CMYK

UNI-T®

UT2000E/3000E Series

OPERATING MANUAL

Digital Storage Oscilloscope

P/N:110401101166

UNI-T®

UT2000E/3000E SERIES
OPERATING MANUAL

General Safety Rules

This unit is designed and manufactured strictly in accordance with GB4793 safety requirements for electronic testing meters and IEC61010-1 safety standards. It fully meets CAT II 600V insulation and overvoltage requirements and Grade II pollution safety standards. To prevent personal injuries and damage of this unit or any product connected to it, please take note of the following safety precautions. To avoid potential hazards, use this unit as instructed by this User Manual.

Maintenance should only be carried out by a trained professional.
To avoid fire and personal injury :

Use a correct power cable : Use only a specified power cable which is authorized in the country of use.

Remove the plug correctly : Do not remove the probe or testing cable when they are connected to power.

Ensure good grounding : This unit is grounded by the ground wire of the power cable. To avoid electric shock, the grounding conductor must touch the ground. Before connecting the input or output terminal, ensure the unit is properly grounded.

Connect the probe of the digital storage oscilloscope : The probe ground cable is the same as ground potential. Do not connect the ground cable to high voltage.

Check the rated values of all terminals :
To prevent fire and excessive current shock, please check all rated values and label data. Read the manual carefully to check the rated values before connecting the unit.
Do not operate the unit with the chassis cover open : Do not operate this unit when the outer cover or front panel is open.

Use suitable fuses : Only use specified fuse types and rated specifications.

Avoid exposing circuitry : When power is on, never make contact with exposed adaptor or components.

When fault is suspected, stop operation : If you suspect a fault, ask a qualified maintenance professional to carry out inspection.

Maintain good ventilation.

Do not operate in a humid environment.

Do not operate in combustible and explosive conditions.

Keep the product surface clean and dry.

Safety Glossary and Symbols

Safety terminology used in this manual. The following messages may appear in this manual :

Warning : Warning statements identify conditions or practices that could result in injury or loss of life.

Caution : Caution statements identify conditions or practices that could result in damage to this product or other property.

Glossary on the product : The following glossary may appear on the product :
“Danger” means potential damage that is immediate.
“Warning” means potential damage that is not immediate.
“Important” means possible damage to this product or other properties.

Symbols on the product : The following symbols may appear on the product :

High voltage

Caution! Refer to manual

Protective earth terminal

Earth terminal for chassis

Earth terminal for testing

Preface

This manual provides information on the operation of the UT2000E and UT3000E digital storage oscilloscope series. Guidance is given in several chapters as follows :

Chapter 1— User Guide : Simple guide to the oscilloscope functions and notes on installation.

Chapter 2— Instrument Setups : Guide to operation of the UT2000E and UT3000E digital storage oscilloscope series.

Chapter 3— Practical Illustrations : Example illustrations are provided to solve various testing problems.

Chapter 4—System Prompts and Trouble-shooting :

Chapter 5—Servicing and Support :

Chapter 6—Appendixes :

Appendix A : Technical Indicators
Appendix B : Accessories for UT2000E/3000E Oscilloscopes
Appendix C : Maintenance and Cleaning

UT2000E/3000E User Manual

The UT2000E/3000E Digital Storage Oscilloscope Series

UT2000E/3000E oscilloscopes offer user-friendliness, outstanding technical indicators and a host of advanced features. They are your perfect tools to complete testing tasks swiftly and efficiently.

This manual is a user guide for 24 models of the digital storage oscilloscope series :

Model	Bandwidth	Sampling Rate	Display
UT2042BE	40MHz	1GS/s	Mono-
UT2062BE	60MHz	1GS/s	
UT2082BE	80MHz	1GS/s	
UT2102BE	100MHz	1GS/s	
UT2152BE	150MHz	1GS/s	
UT2202BE	200MHz	1GS/s	
UT3042BE	40MHz	1GS/s	
UT3062BE	60MHz	1GS/s	
UT3082BE	80MHz	1GS/s	
UT3102BE	100MHz	1GS/s	
UT3152BE	150MHz	1GS/s	
UT3202BE	200MHz	1GS/s	

Model	Bandwidth	Sampling Rate	Display
UT2042CE	40MHz	1GS/s	Colour
UT2062CE	60MHz	1GS/s	
UT2082CE	80MHz	1GS/s	
UT2102CE	100MHz	1GS/s	
UT2152CE	150MHz	1GS/s	
UT2202CE	200MHz	1GS/s	
UT3042CE	40MHz	1GS/s	
UT3062CE	60MHz	1GS/s	
UT3082CE	80MHz	1GS/s	
UT3102CE	100MHz	1GS/s	
UT3152CE	150MHz	1GS/s	
UT3202CE	200MHz	1GS/s	

UT2000E/3000E digital storage oscilloscopes offer user-friendly front panel with clear indications to allows access to all basic functions for easy operation. The scaling and position buttons for all channels are optimally arranged for direct view operation. As design is based on the mode of traditional instruments, users can use the new units without spending considerable time in learning and familiarizing with operation. For faster adjustment to ease testing, there is an [AUTO] key to instantly display the appropriate waveform and range position.

In addition to easy operation, the UT2000E/3000E series have all the high performance indicators and powerful functions that ensure speedy testing and measurement. With 1GS/s real-time sampling rate and 25GS/s equivalent sampling rate, these oscilloscopes can display signals much quicker, while powerful trigger and analytical features enable easy capture and analysis of waves, while a clear LCD display and mathematics functions enable the user to observe and analyse signal problems promptly and clearly.

The performance features listed below will explain why the new series can fully satisfy your testing and measurement requirements :

- Dual analog channels
- HD colour/mono LCD display system at 320 x 240 pixel aspect ratio
- Supports hot-plugging storage devices and capable of communicating with a computer through the USB storage device
- Automatic waveform and status configuration
- Storage of waveforms, setups and bit map and waveforms, setups reproduction
- Sophisticated window expansion function to analyse waveform details and overview precisely
- Automatic measurement of 28 waveform parameters
- Automatic cursor tracing measurement
- Unique wave recording and replay function
- Built-in FFT
- Multiple waveform mathematics functions (including add, subtract, multiply and divide)
- Edge, video, pulse width and alternate trigger functions
- Multilingual menu displays
- Chinese and English help system

UT2000E/3000E Oscilloscope accessories

- 2 x 1.5m, 1:1/10:1 probe. For details refer to the probe instructions. These accessories conform with EN61010-031: 2002 standards.
- Power supply line conforming to applicable international standards in the country of use
- User Manual
- USB connecting cable : UT-D06
- UT2000E/3000E remote control software (USB-DEVICE)

Table of Contents

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Chapter One — User Guide

UT2000E/3000E Series digital storage oscilloscopes are small and compact benchtop devices. The user-friendly front panel enables easy operation for basic testing and measuring tasks.

This chapter provides notes on the following :

- General inspection
- Functional check
- Probe compensation
- Automatic setups for waveform display
- Getting to know the vertical system
- Getting to know the horizontal system
- Getting to know the trigger system

When beginning to use your new 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 UT2000E/3000E series digital storage oscilloscope as quickly as possible.

The UT2000E/3000E series comes with a front panel with at-a-glance functions for easy operation. There are buttons and function keys on the front panel. The functions of knobs are similar to other oscilloscopes. The row of 5 keys on the right of the display panel are 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.

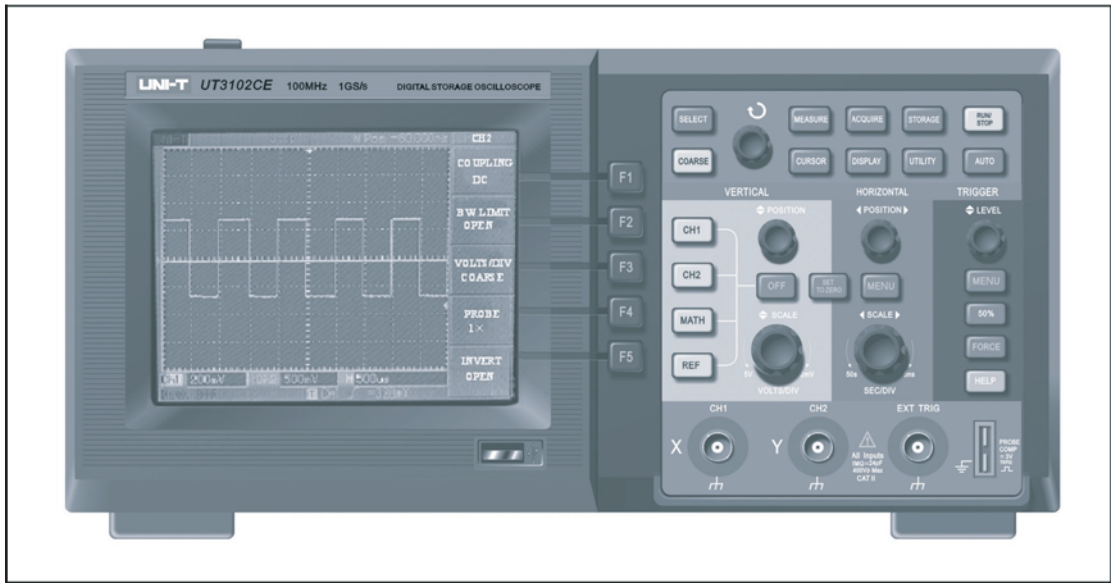

Figure 1-1 Front panel of UT2000E/3000E Series Digital Storage Oscilloscopes

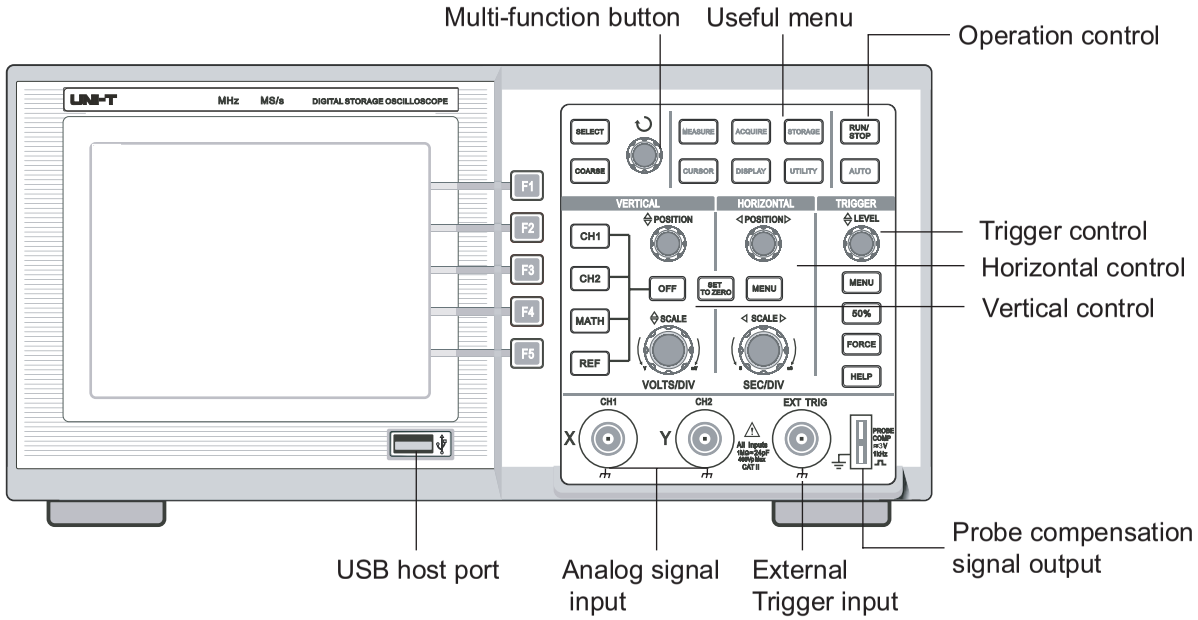

Figure 1-2 Schematic diagram for operating the UT2000E/3000E front panel

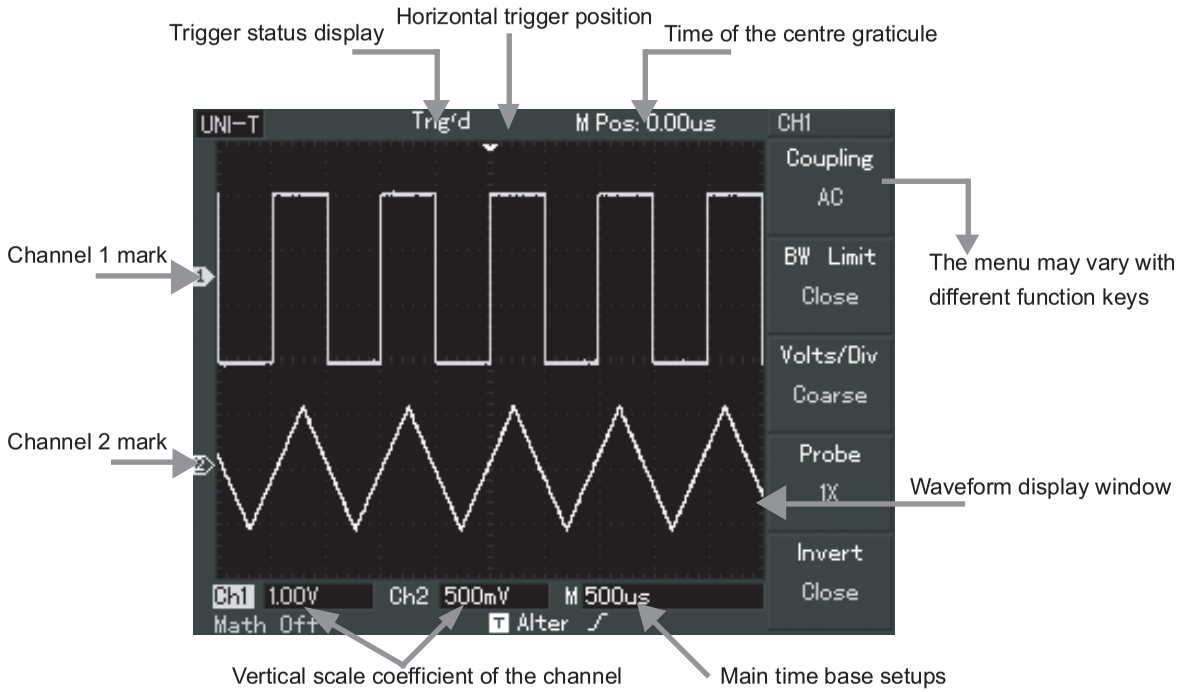

Figure 1-3 Schematic diagram for the display interface

General Inspection

We suggest checking your new UT2000E/3000E oscilloscope in the following steps.

