# UNI-T®

# UTD4000 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 anti-pollution safety standards. To prevent personal injuries and damage of this unit or any other devices connected to it, please take note of the following safety precautions. To avoid potential hazards, use this unit strictly as instructed by this Operating Manual.

**Maintenance should only be carried out by a trained professional.**

**To avoid fire and personal injury :**

**Use a correct power cable :** Use only the 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 and check the rated values before connecting the unit.

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**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 humid condition.**

**Do not operate in combustible and explosive conditions.**

**Keep the product surface clean and dry.**

# Safety Messages 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 unit or other properties.

**Messages on the product :** The following messages may appear on the product :

"Danger" means potential damage that is immediate.

"Danger" means potential damage that is immediate.

"Warning" means potential damage that is not immediate.

"Caution" 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
ground terminal



Ground terminal
for chassis



Ground terminal
for testing

# Preface

This manual provides information on the operation of the UTD4000 digital storage oscilloscope series. G-uidance is given in several chapters as follows :

**Chapter 1** — **User Guide :** Simple guide to oscilloscope functions and installation.

**Chapter 2** — **Instrument Setups :** Guide to operation of the UTD4000 digital storage oscilloscope series.

**Chapter 3** — **Practical Illustrations :** Example illustrations are pro vided 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 UTD4000 Oscilloscopes**

**Appendix C :** **Maintenance and Cleaning**

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# UTD4000 Introduction

UTD4000 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 7 models of this digital storage oscilloscope series :

| Model | Bandwidth | Single Channel Sampling Rate | Dual Channel Sampling Rate | Equivalent Sampling Rate |
|---------|-----------|------------------------------|----------------------------|--------------------------|
| UTD4042C | 40MHz | 2GS/s | 1GS/s | —— |
| UTD4062C | 60MHz | 2GS/s | 1GS/s | —— |
| UTD4082C | 80MHz | 2GS/s | 1GS/s | —— |
| UTD4102C | 100MHz | 2GS/s | 1GS/s | —— |
| UTD4152C | 150MHz | 2GS/s | 1GS/s | 50GS/s |
| UTD4202C | 200MHz | 2GS/s | 1GS/s | 50GS/s |
| UTD4302C | 300MHz | 2GS/s | 1GS/s | 50GS/s |

UTD4000 oscilloscopes offer a 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 controls 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.)

The performance features listed below will explain why UTD4000 series can fully satisfy your testing and measurement requirements :

● 2GS/s real-time sampling rate (dual channel 1GS/s, single channel 2GS/sand 50GS/s equivalent sampling rate (UTD4152C/UTD4202C/UTD4302C)

● Dual time base function; unrivaled waveform detail observation and analysis capabilities

● 24k storage depth; 60M equivalent storage depth; 1024k recording length

● 16-channel logic analyzer; 3½ digital multimeter

● Unique envelop sampling feature with direct visual display of carrier wave details after amplitude modulation

● Quick waveform acquisition and colour change function that visually describes the strength of waveform

● Scroll display in scan mode for continuous monitoring of signal variations

● HD colour LCD system at 320 x 240 pixel aspect ratio

● Unique XY mode that displays the waveform and Lissajous figure

● USB drive system software upgrade

● Supports plug-and-play USB storage devices and capable of communicating with a computer

through the USB storage device

- Automatic waveform and status configuration
- Storage of waveforms, setup and bit map; waveforms and setups reproduction
- Automatic measurement of 27 waveform parameters; parameters testing and customization
- 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, slew rate and alternate trigger functions
- Visual system help messages

**UTD4000 accessories :**

- 2 x 1.2m, 1:1/10:1 probe. For details refer to the probe instructions. These accessories conform with EN61010-031: 2008 standards
- Power line conforming to international standards applicable in the country of use
- Operating Manual
- Product Warranty Card
- USB connecting cable : UT-D06
- UTD4000 communication control software (USB-DEVICE)
- 2 x multimeter pen; 2 x current-to-voltage converter module;UT-M03/UT-M04
- UTD4000 logic analyzer probe (including clamps and cable, flex cable) : UT-U01

# Chapter 1－User Guide

UTD4000 Series digital storage oscilloscopes are small and compact portable 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 UTD4000 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 UTD4000 series digital storage oscilloscope as quickly as possible.

