

# **UTD2000 Series User Manual**

## **Guaranty and Declaration**

**Dear customer,**

Thank you for choosing this UNI-T device. In order to safely and correctly use this instrument, please read this manual thoroughly, especially the Safety Notes part. After reading this manual, it is recommended to keep the manual at an easily accessible place, preferably close to the device, for future reference.

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### **Trademark Information**

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### **Document Version**

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Information in this manual supercedes all previously published versions.

If this product is sold or assigned by the original purchaser to a third party within three years of purchase, the new owner should note that warranty is available for a period of three years from the day the original purchaser acquired the product from Uni-T or an authorized dealer. The probe, other accessories and fuses are not covered by warranty.

If any genuine defect is found during the valid warranty period, Uni-T has the option to repair the defective product without any charge for parts or labor, or replace it with another product (at the discretion of Uni-T). Uni-T may use parts, modules and replacement products that are brand new or repaired to a good-as-new standard. All old parts, modules and products that are removed during replacement become properties of Uni-T.

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This warranty shall not apply to any defects or damages caused by accidental, machine parts' wear and tear, improper use, and improper or lack of maintenance. UNI-T under the provisions of this warranty has no obligation to provide the following services:

- a) Any repair damage caused by the installation, repair, or maintenance of the product by non UNI-T service representatives.
- b) Any repair damage caused by improper use or connection to an incompatible device.
- c) Any damage or malfunction caused by the use of a power source that does not conform to the requirements of this manual.
- d) Any maintenance on altered or integrated products (if such alteration or integration leads to an increase in time or difficulty of product maintenance).

This warranty written by UNI-T for this product, and it is used to substitute any other express or implied warranties. UNI-T and its distributors do not offer any implied warranties for merchantability or applicability purposes.

For violation of this guarantee, UNI-T is responsible for the repair or replacement of defective products is the only remedy available to customers. Regardless of whether UNI-T and its distributors are informed that any indirect, special, incidental, or consequential damage may occur, UNI-T and its distributors shall not be responsible for any of the damages.

## General Safety Overview

This instrument strictly complies with the safety requirements for electronic measuring instrument GB4793 and IEC 61010-1 safety standard during design and manufacturing. Please understand the following safety preventative measures, to avoid personal injury, and to prevent damage to the product or any connected products. To avoid possible dangers, be sure to use this product in accordance with the regulations.

- Only trained personnel can perform the maintenance program.
- Use the correct power line: Only use the dedicated UNI-T power supply appointed to the local region or country for this product.
- Correct Plug: Don't plug when the probe or test wire is connected to the voltage source.
- Ground the product: This product is grounded through the power supply ground wire. To avoid electric shock, grounding conductors must be connected to the ground. Please be sure that the product is properly grounded before connecting to the input or output of the product.
- Correct connection of oscilloscope probe: Ensure that the probe ground and ground potential are correctly connected. Do not connect ground wire to high voltage.
- Check all terminal ratings: To avoid fire and the large current charge, please check all the ratings and the marks on the product. Please also refer to the product manual for details on the ratings before connecting to the product.
- Do not open the case cover or front panel during operation.
- Only use fuses with ratings listed in the technical index
- Avoid circuit exposure: Do not touch exposed connectors and components after power is connected.
- Do not operate the product if you suspect it is faulty, and please contact UNI-T authorized service personnel for inspection. Any maintenance, adjustment, or replacement of parts must be performed by UNI-T authorized maintenance personnel.
- Maintain proper ventilation
- Please do not operate the product in humid conditions
- Please do not operate in inflammable and explosive environment
- Please keep the product surface clean and dr

## Safety Terms and Symbols

The following terms may appear in this manual:

**Warning:** The conditions and behaviors may endanger life.

**Note:** The conditions and behaviors may cause damage to the product and other properties.

The following terms may appear on the product:

**Danger:** Performing this operation may cause immediate damage to the operator.

**Warning:** This operation may cause potential damage to the operator.

**Note:** This operation may cause damage to the product and devices connected to the product.

The following symbols may appear on the product:



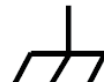
High Voltage



Caution!  
Refer to Manual



Protective  
Ground Terminal



Ground Terminal  
for Chassis



Ground Terminal  
for Testing

## Preface

The Manual introduces information related to operation of digital storage oscilloscope of UTD2000 series user manual series. The Manual comprise the following chapters:

- Chapter 1 Introduction Guide
- Chapter 2 Vertical channel setting
- Chapter 3 Horizontal system setting
- Chapter 4 Trigger system setting
- Chapter 5 Sampling system setting
- Chapter 6 Display system setting
- Chapter 7 Automatic measurement
- Chapter 8 Cursor measurement
- Chapter 9 Storage and callback
- Chapter 10 Auxiliary function setting
- Chapter 11 Other function keys
- Chapter 12 Applicaion example
- Chapter 13 System prompt and troubleshooting
- Chapter 14 Technical specification
- Chapter 15 Appendix

UTD2000 Series Digital Storage Oscilloscope contains the following 6 models

Series	Model	Band width	Real-time
UTD2000L	UTD2025CL	25MHz	250MS/s
	UTD2052CL	50MHz	500MS/s
UTD2102e	UTD2102e	100MHz	500MS/s
UTD2000EX	UTD2052CEX	50MHz	1GS/s
	UTD2072CEX	70MHz	1GS/s
	UTD2102CEX	100MHz	1GS/s

UTD2000 series provide the users with front panels with simple operation and clear functions to perform all the basic operations. Scale and position knobs of each channel provide visual operations that are suitable for user habits as the traditional instrument. Users may be able to master it without spending plenty of time learning and understanding operations of any UTD2000 series DSO. In order to accelerate adjustment and facilitate measurement, the users can directly press **AUTO** key and the instrument will then display applicable waveform and gear position settings.

Apart from easy to use, UTD2000 series DSO also has high performance indexes and powerful functions required for faster completion of measurement tasks. Powerful trigger and analysis ability make it easier to capture and analyze waveforms. Clear LCD and mathematical operation functions make it easier for users to observe and analyze

signal problems in a faster and clearer way.

From the following parameter features, you can understand how this series of DSO can satisfy your measurement requirements.

- Two analog channels
- High resolution LCD display 400×240 (or 800×480) resolution
- Support plug and play USB storage equipment or be capable of communicating with computer via USB storage equipment.
- Automatic waveform and state settings
- Waveform saving and replay feature
- Delicate window extension function and precise analysis on waveform details and overview
- Automatic measurement of 28 waveform parameters
- Automatic cursor tracking measurement function
- Unique functions of waveform recording and playback.
- Built-in FFT software function
- Multi-waveform mathematical operation function (including: addition, subtraction, multiplication and division)
- Edge, Video, Pulse width, Alternating trigger and other functions
- Multi-language menu selection

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# Chapter I Introductions

UTD2000 series DSO is desk type DSO. It is designed with conventional user interface design for any of the basic DSO at the test and measurement industry.

This chapter will cover the following as the beginning guide the UTD2000 series DSO:

- △ General inspection
- △ Functional inspection
- △ Probe compensation
- △ Automatic settings of waveform display
- △ Introduction to the vertical system
- △ Introduction to the horizontal system
- △ Introduction to the trigger system

When beginning to use your UTD2000L oscilloscope, first familiarize yourself with the operation front panel. This chapter briefly describes the operation and functions of the front panel, so you can get started with your UTD2000L series digital storage oscilloscope as quickly as possible.

Your UTD2000L oscilloscope comes with a front panel with at-a-glance functions for easy operation. There are knobs and function keys on the front panel. The functions of knobs are similar to other Oscilloscope. On the right you will find the screen copy key (PrtSc) which enables you to save the current screen in an external USB device in picture format and 5 menu operation keys (designated as F1 to F5 from top down). With these keys you can set up different options of the current menu. The other keys are function keys. You can use them to enter different function menus or access particular functions directly

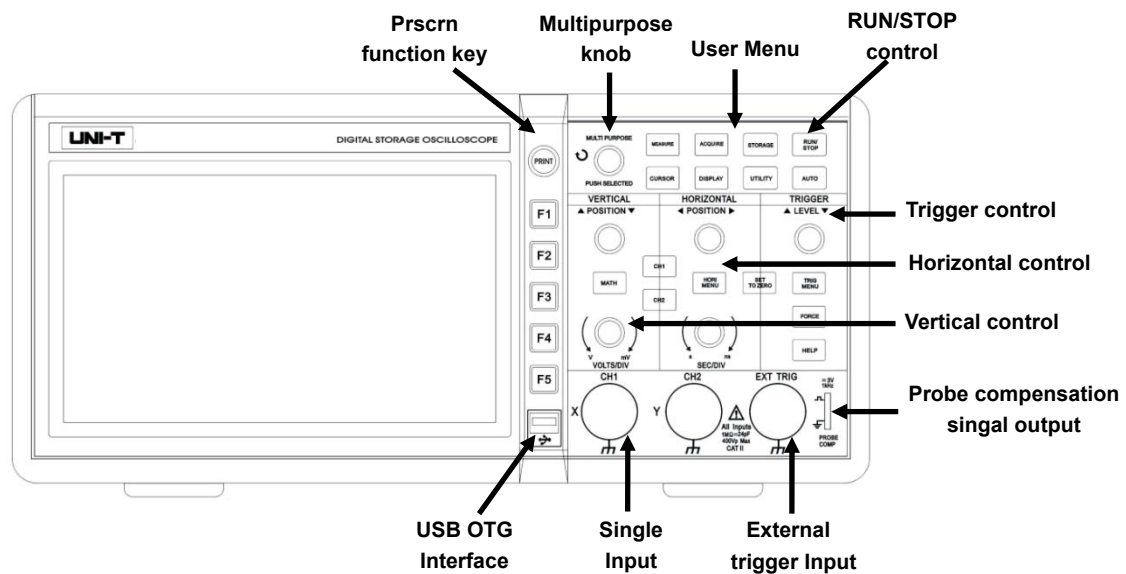


Figure 1-1 Schematic Diagram of the UTD2000L Front Panel

Display horizontal trigger position

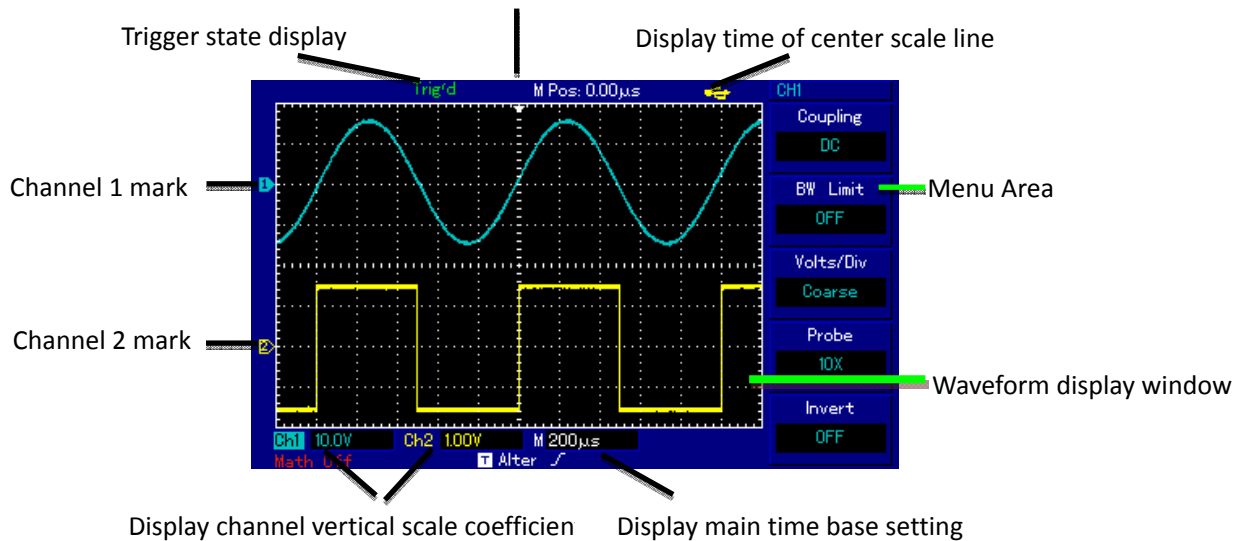


Figure 1-2 UTD2000 Series DSO User Interface Menu Display

### 1.1 General Inspection

After purchasing a new UTD2000 DSO, we recommend you to inspect the instrument according to the following steps.

(1) Inspect whether there are damages caused by transportation

In case of badly damages to packing box or foamed plastic mat, you should replace immediately.

(2) Accessories inspection

For provided accessories details, description has been made in aforesaid “accessories of UTD2000 DSO” item of this user manual. Please check whether there are shortages in the accessories. If you found shortage or damages of accessories, please contact the UNI-T distributors distributing the product or local offices of UNI-T.

(3) Check the complete instrument

In case of damages to the appearance of instrument, abnormal operation or failure to pass the performance tests, please contact the UNI-T product distributors or local UNI-T offices.

If the instrument is damaged due to transportation, please pay attention to keeping the package, notify transportation department and UNI-T product distributors and UNI-T will make arrangement for repair or replacement.

Warning: please confirm that the DSO has been safely grounded to avoid hazard.

### 1.2 Function Inspection

Conduct a fast function inspection to verify whether the instrument is in normal operation. Please take the steps as follows:

(1) Power on the instrument:

The power supply voltage range is from 100 VAC to 240 VAC, the frequency range is 45Hz to 440Hz. Connect the oscilloscope to the power supply line that came with the

oscilloscope or any power supply line that meets the host country standards. Press the power switch button on the top of the oscilloscope, The oscilloscope then will show a boot animation, and it will enter the normal interface afterwards.

**Warning: please confirm that the DSO has been safely grounded to avoid hazard.**

### (2) DSO accessing to signal

UTD2000 series DSO has two input channels with an additional external trigger input channel. Please check the signal according to the following steps.

① Connect DSO probe to CH1 input terminal and set the attenuation rate switch on the probe as 10× (Figure 1-3)

② It is required to set probe attenuation coefficient on DSO.

Attenuation coefficient changes the vertical gear position rate of instrument, thus making the measurement result correctly reflect the amplitude of measured signals. Probe attenuation coefficients are set in the following ways: press F4 to make the menu display 10×.