1. Check the unit for possible shipping damages
If the package carton or foam plastic protective lining is seriously damaged, request replacement immediately.

2. Check the accessories
A checklist of accessories that come with your UT2000E/3000E oscilloscope is provided in the section “Accessories for UT2000E/3000E Oscilloscopes”. Please check for any missing items against this list.
If any item is missing or damaged, please contact your UNI-T dealer or our local office.

3. Thorough inspection of the entire unit
If the exterior of the unit is damaged, or it is nor operating normally or it fails to pass performance tests, please contact your UNI-T dealer or our local office.

In the event of shipping damage, please retain the packaging and inform our shipping department or your UNI-T dealer. UNI-T will arrange for repair or replacement.

Functional Check

Carry out a quick functional check in the following steps to make sure your oscilloscope is operating normally.

1. Power on the unit
Power on the unit. Power supply voltage is 100-240V AC, 45-440Hz. After connecting to power, let the unit carry out self calibration to optimize the oscilloscope signal path for measurement accuracy. Press the UTILITY button and then F1 to start the calibration. Then press F1 on the next page to display default setup. See Figure 1-4 for details.

When the above procedure is complete, press CH1 to enter the CH1 menu.

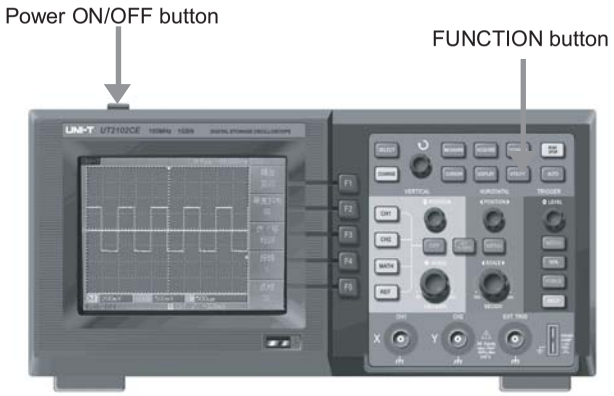

Figure 1-4

Warning : To avoid danger, ensure the digital storage oscilloscope is safely grounded.

2. Accessing signals

The UT2000E/3000E Series Oscilloscopes have dual input channels and one external trigger input channel. Please access signals in the following steps :

① Connect the probe of the digital storage oscilloscope to the CH1 input, and set the attenuation switch of the probe to 10X (Figure 1-5).

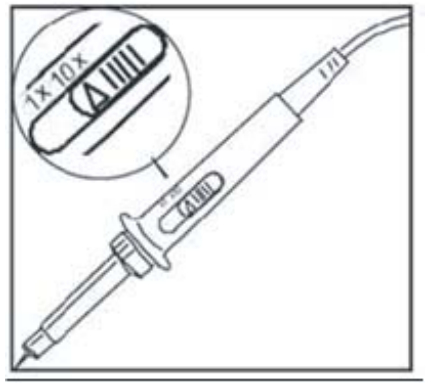

Figure 1-5 Setting the attenuation switch

② You have to set the probe attenuation factor of the oscilloscope. This factor changes the vertical range multiple to ensure the measurement result correctly reflects the amplitude of the measured signal. Set the attenuation factor of the probe as follows : Press F4 to display 10X on the menu.

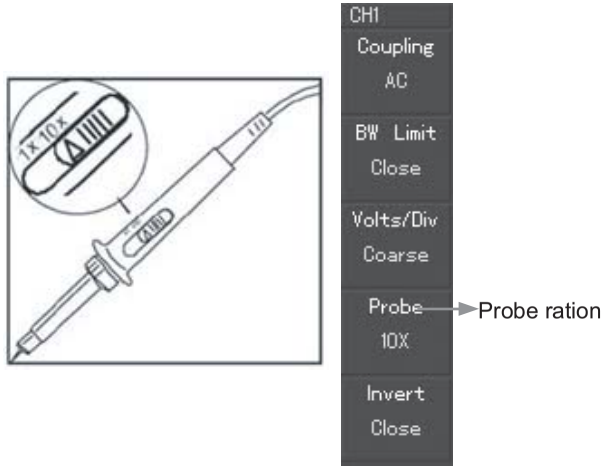

Figure 1-6
Deflection factor setting of the probe on the oscilloscope

③ Connect the probe tip and ground clamp to the corresponding probe compensation signal terminals. Press AUTO and you will see a square wave in the display of about 3V peak-to-peak at 1kHz in a few seconds. See Figure 1-7 for details. Repeat these steps to check CH2. Press the OFF function button to close CH1, then press CH2 function button to open CH2. Repeat steps 2 and 3.

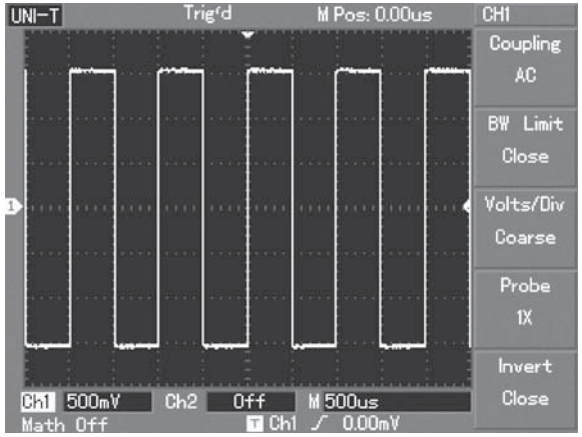

Figure 1-7 Probe compensation signal

Probe Compensation

When connecting the probe to any input channel for the first time, perform this adjustment to match the probe to the channel. Skipping the compensation calibration step will result in measurement error or fault. Please adjust probe compensation as follows :

1. In the probe menu set the attenuation factor to 10X. Move the switch on the probe to 10X and connect the probe to CH1. If you are using the probe hook-tip, ensure a proper and secure connection. Connect the probe tip to the probe compensator's signal output, then connect the ground clamp to the ground wire of the probe compensator. Display CH1 and press AUTO.

2. Observe the shape of the displayed waveform.

Overcompensation Correct Compensation Undercompensation

Figure 1-8 Probe Compensation calibration

3. If you see an "Undercompensation" or "Overcompensation" waveform display, adjust the variable capacitor on the probe with a screwdriver with non-metal handle, until a "Correct Compensation" waveform illustrated above is displayed.

Warning : To avoid electric shock when measuring high voltage with the probe, ensure the probe's insulation lead is in good condition. Do not touch the metal part of the probe when connecting to HV power.

Automatic Setups for Waveform Display

UT2000E/3000E Series Digital Storage Oscilloscopes feature an autoset function. Your oscilloscope can automatically adjust the vertical deflection factor, scanning time base and trigger mode based on the input signal, until the most appropriate waveform is displayed. The autoset function can only be operated when the signal to be measured is 50Hz or above and the duty ratio is larger than 1%.

Using the Autoset Function :

1. Connect the signal to be measured to the signal input channel.
2. Press AUTO. The oscilloscope will automatically set the vertical deflection factor, scanning time base and trigger mode. Should you require to make more detailed check, you can adjust manually after the autoset process until you get the optimal waveform display.

Getting to Know the Vertical System

As shown in the figure below, there are a series of buttons and knobs in the vertical control zone. The following steps will get you familiar with the use of these controls.

Figure 1-9 Vertical control zone on the front 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.

Measurement Tips :
If the channel coupling is DC, you can measure the signal's DC component quickly by checking the difference between the waveform and signal ground. In the case of AC coupling, the DC component within the signal will be filtered. With this coupling mode you can display the AC component of the signal with higher sensitivity.

Shortcut key for resetting the vertical position of the dual analog channel to zero : SET TO ZERO
This shortcut key can reset vertical shift, horizontal shift and holdoff to the zero position (center point).

2. Change the vertical setups and check changes of status information.
You can identify changes of any vertical range by reading the status display column at the lower corner of the waveform

window. Turn the vertical scale knob to change the vertical VOLT/DIV range. You will find that the range in the current status column has changed accordingly. Press CH1, CH2, MATH or REF and the screen will show the corresponding operation menu, sign, waveform and range status information. Press OFF to close the selected channel.

Getting to Know the Horizontal System

As shown in the figure below, there are one button and two knobs in the horizontal control zone. The following steps will get you familiar with horizontal time base setups.

Figure 1-10 Horizontal control zone on the front panel

1. Use the horizontal SCALE knob to change the horizontal time base setup and check any changes in status information. Turn the horizontal SCALE knob to change the SEC/DIV time base range. You will find that the time base range in the current status column has changed accordingly. Range of horizontal scanning rate is 5ns~50s, in steps of 1-2-5.

* Note : Horizontal scanning time base range of the UT2000E/3000E Series varies from model to model.

2. Use the horizontal POSITION knob to adjust the horizontal position of the waveform window. The horizontal POSITION knob controls trigger shift of the signal. When this function is used for trigger shift and the horizontal POSITION knob is turned, you can see that the waveform moves horizontally with the knob.

3. Press MENU to display the ZOOM menu. In this menu press F3 to activate window expansion. Then press F1 to quit window expansion and return to the main time base. You can also set the holdoff time with this menu.

Shortcut key for resetting the trigger point shift to horizontal zero positionThe shortcut key **SET TO ZERO** can quickly reset the trigger point to the vertical centre point. You can also turn the horizontal POSITION knob to adjust the horizontal position of the signal in the waveform window.

Definition
Trigger point means the actual trigger point relative to the centre point of the storage device. By turning the horizontal POSITION knob, you can move the trigger point horizontally.Holdoff means reactivating the time interval of the trigger circuit. Turn the multi-function control knob to set the holdoff time.

Getting to Know the Trigger System

As shown in Figure 1-11, there are one knob and three buttons in the trigger menu control zone. The following steps will get you familiar with trigger setups.

Figure 1-11 Trigger menu on the front panel

1. Use the trigger level knob to change the trigger level. You will see a trigger sign on the screen that indicates the trigger level. The sign will move up and down with the knob. While you move the trigger level, you will find the trigger level value on the screen changing accordingly.
2. Open the [TRIGGER MENU] (see the figure below) to change trigger setups.
Press [F1] and select [EDGE] TRIGGER.
Press [F2] and select CH1 as [TRIGGER SOURCE].

Press [F3] and set [EDGE TYPE] as RISING.
Press [F4] and set [TRIGGER MODE] as AUTO.
Press [F5] and set [TRIGGER COUPLING] as DC.

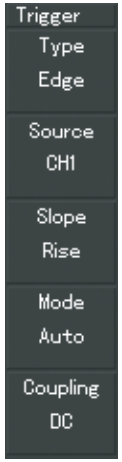

Figure 1-12 Trigger Menu

3. Press the [50%] button and set the trigger level at the vertical centre point of the trigger signal amplitude.

4. Press [FORCE] to generate a compulsory trigger signal that is mainly used in the normal and single trigger modes.

Chapter 2 — Instrument Setups

You should be familiar with basic operation of the vertical controls, horizontal controls and trigger system menu of your UT2000E/3000E Series by now. After reading the last chapter, you should be able to use the menus to set up your digital storage oscilloscope. If you are still unfamiliar with these basic operation steps and methods, please read Chapter 1.

This chapter will guide you through the following :

- Setting up the vertical system (CH1, CH2, MATH, REF, OFF, VERTICAL POSITION, VERTICAL SCALE)
- Setting up the horizontal system (MENU, HORIZONTAL POSITION, HORIZONTAL SCALE)
- Setting up the Trigger system (TRIGGER LEVEL, MENU, 50%, FORCE)
- Setting up the sampling method (ACQUIRE)
- Setting up the display mode (DISPLAY)
- Save and transfer (STORAGE)
- Setting up the assistant system (UTILITY)
- Automatic measurement (MEASURE)
- Cursor measurement (CURSOR)
- Using the execution buttons (AUTO, RUN/STOP)

It is recommended that you read this chapter carefully to understand the various measurement functions and system operation steps of your UT2000E/3000E Series Oscilloscope.

Setting up the Vertical System

CH1, CH2 and setups

Each channel has its own vertical menu. You should set up each item for each channel individually. Press the CH1 or CH2 function button and the system will display the operation menu for CH1 or CH2. For explanatory notes please see Table 2-1 below :

Table 2-1：Explanatory notes for channel menu

Function Menu	Setup	Explanatory Note
Coupling	AC	Intercept the DC quantities of the input signal.
	DC	Pass AC and DC quantities of input signal.
	Ground	Disconnect input signal.
Bandwidth limit	On	Limit bandwidth to 20MHz to reduce noise display
	Off	Full bandwidth.
VOLTS/DIV	Coarse tune Fine tune	Coarse tune in steps of 1-2-5 to set up the deflection factor of the vertical system. Fine tune means further tuning within the coarse tune setup range to improve the vertical pixel aspect ratio.
Probe	1X 10X	Select either one value based on the probe attenuation factor to keep the vertical deflection factor reading correct. There are four values : 1X, 10X, 100X and 1000X.
Invert	On	Waveform invert function on.
	Off	Normal waveform display.

1. Setting up channel coupling :

Take an example of applying a signal to CH1. The signal being tested is a sine signal that contains DC components.