Your UTD4000 oscilloscope 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 UTD4000 Oscilloscopes



Multifunction control knob

Frequently used menus

Operation control

Trigger control
Horizontal control
Vertical control

probe compensation signal input

Power switch

USB Host interface

Multimenter input port

Signal input

external trigger input
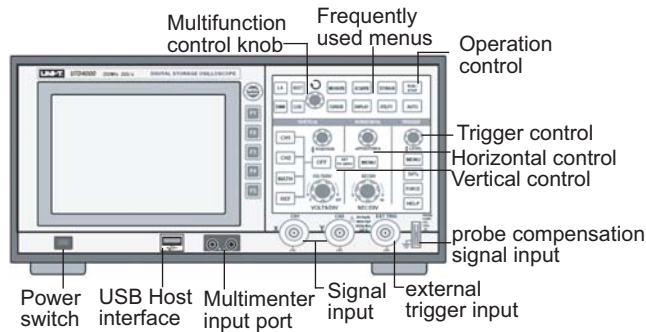
Figure 1-2  Schematic diagram for operating the UTD4000 front panel



Trigger status display

Horizontal trigger position

Frequency of the triggered signal

Channel 1 vertical reference

The menu may vary with individual function keys

Waveform display window

Main time base setup

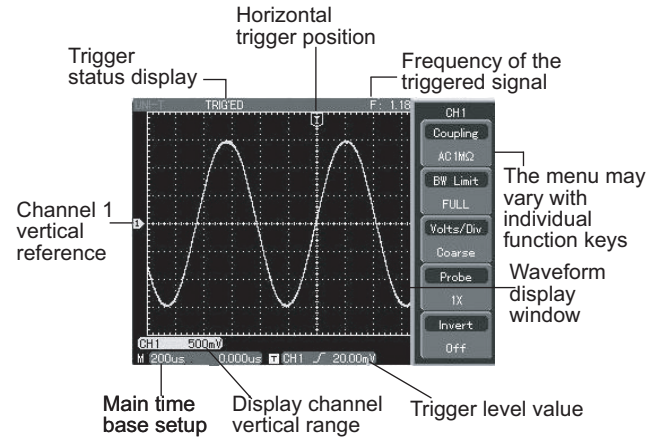Display channel vertical range

Trigger level value

Figure 1-3  Schematic diagram for the display interface

**General Inspection**

We suggest checking your new UTD4000 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, do not discard until you have carried out an electrical and mechanical check and found the product and accessories performing satisfactorily.

**2. Check the accessories**
A checklist of accessories that come with your UTD4000 oscilloscope is provided in the section "UTD4000 Accessories" of this operating manual. 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 not operating normally, or it fails to pass the performance test, please contact your UNI-T dealer or our local office.

**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, start the self calibration process by pressing the [UTILITY] button (utility function) once and [F1] twice. Then press [SELECT] to run.

To go to the next page press [UTILITY], [F1], THEN [F5]. To run the factory default setup, press[F1] then [SELECT], as shown in Figure 1-4.

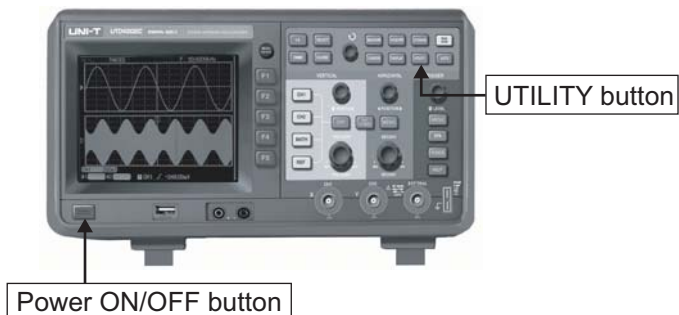When the above procedure is complete, press [CH1] to enter the CH1 menu.