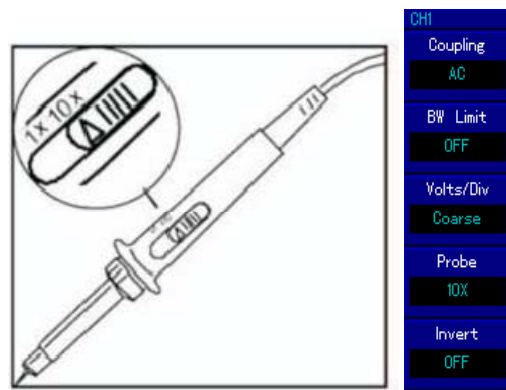


Figure 1-3 Setting of attenuation coefficient on DSO

③ Connect the probe pin and ground clamp to the corresponding terminal of the probe compensation signal. Press **AUTO** key. Within several seconds, square wave display (1kHz, about 3V, peak-to-peak value) is as shown in Figure 1-7. Check CH2 in the same way; press **CH1** function key to close CH1; press **CH2** function key to turn on CH2; repeat step 2 and step 3.

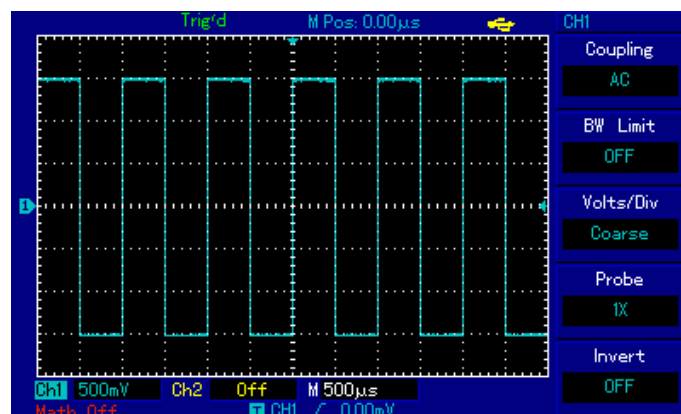


Figure 1-4 Probe Compensation Signal

### 1.3 Probe Compensation

When connecting the probe with any input channel for the first time, it is required to make adjustment for this item, matching the probe with input channel. Probe without being compensated and corrected will lead to measurement error or mistake. In case of adjustment of probe compensation, follow the following steps:

(1) Set the probe menu attenuation coefficient as 10×, place the switch on the probe at 10× and connect DSO probe with **CH1**. Connect the probe end and signal output connector to the probe compensator, the ground clamp and ground lead connector of probe compensator, turn on CH1 and press **AUTO**.

(2) Observe displayed waveform

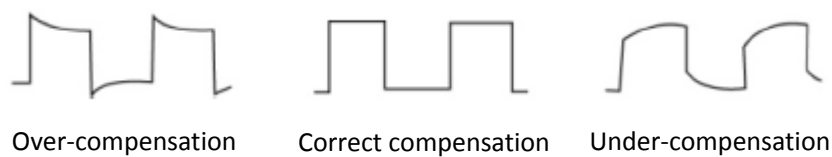


Figure 1-5 Probe Compensation and Correction

(3) If screen displays “under-compensation” or “over-compensation” for waveform as shown in above figures, use screwdriver with nonmetal handle to adjust the variable capacitance on the probe until screen displays “correct compensation” for waveform as shown in the below figure.

**Warning: in order to avoid electric shock when measuring high voltage with probe, please ensure that the insulation lead of the probe is in good condition and do not contact the metal part of the probe when connecting high pressure power supply.**

### 1.4 Automatic Settings of Waveform Display

UTD2000 series DSO has automatic setting function. According to input signals, automatically adjust the vertical deflection factor, scanning time base and trigger mode until the most appropriate waveform is displayed. Apply automatic setting, the frequency of the measured signal is required to be  $\geq 50\text{Hz}$  and the duty ratio is  $> 1\%$ .

Apply automatic setting:

(1) Connect measured signal to signal input channel.

(2) Press **AUTO** key. DSO will automatically set its vertical deflection factor, scanning time base and trigger mode. If further careful observation is required, adjustment can be conducted again after automatic settings until the waveform display reaches required optimum effect.

### 1.5 Introduction to The Vertical System

As shown in the figure below, there are a series of keys and knobs in the vertical

control area. Practices below will gradually guide you to get familiar with the controlling of the vertical system.



Figure 1-6 Vertical Control Area on the Panel

(1) Turn the vertical position knob to display the signal in the centre of the window. The vertical position knob controls the vertical display position of the signal.

When you turn the vertical position knob, the sign indicating the **GROUND** channel will move up and down with the waveform.

(2) User should see the waveform will move vertically upward and downward when the knob is rotating.

(3) User can also change the waveform scale by rotating the Scale Knob on the vertical system. Please notice that the “V/div” will be changed to indicate the corresponding vertical scale level.

(4) User can enable/disable the input channel by pressing the **CH1** and **CH2** button on the vertical system.

All of the other vertical system setting will be explain more on chapter II of this user manual.

### 1.6 Introduction to The Horizontal System

As shown in the figure below, there is one key and two knobs within the horizontal control area. Practices below will gradually guide you get familiar with the setting of horizontal time base.



Figure 1-7 Horizontal Control Area on the Panel

1. Use horizontal SEC/DIV knob to change gear position settings of horizontal time base and observe the changes of state information. Turn horizontal SEC/DIV knob to change “s/div” time base gear position, and you can find that corresponding changes have taken place in the time base gear position display of corresponding channel in the status bar.

Horizontal scanning rate steps up in the multiple of 1,2 and then 5

e.g. 1ms/div->2ms/div->5ms/div->10ms/div.... etc.

\*Note: the horizontal time base range of different UTD2000 models are varies between 2ns/div to 50s/div. Details is listed in technical specification.

2. Use horizontal POSITION knob to adjust the horizontal position of the signal in the waveform window. Horizontal POSITION knob controls the trigger position of the input signal. When applying to trigger position and turning horizontal POSITION knob, it is possible to observe the horizontal movement of waveform along with POSITION knob turning.

All of the other horizontal systemsetting will be explain more on chapter II of this user manual.

### 1.7 Introduction to The Trigger System

As shown in Figure 1-11, there is one knob and three (or two) keys in trigger menu control area. Practices below will gradually guide you to be familiar with the setting of.



Figure 1-8 Trigger Menu on the Panel

(1) Turn trigger level knob to change trigger level. Please refer to the trigger marking on the screen to indicate the trigger level line. The trigger level line should move up/down corresponding when turning the trigger control panel knob.

(2) Press SET TO ZERO key on the oscilloscope to enable 50% amplitude triggering;

All of the other trigger systemsetting will be explain more on chapter II of this user manual.

# Chapter II Vertical System

Each channel for UTD2000 series DSO can be set independently through the vertical system menu. After pressing CH1 or CH2 function key, the system shall display function menu of CH1 or CH2 channel. See Table 2-1 below for description.

Table 2-1 Channel Menu

Function Menu	Setting	Description
Coupling	AC	Block the DC component of input signal.
	DC	Pass through DC and AC components of input signal
	GND	Disconnect input signal
BW Limit	ON	Limit bandwidth to 20MHz to reduce displayed noise.
	OFF	Turn off bandwidth limited
Volts/Div	Coarse	Set vertical deflection factor by coarse adjustment based on 1-2-5 scale.
	Fine	Rough adjustment setting range is further subdivided for fine adjustments to improve vertical resolution.
Probe	1×	Please set the probe compensation system ratio to match the probe attenuation coefficient of the probe to be used.
	10×	
	100×	
	1000×	
Invert	ON	Activate reverse function of waveform. Waveform will be displayed reversely
	OFF	Waveform is displayed normally.

### 2.1 Setting coupling channel

You will be learning through the following example to change the coupling of the input channel. If the measured signal connect to the CH1 channel is a sinusoidal signal containing DC component. If you press **F1** to select as **AC** coupling, to set the CH1 into AC coupling mode. Then the DC component of the measured signal is blocked. Waveform display is shown in figure below.

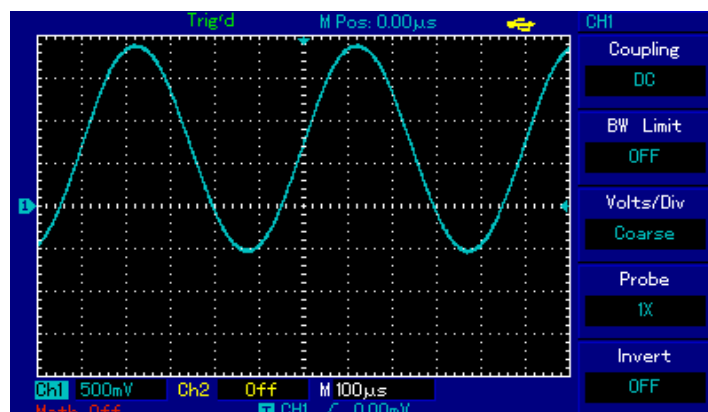


Figure 2-1 Blocked DC Component of Signal

If you press **F1** to select as **DC** coupling, setting the CH1 to DC coupling mode. You should be able to see both the DC and AC components of measured signals at CH1 channel as shown in figure below.



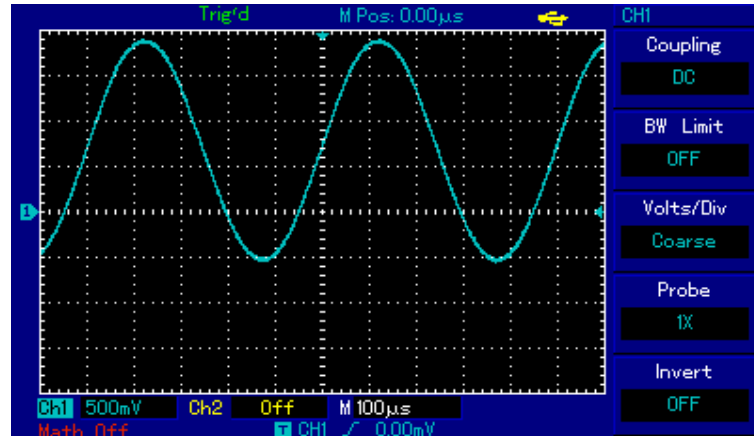


Figure 2-2 Simultaneous Display of Signal DC and AC Components

If you Press **F1** to select as **GND**, to set CH1 to connect to the internal ground of the instrument, both DC and AC components of the input signal are blocked. And, waveform display is shown in figure below.

(Note: although no waveform is displayed on the screen in this mode, input signal is still connected with channel circuit.)

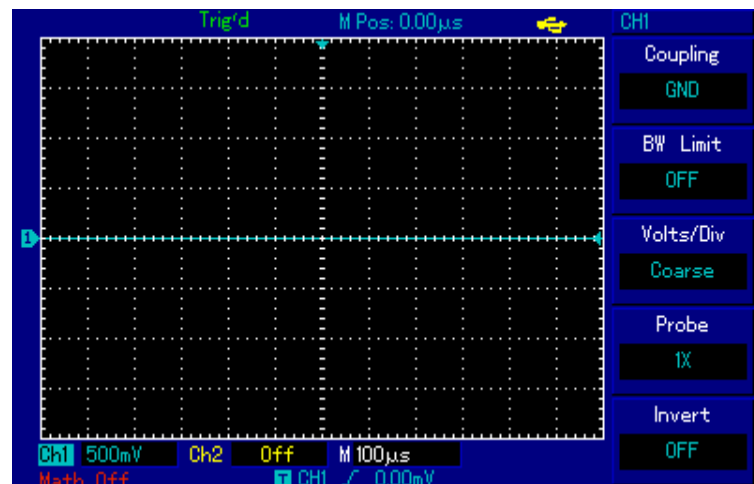


Figure 2-3 Simultaneous Blocking of Signal DC and AC Components

### 2.2 Setting channel bandwidth Limited

You will be learning through the following example to change the bandwidth limited of the input channel. Assuming that the input signal is a 40MHz sinusoidal signal connect to CH1. If you press **F2** to set **BW Limit** as **OFF**, there will be not any bandwidth limited to CH1. And, you can see all the high-frequency component in measured signal as waveform displayed is shown in the figure below.

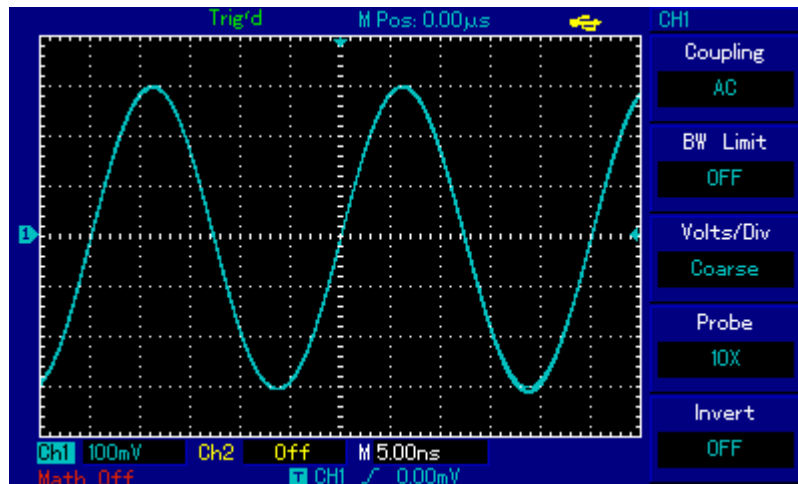


Figure 2-4 Waveform Display When Setting Bandwidth throttling in OFF Position

If you press **F2** again to set the **BW Limit** as **ON**, the noises or high-frequency component over 20MHz in measured signal shall be attenuated, as waveform display shown in figure below.