Press F1 to select AC. It is now set up as AC coupling. DC quantities of the signal being tested will be intercepted. The waveform display is as follows :

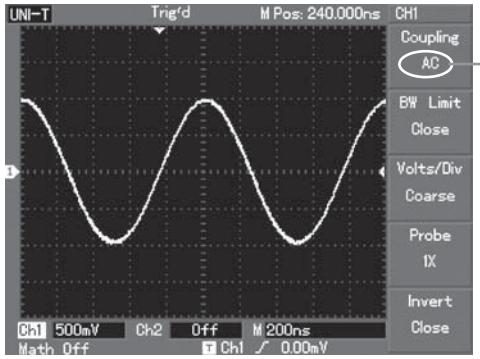

Figure 2-1 DC quantities of the signal are intercepted

Press F1 to select DC. Both DC and AC quantities of the testing signal being inputted to CH1 can pass through. The waveform display is as follows :

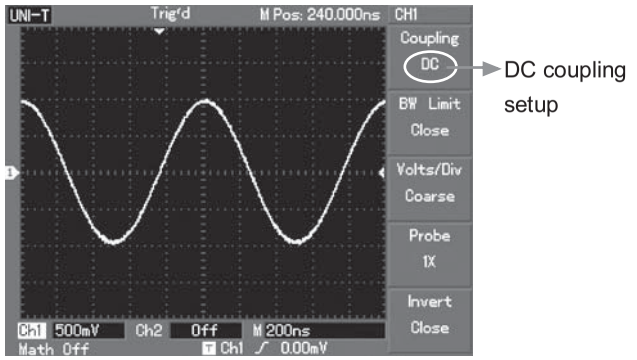

Figure 2-2 Both DC and AC quantitiesof the signal are displayed

Press F1 to select ground. It is now set up as ground. Both DC and AC quantities contained in the signal being measured will be intercepted. The waveform display is as follows :
(Note : in this mode, although waveform is not displayed, the signal remains connected to the channel circuit)

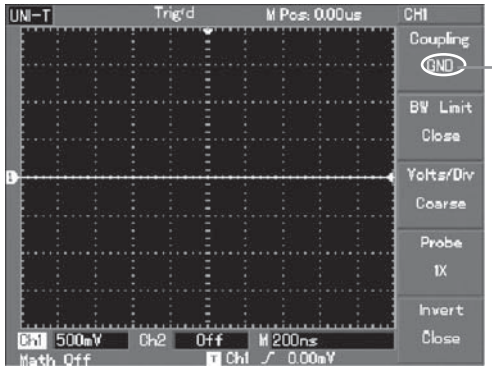

Figure 2-3 Both DC and AC quantities of the signal are intercepted

2. Setting up the channel bandwidth

Take an example of applying a signal to CH1. The signal being tested is a pulse signal that contains high frequency oscillation.

Press CH1 to turn CH1 on. Then press F2 to set bandwidth limit OFF. It is now set up as full bandwidth. The signal being measured can pass through even if it contains high frequency quantities. The waveform display is as follows :

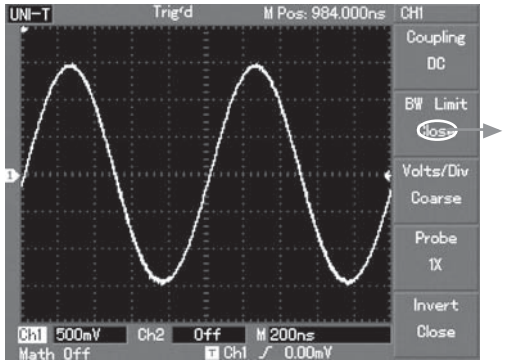

Figure 2-4 Waveform display when bandwidth limit is off

Press F2 to set bandwidth limit ON. All noise and high frequency quantities higher than 20MHz in the signal being tested will be attenuated significantly. The waveform display is as follows :

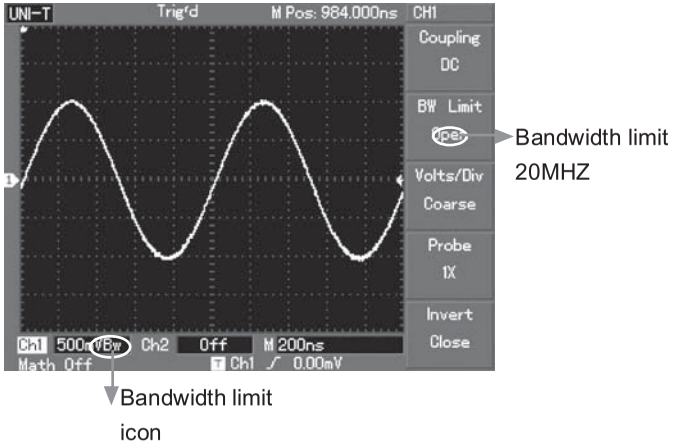

Figure 2-5 Waveform display when bandwidth limit is on

3. Setting up the probe rate

To match the probe attenuation factor setup, it is necessary to set up the probe attenuation factor in the channel operation menu accordingly. For example, when the probe attenuation factor is 10:1, set the probe attenuation factor at 10X in the menu. Apply this principle to other values to ensure the voltage reading is correct.

The figure below shows the setup and vertical range display when the probe is set at 10:1.

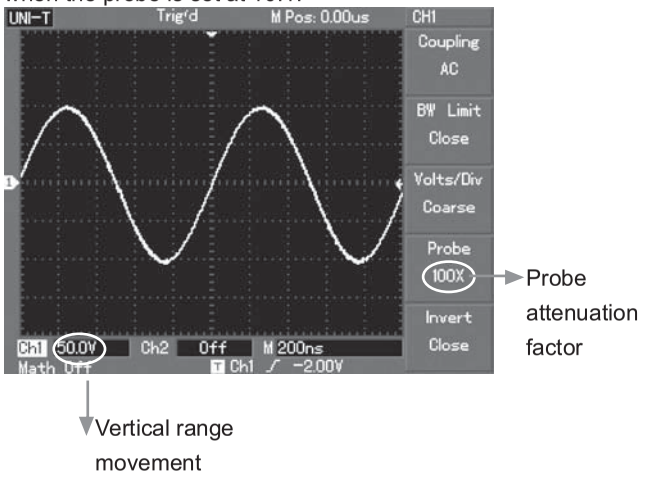

Figure 2-6 Setting up the probe attenuation factor in the channel menu

4. Vertical VOLTS/DIV adjustment setup

You can adjust the VOLTS/DIV range of the vertical deflection factor either in the coarse tune mode or fine tune mode. In coarse tune mode, the VOLTS/DIV range is 2mV/div~5V/div. Tuning is in steps of 1-2-5. In fine tune mode, you can change the deflection factor in even smaller steps within the current vertical range, so as to continuously adjust the vertical deflection factor within the range of 2mV/div~5V/div without interruption.

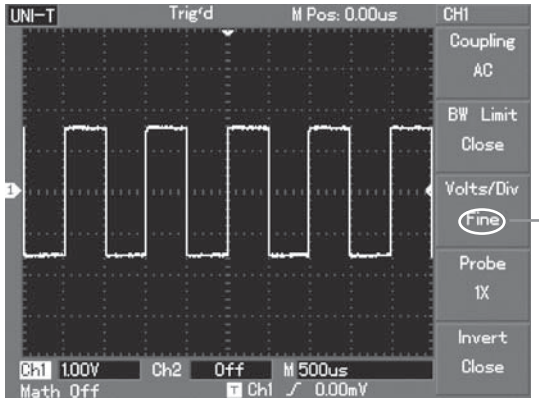

Figure 2-7 Coarse tuning and fine tuning the vertical deflection factor

5. Waveform inversion setup

Waveform inversion : The displayed signal is inverted 180 degrees with respect to the ground level. Figure 2-8 shows the non-inverted waveform. Figure 2-9 shows the inverted waveform.

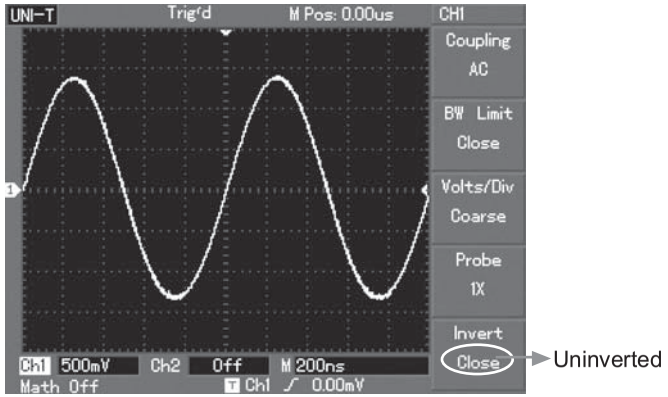

Figure 2-8 Inversion setup for vertical channel inversion (non-inverted)

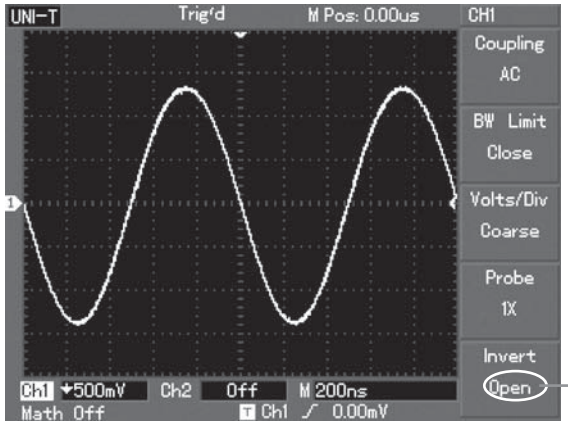

Figure 2-9 Inversion setup for vertical channel inversion (inverted)

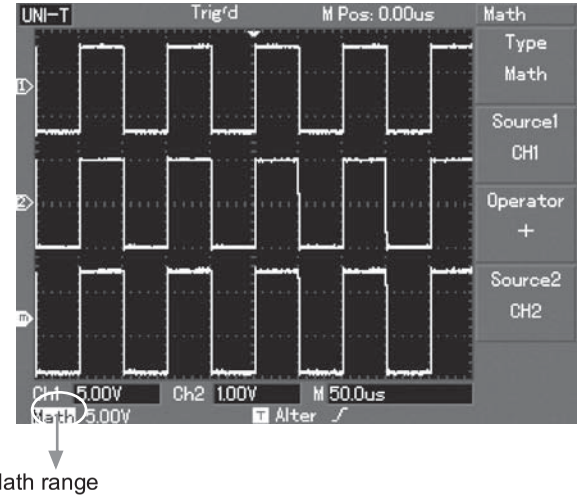

Figure 2-10 Math functions

Operating Math Functions

Math functions are displays of +, -, ×,÷ and FFT mathematical results of CH1 and CH2. The menu is as follows :

Table 2-2 : Explanatory notes for the Math menu

Function Menu	Setup	Explanatory Note
Type	Math	To carry out +, -, ×, ÷ functions
Signal source 1	CH1	Set signal source 1 as CH1 waveform
	CH2	Set signal source 1 as CH2 waveform
Operator	+	Signal source 1 + Signal source 2
	-	Signal source 1 - Signal source 2
	×	Signal source 1 x Signal source 2
	÷	Signal source 1 ÷ Signal source 2
Signal source 2	CH1	Set signal source 2 as CH1 waveform
	CH2	Set signal source 2 as CH2 waveform

Table 2-3 Explanatory notes for the FFT menu

Function Menu	Setup	Explanatory Note
Type	FFT	To carry out FFT algorithm functions
Signal source	CH1	Set CH1 as math waveform
	CH2	Set CH2 as math waveform
Window	Hanning	Set Hanning window function
	Hamming	Set Hamming window function
	Blackman	Set Blackman window function
	Rectangle	Set Rectangle window function
Vertical unit	Vrms dBVrms	Set the vertical unit to Vrms or dBVrms

FFT spectrum analysis

By using the FFT (Fast Fourier Transform) algorithm, you can convert time domain signals (YT) into frequency domain signals. With FFT, you can conveniently observe the following types of signals :

- Measure the harmonic wave composition and distortion of the system
- Demonstrate the noise characteristics of the DC power
- Analyse oscillation

How to use FFT functions

Signals with DC quantities or DC offset will cause error or offset of FFT waveform quantities. To reduce DC quantities, select AC coupling. To reduce random noise and frequency aliasing resulted by repeated or single pulse event, set the acquiring mode of your oscilloscope to average acquisition.

Select the FFT Window

Assuming the YT waveform is constantly repeating itself, the oscilloscope will carry out FFT conversion of time record of a limited length. When this cycle is a whole number, the YT waveform will have the same amplitude at the start and finish. There is no waveform interruption. However, if the YT waveform cycle is not a whole number, there will be different amplitudes at the start and finish, resulting in transient interruption of high frequency at the connection point. In frequency domain, this is known as leakage. To avoid leakage, multiply the original waveform by one window function to set the value to 0 for start and finish compulsively. For application of the window function, please see the table below :

Table 2-4

FFT Window	Feature	Most Suitable Measurement Item
Rectangle	The best frequency recognition rate, the worst amplitude recognition rate. Basically similar to a status without adding window.	Temporary or fast pulse. Signal level is generally the same before and after. Equal sine wave of very similar frequency. There is broad-band random noise with slow moving wave spectrum.
Hanning	Frequency recognition rate is better than the rectangle window, but amplitude recognition rate is poorer.	Sine, cyclical and narrow-band random noise.
Hamming	Frequency recognition rate is marginally better than Hanning window.	Temporary or fast pulse. Signal level varies greatly before and after.
Blackman	The best amplitude recognition rate and the worst frequency recognition rate.	Mainly for single-frequency signals to search for higher-order harmonic wave.

Definition :
FFT recognition rate: means the quotient of the sampling and math points. When math point value is fixed, the sampling rate should be as low as possible relative to the FFT recognition rate.
Nyquist frequency : To rebuild the original waveform, at least 2f sampling rate should be used for waveform with a maximum frequency of f. This is known as Nyquist stability criterion, where f is the Nyquist frequency and 2f is the Nyquist sampling rate.

