the start packet to set the expansion parameters and account values, the setup package to set the expansion parameters, address values and port values.
SD_SPI	SD_SPI has two sources, including clock source and command source. On the 20Mb/s SD bus (SPI mode), the specific command or specific command + parameter can be triggered and decoded.
SD_SD	On the 20Mb/s SD bus (SD mode), the specific command or specific command + parameter can be triggered.

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Characteristics	Description
Wiegand	Triggers when the specified OEM, FC, CC segment encountered on the Wiegand bus (26Bit, 39Bit, 44Bit or customized frame format), or data is the specified value. Supports for masking certain fields as needed.
DS18B20	DS18B20 has one data channel. The temperature resolution of 9, 10, 11, 12 bits can be set for decoding. The start bit, the specified ROM command and the specified RAM command on the DS18B20 bus can be triggered.
PS/2	PS/2 has two sources, including clock source and data source. The start bit and data on the PS/2 bus within 1Mb/s can be triggered, which support triggering from the host to slave and from the slave to host.
MDIO	MDIO has two sources, including clock source MDC and data source MDI. Supports triggering for ST segment, OP segment, PHYAD segment, REGAD segment and DATA segment on the MDIO bus, and they can be decoded in both LSB and MSB modes.
DALI	DALI has one data source. Triggers for decoding when the specified Forward19, Forward27, Backward frame encountered on the DALI bus.
HDQ	HDQ has one data source. The data length of 8-bit or 16-bit can be set for decoding. The reset segment and the specified command are triggered on the HDQ bus.
1-Wire	1-Wire has one data source. Its speed mode can be set to standard or drive for decoding. The start bit and the specified ROM command are triggered on the 1-Wire bus (low-speed, high-speed mode).
IrDA	IrDA has one data source. The plug-in mode can be set to SIR, HDLC, CIR and FIR. The Baud rate, data width and data transfer mode can be set for decoding according to the protocol. Supports the start bit and data triggering of the SIR, HDLC, CIR, FIR plug-in on the IrDA bus.
Miller	Miller has one data source Its Baud rate can be set for decoding, and the data transfer mode can be specified on the Miller bus for data triggering.
Manchester	Manchester has one data source. The encoding mode can select G.E or IEEE for decoding. The start bit of the specified package is triggered on the Manchester bus.
Diff-Manche	Diff-Manche has one data source. The encoding mode can select G.E or IEEE for decoding. The start bit of the specified package is triggered on differential Manchester bus.

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Characteristics	Description
DHT11	DHT11 has one data source. The start bit is triggered on the DHT11 bus.
SHT11	SHT11 has one data source. The specified command is triggered on the SHT11 bus.
SPI_CS	SPI4 has three sources, including clock line, data line and chip select line. Its operating mode, transmission mode, data bit width and idle time can be set for decoding.
NEC	NEC has one data source. The level inverting and carrier mediation can be set for decoding. No protocol triggering.
RC5	RC5 has one data source. The level inverting and carrier mediation can be set for decoding. No protocol triggering.
RC6	RC6 has one data source. The level inverting and carrier mediation can be set for decoding. No protocol triggering.

4.7 Measurement Parameters

Table 4-9: Measurement Parameters

Characteristics	Description	
Cursor measurement	Display X1, X2, ΔX , $1/\Delta X$, Y1, Y2, ΔY , $1/\Delta Y$ at the same time	
Parameter measurement (53 kinds)	Voltage parameters (19 kinds)	Peak to peak, amplitude, maximum, minimum, top value, bottom value, positive overshoot, negative overshoot, positive preshoot, negative preshoot, average value-cycle, average value-full screen, DC RMS - cycle, DC RMS - full screen, AC RMS - cycle, AC RMS - full screen, ratio - cycle, ratio - full screen, mean value
	Time parameters (23 kinds)	Cycle, frequency, rising time, falling time, positive pulse width, negative pulse width, positive duty cycle, negative duty cycle, burst width, string pulse length, X@min, X@max, delay 1 \uparrow \rightarrow 2 \uparrow , delay 1 \downarrow \rightarrow 2 \downarrow , delay 1 \uparrow \rightarrow 2 \downarrow , delay 1 \downarrow \rightarrow 2 \uparrow , phase 1 \uparrow \rightarrow 2 \uparrow , phase 1 \downarrow \rightarrow 2 \downarrow , Setup time, hold time, setup-hold ratio, baud rate , CAN-bus load rate
	Count (5 kinds)	Rising edge count, falling edge count, positive pulse count, negative pulse count, trigger counter
	others (6 kinds)	Area - cycle, area - full screen, positive area - cycle, negative area - cycle, positive area - full screen, negative area - full screen
Number of measurements	Display 24 kinds of measurement items at the same time	