UTILITY button

Power ON/OFF button

Figure 1-4



Figure 1-5  Setting the attenuation switch

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

**2. Accessing signals**

Your UTD4000 oscilloscope has 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).
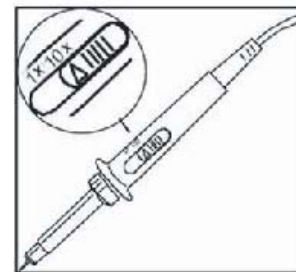
(2)  You have to set the probe attenuation factor of the oscilloscope. This factor changes the vertical range multiple to ensure the measurement result correctly reflects the amplitude of the signal being tested. Set the attenuation factor of the probe as follows : Press [F4] then [F2] to display 10X on the menu.
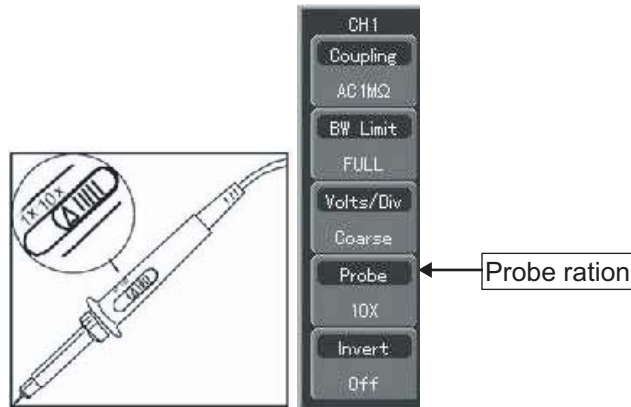
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Figure 1-6      Setting the probe
deflection factor of the oscilloscope

(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 (about 3V peak-to-peak at 1kHz) in a few seconds, as shown in Figure 1-7.

(4)   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.
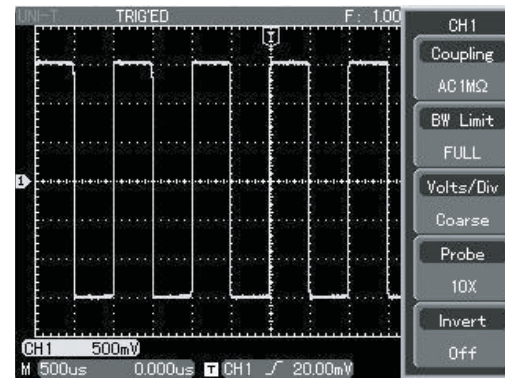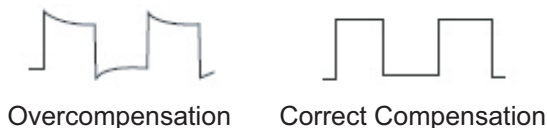


Figure 1-7        Probe compensation signal

**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 :

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1.  In the CH1 menu set the probe to 10X. Move the switch on the probe to 10X and connect the probe to CH1. Connect the probe tip to the probe compensator's signal output connector, then connect the ground clamp to the ground wire connector 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 adjustable tab inside the adjustment hole at the tip of the probe with the adjusting rod in the probe accessory pack, until a "Correct Compensation" waveform shown in Figure 1-8 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 connected to HV power.

**Automatic Setups for Waveform Display**

Your UTD4000 oscilloscope features an autoset function. It 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 tested 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 auto-set 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.
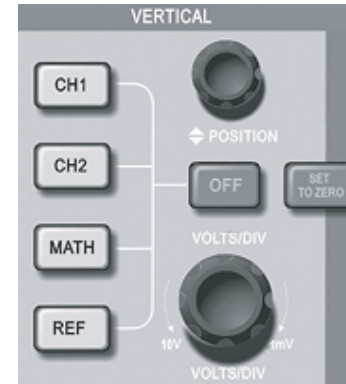


Figure 1-9        Vertical controls

1. Turn the vertical position knob [POSITION] to enable the waveform 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 vertical reference of the [GROUND] channel will move up and down with the waveform.