II. Reference Waveform

Display of the saved reference waveforms can be open or off in the REF menu. The waveforms are saved in the non volatile memory of the oscilloscope or an external USB device and are identified with the following names : RefA, RefB. To display (recall) or hide (off) the reference waveforms, take the following steps :

1. Press the REF menu button on the front panel.
2. Press RefA (RefA reference option). Select the signal source and then select the position of the signal source by turning the multi-function control knob on the upper part of the front panel. You can choose from 1 to 10. After selecting a numeral for saved waveform, e.g. 1, press the recall button to display the waveform which was originally stored in that position.
If the saved waveform is on the USB, insert the USB and then press F2. You have two options : DSO/USB. Select USB to recall the saved waveform. The recalled waveform will appear on the screen.
After displaying the waveform, press the cancel button F5 to go back to the previous menu.
3. Press RefB (RefB reference option). Select the second signal source for the math function by repeating step 2.
In actual application, when using your UT2000E/3000E Series Oscilloscope to measure and observe such waveforms, you can compare the current waveform with the reference waveform for analysis. Press REF to display the reference waveform menu. Setup is as follows :

Table 2-5 Selecting the Storage Position

Function Menu	Setup	Explanatory Note
Storage position	1~10	1~10 stand for positions of 10 groups of waveforms respectively (When saving to USB, there is a 200 set waveform position.)
Disk	DSO	Select an internal storage position
	USB	Select an external storage position (The USB disk must be plugged in)
Close	- -	Close the recalled waveform
Recall	- -	Recall the selected waveform
Cancel	- -	Go back to the previous menu

To select an internal storage position, choose between 1 and 10.
In the case of external storage device, plug in the U disk and then press F2 to select the USB disk.
To save a waveform, see the STORAGE menu.

Setting up the Horizontal System

Horizontal Control Knob

You can use the horizontal control knob to change the horizontal graticule (time base) and trigger the horizontal position of the memory (triggering position). The vertical centre point above the horizontal orientation of the screen is the time reference point of the waveform. Changing the horizontal graticule will cause the waveform to increase or decrease in size relative to the screen centre. When the horizontal position changes, the position with respect to the waveform triggering point is also changed.

Horizontal position : Adjust the horizontal positions of channel waveforms (including math waveforms). Resolution of this control button changes with the time base.

Horizontal scaling : Adjust the main time base, i.e s/div. When time base extension is on, you can use the horizontal scaling knob to change the delay scanning time base and change the window width. For details see notes on time base extension.

Horizontal control knob menu : Display the horizontal menu (see the table below).

Table 2-6

Function Menu	Setup	Explanatory Note
Main time base	--	1. Open the main time base. 2. If you press the main time base when window extension is on, window extension will close.
--		
Window extension	--	Open time base extension.
--		
Holdoff	--	Adjust holdoff time.

Figure 2-11 Horizontal system interface

Icon definitions :

① represents the memory position of the current waveform window.

② represents the memory position of the triggering point.

③ represents the position of the triggering point in the current waveform window.

④ Horizontal time base (main time base), i.e s/div.

⑤ Horizontal distance between the triggering position and the window centre point.

Definitions

Y-T Mode : In this mode the Y axis indicates voltage and the X axis indicates time.

X-Y Mode : In this mode the X axis indicates CH1 voltage and the Y axis indicates CH2 voltage.

Slow Scanning Mode : When horizontal time base control is set at 100ms/div or slower, the unit will operate in the slow scan sampling mode. When observing low frequency signals in slow scanning mode, it is advised to set the channel coupling as DC.

S/div : A horizontal scaling (time base) unit. If waveform sampling is stopped (by pressing the [RUN/STOP] button), time base control can expand or compress the waveform.

Window Extension

Window extension can be used to zoom in a band of waveform to check image details. The window extension setting must not be slower than that of the main time base.

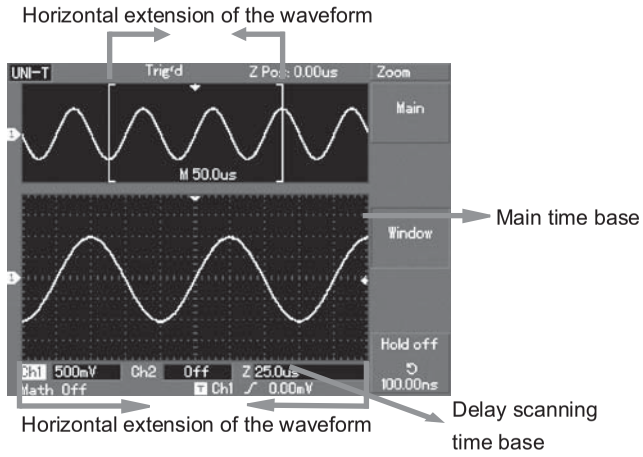

Figure 2-12 Display with the window extended

In the time base extension mode, the display is divided into two zones as shown above. The upper part displays the original waveform. You can move this zone left and right by turning the horizontal POSITION knob, or increase and decrease the selected zone in size by turning the horizontal SCALE knob.

The lower part is the horizontally extended waveform of the selected original waveform zone. Please note that the recognition rate of extended time base relative to the main time base is now higher (as shown in the above figure). Since the waveform shown in the entire lower part corresponds to the selected zone in the upper part, you can increase the extended time base by turning the horizontal SCALE knob to decrease the size of the selected zone. In other words, you can increase the multiple of waveform extension.

X-Y Mode

This mode is suitable for CH1 and CH2 only. After selecting the X-Y display mode, the horizontal axis will display CH1 voltage, while the vertical axis will display CH2 voltage.

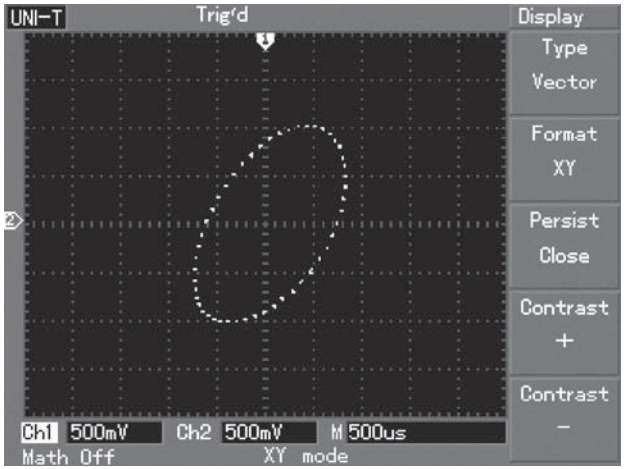

Figure 2-13 Waveform display in X-Y mode

Caution : In the normal X-Y mode, the oscilloscope can use the random sampling rate to acquire waveforms. To adjust sampling rate and channel vertical range in the X-Y mode and to adjust the time range, the omitted sampling rate is 100Ms/s. Generally, lower the sampling rate appropriately will result in lissajous figures of better display quality. The following functions have different effects in the X-Y display mode :

- Automatic measurement mode
- Cursor measurement mode
- Reference or math waveform
- Vector display type
- Extend window function
- Trigger control

Setting up the Trigger System

Triggering decides when the oscilloscope collects data and display waveforms. Once the trigger is correctly set up, it can convert unstable display into significant waveforms. When beginning to collect data, the oscilloscope first collects sufficient data to draw a waveform on the left of the triggering point. While waiting for the triggering condition to occur, it will continuously collect data. When trigger is detected, the oscilloscope will

continuously collect sufficient data to draw a waveform on the right of the triggering point. The trigger control zone on the operation panel of your oscilloscope comprises a trigger level adjustment knob, a trigger menu button [MENU], [50%] for setting up the trigger level at the vertical centre point of the signal, and a compulsory trigger button [FORCE].

Trigger level : Trigger level sets the signal voltage with respect to the triggering point.

[50%] : Setting the trigger level at the vertical centre point of the trigger signal amplitude.

[FORCE] : To generate a compulsory trigger signal. Mainly used in the trigger mode and “Normal” and “Single” modes.

[MENU] : Button for the trigger setup menu.

Trigger Control

Trigger modes : edge, pulse, video and alternate.

Edge Trigger

When the edge of the trigger signal reaches a given level, trigger occurs.

Pulse Trigger

When the pulse width of the trigger signal reaches a preset trigger condition, trigger occurs.

Video Trigger

Carry out field or line trigger to standard video signals.

Alternate Trigger

Applicable to triggering signals without frequency coherence.

Below are notes for various trigger menus.

Edge Trigger

Edge trigger means triggering at the trigger threshold. When selecting “edge trigger”, you are triggering at the rising and falling edges of the input signal.

Table 2-7

Function Menu	Setup	Explanatory Note
Type	Edge	
Signal source selection	CH1	Set CH1 as the signal source trigger signal
	CH2	Set CH2 as the signal source trigger signal
	EXT	Set the external trigger input channel as the signal source trigger signal
	EXT/5	Set the external trigger source divided by 5 to extend the external trigger level range
	AC Line	Set up as AC line trigger
	Alternate	CH1, CH2 trigger their own signals alternately
Inclination	Rising	Set to trigger on the signal's rising edge
	Falling	Set to trigger on the signal's falling edge
	Rising/ Falling	Set to trigger on the signal's rising/falling edge

Function Menu	Setup	Explanatory Note
Type	Edge	
Trigger mode	Auto	Set to sample waveform only if no trigger condition is detected
	Normal	Set to sampling waveform only when trigger condition is met
	Single	Set to sample waveform once when detecting one trigger and then stop
Trigger coupling	AC	Intercept DC quantities of the input signal
	DC	Allow AC and DC quantities of the input signal to pass
	HF Suppression	Reject high frequency quantities above 80kHz of the signal
	LF Suppression	Reject low frequency quanti-ties below 80kHz of the signal

Pulse Trigger

Pulse trigger means determining the triggering time based on the trigger width. You can acquire abnormal pulse by setting the pulse width condition.

Table 2-8 (P. 1)

Function Menu	Setup	Explanatory Note
Type	Pulse	
Trigger source	CH1	Set CH1 as the signal source trigger signal
	CH2	Set CH2 as the signal source trigger signal
	EXT	Set the external trigger input channel as the signal source trigger signal
	EXT/5	Set the external trigger source divided by 5 to extend the external trigger level range
	AC Line	Set up as AC line trigger
	Alternate	CH1, CH2 trigger their own signals alternately
Pulse width condition	Larger	Trigger when pulse width is larger than default value
	Smaller	Trigger when pulse width is smaller than default value
	Equal	Trigger when pulse width equals to default value
Pulse setup		Set the pulse width at 20ns~10s and adjust by turning the multifunction control knob on
		the upper front panel
Next page1/2	--	Move to next page

Table 2-9 (P.2)

Function Menu	Setup	Explanatory Note
Type	Pulse	
Trigger polarity	Positive pulse width	Set positive pulse width as the trigger signal
	Negative pulse width	Set negative pulse width as the trigger signal
Trigger mode	Auto	The system automatically samples waveform data when there is no trigger signal input. The scan baseline is shown on the display. When the trigger signal is generated, it automatically turns to trigger scan.
	Normal	The system stops acquiring data when there is no trigger signal. When the trigger signal is generated, trigger scan occurs.
	Single	One trigger will occur when there is an input trigger signal. Then trigger will stop.

Function Menu	Setup	Explanatory Note
Type	Pulse	
Trigger coupling	DC	Allow AC and DC quantities of the trigger signal to pass.
	AC	Intercept DC quantities of the trigger signal.
	HF Suppression	Reject high frequency quantities and allow only low frequency quantities to pass.
	LF Suppression	Reject low frequency quantities and allow only high frequency quantities to pass.
Previous page2/2	--	Return to previous page

Video Trigger

By selecting video trigger, you can carry out field or line trigger with NTSC or PAL standard video signals. Default trigger coupling is DC. Trigger menus are as follows :

Table 2-10 Video trigger setup

Function Menu	Setup	Explanatory Note
Type	Video	
Trigger source	CH1	Set CH1 as the trigger signal
	CH2	Set CH2 as the trigger signal
	EXT	Set the external trigger input channel as the trigger signal
	EXT/5	Attenuate the external trigger source 5 times as the trigger signal
	AC line	Set AC line as the trigger signal
	Alternate	Set CH1 and CH2 as alternate trigger signals
Standard	PAL	Suitable for PAL video signals
	NTSC	Suitable for NTSC video signals
Synchronization	All lines	Set the TV line to synchronize with trigger Set synchronized trigger on
	Specified lines	the specified line and adjust by turning the multifunction control knob on the upper front panel
	Odd lines	Set the video odd field to synchronized trigger
	Even lines	Set the video even field to synchronized trigger

When PAL is selected for standard format and synchronization mode is line, you will see a screen display as shown in Figure 2-14. When synchronization mode is field, you will see a screen display as shown in Figure 2-15.