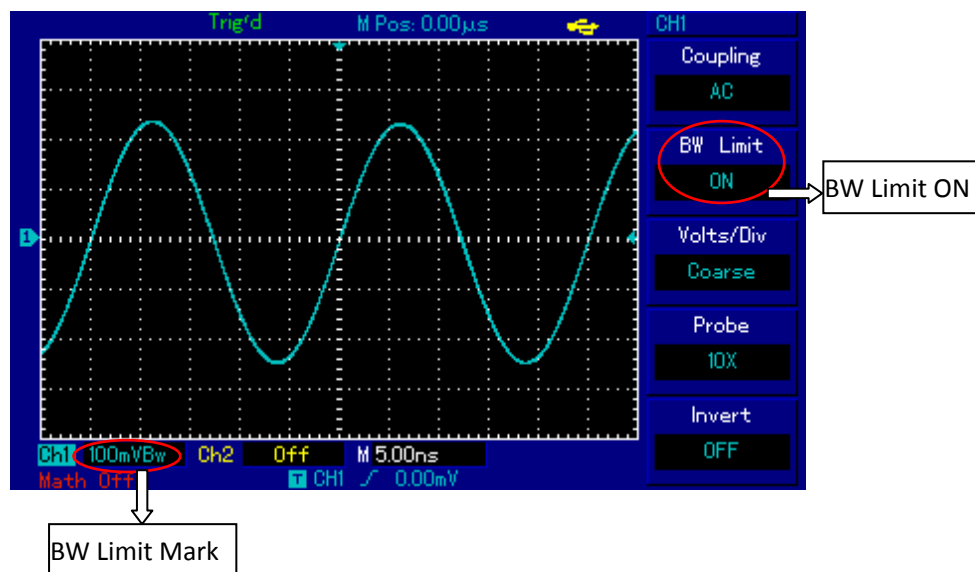


Figure 2-5 Waveform Display When Setting Bandwidth throttling as ON

### 2.3 Setting probe Rate

In order to cooperate with attenuation coefficient setting of probe, it is required to set the probe attenuation coefficient in channel function menu. If the probe attenuation coefficient is 10:1, the probe coefficient in channel function menu shall be set to be **10×** and vice-versa.

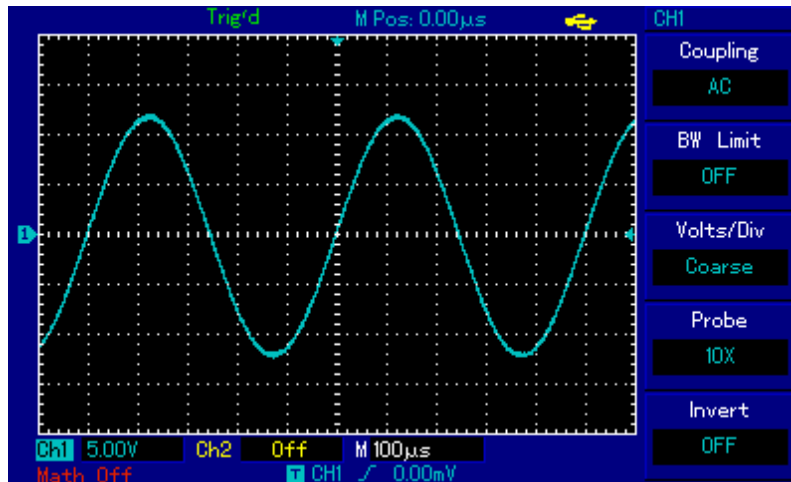


Figure 2-6 Probe Attenuation Coefficient Setting in Channel Menu

### 2.4 Vertical Volts/Div adjustment setting

Adjustments of vertical deflection factor V/div gear position can be set to coarse adjustment and fine adjustment by pressing F3 function key.

Coarse adjustment, V/div can be adjusted in step of multiple of 1,2 and 5, e.g. 10mV/div->20mV/div ->50mV/div.... etc.

Fine adjustments refer to changing deflection factor with smaller stepping within the current vertical gear position range.

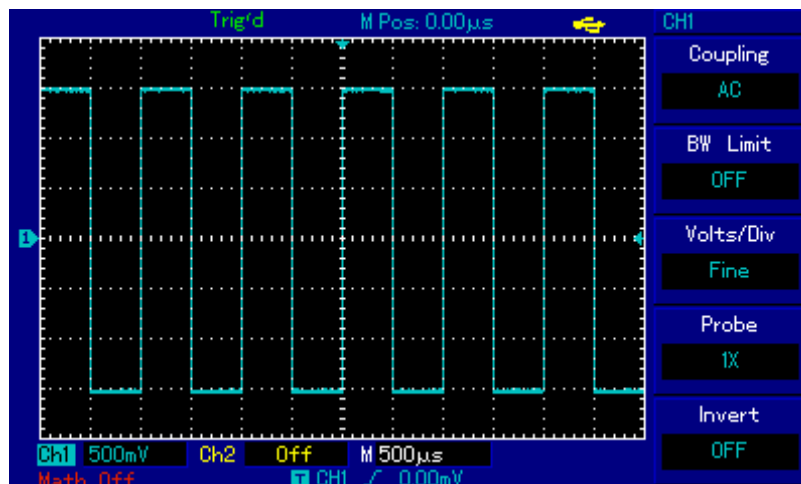


Figure 2-7 Coarse and Fine Adjustment of Vertical Deflection Factors

### 2.5 Settings of waveform inverting

Waveform inverting can be set by F5 function button. The measured input signal will be display with 180 degrees difference (Vertically invert) if the Waveform inverting is ON. Please see Figure 2-8 for a non-inverted waveform and Figure 2-9 for an inverted waveform.

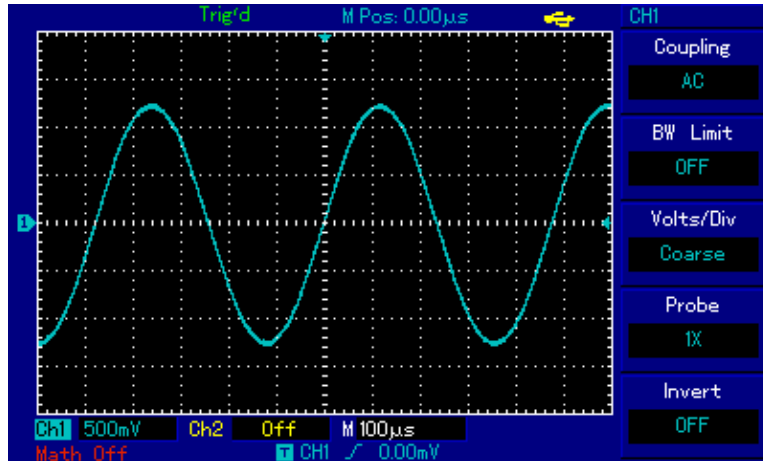


Figure 2-8 Vertical Channel Inverted Settings (Invert: OFF)

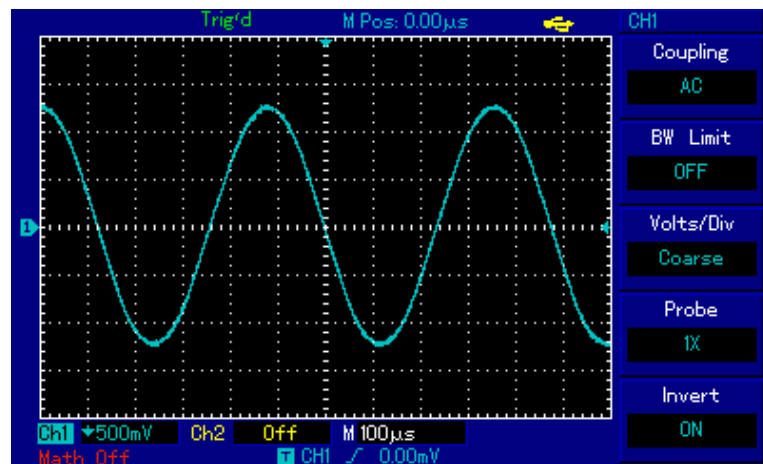


Figure 2-9 Vertical Channel Inverted Settings (Invert: ON)

### 2.6 Mathematical operation function

UTD2000 series DSO support mathematical operation function for the input signals.

Figure below show the match result for CH1 + CH2 as example.

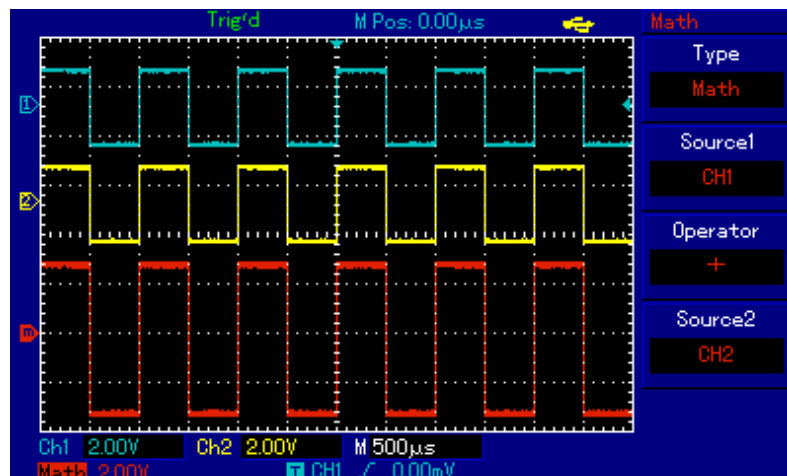


Figure 2-10 Math Operation

After pressing the MATH button at the menu area to active mathematic operation.

Table 2-2: Math Menu

Function Menu	Setting	Description
Type	Math	Mathematic operation (+, -, ×, ÷)
Source1	CH1	You can select signal <b>source1</b> as CH1 or CH2
	CH2	
Operator	+	Source1+Source2
	-	Source1-Source2
	×	Source1×Source2
	÷	Source1÷Source2
Source2	CH1	You can select signal <b>source2</b> as CH1 or CH2
	CH2	

### 2.7 FFT spectral analysis

By pressing **F1** button again at mathematical operation mode to enter **FFT** (fast fourier transform) operation, the time domain (YT) signal can be converted into frequency domain signal.

At FFT operation, it is convenient to observe signals of the following types:

- Measure harmonic content and distortion in the system
- Display noise characteristic in DC power supply
- Analyze vibration

Table 2-3: FFT Menu Description

Function Menu	Setting	Description
Type	FFT	FFT mathematical operation
Source	CH1	You can select signal <b>source</b> as CH1 or CH2
	CH2	
Window	Hanning	Set to select Hanning, Hamming, Blackman, or Rectangle window function
	Hamming	
	Blackman	
	Rectangle	
Vertical unit	Vrms	Set vertical units as Vrms or dBVrms
	dBVrms	

#### Select FFT window

Assuming that YT waveform is continuously repeated, DSO shall conduct FFT conversion for time record with finite length. In this case, when the cycle is an integer, YT waveforms are of the same amplitude at the starting and ending positions, without interrupting. However, if the cycle of YT waveform is not an integer, the waveform

amplitudes shall be different at starting and ending positions. Therefore, high-frequency transient interruption shall occur at the joints. In frequency domain, this effect is called leakage. Therefore, in order to avoid the generation of leakage, by multiplying original waveform by a window function, the value at forced starting and ending positions is 0. See the table below for window function application:

Table 2-4: FFT window function

FFT Window	Features	The most suitable measurement content
Rectangle	The best frequency resolution and the worst amplitude resolution. It is basically similar to the condition without window.	Signal levels, before and after transient state or short pulse, are basically equal. Constant amplitude sinusoid with very similar frequency possesses bandwidth random noise with slow spectrum change.
Hanning	Compared with rectangular window, it has better frequency resolution and worse amplitude resolution.	Random noise of sine, cycle and narrow-band.
Hamming	The frequency resolution of Hamming window is slightly superior to Hanning window.	Signal levels, before and after transient state or short pulse, are of large difference.
Blackman	The best amplitude resolution and the worst frequency resolution.	Mainly used for single frequency signal seeking for higher subharmonic.

### Explanation of nouns

**FFT resolution:** defined as the quotient of sampling and operation point. When the number of operation point are fixed, the lower the sampling rate is, the better the FFT resolution will be.

**Nyquist frequency:** for waveform with maximum frequency of  $f$ , at least  $2f$  sampling rate is required to reconstruct original waveform. It is also called Nyquist rule, where  $f$  refers to Nyquist frequency, while  $2f$  refers to Nyquist sampling rate.

# Chapter III Horizontal System

## 3.1 Horizontal control



Figure 3-1 Horizontal System Interface

### (1) Horizontal control knob

Using the horizontal control knob can change the horizontal scale (time base) and trigger horizontal position (trigger position) in internal storage. The vertical midpoint in screen horizontal direction is the time reference point of waveform. Changing of horizontal scale can lead to expansion or shrink of waveforms relative to screen center. When the horizontal position changes, the position relative to waveform trigger point will be changed.

The horizontal system can be controlled by the following panel buttons/knobs.

The horizontal position control knob is use to adjust the horizontal position of channel waveform (including mathematical operation). The resolution of the horizontal position control knob varies at different time base.

Horizontal scale control knob is use to change the time base of the channel waveform, by shown as s/div. If the extension time base is being turn on, the window width will be changed by due to the delay scanning time base through turning the horizontal scale knob.

### (2) Horizontal menu button

user can press to enter the horizontal menu function. (See table below)

Table 3-1 HORI MENU

Function Menu	Setting	Description
Main	—	Press to turn on the main time base
—		
Window	—	Press to turn on the extension time base
—		
Hold off		To adjust the trigger hold-off time by multi-purpose knob

## 3.2 Explanation of nouns

**YT Mode:** In this mode, the Y axis represents the amount of voltage, and the X axis represents the amount of time.

**XY Mode:** In this mode, the X axis represents the CH1 voltage amount, and the Y axis represents the CH2 voltage amount.

**Scan Mode:** When the horizontal time base control is set at 100ms/div or slower, the instrument enters the slow scan sampling mode. When using the slow scan mode to observe low frequency signals, it is recommended to set the channel Coupling to DC.

**SEV/DIV:** Horizontal scale (time base) units, such as waveform sampling is stopped (using the **RUN/STOP** button), and the time base control expands or compresses the waveform.

### 3.3 Window extension

Window extension time base function is used to observe the waveform detail for a given window of the waveform. User can active this function by pressing **F3** button at the horizontal function menu.