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**Measurement Tips**

If the channel coupling is DC, you can test the signal's DC quickly by checking the difference between the waveform and signal ground.

In the case of AC coupling, the DC within the signal will be intercepted. In this coupling mode you can display the AC 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 VOLTS/DIV knob to change the vertical VOLT/DIV range. You will find that the range in the

current status column changes accordingly. Press [CH1], [CH2], [MATH] or [REF] and the screen will show the operation menu, icon, waveform and range status information of the corresponding channel. Press [OFF] to close the selected channel.

**Getting to Know the Horizontal System**

Horizontal controls are shown in the figure below. The following steps will get you familiar with horizontal time base setups.



Figure 1-10      Horizontal controls

1. Use the horizontal SEC/DIV knob to change the horizontal time base setup. Turn the horizontal SEC/DIV knob to change the SEC/DIV time base range. You will find that the time base range in the current status column of the corresponding channel changes accordingly. Range of horizontal scanning rate is 5ns~50s/div (UTD4102C), in steps of 1-2-5.

      * Note : Minimum time base range of the UTD4000 Series varies from model to model.

2. Use the horizontal [POSITION] knob to adjust the horizontal position of the signal in the waveform window. When the horizontal [POSITION] knob is turned, you can see that the waveform moves horizontally with the knob.

3. Press [MENU] to display the ZOOM and dual time base menu. In this menu press [F1] to activate window expansion. Then press [F1] again to quit window expansion and return to the main window. To access dual time base setup, press [F3]. You can also set the holdoff time with the multifunction control knob [↻].

Shortcut key for resetting the trigger point shift to horizontal zero position
When trigger point has moved from the horizontal centre point considerably by way of horizontal shift, pressing the shortcut key [SET TO ZERO] can quickly reset the trigger point to the vertical centre point. You can also turn the knob to make adjustments.

**Definition**
**Trigger point**  means the actual trigger point relative to the centre point of the storage device. When it is at the horizontal centre point, it is also at the centre point of the storage device. By turning the horizontal knob, you can move the trigger point horizontally.
**Holdoff**  means the time interval until the trigger circuit is next reactivated. Turn the multifunction control knob to set the holdoff time. By adjusting the holdoff time, you can observe combination or complex signals more effectively.

**Getting to Know the Trigger System**

Trigger controls are shown in the figure 1-11. The following steps will get you familiar with trigger setups.

1.  Use the trigger level knob to change the trigger level. The trigger level line on the screen will move up and down with the knob. While you move the trigger level, you will find the trigger level value at the bottom of the screen changing accordingly.

2.  Open the [TRIGGER MENU] (see Figure 1-12) to change trigger setups. General setups are as follows :

Press [F1] twice to select the edge as [TRIGGER TYPE].

Press [F2] to select CH1 as [TRIGGER SOURCE] (Select with the multifunction control knob then press [SELECT] to confirm).

Press [F3] then [F1] to set [TRIGGER COUPLING] as DC.

Press [F4] then [F1] to set [TRIGGER MODE] as AUTO.

Press [F5] to set [EDGE TYPE] as RISING.

Figure 1-11
Trigger controls

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 UTD4000 oscilloscope 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], [VOLTS/DIV])
● Setting up the horizontal system ([MENU], [HORIZONTAL POSITION], [SEC/DIV]
● 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 utility function ([UTILITY])
● Automatic measurement ([MEASURE])
● Cursor measurement ([CURSOR])
● Using the auto setup, run/stop buttons ([AUTO], [RUN/STOP])
● Logic analyzer [LA]
● Digital multimeter [DMM]

It is recommended that you read this chapter carefully to understand the various measurement functions and system operation steps of your UTD4000 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

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Table 2-1   Explanatory notes for channel menu