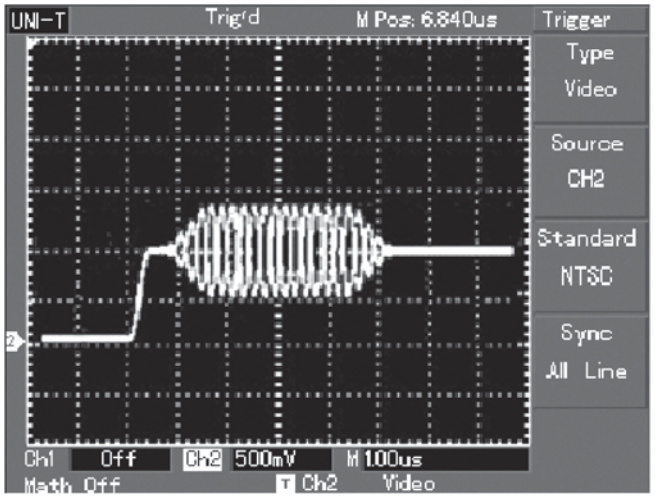

Figure 2-14 Video trigger : Line synchronization

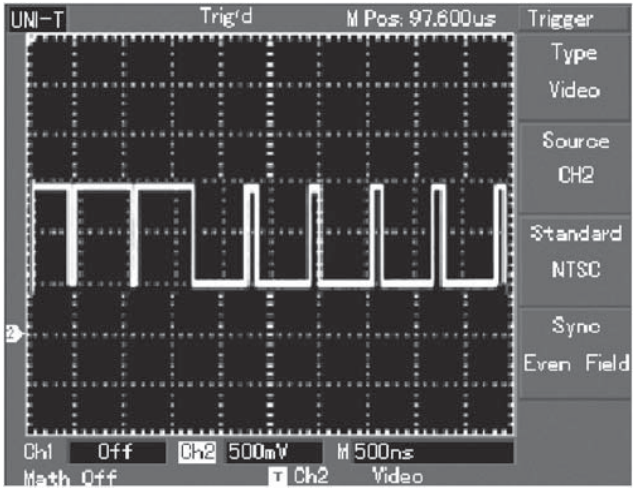

Figure 2-15 Video trigger : Field synchronization

Alternate Trigger

When alternate trigger is selected, the trigger signal will be present in two vertical channels. This triggering mode is suitable for observing two signals of unrelated signal frequencies. The figure below shows the alternate trigger waveform. Alternate trigger menu is listed in Table 2-11.

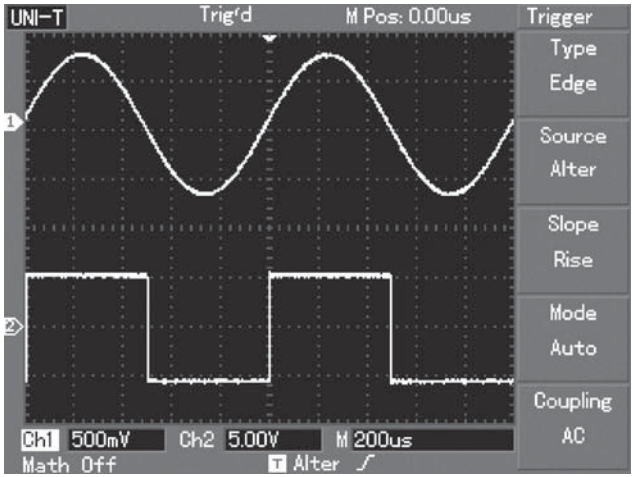

Figure 2-16 Observing two signals of different frequencies in the alternate trigger mode

Table 2-11

Function Menu	Setup	Explanatory Note
Type	Edge	Set trigger mode to edge
Trigger source	Alternate	Set CH1 and CH2 to alternate trigger
Inclination	Rising	Set trigger inclination as rising edge
Trigger mode	Auto	Set trigger mode to automatic
Trigger coupling	AC	Set trigger coupling mode to AC

“Alternate trigger” can also be used to compare pulse width.

Setup for Trigger coupling mode

Enter the trigger setup menu to set up the trigger coupling mode and achieve the most stable synchronization. The trigger coupling menus are as follows :

Table 2-12

Function Menu	Setup	Explanatory Note
Type	Edge	
Trigger source	Alternate	Set CH1 and CH2 to alternate trigger
Inclination	Rising	Set trigger inclination as rising edge
Trigger mode	Auto	Set trigger mode to automatic
Coupling	AC	Intercept DC quantities
	DC	Allow all quantities to pass
	HF Suppression	Intercept high frequency quantities of the signal, only allow low frequency quantities to pass
	LF Suppression	Intercept low frequency quantities of the signal, only allow high frequency quantities to pass

Adjusting the Holdoff Time

You can adjust the holdoff time to observe complicated waveforms (e.g. pulse string series). Holdoff time means the waiting time for the trigger circuit to be ready for use again when the oscilloscope is restarted. During this time the oscilloscope will not trigger until the holdoff is complete. For example, if you wish to trigger one group of pulse series at the first pulse, set the holdoff time to the pulse string width as shown in Figure 2-17. For holdoff menus please see the table below :

Function Menu	Setup	Explanatory Note
Main time base	--	1. Open the main time base. 2. If you press the main time base when window extension is on, window extension will close.
--		
Window extension	--	Open time base extension.
--		
Holdoff	--	Adjust holdoff time.

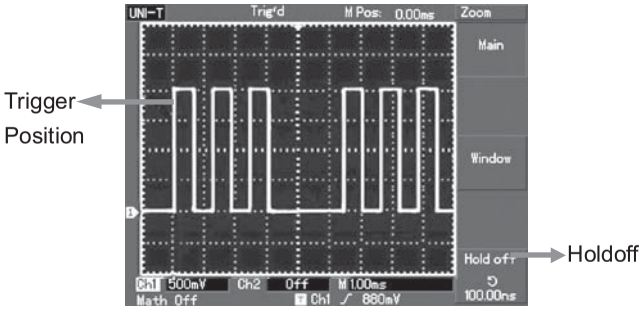

Figure 2-17 Use the holdoff function to synchronize complicated signals

Operation

1. Follow the normal signal synchronization procedure and select the edge, trigger source and inclination in the trigger MENU . Adjust the trigger level to make the waveform display as stable as possible.
2. Press the horizontal MENU key to display the horizontal menu.
3. Adjust the multi-function control knob in the upper front panel. The holdoff time will change accordingly until the waveform display is stable.

Definitions

1. **Trigger source :** Trigger can be obtained from various sources : Input channel (CH1, CH2), external trigger (EXT, EXT/5), AC line.

- **Input Channel :** The most common trigger source is input channel (choose either one). The selected trigger source can operate normally whether the input is displayed or not.
- **External Trigger :** This type of trigger source can trigger in a third channel while acquiring data in two other channels. For example, you can use an external clock or the signal from a circuit to be tested as the trigger source. Both EXT and EXT/5 trigger sources use external trigger signals from the EXT TRIG adaptor. EXT can use the signals directly. You can use EXT within the trigger level range of –3V and +3V.
  EXT/5 divide the trigger by 5. As a result, trigger range is extended to –15V to +15V, enabling the oscilloscope to trigger at a large signal.
- **AC Line :** It means the AC line power source. This trigger

suitable for observing signals related to the AC line - e.g. the correlation between lighting equipment and power source equipment - to achieve stable synchronization.

2. **Trigger mode :** Determine the action of your oscilloscope at no trigger. This oscilloscope offers three trigger modes for selection : auto, normal and single.

- **Auto Trigger :** The system will sample waveform data automatically when there is no trigger signal input. The scan baseline is shown on the display. When the trigger signal is generated, it automatically turns to trigger scan for signal synchronization.
  Note : When time base of the scan waveform is set to 50ms/div or slower, the “Auto” mode allows no trigger signal.
- **Normal Trigger :** In this mode, your oscilloscope samples wave forms only when triggering conditions are met. The system stops acquiring data and waits when there is no trigger signal. When the trigger signal is generated, trigger scan occurs.
- **Single Trigger :** In this mode, you only have to press the “Run” button once and the oscilloscope will wait for trigger. One sampling will occur and the acquited waveform will be displayed. Then trigger will stop.

3. **Trigger coupling :** Trigger coupling determines which quantities of the signal are transmitted to the trigger circuit. Coupling modes are DC, AC, low frequency suppression and high frequency suppression.

- **DC :** Allowing all quantities to pass.
- **AC :** Intercepting DC quantities and attenuating signals under 10Hz.
- **Low Frequency Suppression :** Intercepting DC quantities and attenuating low frequency quantities under 80kHz.
- **High Frequency Suppression :** Attenuating high frequency quantities over 80kHz.

4. Pretrigger/Delayed Trigger : Data sampled before/after triggering.

The trigger position is typically set at the horizontal center of the screen. In this case, you are able to view 5 divisions of pretrigger and delay information. By turning horizontally to adjust the horizontal displacement of the waveform, you can see more pretrigger information. By observing pretrigger data, you can see the waveform before trigger occurs. For example, you can detect the glitch that occurs when the circuitry starts. Observation and analysis of trigger data can help you identify the cause of glitch.

Setting up the Sampling System

As shown below, ACQUIRE button in the control zone is the function key for the sampling system.

Figure 2-18 Function key for the sampling system.

Press the ACQUIRE button to pop out the sampling setup menu. You can use this menu to adjust the sampling mode.

Table 2-14 Sampling menu

Function Menu	Setup	Explanatory Note
Acquisition mode	Sample	Turn on the ordinary sampling mode
	Peak detect	Turn on the peak detect mode
	Average	Set to average sampling and display the average number of times
Average number of times	2~256	Set the average number of times in multiples of 2, i.e. 2, 4, 8, 16, 32, 64, 128, 256. To change the average number of times, use the multi-function control knob on the left of figure 2-18.
Sampling mode	Real time	Set sampling to real time sampling
	Equivalent	Set sampling to equivalent sampling
Fast ACQ (Colour)	On	Acquire at a high screen refresh rate for more realistic reflection of
	Off	waveform status. Close the quick acquisition function.

By changing acquisition setup, you can observe the consequent changes in waveform display. If the signal contains considerable noise, you will see the following displays when average sampling is not selected and when 32-time average sampling is selected. For sampling waveform display please see Figure 2-19 and Figure 2-20.

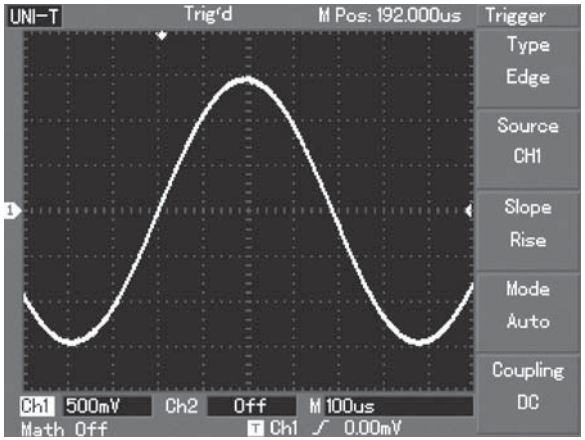

Figure 2-19 Waveform without average sampling

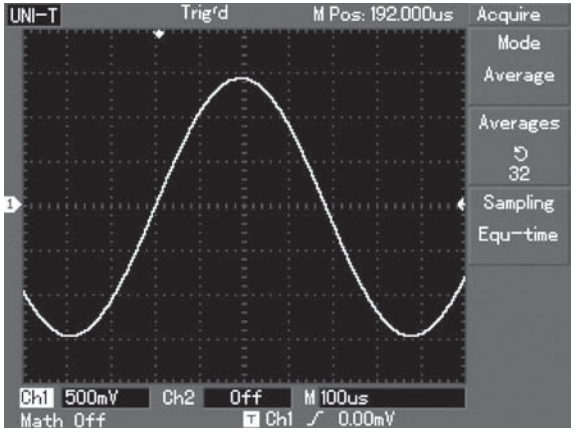

Figure 2-20 Waveform when 32-time average sampling is selected

Notes :

1. Use Real time sampling to observe single signals.
2. Use Equivalent sampling to observe high frequency cyclical signals.
3. To avoid mixed envelop, select Peak Detect. To reduce random noise of the displayed signal, select average sampling and increase the average number of times in multiples of 2, i.e selecting from 2 to 256.

Definitions :
Real time sampling : In this mode, the system makes full acquisition to fill the memory. Maximum sampling rate is 1GS/s.
Equivalent sampling : This is a repeated sampling mode that allows detailed observation of repeated cyclical signals. In the equivalent sampling mode, the horizontal pixel aspect ratio is 40ps higher than the real time mode, i.e. 25GS/s equivalent.
Sampling modes : Equivalent sampling and real-time sampling.
Peak detect mode : In this acquisition mode, the oscilloscope identifies the biggest and smallest values of the input signals at each sampling interval and use these values to display the waveform. In effect, the oscilloscope can acquire and display narrow pulse which would otherwise be omitted in the sampling mode. Noise seems to be more significant in this mode.
Average mode : The oscilloscope acquires several waveforms and take the average value to display the final waveform. You can use this mode to reduce random noise.

Setting up the Display System

As shown below, the DISPLAY button in the control zone is the function key for the display system.

Figure 2-21 Function key for the sampling system (display).

Press the DISPLAY button to pop out the setup menu shown below. You can use this menu to adjust the display mode.

Table 2-15 Display menu

Function Menu	Setup	Explanatory Note
Display type	Vector	Sampling points are linked for display
	dots	Sampling points are directly displayed
Format	YT	Operating mode of the oscilloscope
	XY	X-Y is the display mode; CH1 is X input, CH2 is Y input
Persist	Off	The waveform on the screen is refreshed at real time;
	Infinite	The original waveform on the screen remains on display. New data will be added continuously until this function is disabled.
Contrast	+, -	Setting the waveform contrast (mono display)
Wave Bright	1%-100%	Setting the waveform bright (Colour display)

Key points :

Display Type : Vector dots fill the space between adjacent sample points in the display Dots display only the sampling points.

Refresh Rate : Refresh rate is the number of times the digital storage oscilloscope refreshes the waveform display per second. The refreshing speed affects the capability to observe signal movements speedily.

Save and Recall

As shown below, the STORAGE button in the control zone is the function key for the storage system.

Figure 2-22 Function key for the sampling system (storage).

Press the STORAGE button to display the setup menu. You can use this menu to save waveforms or setup status of the oscilloscope in the internal memory or the USB key, and recall any stored waveform through RefA (or RefB), or press [STORAGE] to recall the setup status. When the USB key is inserted, you can store the oscilloscope's waveform display in bitmap format in the USB key under UT2000 (or UT3000). The bitmap can be read in a PC.

Operation steps :

Press STORAGE to go to the type menu. There are three types to choose from : waveform, setup and bitmap.