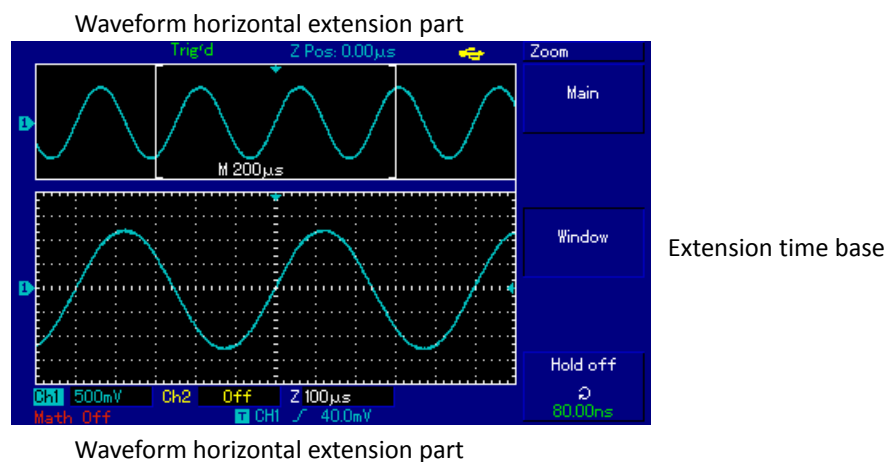


Figure 3-2 Screen Display under Window Extension

Under Window extension time base, there are two display areas, as shown in the figure above. The original waveform is displayed in the upper part, this area can be moved left and right by turning horizontal **POSITION** knob or can be enlarged and reduced by turning the horizontal **SEC/DIV** knob.

The waveform generated through horizontal extension time base of the selected original waveform area shall be displayed in the lower part. As the waveform displayed in the whole lower part corresponds to the selected area in the upper part, the extension time base can be enhanced by turning horizontal **SEC/DIV** knob to reduce the selected area of the waveform.

### 3.4 Trigger hold-off time adjustment

Trigger hold-off time is the time interval between two trigger events (100ns by default); Trigger hold-off time can be adjusted by using the multi-purpose knob at the horizontal function menu.

During trigger hold-off, DSO will not be triggered any new event until the hold-off time is over. For example, if a set of pulse train shall be triggered from the first pulse upon request, then the hold-off time can be set as the pulse train width. As shown as below.



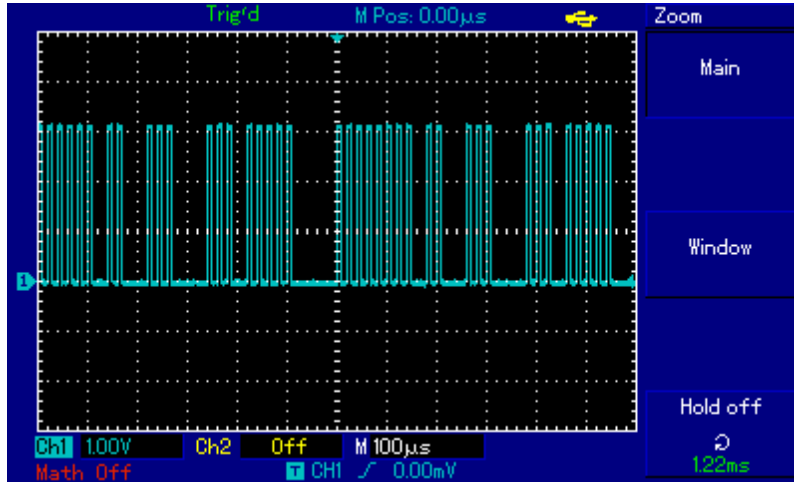


Figure 2-13 Trigger Hold-off for Synchronization of Complex Waveform

## Chapter IV Trigger System

Trigger level knob: trigger knob is used to adjust the trigger level (To set the voltage level corresponding to trigger point).

### Trigger Type

UTD2000 series DSO support: Edge, Pulse, Video and Alternative trigger;

**Edge** Trigger: edge trigger mode refers to triggering of trigger threshold on the input signal edge.

**Pulse** Width trigger: trigger produces when the pulse width of the trigger signal satisfies some set trigger  $>$ ,  $<$  or  $=$  condition.

**Video** Trigger: conduct field or line trigger for standard video signal (Only for UTD2025CL)

These three triggering can be active by pressing **F1** button at the **TRIG MENU**.

**Alternating** trigger: applicable to trigger signals without frequency correlation.

All kinds of trigger menus shall be respectively described as follows.

User can active Alternative trigger by pressing **F2** button at the **TRIG MENU**.

### 4.1 Edge trigger

Edge trigger mode refers to triggering of trigger threshold on the input signal edge.

When selecting “edge trigger”, trigger on the rising edge or falling edge of input signal shall be completed.

Table 4-1 Edge trigger menu

Function Menu	Setting	Description
Type	Edge	
Source	CH1	Set CH1 as the triggering signal source
	CH2	Set CH2 as the triggering signal source
	EXT	Set external trigger input channel as the triggering signal source
	AC Line	Set AC power line as trigger source
	Alter	Set to Alternative trigger between CH1 and CH2 as signal source
Slope	Rising	Set trigger on the signal rising edge
	Falling	Set trigger on the signal falling edge
	Rise/fall	Set trigger on the signal both rising and falling edge
Mode	AUTO	Set to automatic trigger. The DSO will continuously perform data acquisition without triggering signal.
	Normal	Set to normal trigger. The DSO will only perform data acquisition when there is triggering signal.
	Single	Set to single trigger. The DSO will only perform 1 cycle of the data acquisition when there is triggering signal.
Coupling	AC	Block the DC component of triggering signal

	DC	Pass through DC and AC components of triggering signal
	HF	Reject high-frequency component of the triggering signal (over 80kHz signals)
	LF	Reject low-frequency component of the triggering signal (below 80kHz signals)

### 4.2 Pulse width trigger

For pulse width trigger, the trigger time shall be subject to pulse width of the triggering signal. You can capture abnormal pulse by setting pulse width conditions.

Table 4-2 Pulse width trigger menu (page 1)

Function Menu	Setting	Description
Type	Pluse	
Source	CH1	Set CH1 as the triggering signal source
	CH2	Set CH2 as the triggering signal source
	EXT	Set external trigger input channel as the triggering signal source
	AC Line	Set AC power line as trigger source
	Alter	Set to Alternative trigger between CH1 and CH2 as signal source
Pulse width conditions	>	Trigger when pulse width is greater than Pulse Width setting values
	<	Trigger when pulse width is less than Pulse Width setting values
	=	Trigger when pulse width is equal than Pulse Width setting values
Pulse width setting		Set the pulse width to between 20ns~10s by using the <u>multi-purpose</u> knob on the front panel.
Next	1/2	Go to next page

Table 4-3 Pulse width trigger menu (page 2)

Function Menu	Setting	Description
Type	Pluse	
Polarity	Positive	Set the positive pulse width as trigger signal
	Negative	Set the negative pulse width as trigger signal
Mode	AUTO	Set to automatic trigger. The DSO will continuously perform data acquisition without triggering signal.
	Normal	Set to normal trigger. The DSO will only perform data acquisition when there is triggering signal.
	Single	Set to single trigger. The DSO will only perform 1 cycle of the data acquisition when there is triggering signal.
Coupling	AC	Block the DC component of triggering signal
	DC	Pass through DC and AC components of triggering signal
	HF	Reject high-frequency component of the triggering signal (over 80kHz signals)
	LF	Reject low-frequency component of the triggering signal (below 80kHz signals)
Previous	2/2	Go to previous page

### 4.3 Video trigger

UTD2025CL support video trigger compactable to NTSC or PAL standard video signals. (Only UTD2025CL have such functions)

Trigger coupling will automatic preset to DC coupling if the video trigger is active. Video trigger menus are shown in the table below:

Tabel 4-4 Video trigger menu

Function Menu	Setting	Description
Type	Viedo	
Source	CH1	Set CH1 as the triggering signal source
	CH2	Set CH2 as the triggering signal source
	EXT	Set external trigger input channel as the triggering signal source
	AC Line	Set AC power line as trigger source
	Alter	Set to Alternative trigger between CH1 and CH2 as signal source
Standards	PAL	Select to PAL video standard
	NTSC	Select to NTSC video standard
Sync	All line	Set trigger synchronize to video line.
	Lines	Set the video to sync and trigger on specific lines
	Even field	Set the video to sync and trigger on even field
	Odd field	Set the video to sync and trigger on odd field

Figure 4-1 is an example screen display when PAL video trigger model is selected as standard and synchronization mode is All line synchronization.

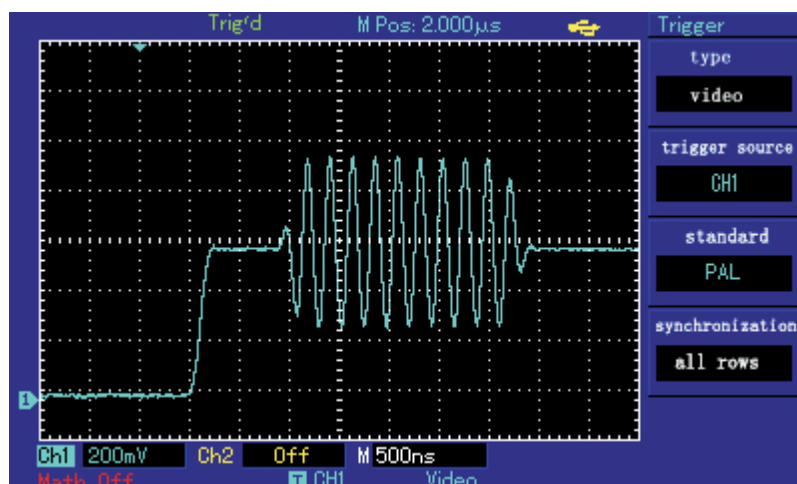


Figure 4-1 Video Trigger: Line Synchronization

Figure 4-2 is an example screen display when PAL video trigger model is selected as standard and synchronization mode is set to field synchronization.

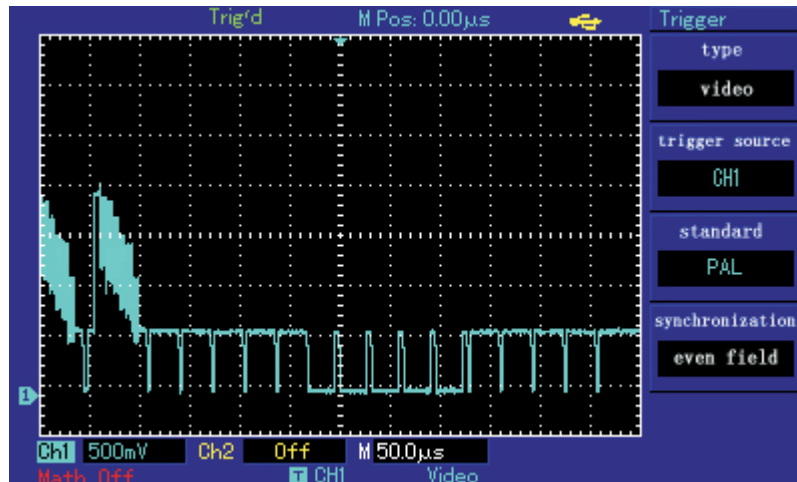


Figure 4-2 Video Trigger: Field Synchronization

### 4.4 Alternating trigger

During alternating trigger, the trigger signal comes from two input channels CH1 and CH2 alternately. Alternating trigger is useful for observing two signals with different frequencies.

See the figure below for display of triggered alternating waveform example and Table 4-4 for triggered alternating menu setting

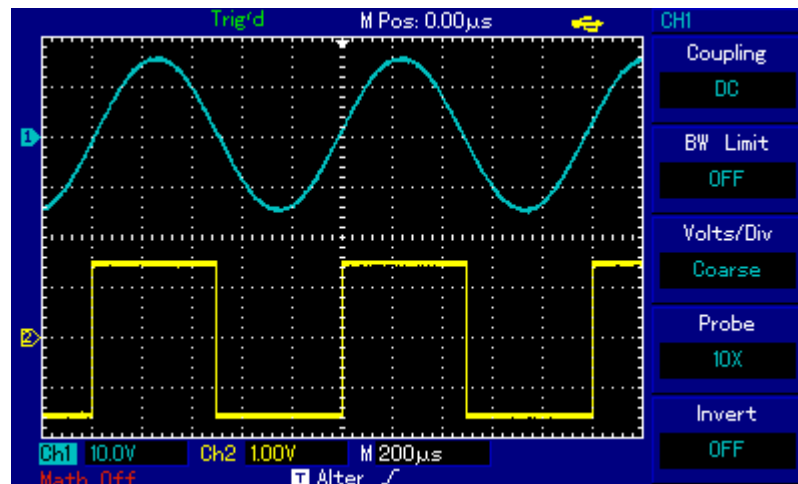


Figure 4-3 Observing Signals with Two Different Frequencies by Alternating Trigger Mode

Table 4-4 Alternating Trigger Mode Setting

Function Menu	Setting	Description
Type	Edge	
Source	Alternating	CH1 and CH2 alternating trigger
Slope	Rising	Set trigger on the signal rising edge
	Falling	Set trigger on the signal falling edge
	Rise/fall	Set trigger on the signal both rising and falling edge
Mode	AUTO	Set to automatic trigger. The DSO will continuously perform data acquisition

		without triggering signal.
	Normal	Set to normal trigger. The DSO will only perform data acquisition when there is triggering signal.
	Single	Set to single trigger. The DSO will only perform 1 cycle of the data acquisition when there is triggering signal.
Coupling	AC	Block the DC component of triggering signal
	DC	Pass through DC and AC components of triggering signal
	HF	Reject high-frequency component of the triggering signal (over 80kHz signals)
	LF	Reject low-frequency component of the triggering signal (below 80kHz signals)

### 4.5 Explanation of nouns

(1) **Trigger source:** trigger can be achieved from several signal sources: input channels (CH1 and CH2), external triggers (EXT and EXT/5) and AC line.

- **External trigger (EXT TRIG):** meaning to set the triggering source base on given external connection to the “EXT TRIG” input channel. This can be signification application for UTD2000 series to perform data acquisition using CH1 and CH2 based on an external clock signal connects to the “EXT TRIG” input channel. External trigger signal connects to “EXT TRIG” input terminal is used for EXT trigger source selection. When selecting EXT as trigger source, external trigger levels voltage range limited to -3V and +3V.

- **AC line trigger:** use AC line power as trigger source. This can be signification application to observe the signals correlated to AC line power for applications in lighting equipment and power supply equipment R&D development.

(2) **Trigger mode:** deciding the behavioral pattern of DSO under no trigger event conditions. Three trigger modes are provided for DSO: auto, normal and single.

- **Auto trigger:** Set to automatic trigger mode. The DSO will continuously perform data acquisition without triggering signal. When there is trigger signal, DSO will automatically synchronizing with the trigger signal.

Attention: when scanning waveform is set as 50ms/div or slower time base, no trigger signal is allowed under “auto trigger” mode.