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Coupling | DC 1MΩ | AC and DC quantities of input signal is allowed to pass. |
|  | AC 1MΩ | DC quantities of the input signal are intercepted. |
|  | GND | DC level of the channel input terminal upon equivalent grounding is displayed. |
| BW Limit | Full | Full bandwidth. |
|  | 20M | Limit bandwidth to 20MHz to reduce noise display. |
| Volts/Div | Coarse | 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. |
|  | Fine |  |
| Probe | 1X | Select one of the values based on the probe attenuation factor to keep the vertical deflection factor reading correct. There are four values : 1X, 10X, 100X and 1000X. |
|  | 10X |  |
|  | 100X |  |
|  | 1000X |  |
| Invert | On | Waveform invert function on. |
|  | Off | Normal waveform display. |

**1. Setting up channel coupling**

Take the example of applying a signal to CH1. The signal being tested is a sine signal that contains DC . Press [F1] then [F2] 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 :
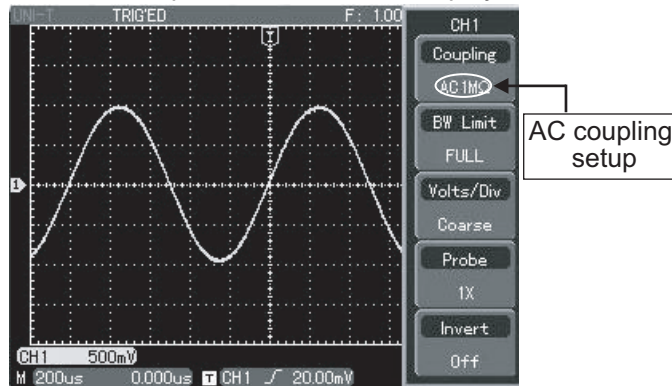


AC coupling setup

Figure 2-1  DC quantities of the signal are intercepted
Press [F1] twice 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 :
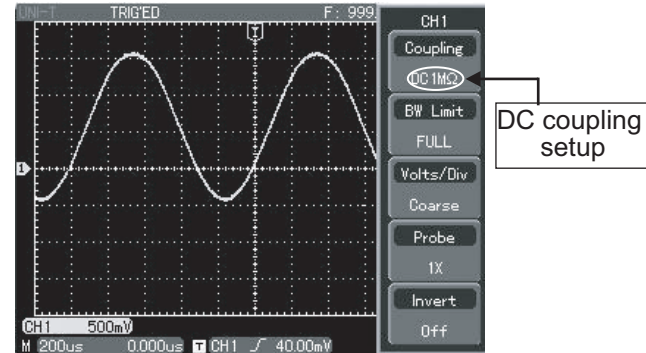


DC coupling setup

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

Press [F1] then [F3] to select ground. It is now set up as ground. The waveform display is as follows :
(Note : In this mode, although waveform is not displayed, the signal remains connected to the channel circuit)

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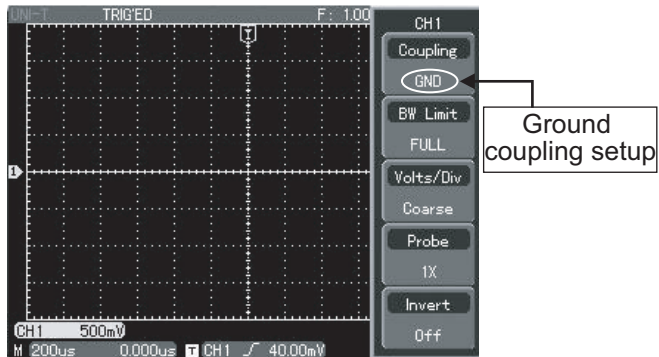
Figure 2-3  Screen display for theground mode

**2. Setting up the channel bandwidth**

Take the example of applying a signal to CH1. The signal being tested is a signal stacked with high frequency quantities.