1. Select waveform to go to the waveform storage menu shown below (see Figure 2-16). A stored waveform can be recalled with the REF key as mentioned in Chapter 2 (see "Waveform", page 23). For specific steps please see REF operation steps.

Table 2-16 Waveform storage menu (page 1)

Function Menu	Setup	Explanatory Note
Type	Waveform	Select the waveform storage and recall menu
Signal source	CH1	Select a signal from CH1
	CH2	Select a signal from CH2
Storage position	1~20	Set and select the position in which the waveform is stored in the internal memory. Adjust by turning the multi-function control knob.
	1~200	Set up the waveform saving position at the USB drive (the feature can only be used after inserting USB and changing the disk menu to "USB")
Store	– –	Store the waveform.
Next page½	– –	Go to the next page

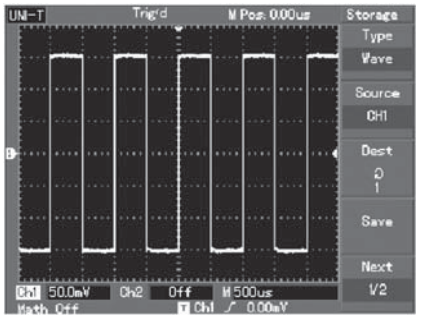

Figure 2-23 Storing the waveform

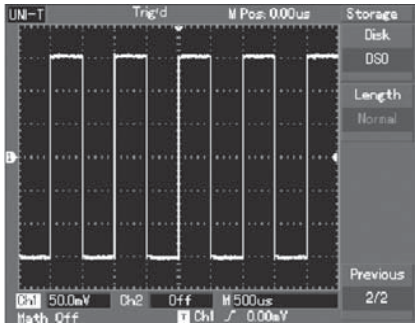

Figure 2-24 Storing a waveform in the USB

Table 2-17 Storage menu (page 2)

Function Menu	Setup	Explanatory Note
Disk	DSO	Select the internal memory of the oscilloscope
	USB	Select the external USB. (This function can only be used when the USB key is inserted)
Depth	Normal	Select normal storage depth (Data stored in the USB key can only be recalled in the REF zone)
	Long	Select long storage depth (Note : this function can only be activated when the USB key is inserted. Date stored in a USB key can only recalled with the waveform loading function of the UT2000E_3000E Series computer test and control software).
Previous page2/2	— —	Return to the previous page

2. Select setup to enter the setup storage menu. See Table 2-18.

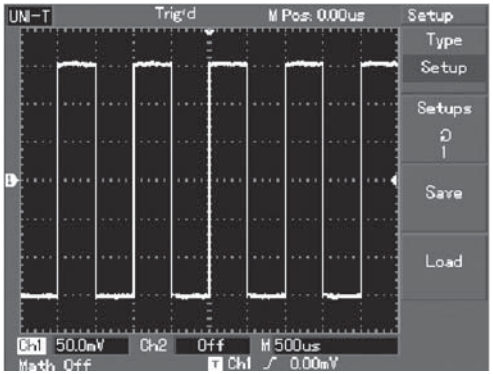

Figure 2-25 Setup storing

Table 2-18 Setting save menu

Function Menu	Setup	Explanatory Note
Setup		Select the front panel setup menu
Setup(Storage position)	1~20	Maximum 20 front panel setups can be stored. Select storage setup with the multifunction control knob on the front panel
Store		Store the setting
Recall		Recall the setting

3. Select bitmap to enter the bitmap storage menu. See Table 2-19.
Note : This function can be recalled and used only when the USB key is inserted.

Table 2-19 Bitmap storage menu

Function Menu	Setup	Explanatory Note
Bitmap		Select the bitmap menu
Storage position	1~200	Maximum 200 position data can be stored. Select with the multi-function control knob on the front panel
Store		Store the data

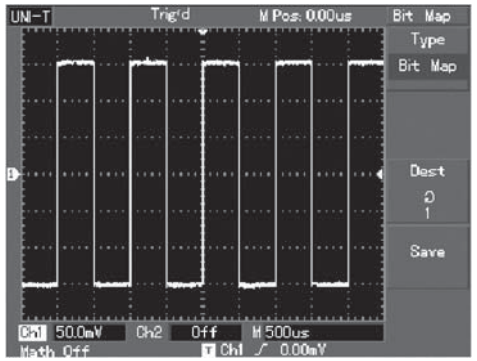

Figure 2-26 Bitmap storing

Setting up Alternative Functions

As shown below, the UTILITY button in the control zone is the function key for alternative functions.

Figure 2-27 Function key for the sampling system (function).

Press the UTILITY button to pop out the setup menu for alternative functions.

Table 2-20 (page 1)

Function Menu	Setup	Explanatory Note
Auto calibration	Run	Run auto calibration
	Cancel	Cancel auto calibration and return to the previous page
Pass check	See Table 2-23	Setup for waveform pass/fail
Recording waveform	See Table 2-22	Setup for recording the waveform
Language	Simplified Chinese Traditional Chinese English	Select the language interface
Next page1/3	--	Go to the next page

Table 2-21 (page 2)

Function Menu	Setup	Explanatory Note
Factory setup		Setting up factory setup recall
Skin	Design 1 Design 2 Design 3 Design 4	Setting up the interface designs. Two designs (mono display) / four designs (colour)
Grid Brightness (Colour)	1%-100%	Adjust mesh brightness with the multifunction control knob
Next page2/3	_ _	Return to previous page
Version	– –	Display the current oscilloscope system message
Cymometer	ON/OFF	open or close the function of cymometer
First page 3/3	– –	Go back to the first page

Table 2-22 Waveform record menu

Function Menu	Setup	Explanatory Note
source	CH1/CH2/ CH1+CH2	Select CH1, CH2 or CH1+CH2 as the recording signal source
Operation	Record	Record button. Press this button to record. The number of screens recorded is displayed at the bottom.
	RePlay	1. Playback button 2. When you press this button the system plays back and displays the number of the rewinding screen in the bottom right corner. By turning the multi-function control knob on the upper front panel now, you can suspend playback. Turn the knob further and you can select the waveform of a certain screen to be played back repeatedly. 3. If you wish to continue full playback, press F3 to stop and then press F2. 4. You can record as many as 1000 screens
	Stop	Stop recording

Function Menu	Setup	Explanatory Note
Operation	Return	Return to the previous menu.
Save	1-30	Save the last recorded waveforms,if there is U-disk pluged in the DSO. Adjust by turning the multi-function control knob.
Load	1-30	Load the recorded waveforms from the U-disk. Adjust by turning the multi-function control knob.
Return		Return to the previous menu.

Table 2-23 Pass check

Function Menu	Setup	Explanatory Note
Check status	On/Off	Waveform pass/fail numbers on/off
Signal source	CH1	Select CH1 as the checking signal source
	CH2	Select CH2 as the checking signal source
	MATH	Select MATH as the checking signal source
	RefA	Select RefA as the checking signal source
	RefB	Select RefB as the checking signal source
Output condition	Pass	Output during waveform pass check and a prompt is displayed
	Pass/Halt	Output during waveform pass check and then suspend
	Fail/Halt	Output during waveform fail check and then suspend
	Fail	Output during waveform fail check and a prompt is displayed
Module setup	See Table 2-24	Go to the template setup menu
Return	/	Return to the previous menu

Table 2-24 Template setup

Function Menu	Setup	Explanatory Note
Template output	/	Set the horizontal and vertical pass/fail tolerance ranges according to adjustment
Horizontal	1-200 pixel	Set the horizontal tolerance range
Vertical	1-100 pixel	Set the vertical tolerance range
Return	/	Return to the pass check menu

Important Points :

Auto Calibration :

You can correct measurement errors caused by environmental changes with the auto calibration function. This process can be run selectively when necessary. To make calibration more accurate, power on your oscilloscope and allow 20 minutes to warm up. Then press the UTILIITY button (help function) and follow on-screen instructions.

Choose your language :

Your UT2000E/3000E Series Digital Storage Oscilloscope can be operated in many languages.

To select a display language, press the UTILITY menu button and choose your desired language.

Automatic Measurement

As shown below, the MEASURE button is the function key for auto measurement. Read the following instructions to familiarize with all the powerful automatic measurement functions of your UT2000E/3000E Series Oscilloscope.

Figure 2-28 Function key for the sampling system (auto measurement).

Application Examples

The measurement menu of your oscilloscope is capable of measuring 28 waveform parameters.

Press MEASURE to enter the parameter measurement display menu which has 5 zones for simultaneous display of measurement values, assigned to function keys F1~F5 respectively. When selecting the measurement type of any zone, press the corresponding function key to enter the type option menu.

The measurement type option menu lets you choose voltage or time.

You can enter the voltage or time measurement by pressing F1~F5 for the corresponding type, and then return to the measurement display menu. You can also press F5 and select “ALL PARAMETERS” to show all measurement parameters of both voltage and time. Press F2 to select the channel (measurement is carried out only when the channel is enabled). If you do not wish to change the current measurement type, press F1 to return to the measurement parameter display menu.

Example 1 :
To display the measurement peak-to-peak value of CH2 in the F1 zone, follow the steps below :
1. Press F1 to enter the measurement type option menu.
2. Press F2 to select channel 2 (CH2).
3. Press F3 to select voltage.
4. Press F5 (1/4 next page) and you will see the peak-to-peak value at position F3.
5. Press F3 to select peak-to-peak value and then automatically return to the measurement parameter display menu.

On the first page of the measurement menu, peak-to-peak value is displayed in zone F1.

Example 2 :
Setup for delayed measurement. You can use the delayed measurement function to measure the time interval between the rising edge of two signal source, i.e. the time interval between the rising edge of the first cycle of a certain signal source and the rising edge of the first cycle of another signal source. Measure as follows :

1. In the measurement menu, as shown in the previous example, select the display zone for delayed measurement value (time type page 3/3).
2. Press F2 to enter the delay menu.
3. Select reference signal source : CH1, and then select the delay signal source : CH2.
4. Press F5 to confirm. The delayed measurement is now displayed in your specified zone.

Automatic measurement of voltage parameters

Your UT2000E/3000E Series Oscilloscope can automatically measure the following voltage parameters :
Peak-to-peak value (Vpp) : The voltage value from the highest point to lowest point of the waveform.
Maximum value (Vmax) : The voltage value from the highest point to ground (GND) of the waveform.

Minimum value (Vmin) : The voltage value from the lowest point to ground (GND) of the waveform.
Amplitude value (Vamp) : The voltage value from top to base of the waveform.
Middle(Vmid)：Half of the amplitude
Top value (Vtop) : The voltage value from the level top to ground (GND) of the waveform.
Base value (Vbase) : The voltage value from the level base to ground (GND) of the waveform.
Overshoot : The ratio value of the difference between maximum value and top value to the amplitude value.
Preshoot : The ratio value of the difference between minimum value and base value to the amplitude value.
Average value : Average amplitude of signals within 1 cycle.
Root mean square value (Vrms) : The effective value. Energy generated by AC signal conversion during 1 cycle with respect to the DC voltage that produces equivalent energy, i.e. root mean square value.

Automatic measurement of time parameters

Your UT2000E/3000E Series Oscilloscope can automatically measure the frequency, cycle, rising time, falling time, positive pulse width, negative pulse width, delay 1➔2(rising edge), delay 1➔2(falling edge), positive duty ratio, negative duty ratio and 10 time parameters. Definitions of these parameters are as follows :

Rise Time : The time taken by the waveform amplitude to rise from 10% to 90%.
Fall Time : The time taken by the waveform amplitude to fall from 90% to 10%.
Positive Pluse Width (+Width) : The pulse width when positive pulse is at 50% amplitude.
Negative Pluse Width (-Width) : The pulse width when negative pulse is at 50% amplitude.
Delay 1➔2 (Rising edge) : Delayed time of the rising edge of CH1, CH2.
Delay 1➔2 (Falling edge) : Delayed time of the falling edge of CH1, CH2.
Positive duty ratio (+Duty) : Ratio of positive pulse width to cycle.
Negative duty ratio (-Duty) : Ratio of negative pulse width to cycle.

Measurement menu

Operation :
Press MEASURE to display the zones for 5 measurement values. You can press any one of F1~F5 to enter the measurement option menu, as shown in Table 2-25.

Table 2-25

Function Menu	Setup	Explanatory Note
Return		Return to the parameter measurement display menu
Signal source	CH1	Select the channel for parameter measurement
	CH2	Select the channel for parameter measurement
Voltage type		Enter the voltage type parameter menu
Time type		Enter the time type parameter menu
All parameters		Display/close all measurement parameters

Voltage type menus are shown in Table 2-26 to Table 2-29.

Table 2-26

Function/Measurement	Explanatory Note
Return	Return to the menu shown in Table 2-25
Preshoot	Select to return to the parameter measurement display menu and replace the original parameter in that position
Amplitude	Ditto
Overshoot	Ditto
Next page(1/4)	Turn page

Table 2-27

Function/Measurement	Explanatory Note
Previous page	Return to the previous page
Average value	Select to return to the parameter measurement display menu and replace the original parameter in that position
Peak-to-peak value	Ditto
Root mean square value	Ditto
Next page(2/4)	Turn page

Table 2-28

Function/Measurement	Explanatory Note
Previous page	Return to the previous page
Top value	Select to return to the parameter measurement display menu and replace the original parameter in that position
Base value	Ditto
Mean value	Ditto
Next page(3/4)	Turn page

Table 2-29

Function/Measurement	Explanatory Note
Previous page	Return to the previous page
Maximum value	Select to return to the parameter measurement display menu and replace the original parameter in that position
Minimum value	Ditto
First page(4/4)	Return to page 1 (as shown in Table 2-26)

"Time Type" menus are shown in Table 2-30 to Table 2-32.