- **Normal trigger:** Set to normal trigger mode. The DSO will only perform data acquisition only when trigger conditions are satisfied. When trigger condition is not satisfied, DSO stops data collection.

- **Single trigger:** Set to single trigger mode. The DSO will only perform one cycle of data acquisition only when trigger conditions are satisfied. When trigger condition is not satisfied, DSO stops data collection.

### Chapter V Acquire System

User can change the data acquisition setting of the DSO by pressing the **ACQUIRE** button as shown in the figure below UTD2000 series DSO.



Figure 5-1 Function Key of Acquire System

While **ACQUIRE** button is pressed, the function menu will change to set the data acquisition setting for the DSO.

Table 5-1 Acquire Function Menu

Function Menu	Setting	Description
Acquisition Mode	Sampling	Set to sampling acquisition mode.
	Peak value	Set to peak value acquisition mode.
	Average	Set to average acquisition mode.
Averages	2~256	At the average sampling mode, set average number by using the multipurpose knob (Average number can set to 2,4,8,16,32,64,128,256)
Sampling	Real-time	Set to Real-time sampling.
	Equivalence	Set to Equivalent sampling.
Fast Acq	ON	Turn on fast acquiring. Waveform capturing rage up to at 2k waveform/second.
	OFF	Turn off fast acquiring.
—		

By changing the acquisition setting of the DSO, user can observe the input signal at different manner. Example below is a noise waveform acquired by different acquisition setting of the UTD2000 series DSO.

Figure 5-1 shows the original signal using sampling acquisition, user can see that the waveform display is very noise.

Figure 5-2 shows the same signal with average acquisition of a 32 number, please observe that the waveform display become much more smooth.

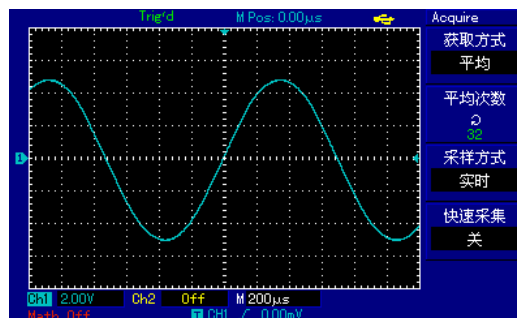
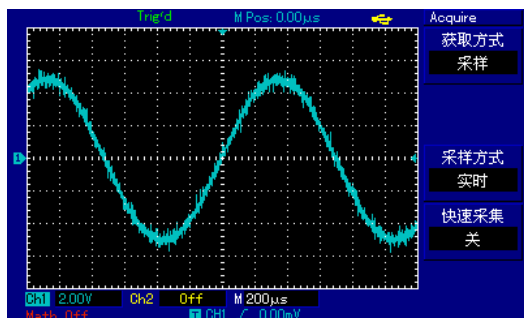


Figure 5-1 using sampling method      Figure 5-2 using average acquisition of 32 number

**Notice:**

- (1) Please select real-time sampling mode when observing single signal.
- (2) Please select equivalent sampling mode when observing high frequency periodic signal.
- (3) Please select peak detection mode when hoping to observe the signal envelope for any modulation signal.
- (4) Please select average sampling mode when hoping to reduce the random noise in displayed signals.

**Explanation of nouns****Real-time sampling mode:**

Data sampling at the real-time sampling rate of the system. This is used to observe any waveform within the sampling rate of the system.

**Equivalent sampling mode:**

Data sampling at higher than maximum sampling rate of the system. This is used to observe any periodical waveform at beyond the maximum sampling rate.



### Chapter VI Display System

User can change the display setting of the DSO by pressing the **DISPLAY** button of the UTD2000 series DSO as figure below.



Figure 6-1 Function Keys of Display System

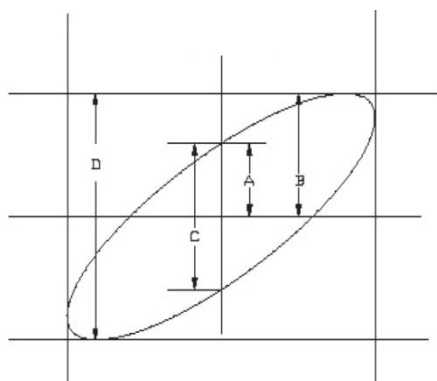
After press **DISPLAY** button, the function menu will change to the display setting for the DSO.

Table 6-1 Display Menu

Function Menu	Setting	Description
Types	Vector	Display as vector of sampled data points
	Dots	Display any of the sampled data points
Format	YT	Display Y-axis as voltage level of input signal and X-axis as time
	XY	Display Y-axis as CH2 voltage level of input signal and X-axis as CH1 voltage level of input signal
Persist	Off	Real-time updating (Display) of the acquired signal.
	1s	Display the acquired signal every 1s
	2s	Display the acquired signal every 2s
	5s	Display the acquired signal every 5s
	Infinite	Accumulate display all the acquired
—		
Brightness	1%-100%	Set the brightness of the waveform by multi-purpose node between 1%-100% brightness.

#### 6.1 XY Mode

The phase difference between the two signals of the same frequency can be easily observed by Lissajous method. The following chart gives the observation of phase difference.



Since  $\sin\theta = A/B$  or  $C/D$ , theta ( $\theta$ ) is the angle between the two signals, the definition of A, B and C, D is shown above. We can draw a difference angle  $\theta = \pm \arcsin(A/B)$  or  $\theta = \pm \arcsin(C/D)$ . If the principal axis of an ellipse is in quadrants I and III, then the phase angle should be in I, IV quadrant, in 0 to  $(\pi/2)$  or  $(3\pi/2)$  to  $2\pi$ . If the principal axis of an ellipse in II, IV quadrant, then the phase angle should be  $(\pi/2)$  to  $\pi$  or  $\pi$  to  $(3\pi/2)$ .

In addition, if the frequency or phase difference of the two detected signals is an integer, the frequency and the phase relationship between the two signals can be calculated .

Furthermore, if the frequencies and phase differences of two signals being measured are whole multiples, you can calculate the frequency andphase correlationbetween the twosignals.

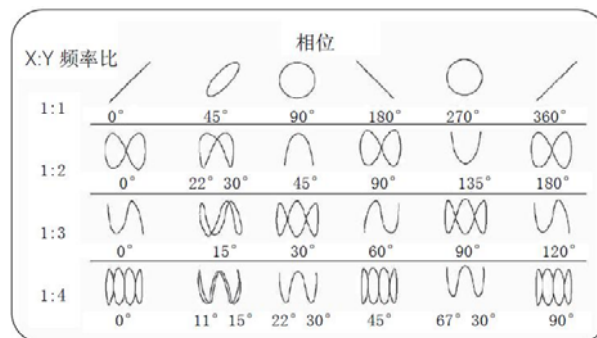


Figure 6-3 X-Y Phase difference table

User can enter the X-Y mode by press **Display** button and select **F2**. In this mode, CH1 and CH2 are required to be applied simultaneously. Figure below shows an example for the XY mode display.

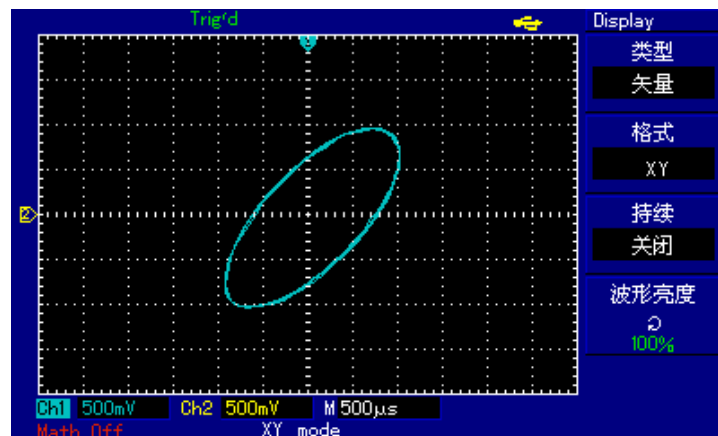


Figure 6-4 Waveform Display in XY Mode

Attention:

The following functions will be disable at XY display mode.

- Automatic measurement
- Automatic measurement mode
- Cursor measurement mode

- Reference waveform
- Vector display type
- Horizontal knob
- Trigger control

### Chapter VII Measurement Parameters

UTD2000 series DSO support up to 28 of the automatic waveform measurement parameters. You can view at most 5 the measurement parameters at the same time on **F1-F5** function menu. To see measurement parameters, please press **MEASURE** on the control panel.



Figure 7-1 Function Key of Auto measurement parameter

#### 7.1 Measurement Menu

For each of the measurement parameter located on the **F1-F5** on the function measurement, you can press **F1-F5** to set the view of the parameter (Measurement sub menu)

Table 7-1 Measurement menu

Function Menu	Setting	Description
Back		Return to measurementparameterfunction menu
Source	CH1	Select the CH1as source
	CH2	Select the CH2 as source
Volt		Select different Voltage parameters
Time		Select different Time parameters
Parameters		Press to display all the measurement parameter of the input source. Or, press to turn of parameter display.

#### 7.2 Voltage Parameter

Below are the automatically measured voltage parameter for the UTD2000 series DSO and its definitions:

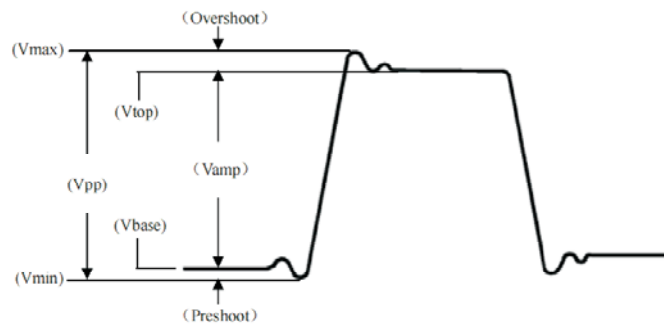


Figure 7-2 Voltage Parameter Diagram

**Vpp**: Peak-to-peak voltage

**Vmax:** Maximum voltage level.

**Vmin:** Minimum voltage level.

**Vmid:** Medium voltage level.

**Vamp:** The voltage amplitude from waveform top to bottom.

**Vtop:** The voltage value from waveform top level to GND (Ground).

**Vbase:** The voltage value from waveform base level to GND (Ground).

**Over-shoot:** The ratio between  $(V_{max} - V_{top})$  and voltage amplitude ( $V_{amp}$ ) in percentage

**Pre-shoot:** The ratio between  $(V_{min} - V_{base})$  and voltage amplitude ( $V_{amp}$ ) in percentage

**Average:** The average amplitude of signal within 1 cycle.

**Vrms:** Root-mean-squarevalue (effective value).

### 7.3 Time parameter

Below are the automatically measured timing parameter for the UTD2000 series DSO and its definitions:

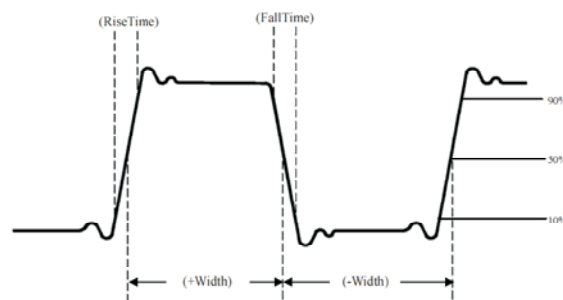


Figure 7-3 Timing Parameter Diagram

**RiseTime:** The time of waveform amplitude rising from 10% to 90%.

**FallTime:** The time of waveform amplitude falling from 90% to 10%.

**+Width:** The width of positive pulse at amplitude of 50%.

**-Width:** The width of negative pulse at amplitude of 50%.

**Delay (rising edge):** The delay time between rising edges. **Delay (falling edge):** the delay time between falling edges.

**+Duty:** The specific value of positive pulse width and cycle.

**-Duty:** The specific value of negative pulse width and cycle.

## Chapter VIII Cursor Measurement

User can press the **CURSOR** button to enable the cursor measurement function for UTD2000 series DSO, where the location of the **CURSOR** button can be found on figure below.



Figure 8-1 Function Key of CURSOR

UTD2000 series DSO supports 3 different type of cursor measurements.

**Volt:** Voltage (Vertical System)

**Time:** Time (Horizontal System)

**Track:** Volt and Time working at the same time.

At the **Volt** cursor measurement, user should be able to see the  $\Delta V$ ,  $V_a$ , and  $V_b$  parameters on the display screen, where  $\Delta V$  is the different between  $V_a$  and  $V_b$ ;

User can move the  $V_a$  cursor by rotating the multi-purpose knob by default. Once the location of the  $V_a$  cursor is moved to the ideal location, user can press the multi-purpose knob to switch to  $V_b$ ; User can move the  $V_b$  cursor by rotating the multi-purpose knob as the same way as moving the  $V_a$  cursor.

At the **Time** cursor measurement, user can repeat the similar operation as Volt cursor measurement by using the multi-purpose knob and the.

The **Track** cursor measurement mode is similar to the Time cursor measurement except, it will automatic track any of the voltage level where the time cursor is pointing at the screen.

After activating the **COARSE** button, there will be quicker response for the cursor movement.

### Chapter IX Storage and Load System

User can enter the storage and load menu by pressing the **STORAGE** button.



Figure 9-1 Function Key of STORAGE

Press **STORAGE** to go to the type menu. There are three types to choose from: **Setup**, **Wave** and **Bitmap**

#### 9.1 Setup storage and load

Press the **Storage** button, then Press **F1** to choose storage type **Setup**, and you will see the following menu.

Table 9-1 Setup storage menu

Function Menu	Setting	Description
Type	Setup	Select to store a DSO setting
Dest	1~20	Maximum 20 front panel setups can be stored with the multifunction control knob on the front panel
	1~200	Set the waveform storage position on the USB device (This function can be enabled only when the USB device is plugged in and the disk menu is set to "USB")
Save	—	Store waveform
Load		Recall the setting

#### 9.2 Waveform storage and load

Press the **Storage** button, then Press **F1** to choose storage type **Wave**, and you will see the following menu.