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Characteristics	Description
Measurement Statistics	Current value, maximum, minimum, average value, standard deviation, statistic times
Hardware frequency meter	Supported. The maximum frequency is the oscilloscope bandwidth.

Notes: Baud rate and CAN-bus load rate are only supported by 4000 series Plus oscilloscopes.

4.8 Waveform Mathematic Operation

Table 4-10: Waveform Mathematic Operation

Characteristics	Description
Waveform operation	<p>Basic operation: A+B, A-B, A×B, A/B, integral, differential.</p> <p>Advanced operation: include multiple expression operations, such as 2CH1+Diff (CH2) x 3CH3, which is a combination of basic operators (+, -, X, /), logical operators (>, <, =, ≥, ≤, !=, &&, , (), !(), function operators(Intg, Diff, Ln, Exp, Sqrt, Sin, Cos, Tan).</p> <p>Trend: frequency, cycle.</p>
FFT	Fast Fourier transform
Number of FFT sample points	4Mpts
FFT display mode	dBm、Vrms、Ampl、PSD
FFT window type	Rectangle、Hamming、Hanning、Blackman-Harris
Hardware filter	Custom filter frequency

4.9 Display Characteristics

Table 4-11: Display Characteristics

Characteristics	Description
Display type	9.0-inch TFT touch screen
Display resolution	800 (horizontal) × 480 (vertical)
Waveform type	Point, vector
Display mode	Normal, persistence, color temperature
Persistence length	100ms, 200ms, 500ms, 1s, 2s, 5s, 10s, 20s, 50s, infinite
Scale	14div (horizontal) × 8div (vertical)

4.10 Input/output Port

Table 4-12: Input/output Port

Port Type	Description
USB HOST	Connect U disk
USB DEVICE	Connect PC
LAN	RJ-45 connector, support 10/100BASE-T
VGA	VGA communication port
Trig Out	The BNC connector on the rear panel provides pulse output when the oscilloscope is triggered.
Probe compensation output	Front panel pins; amplitude: 3.0V, frequency: 1KHz

4.11 Technical Specifications

Table 4-13: Technical Specifications

Power Supply	Description
Supply voltage	100 — 240V~
Supply frequency	50 — 60 Hz
Power	100W max
Fuse	2A, Class T, 240V
Mechanical Specifications	Description
Dimensions	Width*height*depth = 427mm*204mm*120mm
Weight	Net weight: 4.5Kg; gross weight: 6.7Kg
Environment	Description
Temperature range	Operation: 10°C~+40°C, Storage: -20°C~+70°C
Humidity range	≤60% relative humidity
Cooling method	Fan
Altitude	Less than 3000m (operating), less than 12000m (non-operating)
Electromagnetic Compatibility	2014/30/EU, EN61326-1:2013
Safety	EN61010-1: 2010, IEC61010-1: 2010, GB4793.1-2007

4.12 Accessories

Table 4- and Table 4- list the accessories of ZDS3000/4000 series oscilloscope.

Table 4-14: Standard Accessories

Accessory Name	Description
USB communication cable	Communication between PC and oscilloscope
Probe	Standard configuration of 10:1 500MHz and 350MHz passive probe for each channel; Standard configuration of a 200MHz passive probe (X1 and X10 range) for each channel.
Power line	For the power supply of an oscilloscope
Information disk	Product e-information
Warranty Card	To apply for product warranty service

Notes: The oscilloscopes with 500MHz (200MHz) analog bandwidth are equipped with 500MHz (200MHz) passive probe (ZLG ZHIYUAN Electronics assumes no responsibility for the risk due to use of the probe from other companies).

Table 4-15: Optional Accessories

Accessory Name	Description
Current probe	For current signals measurement
High voltage differential probe	For high voltage and floating voltage measurement
Terminal	50Ω matching resistance

Chapter 5: Rights & Statements

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