Table 2-30

Function/Measurement	Explanatory Note
Return	Return to the menu shown in Table 2-25
Frequency	Select to return to the parameter measurement display menu and replace the original parameter in that position
Period	Ditto
Rise	Ditto
Next page(1/3)	Turn page

Table 2-31

Function/Measurement	Explanatory Note
Previous page	Return to the previous page
Fall Time	Select to return to the parameter measurement display menu and replace the original parameter in that position
Positive pulse width	Ditto
Negative pulse width	Ditto
Next page(2/3)	Turn page

Table 2-32

Function/Measurement	Explanatory Note
Previous page	Return to the previous page
Delay	Select to return to the delay option menu (as shown in Table 2-32a)
Positive duty ratio	Select to return to the parameter measure-ment display menu and replace the original parameter in that position
Negative duty ratio	Ditto
First page(3/3)	Return to page 1 (as shown in Table 2-30)

Table 2-32a

Function Menu	Setup	Explanatory Note
Channel	CH1/CH2/MATH	Select the measurement channel
Channel	CH1/CH2/MATH	Select the reference channel
Confirm		Select to return to the parameter measurement display menu and replace the original parameter in that position

Cursor Measurement

Press CURSOR to display the measurement cursor and cursor menu, then adjust the cursor position by turning the multi-function control knob. As shown in the figure below, CURSOR in the control zone is the function key for cursor measurement.

Figure 2-29 Function key for the sampling system (cursor).

You can move the cursor to carry out measurement in the CURSOR mode. There are three modes to choose from : voltage, time and tracking. When measuring voltage, press SELECT and COARSE on the front panel. Positions of the two cursors can be adjusted with the multi-function control knob to measure ΔV. Likewise, by selecting time, you can measure ΔT. In the tracking mode and waveform display is on, you can see the cursor tracking the changing signal automatically.

1. Measuring voltage/time : Cursor 1 or cursor 2 will appear simultaneously. Adjust their positions on the screen with the multi-function control knob and select which cursor to adjust with the SELECT button. The displayed reading is the voltage or time value between the two cursors.
2. Tracking mode : Horizontal and vertical cursors cross to form a cross-shaped cursor. It automatically positions itself on the waveform. You can adjust the horizontal position of the cross cursor by turning the multi-function control knob. Your oscilloscope will also display the coordinate of the cursor point.
3. When the cursor function is enabled, measurement value is automatically displayed in the upper right hand corner.

Using the Run Button

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

Remark:

1) SELECT: select cursor
2) COARSE: adjust cursor speed

Figure 2-30 RUN/STOP button

Auto Setup :

As shown above, Auto Setup can simplify operation. Press AUTO and the oscilloscope can automatically adjust the coefficient of vertical deflection and range of horizontal time base according to the amplitude and frequency of the waveform, and ensure stable display of the waveform. When the oscilloscope is in auto setup mode, the system setup is as follows :

Table 2-33

Function Menu	Setup
Acquisition mode	Sampling
Display format	Set to YT
Horizontal position	Adjusted
SEC/DIV	Adjust according to signal frequency
Trigger coupling	AC
Holdoff	Minimum value
Trigger level	Set at 50%
Trigger mode	Auto
Trigger source	Set to CH1 but if there is no signal in CH1 and CH2 applies a signal, it will set to CH2
Trigger inclination	Rising
Trigger type	Edge
Vertical bandwidth	Full
VOLT/DIV	Adjust according to amplitude of the signal

RUN/STOP : 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.

Chapter 3 —— Practical Example Illustrations

Illustration 1 : Measuring simple signals

To observe and measure an unknown 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 to be measured.

③ Press [AUTO].

The oscilloscope will carry out auto setup to optimize 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-to-peak value.

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 measurement value are now displayed in positions [F1] and [F2] respectively.

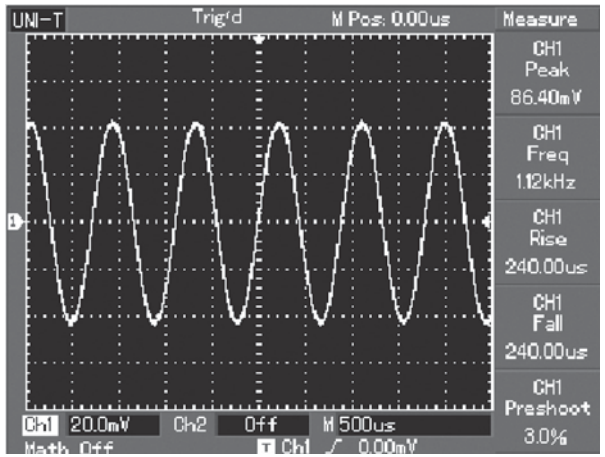

Figure 3-1 Automatic measurement

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

As in the previous illustration, 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 [CH1] to select CH1. Adjust vertical position of the CH1 waveform by turning the vertical position control knob.

④ Press [CH2] 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)

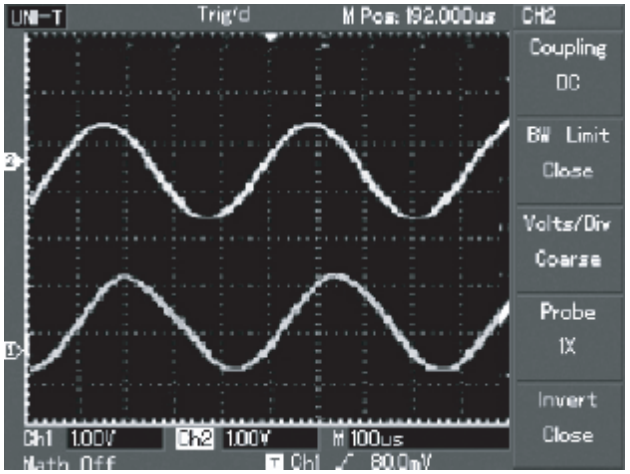

Figure 3-2 Waveform delay

Illustration 3 : Acquiring single signals

The advantage and special feature of digital storage oscilloscope lies 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 [MENU] in the trigger control zone to display the trigger setu menu.

② In this menu, use F1~F5 menus to 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 level.

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.

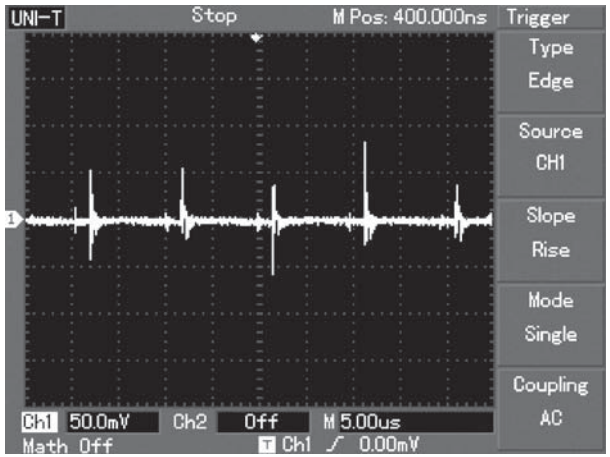

Figure 3-3 Single signal

Illustration 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)

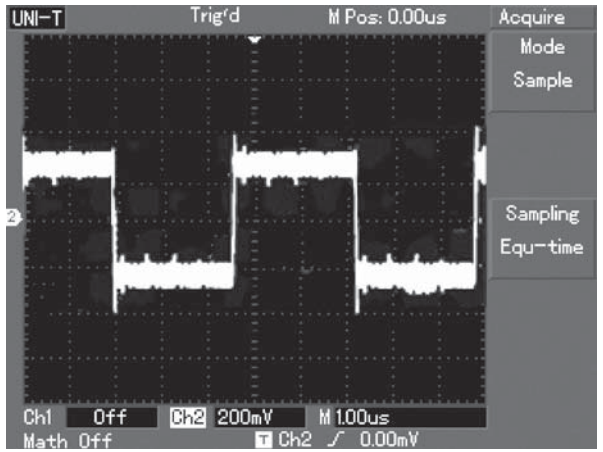

Figure 3-4 Reducing random noise of signals

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 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 MEAN, then press menu operation key F2 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)

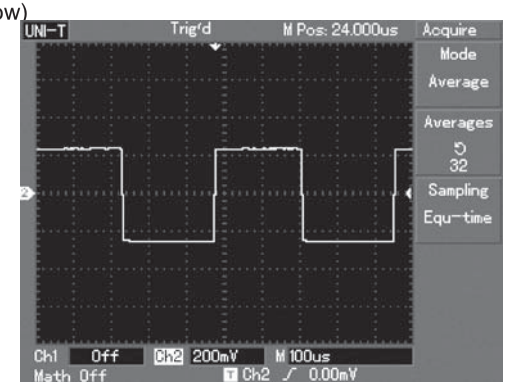

Figure 3-5 Signal noise suppressed

(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.

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

Measuring the frequency of Sinc first peak

To measure the Sinc frequency of the signal rising edge, follow the steps below :

1. Press CURSOR to display the cursor measurement menu.
2. Press menu operation key F1 to set cursor type to time.
3. Turn the multi-function control knob to set cursor 1 at the Sinc first peak.
4. Press SELECT to select the cursor, then turn the multi-function control knob again to set cursor 2 at the Sinc second peak.

The cursor menu will automatically display the 1/ΔT value, i.e. the frequency of that point. See the figure below.

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

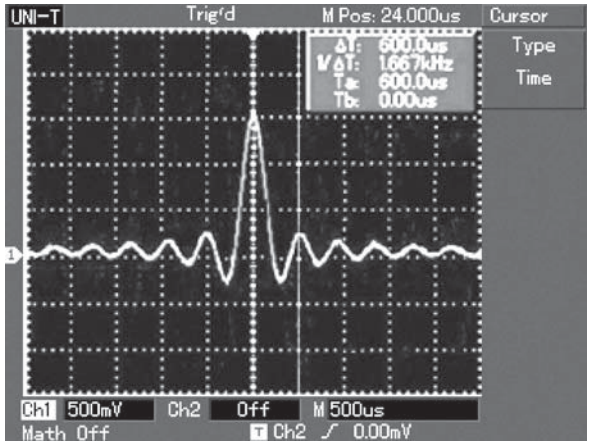

Figure 3-6 : Frequency of the cursor testing signal

Illustration 6 : Using the X-Y function

To check the phase difference between two channels.

Example : To measure the phase variation when a signal passes through the circuit, connect your oscilloscope to the circuit and monitor the input and output signals. To check the circuit's input and output in the X-Y coordinate mode, follow the steps below:

1. Set the attenuation factor of the probe to 10X. Set the switch of the probe to 10X.
2. Connect the CH1 probe to the input terminal of the network. Connect the CH2 probe to the output terminal of the network.
3. If the channel is not displayed, press the CH1 and CH2 menu button to enable the two channels.
4. Press AUTO.
5. Adjust the vertical SCALE knob to make the displayed amplitude of the two channels to about equal.
6. Press the DISPLAY menu key to recall the display menu.
7. Press F2 to select X-Y. The oscilloscope will display the circuit's input and output characteristics in a Lissajous figure.
8. Adjust the vertical scale and vertical position knob to achieve the best result of waveform.
9. Using the elliptic oscilloscope display graph to observe, measure and calculate the phase difference. (see the figure below)

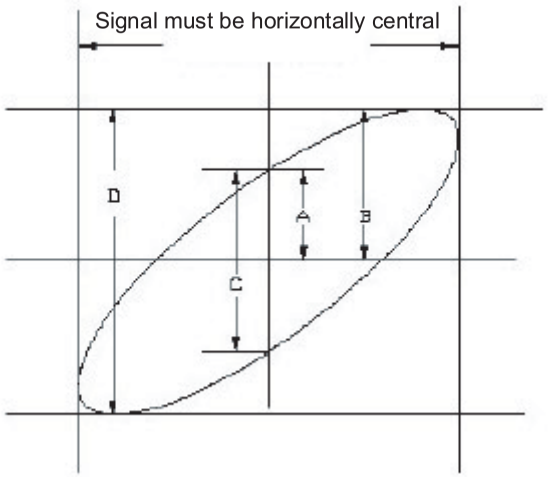

Figure 3-7

If $\sin\theta = \frac{A}{B}$ or $\frac{C}{D}$

θ is the angle of disparity between the channels. For definitions of A,B,C,D see the above figure. Calculating with this formula, the angle of disparity is

$\theta = \pm\arcsin(\frac{A}{B})$ or $\theta = \pm\arcsin(\frac{C}{D})$.

If the elliptic main axis is within quadrants I and III, the angle of disparity should be within quadrants I and IV, i.e. inside (0~π) or ($\frac{3\pi}{2}$ ~ $\frac{2\pi}{2}$).

If the main axis is within quadrants II and IV, the angle of disparity should be within quadrants II and III, i.e. inside ($\frac{\pi}{2}$ ~ π) or (π ~ $\frac{3\pi}{2}$).

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

10. X-Y Phase difference table :

Signals'frequency ratio	Phase difference					
	0 degree	45 degree	90 degree	180 degree	270 degree	360 degree
1:1						

Illustration 7 : Video signal triggering

To observe a video signal, use the video trigger function to obtain a stable display of video output signal.

Video field triggering

To trigger in the video field, follow the steps below :

1. Press MENU in the trigger control zone to display the trigger menu.
2. Press menu operation key F1 to set the type to video.
3. Press menu operation key F2 to set trigger source to CH2.
4. Press menu operation key F3 to select PAL as the video standard.
5. Press menu operation key F4 to select odd field or even field synchronization.
6. Turn the SCALE knob in the horizontal control zone to adjust horizontal time base for a clear waveform display.