Table 9-2 Waveform storage menu (Page 1)

Function Menu	Setting	Description
Type	Wave	Select to store a acquired waveform
Source	CH1	Select waveforms from CH1 channel to be saved
	CH2	Select waveforms from CH2 channel to be saved
Dest	1~20	Maximum 20 front panel setups can be stored with the multifunction control knob on the front panel
	1~200	Set the waveform storage position on the USB device (This function can be enabled only when the USB device is plugged in and the disk menu is set to "USB")
Save	—	Store waveform
Next	1/2	Get to the next page

Table 9-3 Waveform storage menu (Page 2)

Function Menu	Setting	Description
Desk	DSO	Select to store a acquired waveform into the internal memory of the DSO
	USB	Select to store a acquired waveform into the USB device
Length	Normal	Select to normal data length (Same data number as display)
	Long	Select to long data length (Same as data number as data buffered in the DSO FIFO)
Load	—	Recall the waveform
—	—	—
Previous	2/2	Go to the previous page

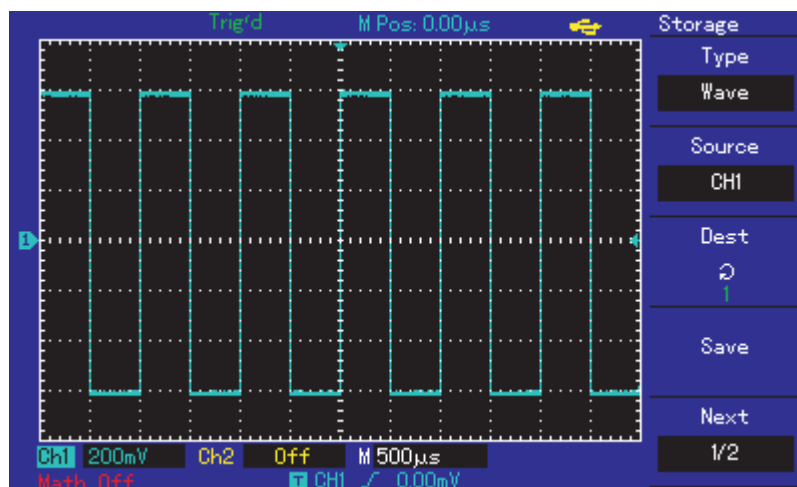


Figure 9-2 Storing the waveform

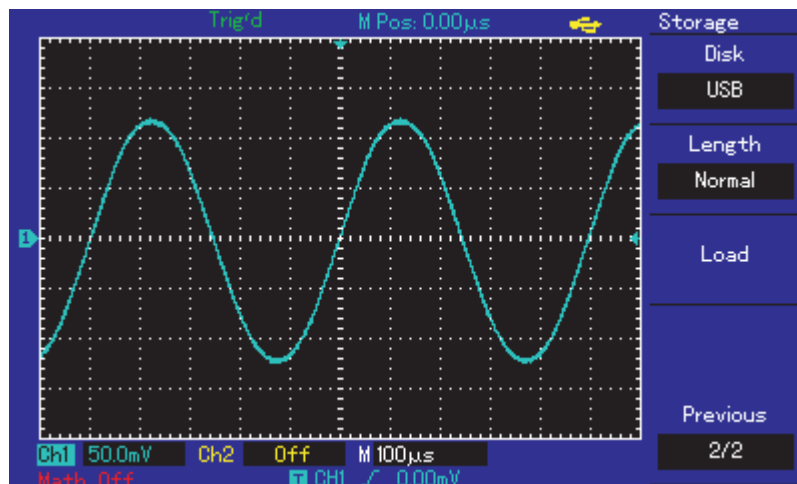


Figure 9-3 Storing a waveform on the USB

Waveform storage menu(Page 2), Press the **F3** button, then choose RefA or RefB, and you will see the following menu.

Table 9-4 Load menu

Function Menu	Setting	Description
Dest	1~20	Select the callback waveform from the storage location specified inside the



		oscilloscope, and use the multi-function knob to select the position where the waveform was previously saved.
	1~200	Select the callback waveform from the specified storage location of the USB flash drive, and use the multi-function knob to select the position where the waveform was previously saved.
Desk	DSO	Callback waveform from inside the oscilloscope
	USB	Callback waveform from U disk
Close		Close the waveform of the current callback on the screen
Load		Perform a callback function to call back the value of the storage location and the waveform corresponding to the disk to the screen.
Cancel		Return to the previous menu

### 9.3 Bit map storage and load

Press the **Storage** button, then Press **F1** to choose storage type **Bit map**, and you will see the following menu.

Table 9-6 Bitmap storage menu

Function Menu	Setting	Description
Type	Bit map	Select to storage a Bit Map file into the USB desk only
—		
Dest	1~200	Destination (Position of the USB desk memory) where the bit map file will be saved. There are 200 sets of USB desk memory available to storage bitmap file navigated by the multipurpose knob.
Save		Press to store bitmap file
—		

### 9.4 Screen copy

You can press the screen copy key **PrtSc** to intercept a full screen. To use this function, follow the steps below :

1. Press the screen copy key **PrtSc**, copying is done when the completion screen is displayed.

2. Store the intercepted graphic on the USB device. Insert the USB device, press **STORAGE** and select bitmap in the type menu.

Select any storage position between 1 and 200 with the multifunction control knob, then press **F4** (storage key) to complete the storage process.

### Chapter X Utility System

By pressing the **UTILITY** function button on the menu area, user can set different utility setting, where the button location are shown in figure below.



Figure 10-1 Function Key of UTILITY

Table 10-1 Utility menu(Page 1)

Function Menu	Setting	Description
Self-Adj	Execute	Press to execute self- calibration function
	Close	Leave self-calibration
Pass/Fail		Set waveform Pass/Fail operation(Only UTD2025CL have such function)
Recorder		Set waveform recording operation.
Language		Press to change to different system language
Next	1/3	Press to next Utility Function Menu page

Table 10-2 Utility menu(Page 2)

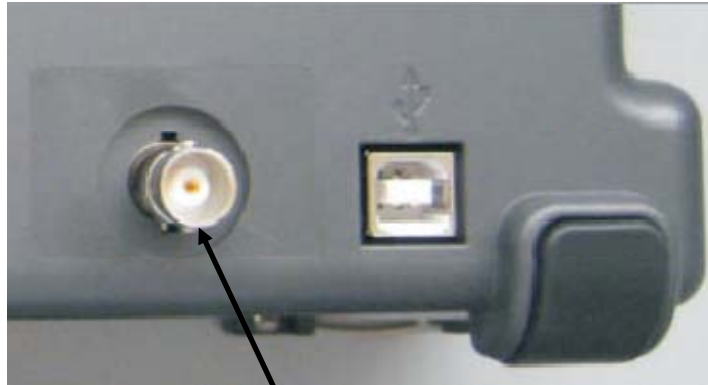
Function Menu	Setting	Description
Factory	Execute	Reset to factory default setting
	Cancel	Cancel and return to Utility Function Menu
—		
Skin	1、 2、 3、 4	Change the skin for the function menu
Grid Bright	1%-100%	Adjust the grid brightness by using the multi-purpose knob
Next	2/3	Press to next Utility Function Menu page

Table 10-3 Utility menu(Page 3)

Function Menu	Setting	Description
Version		Press to view the system version.
—		
—		
Frequency Counter	ON	To turn on frequency counter
	OFF	To turn off frequency counter
First	3/3	Back to page 1

#### 10.1 Pass/Fail

One of the very usefully function is the pass/fail detection function(Only for UTD2025CL). You can create a template of pixels area to compare with the input signal. User can also select the output condition for the logical result between the templates of area and the input source.



Rear panel of Pass / Fail output

You can enable the PASS/FAIL function by pressing **F1** on the PASS/FAIL function menu. After turning on this function, you can see the total number of waveform being process, the number of waveform pass and the number of waveform fail on the LCD screen.

Table 10-4 Pass/Fail function menu

Function Menu	Setting	Description
Status	ON	Press to turn on the PASS/FAIL function
	OFF	Press to turn off the PASS/FAIL function
Source	CH1	Select CH1 as the detection signal source
	CH2	Select CH2 as the detection signal source
	MATH	Select MATH result as the detection signal source
	RefA	Select RefA as the detection signal source
	RefB	Select RefB as the detection signal source
Output	Pass	Select the logical result as input signal within the template of pixels area
	Fail	Select the logical result as input signal outside of the template of pixels area
	Pass/Halt	Same as Pass output condition; Stop once detected.
	Fail/Halt	Same as Fail output condition; Stop once detected.
Template		Press to create template of pixel area, See Table 10-5.
Back		Return to Utility Function Menu

After pressing the **F4** on the Pass/Fail function menu, you will be able to create a Template of pixels to be compared.

Table 10-5 Template Setting

Function Menu	Setting	Description
---------------	---------	-------------

Create		According to adjustment, build horizontal and vertical Pass/Fail tolerance range.
Horizontal	1-200Pixel	Press <b>F2</b> to select horizontal length and use the multi-purpose knob to set the pixel length for the horizontal length;
Vertical	1-100Pixel	Press <b>F3</b> to select vertical length and use the multi-purpose knob to set the pixel length for the vertical length;
Return		Return to pass detection menu
Back		Return to Utility function menu

### 10.2 Recorder

The waveform recorder function at the UTD2000 series DSO is generally easy to operate. User should set up Source and Operation as in below table.

Table 10-6 Recorder menu

Function Menu	Setting	Description
Source	CH1	Select CH1 as recording signal source
	CH2	Select CH2 as recording signal source
	CH1+CH2	Select CH1and CH2 as recording signal sources
Operation	●	Press to start waveform recording; The number waveform being recorded is show on the screen.
	▶	Press to start waveform replay
	■	Press to stop waveform recording
Save	1~200	Save waveform recording into USB memory; Select from 1-200 memory location; Press <b>F3</b> to save.
Load	1~200	Loadthewaveform recording into USB memory; Select from 1-200 memory location; Press <b>F4</b> to load.
Back		Press to return to Utility function menu

You will need to press **F1** to confirm creating the pixel template after setting the horizontal and vertical length of the pixels.

### Chapter XI Other function button

#### 11.1 AUTO



figure 11-1 Function Key of RUN/STOP and AUTO

As shown in above figure, automatic setup is to simplify operation. Digital storage oscilloscope can adjust vertical deflection coefficient and horizontal time base gear automatically for stable waveform display on the screen according to waveform amplitude and frequency when user presses **AUTO** key. System setup is shown in following form during automatic setup:

Function	Setting
Obtainment mode	Sampling
Display format	Set to YT
Horizontal position	Automatic adjustment
Second/Divs	Adjustment according to signal frequency
Hold off	The minimum value
Trigger level	Set to 50%
Trigger mode	AUTO
Trigger source	Set to CH1; Set to CH2 when exerting on signal for it if there is no signal for CH1;
Trigger gradient	Ascending
Trigger type	Edge
Vertical band width	All
Volt/Divs	Adjustment according to signal amplitude

#### 11.2 RUN/STOP

There is a button on the top right hand corner on the front panel : **RUN/STOP** . When this button is pressed and a green indicator lights up, your oscilloscope is in a running status. If a red light comes on after pressing this button, it indicates the unit has stopped operation.

Acquire waveform continuously or stop acquisition. If you want the oscilloscope to acquire waveform continuously, press **RUN/STOP** once. Press the button again to stop acquisition. You can use this button to switch between acquiring and stop acquiring waveform. In the Run mode, a green light comes on and AUTO appears on the screen. In the STOP mode, a red light comes on and STOP appears on the screen.

### 11.3 Help Menu

Press the **HELP** key to enter help menu, then press any key will display the help information of this key.

### 11.4 Upgrade program

The USB upgrade program makes upgrade easier and more flexible. To use this function follow the steps below:

(1) Check the model name, software and hardware versions of your oscilloscope in Table 2-19.

(2) Download the highest version of the update program document that matches your model, software and hardware versions online, and store it on the USB device (preferably a USB device recommended by us).

(3) Power off the oscilloscope then insert the USB device. Then power on the oscilloscope again. The prompt Please press **F5** to continue or **F1** to cancel appears on the screen as shown in the figure on the right

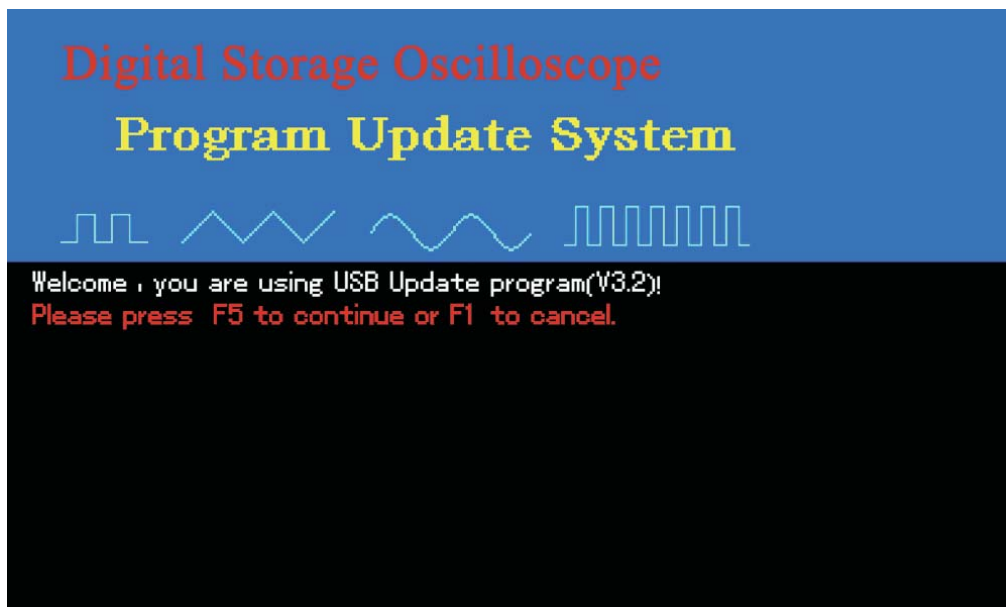


Figure 11-2 USB update confirmation

(4) When **F5** is pressed, the prompt on the right will appear: "Are you sure you wish to update? If yes, press F5, otherwise press F1 to cancel upgrade".

(5) When the USB document is confirmed the following prompt will appear: "System upgrade is in progress. Please wait". (This process may take 3 to 5 minutes)

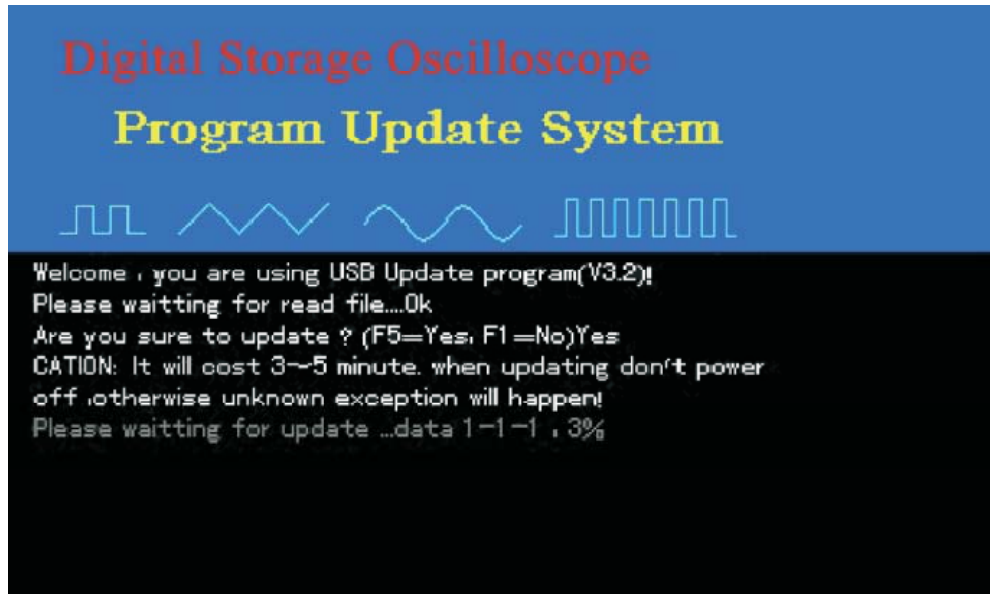


Figure 11-3 USB upgrade in progress

(6) When update is complete, a successful update prompt will appear: “Upgrade is successfully complete. Please 5. When the USB document is confirmed the following prompt will remove USB device, then power off your oscilloscope and power it back on again to complete the process.” The oscilloscope program is now updated and system upgrade is complete. In the event of update failure, follow the steps below.

**Note:** please make sure that the power supply is on throughout the upgrade process in order to avoid the incomplete upgrade. If the system is not completely upgraded, it might not be able to restart.

### Chapter XII Application example

#### Example 1: Measuring simple signals

To observe and measure an unknown circuit signal, and to quickly display and measure the signal's frequency and peak-to-peak value.

(1) To quickly display this signal, follow the steps below:

- ① In the probe menu, set the attenuation factor to 10X and set the switch on the probe to 10X.
- ② Connect the CH1 probe to the circuitry point to be measured press **AUTO**.
- ③ The oscilloscope will carry out auto setup to optimise waveform display. In this status, you can further adjust the vertical and horizontal range until you get the desired waveform display.

(2) Voltage and time parameters for automatic measurement

Your oscilloscope can automatically measure most display signals. To measure signal frequency and peak-to-peak value, follow the steps below :

- ① Press **MEASURE** to display the automatic measurement menu.
- ② Press **F1** to enter the measurement type selection menu.
- ③ Press **F3** to select **Voltage**;
- ④ Press **F5** to go to page 2/4, then press **F3** to select measurement type : Peak value.

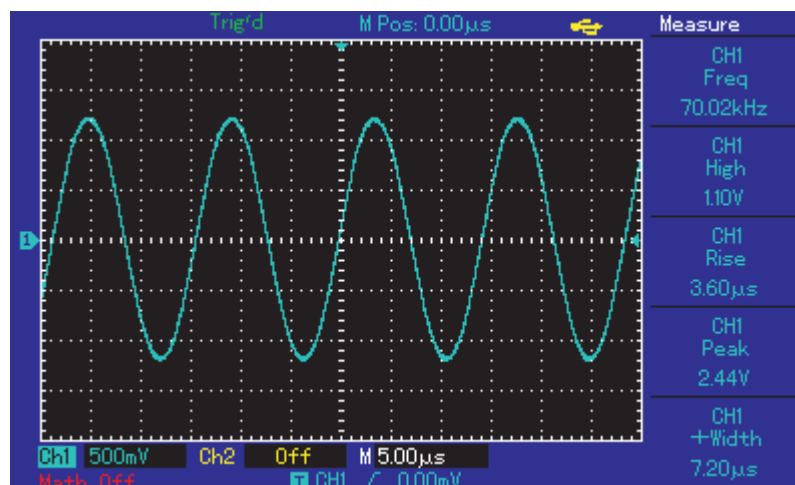


Figure 12-1 Automatic measurement

- ⑤ Press **F2** to enter the measurement type selection menu, then press **F4** to select **Time**.
- ⑥ Press **F2** to select measurement type : **Frequency**. Peak-to-peak value and frequency measurement value are now displayed in positions **F1** and **F2** respectively.

#### Example 2: Observing the delay caused by a sine wave signal passes through the circuit

As in the previous scenario, set the probe attenuation factor of the probe and



oscilloscope channel to 10X. Connect the CH1 to the circuit signal input terminal. Connect CH2 to the output terminal.

Steps :

(1) To display CH1 and CH2 signals

- ① Press AUTO.
- ② Continue to adjust the horizontal and vertical range until you get the desired waveform display.
- ③ Press **F1** to select CH1. Adjust vertical position of the CH1 waveform by turning the vertical position control knob.
- ④ Press **F2** to select CH2. In the same way described above, adjust vertical position of the CH2 waveform so that the waveforms of CH1 and CH2 do not overlap. This will make observation easier.

2. Observing the delay caused by a sine wave signal passes through the circuit and observing waveform changes.

① When measuring channel delay automatically:

Press **MEASURE** to display the automatic measurement menu.

Press **F1** to enter the measurement type selection menu.

Press **F4** to enter the time measurement parameters table.

Press **F5** twice to go to page 3/3.

Press **F2** to select delayed measurement.

Press **F1**, select CH1 and then press **F2** to select moving to CH2, then press **F5** to confirm.

You can see the delay value below “CH1-CH2 delay” in the **F1** zone now.

② Observe waveform changes (see the figure below).

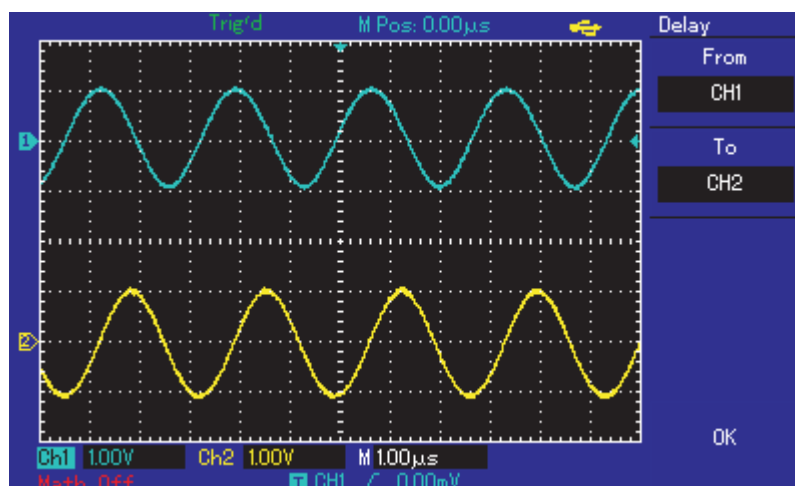


Figure 12-2 Waveform delay

### Example 3: Acquiring single signals

The advantage and special feature of your digital storage Oscilloscope lie in its ability to acquire non cyclical signals like pulse and glitch. To acquire a single signal, you must have transcendental knowledge of that signal to set the trigger level and trigger edge. For

example, if the pulse is a logical signal of TTL level, the trigger level should be set at about 2V and the trigger edge should be set to rising edge trigger. If you are not certain about the signal, you can observe it by automatic or normal trigger to determine the trigger level and trigger edge.

Steps :

(1) As in the previous illustration, set the attenuation factor of the probe and CH1.

(2) Carry out trigger setup

① Press **TRIG MENU** in the trigger control zone to display the trigger setup menu.

② In this menu, use **F1~F5** set the trigger type to **EDGE**, set trigger source to **CH1**, set inclination to **Rising**, set trigger type to **Single** and set trigger coupling to **AC**.

③ Adjust horizontal time base and vertical range to an appropriate range.

④ Turn the **TRIGGER LEVEL** control knob to get the desired

⑤ Press **RUN/STOP** and wait for a signal that meets the trigger condition. If any signal reaches the set trigger level, the system will sample once and display it on the screen. By using this function you can easily acquire any occasional event. For example, when a sudden glitch of relatively big amplitude is acquired : set the trigger level to just higher than the normal signal level. Press **RUN/STOP** and begin waiting. When a glitch occurs, the machine will automatically trigger and record the waveform immediately before and after triggering. By turning the horizontal **POSITION** knob in the horizontal control zone on the front panel, you can change the trigger position horizontally to achieve negative delay trigger of various lengths for easy observation of waveform occurring before the glitch

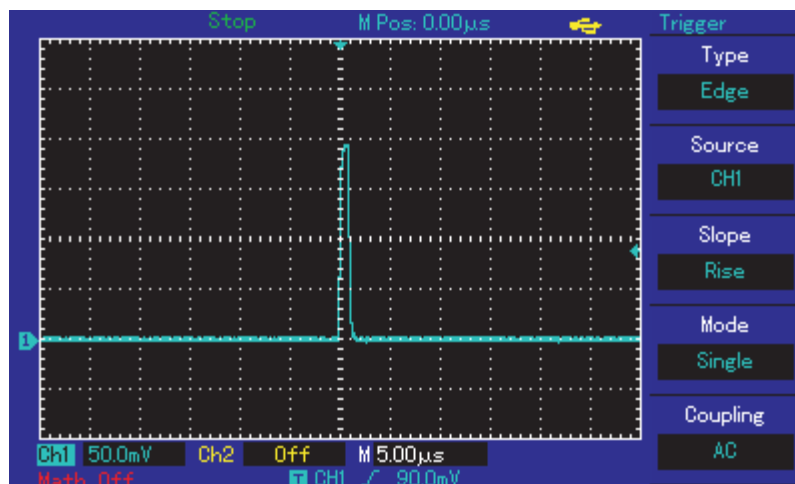


Figure 12-3 Single signal

### Example 4: Reducing random noise of signals

If the signal being measured is stacked with random noise, you can adjust the setups of your oscilloscope to filter or reduce the noise, so it will not cause interference to the signal during measurement. (Waveform is shown below)

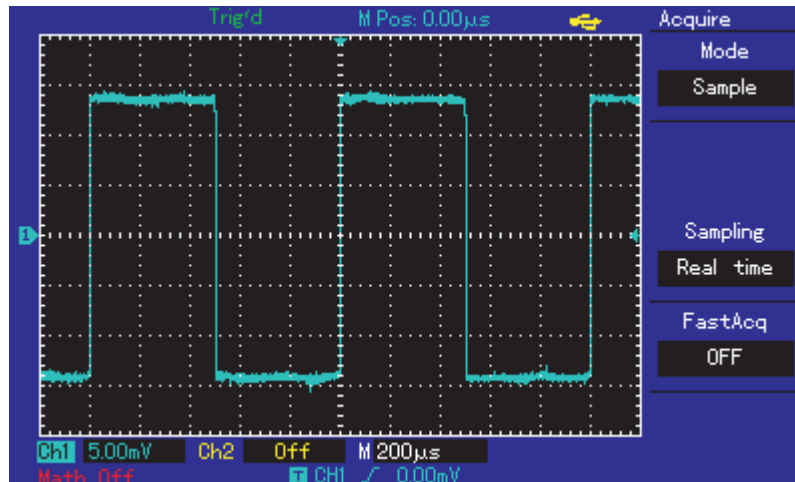


Figure 12-4 Reducing random noise of signals

### Steps :

- (1) As in the previous illustration, set the attenuation factor of the probe and Ch1.
- (2) Connect the signal to ensure stable display of waveform. See the previous illustration for operation instruction. See the previous chapter for guidance on adjusting the horizontal time base and vertical range.

(3) Improving trigger by setting trigger coupling.

① Press **TRIG MENU** in the trigger zone to display the trigger setup menu.

② Set trigger coupling to Low Frequency Suppression or High Frequency Suppression. By selecting low frequency suppression a high-pass filter is set up. It filters low frequency signal quantities under 80kHz and allows high frequency signal quantities to pass through. If you select high frequency suppression a low-pass filter is set up. It filters high frequency signal quantities higher than 80kHz and allows low frequency signal quantities to pass through. By setting Low Frequency Suppression or High Frequency Suppression, you can suppress low frequency or high frequency noise respectively and achieve a stable trigger.

(4) Reducing display noise by setting the sampling mode.

① If the signal being measured is stacked with random noise and the waveform is too coarse as a result, you can use the average sampling mode to eliminate random noise display and reduce the size of waveform for easy observation and measurement. After getting the mean, random noise is reduced and details of the signal are clearer. Follow the steps below:

Press **ACQUIRE** in the menu zone of the front panel to display the sampling setup menu. Press menu operation key **F1** to set acquisition mode to **AVERAGE**, then press the multifunction control knob to adjust the average number of times in multiples of 2, i.e. 2 to 256, until you get the desired waveform display that meets observation and measurement requirements. (See the figure below)

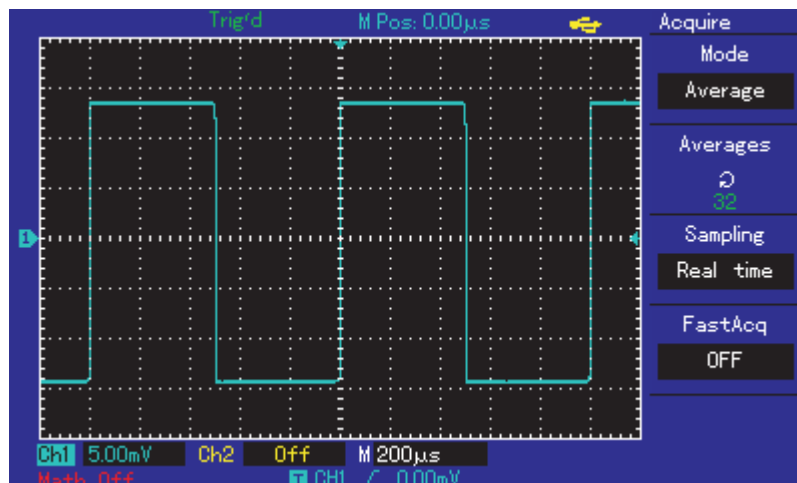


Figure 12-5 Signal noise suppressed

- ② You can also lower the waveform brightness to reduce display noise

**Caution :** In the average sampling mode the waveform display will update at a slower rate. This is normal.

### Example 5: Using the cursors for measurement

Your oscilloscope can measure 28 waveform parameters automatically. All auto parameters can be measured with the cursors.