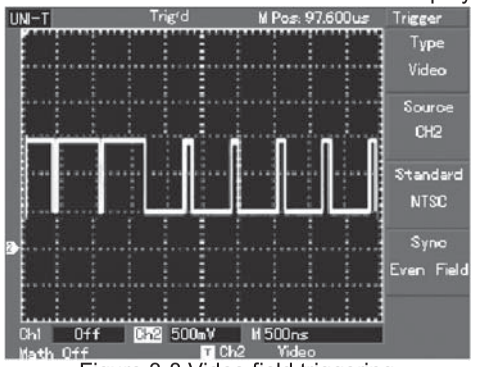

Figure 3-8 Video field triggering

Video line triggering

To trigger on the video line, follow the steps below :

1. Press trigger MENU button in the trigger control zone to display the trigger menu.
2. Press menu operation key F1 to set the type to video.
3. Press menu operation key F2 to set trigger source to CH2.
4. Press menu operation key F3 to select PAL as the video standard.
5. Press menu operation key F4 to select line synchronization.
6. Use the multi-function control knob to select triggering on any line.
7. Turn the horizontal SCALE knob in the horizontal control zone to adjust horizontal time base for a clear waveform display.

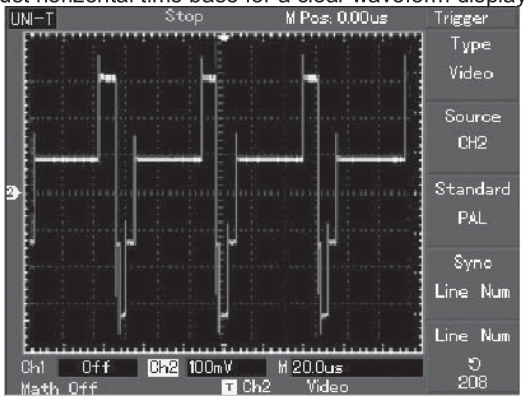

Figure 3-9 Video line triggering

Illustration 8 : Pass/fail check

To check whether the input signal is within the standard range. Fail means outside the range and pass means within range. You can also output the pass/fail signal through the output terminal.

1. Press UTILITY then F2 to enter the pass/fail menu.
2. To set the signal source : Enter the pass/fail menu and press F2 for setup.
3. Template setup : Press F4 to enter the template setup menu (TEMPLATE). In the Template menu press F2 and F3 then set the horizontal and vertical tolerance ranges with the multifunction control knob (i.e. horizontal 1-200 pixel; vertical 1-100 pixel). Then press F1 and lastly press F4 to return to the pass/fail menu.
4. Set the output condition : In the pass/fail menu, press F3 to set the output condition.
5. Begin checking : In the pass/fail menu, press F1 to enable check.

Illustration 9 : Using the USB upgrade programme

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

1. Download the required update programme document online and store it in the USB key (preferably a USB key recommended by us).
2. Power off the oscilloscope then insert the USB key. Then power on the oscilloscope again.
3. If there is only one programme document in the USB key, the screen will ask for confirmation for moving to the update interface. Press F5 to update. To exit the update

If there are two or more programme documents are stored, an interface will appear for you to select one. Selection the programme document that requires update with the multifunction control knob, then press F5 to confirm (press F1 to quit the update operation). The screen will ask for confirmation for moving to the update interface. Press F5 to update.

4. When update is complete a successful prompt will appear. Power off your oscilloscope then power it back on again to complete the process.

Notes :

1. Updating may take several minutes. Please wait patiently.
2. While updating is in progress, do not shut off the oscilloscope or remove the USB key as it would lead to upgrade failure or unexpected errors.
3. If update fails, power off the oscilloscope then turn it back on again. Then retry.

Chapter 4 ——System Prompts and Trouble-shooting

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 ON/OFF, time base ON/OFF, X shift, vertical shift and trigger level adjustments have reached their ultimate limits, this prompt will appear.

USB Drive Connected : After a USB key is plugged into the oscilloscope, this prompt appears when the connection is valid.

USB Drive Disconnected : 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 : When recalling a waveform, this prompt is shown on the screen. A progress bar appears at the bottom.

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 power on, 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 probe is connected properly to the object for measurement.
④ Check whether the object for measurement is generating signals (connect the channel with signals to the questionable channel to find the cause).
⑤ 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 chose.

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 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 level to the centre or set trigger mode to AUTO.
② Press [AUTO] to complete the setup.
6. Display speed is slower after average sampling time is enabled :
① If average sampling is carried out for more than 32 times, the display speed will drop. This is normal.
② You can reduce the intervals of average sampling.

7. Trapezoidal waveform display :
① This is normal. The reason is possibly horizontal time base range is too low. You can improve horizontal pixel aspect ratio and enhance the display quality by increasing the horizontal time base.
② If the display type is vector, the connection between sampling dots may cause a trapezoidal waveform. Set the display type to dot to solve this problem.

Chapter 5 —Service and Support

Warranty (UT2000E/3000E Series Digital Storage Oscilloscopes)

UNI-T (Uni-Trend Electronic (Shanghai) Limited) warrants that product produced and marketed by it will be free from defects in materials and workmanship for a period of three (3) 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 in exchange according to detailed provisions 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.

Contact Us

If you encounter any inconvenience in using this product, contact Uni-Trend Electronic (Shanghai) Limited in China directly.
Office hours : 8:00am – 5:30pm Beijing Time Monday to Friday.

Alternatively, email us at infosh@uni-trend.com.cn.

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.cn

Chapter 6 — Appendixes

Appendix A : Technical Indicators

Unless otherwise specified, all technical specifications apply to probes with a attenuation setting of 10x and the UT2000E/3000E Series Digital Oscilloscopes. To verify that your oscilloscope meets specifications, it must first meet the following conditions :

- The oscilloscope must have been operating continuously for thirty minutes within the specified operating temperature.
- If the operating temperature changes by more than 5 °C, you must perform the Self Cal operation, accessible through the System Functions menu.

All specifications are guaranteed unless noted “typical”.

Technical Indicators

Acquisition		
Acquisition modes	Real time	equivalent
Acquisition rates	1GS/s	25GS/s
Average	When all channels have made N acquisitions simultaneously, N is selectable from 2, 4, 8, 16, 32, 64, 128 and 256.	

Input	
Input coupling	DC, AC, GND
Input impedance	1±2% MΩ in parallel with 24±3PF
Probe attenuation	1X, 10X, 100X, 1000X
Maximum input voltage	400V (DC + AC Peak, 1 MΩ input impedance)
Time delay between channels (Typical)	150ps

Horizontal	
Waveform interpolation	Sin (x) / x
Recording length	2 x 512K sampling dot
Saving depth	25K for single channel; 12.5K for dual channels
Scanning range (s/div)	2ns/div-50s/div (200MHz, 150MHz);5ns/div-50s/div (100MHz, 80MHz, 60MHz, 40MHz);At 1-2-5 increment
Accuracy of sampling rate and delay time	±50ppm (any time interval ≥1ms)
Time interval (ΔT) measurement accuracy (full bandwidth)	Single : ± (1 sampling time interval + 50ppm x reading + 0.6ns);> 16 average values : ± (1 sampling time interval + 50ppm x reading + 0.4ns)

Vertical	
A/D converter	8-bit resolution, two channels sampled simultaneously
Deflection factor VOLTS/DIV Range	2 mV/div ~ 5 V/div at input BNC
Position range	≥ ± 10 div
Analog bandwidth	200MHz, 150MHz, 100MHz, 60MHz, 40MHz
Single bandwidth	200MHz, 150MHz, 100MHz, 60MHz, 40MHz
Selectable analog bandwidth limit (Typical)	20MHz
Low frequency response (AC coupling, -3dB)	≤ 10 Hz at BNC
Rise time (at BNC, typical)	≤1.8ns,≤2.3ns,≤3.5ns,≤5.8ns,≤8.7ns at 200MHz, 150MHz, 100MHz, 60MHz and 40MHz bandwidths respectively.
DC gain accuracy	When vertical sensitivity is 2mV/div, 5mV/div : ±4% (sample or average acquisition mode);When vertical sensitivity is 10mV/div~5V/div : ±3% (sample or average acquisition mode).
DC measurement accuracy (average acquisition mode)	When vertical position is zero and N ≥16 : ± (4% x reading + 0.1 div + 1mV) and 2mV/div or 5mV/div is selected;± (3% x reading + 0.1 div + 1mV) and 10mV/div~ 5V/div is selected.When vertical position is not zero and N ≥16 :± (3% x(reading + vertical shift reading) + (1% x vertical shift reading)] + 0.2div). Set from 2mV/div to 200mV/div plus 2mV;Setup value > 200mV/div to 5V/div plus 50mV.
Voltage difference (ΔV) measurement accuracy (average acquisition mode)	Under identical setup and environmental conditions, the voltage difference (ΔV) between two points of the waveform after the average of ≥16 waveforms acquired waveforms is taken : ± (3% + reading + 0.05 div)

Trigger		
Trigger sensitivity	≤1 div	
Trigger level range	Internal	± 5 div from the centre of the screen
	EXT	± 3V
	EXT/5	± 15V
Trigger level accuracy (Typical) applied on signals of ≥20ns rise or fall time	Internal	± (0.3 div x V/div) (within ± 4 div from the centre of the screen)
	EXT	± (6% default value + 40mV)
	EXT/5	±(6% default value + 200mV)
Trigger capability	Normal mode/scanning mode, pretrigger/delayed trigger. Pretrigger depth is adjustable.	
Holdoff range	100ns – 1.5s	
Set level to 50% (Typical)	Input signal frequency ≥50Hz	
Edge Trigger		
Edge type	Rise, Fall	
Pulse Trigger		
Trigger mode	(Less than, greater than, or equal) positive pulse; (Less than, greater than, or equal) negative pulse.	
Pulse width	20ns – 10s	
Video Trigger		
Trigger sensitivity (video trigger, Typical)	Internal	2 div peak-to-peak
	EXT	400mV
	EXT/5	2V

Signal format and line/field frequency (video trigger type)	Supports standard NTSC and PAL Line range : 1-525 (NTSC), 1-625 (PAL)
Alternate Trigger	
CH1 Trigger	Edge, pulse, video
CH2 Trigger	Edge, pulse, video

Measurement

Cursor : Manual mode : Voltage difference (ΔV) between cursors, time difference (ΔT) between cursors, ΔT countdown (Hz) (1/ΔT). Tracking mode : Voltage and time of waveform dots. Automatic measurement mode: Allows cursor display during automatic measurement
Automatic measurement : Measuring peak-to-peak, amplitude, maximum, minimum, top, bottom, mean, average, root mean square value, overshoot, preshoot, frequency, cycle, rise time, fall time, positive pulse, negative pulse, positive duty ratio, negative duty ratio, delay 1->2 ↑, and delay 1->2 ↓.
Math functions : + ,-, x, ÷
Saving waveforms : 10 groups and 10 setups
FFT : Window : Hanning, Hamming, Blackman, Rectangle Acquisition points : 1024 points
Lissajous figure : Phase difference : ± 3 degrees

General Specifications

Display	
Display Type	145 mm(5.7 inch) diagonal LCD
Display Resolution	320 horizontal by RGB by 240 vertical pixels (Colour) 320 horizontal by 240 vertical pixels (Mono-)
Display Colour	Colour (UT2##2CE, UT3##2CE) Mono- (UT2##2BE, UT3##2BE)
Contrast (typical)	Adjustable (Mono-)
Waveform brightness	Adjustable (Colour)
Backlight Intensity (Typical)	300 nit
Display Languages	Simplified Chinese, Traditional Chinese, English

Probe Compensator Output

Output Voltage (Typical)	about 3V into peak-to-peak ≥ 1 MΩ load
Frequency (Typical)	1 kHz

Interface Functions

Standard setup	1 x USB (D), 1 x USB (H)
Optional	UT2000E Series: LAN; UT3000E Series: GPIB and LAN

Power Source	
Source Voltage	100 - 240 VACRMS, 45-440Hz, CAT IIPower
Consumption	Less than 30 VA
Fuse	F1.6AL, 250 V UT2000E series fuse is on the power board inside the unit UT3000E series fuse is inside the power plug

Environmental	
Temperature	Operating : 0°C to +40°C Non-operating : -20 °C to +60°C
Cooling Method	Forced fan cooling
Humidity	+10°C to +30°C (≤ 95% ±5% RH); +30°C to +40°C (≤ 75% ±5% RH) +10°C to +30°C (≤ 95% ±5% RH); +30°C to +40°C (≤ 75% ±5% RH)
Altitude	Operating under 3,000 m Non-operating : under 15,000 m

Mechanical Specifications			
		UT2000E	UT3000E
Dimension	Width :	320 mm	320mm
	Height :	150 mm	150mm
	Depth :	130mm	292mm
Weight	Unit only:	2.5 kg	4.9 kg
	Including package	4.0kg	6.8kg

Adjust the frequency We recommend setting a one-year frequency

Appendix B : Accessories for UT2000E/3000E Oscilloscopes

Standard Accessories

- Two 1.5m, 1:1 (10:1) passive voltage probes. For details please read the probe manual. EN61010-031: 2002 standard.
  Rating is 150V CAT II when the switch is in the 1X position;
  Rating is 300V CAT II when the switch is in the 10X position.
- One international standard power cord.
- One User Manual
- UT2000E/UT3000E remote control software (USB-Device)
- USB cable: UT-D06

Optional Accessories

- UT2000E LAN module : UT-M01
- UT3000E LAN module : UT-M05
- UT3000E GPIB module : UT-M02

All accessories (standard and optional) are available by order at your local UNI-T dealers.

Appendix C : Maintenance and Cleaning

General Care

Do not store or leave the oscilloscope where the LCD display will be exposed to direct sunlight for long periods of time.
Caution: To avoid damage to the oscilloscope or probes, do not expose them to sprays, liquids, or solvents.

Cleaning

Inspect the oscilloscope and probes as often as operating

conditions require. To clean the exterior surface, perform the following steps :

1. Remove loose dust on the outside of the oscilloscope and probes with a soft cloth. Use care to avoid scratching the clear protection film of the LCD.
2. Use a dampened but not dripping soft cloth to clean the oscilloscope. Remember to disconnect power. Use a cleaner or water. To avoid damaging the product or probe, do not use abrasive chemical cleaner.

Warning : To avoid short circuit or personal injury due to the presence of moisture, please ensure the product is completely dry before reconnecting power for operation.

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This user manual may be revised without prior notice.

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