By using the cursors, you can quickly measure the time and voltage of a waveform.

#### Measuring one step voltage of the step signal

To measure one step voltage of the step signal, follow the steps below:

1. Press **CURSOR** to display the cursor measurement menu.
2. Press menu operation key **F1** to set cursor type to **VOLTAGE**.
3. Turn the multifunction control knob to set cursor 1 at one step voltage of the step signal.
4. Press **SELECT** to select the cursor, then turn the multifunction control knob again to set cursor 2 at another step voltage of the step signal.

The cursor menu will automatically display the V value, i.e. the voltage difference of that point. See the figure below.

**Note :** When using the cursors to measure time, follow step 2 only and set the cursor type to time.

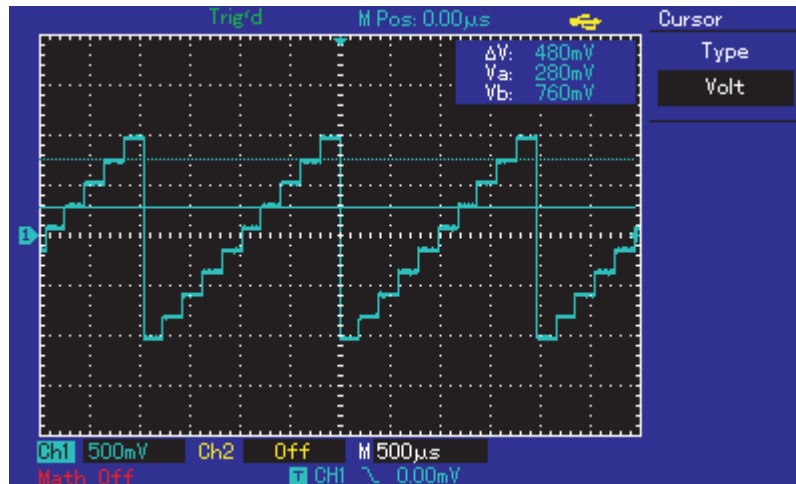


Figure 12-6 Using the cursors to test signal voltage

## Chapter XIII System Prompts and Trouble-shooting

### 13.1 Definitions of System Prompts

**Adjustment at Ultimate Limit:** This informs you that the multifunction control knob has reached its adjustment limit in the current status. No further adjust is possible. When the vertical deflection factor switch, time base switch, X shift, vertical shift and trigger level adjustments have reached their ultimate limits, this prompt will appear.

**USB Device Installed:** After a USB device is plugged into the oscilloscope, this prompt appears when the connection is valid.

**USB Device Unplugged:** After a USB key is unplugged from the oscilloscope, this prompt appears.

**Saving:** When the oscilloscope is saving a waveform, this prompt is shown on the screen. A progress bar appears at the bottom.

**Loading:** During waveform recall, this prompt is shown on the screen. A progress bar appears at the bottom.

### 13.2 Troubleshooting

(1) If the screen of your oscilloscope remains black without any display after powering on, follow the steps below to find the cause :

- ① Check the power cable connection and check if there is normal power supply.
- ② Check if the power switch is properly pressed.
- ③ Restart the unit after performing the above checks.
- ④ If the unit still fails to work, contact UNI-T to request service.

(2) If no waveform is displayed after you have acquired a signal, follow the steps below to find the cause:

- ① Check whether the probe is properly connected to the signal lead.
- ② Check whether the signal lead is properly connected to the BNC (channel adaptor).
- ③ Check whether the object for measurement is generating signals (connect the channel with signals to the question able channel to find the cause).
- ④ Restart the acquisition process.

(3) The measurement voltage amplitude value is 10 times larger or smaller than the actual value:

Check if the channel attenuation factor corresponds with the probe attenuation you have chosen.

(4) There is waveform display but it is not stable :

- ① Check the trigger **Source** setup in the trigger menu. See whether it is the same as the actual signal input channel.
- ② Check the trigger type: Use Edge trigger for ordinary signals and Video trigger

for video signals. Stable waveform display is achieved only when the correct trigger mode is selected.

③ Try changing the Coupling display to High Frequency Suppression or Low Frequency Suppression or to filter any high or low frequency noise that is interfering with triggering.

(5) No display after pressing **RUN/STOP** :

① Check if the trigger mode is set to **NORMAL** or **SINGLE** in the menu, and whether the level exceeds the waveform range.

If so, move the trigger level to the centre or set trigger mode to **AUTO**

② Press **AUTO** to complete the automatic setup.

## Chapter XIV Technical Information

Unless otherwise specified, all technical specifications are applicable to the probes with attenuation switch set as 10× as well as UTD2000 series DSO. DSO must first meet the following two conditions to meet those specification standards:

The instrument must continuously operate for over half an hour with in the operating temperature.

If the operating temperature has exceeds 5°C, please perform the “Self-Adjustment” function in the UTILITY system function.

Any of the specification with “Typical” value represented is for reference only.

### Technical Specification

Acquire System Specification						
Model	UTD2025CL	UTD2052CL	UTD2102e	UTD2052CEX	UTD2072CEX	UTD2102CEX
Real-time	250MS/s	500MS/s	500MS/s	1GS/s		
Equivalence	—	25GS/s	25GS/s	50GS/s		
Average	N can be chosen among 2, 4, 8, 16, 32, 64, 128 and 256; N is the number of average samples.					

Input Channel Specifications	
Input Coupling	DC, AC and GND
Input impedance	(1MΩ± 1%)/(24pF± 3 pF)
Probe attenuation coefficient	1×, 10×, 100×, 1000×
Maximum input voltage	400V (DC+AC peak value, 1MΩ input impedance)

Horizontal System Specification	
Scanning scope	5ns/div-50s/div
Waveform interpolation	Sin(x)/x
amplifying rate and delay time accuracy	±50ppm (any time interval≥1m)
Record length	2×512k sampling point
Storage depth	Single channel: 25k; Double channel: 12.5k
Sampling rate and delay time accuracy	±50ppm(any time interval ≥1ms )
Measurement accuracy of time interval (ΔT) (full bandwidth)	Single time: ± (1 sampling time interval+50ppm×reading+0.6ns) >16 average values: ± (sampling time interval+50ppm×reading+0.4ns)

### Vertical



Model	UTD2025CL	UTD2052CL	UTD2102e	UTD2052CEX	UTD2072CEX	UTD2102CEX
Analog Bandwidth	25MHz	50MHz	100MHz	50MHz	70MHz	100MHz
Rise Time(Typical)	≤14ns	≤7ns	≤3.5ns	≤7ns	≤5ns	≤3.5ns
Channels	2					
Analog-to-digital converter (A/D)	8bit					
Deflection factor range (V/div)	1mV/div~20 V/div(at 1-2-5 increment)					
Position range	≥±10div					
Selectable bandwidth limitation (Typical)	20MHz					
Low frequency response (AC Coupling, -3dB)	≤10 Hz(at BNC)					
DC gain accuracy (sampling or average sampling mode)	10mV ~20V/div: ≤±3%					
	5mV/div: ≤±4%					
	1mV ~2mV/div: ≤±5%					
DC measurement accuracy (average sampling mode)	When vertical position is 0 and N≥16: ± (5%×reading+0.1div+1mV) and selects 1mV /div or 2mV /div; ± (4%×reading+0.1div+1mV) and selects 5mV /div; ± (3%×reading+0.1div+1mV) and selects 10mV /div or 20mV /div;					
	When vertical position is 0 and N≥16: ±(3%×(reading + vertical position reading) + (1%×vertical position reading))+0.2div) The setting from 5mV/div to 200mV/div plus 2mV; the setting value from 200mV/div to 20V/div plus 50mV					
Measurement accuracy of voltage difference (ΔV) (average sampling mode)	Under the same setting and environment conditions and after averaging the captured waveforms with a quantity of ≥16, the voltage difference (ΔV) between any two points on the waveform: ± (3%×reading+0.05div)					

Trigger System Specifications	
Trigger sensitivity	≤1div
Range of trigger level	Interior: From the screen center ±5div
	EXT: ± 3V
Trigger level accuracy (Typical) applicable for the signal with rising and falling time ≥20ns	Interior: ±(0.3div×V/div) (within±4 div from the screen center)
	EXT: ±(6% setting value+40mV)
Pre-trigger capacity	Normal mode/scan mode, pre-trigger/delay trigger, the pre-trigger depth adjustable
Hold-off range	80ns~1.5s
Set the level to 50% (Typical)	Operate under the condition of input signal frequency of ≥50Hz
<b>Edge trigger</b>	

Edge	Rise, fall, rise&fall
<b>Pulse width trigger</b>	
Trigger mode	>, <, =
Polarity	positive pulse width, negative pulse width
Pulse width range	20ns~10s
<b>Video trigger (only UTD2025CL)</b>	
Trigger sensitivity (Typical)	2div Vpp
Signal model and line/field frequency (video trigger type)	Support standard NTSC and PAL, and the line number scope is respectively 1-525 (NTSC) and 1-625 (PAL)
<b>Alternating trigger</b>	
Alter	Edge, Pulse

<b>Measurements</b>		
Cursor	Cursor Parameters	Voltage difference between cursors ( $\Delta V$ ), Time difference between cursors ( $\Delta T$ ), Reciprocal of $\Delta T$ (Hz) ( $1/\Delta T$ )
	Track	Voltage value and time value of point of waveform
Automatic measurement	Vpp, Vamp, Vmax, Vmin, Vtop, Vbase, Vmid, Average, Vrms, Overshoot, Preshoot, Frequency, Period, RiseTime, FallTime, +Width, -Width, +Duty, -Duty, Delay	

<b>Math</b>	
Math operation	+, -, ×, ÷
Window	Rectangle, Hanning, Blackman, Hamming
Sampling size	1024points

<b>Trigger frequency meter</b>	
Reading resolution	6 bits
Trigger sensitivity	≤30Vrms
Accuracy (Typical)	±51ppm (+1 character)

<b>Display</b>	
Displays types	LCD with Diagonal of 178mm (7-inch)
Display resolution	UTD2025CL, UTD2052CL, UTD2102e: 400 horizontal×RGB×240 vertical pixels UTD2000EX Series: 800 horizontal×RGB× 480 vertical pixels
Display color	Color
Waveform luminance	Adjustable (color)

Backlight intensity (Typical)	300nit
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### Interface function:

Standard configuration	1 USB OTG
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### General Technical Specification

#### Probe compensator output

Output voltage (Typical)	About 3Vpp, when the load $\geq$ 1M $\Omega$
--------------------------	--

Frequency (Typical)	1kHz
---------------------	------

#### Power Source

Power voltage	100V~240VAC <sub>RMS</sub> , 50/60Hz, CAT II
---------------	--

Power consumption	$\leq$ 100VA
-------------------	--------------

Fuse	1.6AL 250V (Fuse is located inside the instrument housing)
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#### Environment Specifications

Temperature Range	Operating Temperature Range: 0°C~+40°C
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Storage Temperature Range: -20°C~+60°C
--

Cooling	Build-in cooling fan
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Operating Humidity Range	<35°C: $\leq$ 90%RH
	35°C~40°C: $\leq$ 60%RH

Operating Altitude	Below 3,000m
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#### Mechanical specifications

Size	306mm(W) $\times$ 147mm(H) $\times$ 122mm(D)
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Weight	UTD2000L&UTD2000EX: Excluding package: 2.5kg Including package: 3.5kg
	UTD2102e: Excluding package: 2.5kg Including package: 3.5kg

#### I P protection

IP2X
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#### Recommended calibration Interval

The recommended calibration interval is every one year
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## Chapter XV Appendix

### Appendix A Accessories of UTD2000 Series

- Two probes (selectable for 1:1 and 10:1).

Please refer to instructions on probe accessories for details. Probe conforming to EN61010-031 standards.

When the switch is at 1× position, it belongs to 150V CAT II.

When the switch is located in 10× position, it belongs to 300V CAT II.

- One power cable
- One software CD
- One USB Cable: UT-D05

**Please order all the accessories (standard parts and optional parts) from the local UNI-T distributors.**

### Appendix B Maintenance and Cleaning

#### (1) General Maintenance

Please do not store or place the instrument at any places where the LCD of the instrument is exposed to sunlight directly.

Caution: Please do not stain the instrument or probe with spray, liquid or solvent, so as to avoid damaging the instrument or probe.

#### (2) Clearing

Check the instrument and probe frequently. Clean the surface of the instrument according to the following steps:

① Please wipe the surface the instrument and probe with soft cloth. Pay attention not to scratch the LCD screen.

② Wipe the instrument with wet cloth after disconnecting the power supply. Use detergent or clear water to clean. Do not use any abrasive chemical cleaning agent to avoid damaging the instrument or probe.

**Warnings:** Please make sure that the instrument is completely dry before powering on again, to avoid electrical short circuit or injury.

### Appendix C Warranty

UNI-T (Uni-Trend Technology (China) Co., Ltd.) warrants that product produced and marketed by it will be free from defects in materials and workmanship for a period of three years from the date of shipment by the authorized dealer. If any such product proves defective during this warranty period, UNI-T will repair the defective product or provide a replacement according to specific terms and conditions of the warranty. To request maintenance and repair service or a full copy of the warranty, please contact your nearest UNI-T sales and maintenance office.

Save and except the guarantee given herein or in other applicable warranty, UNI-T makes no other express or implied guarantee, including but not limited to any implied

guarantee on the product's tradability and suitability for any specific purpose. Under no circumstance will UNI-T bear any liability for any indirect, special or subsequent loss.

**Appendix D Contact Us**

If you encounter any inconvenience in using this product, contact Uni- Trend Electronic (Shanghai) Limited (Uni-T, Inc.) in China directly.

For product support outside China, contact your local UNI-T supplier or sales centre.

Service Support : Many UNI-T products offer optional plans of extended warranty period or calibration period. For details please contact your local UNI-T supplier or sales centre.

A list of service centres worldwide is available online at

**<http://www.uni-trend.com>**

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