Press [CH1] to turn CH1 on. Next press [F2] then [F1] to set channel bandwidth to full bandwidth. The signal being measured can pass through even if it contains high frequency quantities. The waveform display is as follows :

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Figure 2-4  Waveform display at full bandwidth

Press [F2] then [F3]. All high frequency quantities higher than 20MHz in the signal being tested will be limited. The waveform display is as follows :



Bandwidth limit 20MHZ
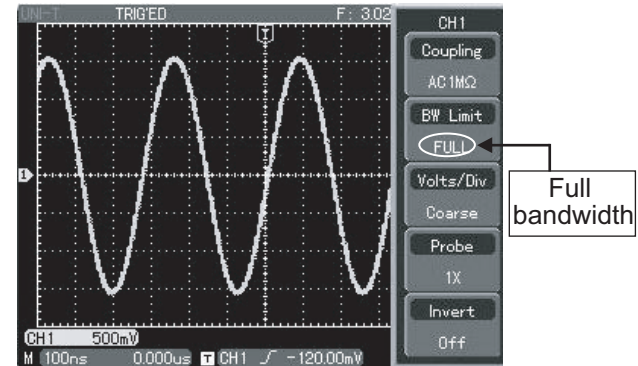
Bandwidth limit icon
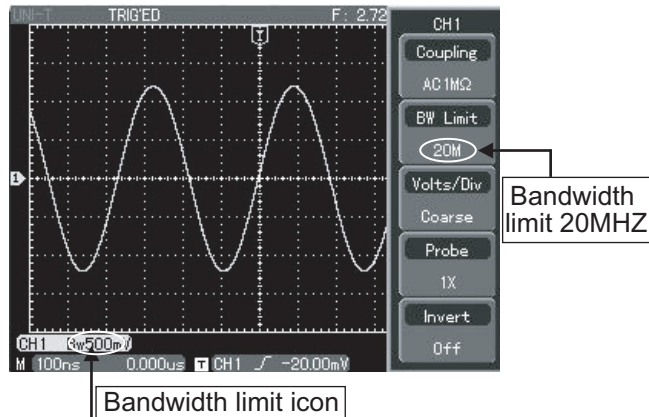
Figure 2-5  Waveform display
when bandwidth limit is on

**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.



Probe attenuation factor

Vertical range movement

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

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**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 1mV/div~10V/div. Tuning is in steps of 1-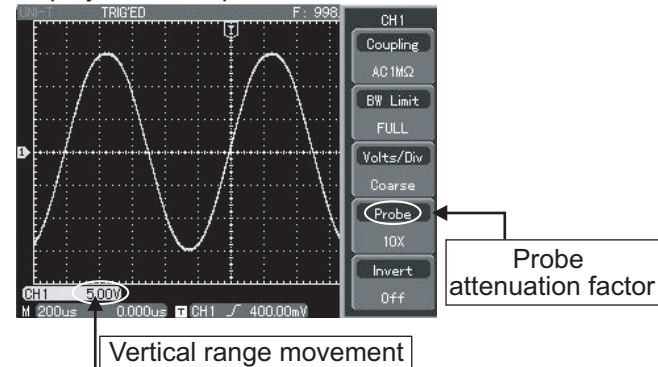2-5. In fine tune mode, you can change the deflection factor in even smaller steps within the current vertical range, so as to continuously adjust the vertical deflection factor within the range of 1mV/div~10V/div without interruption.

*Note: VOLTS/DIV range of vertical deflection factor of the UTD4000 series varies from model to model.
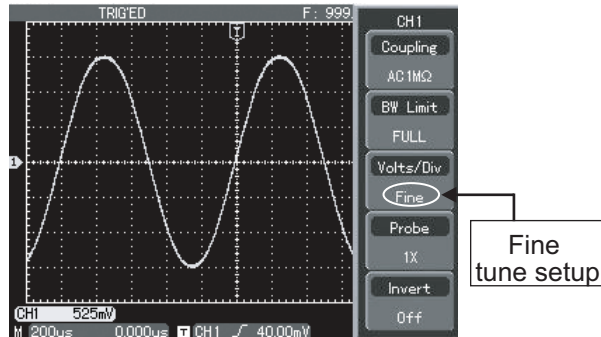


Fine tune setup

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

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**5. Waveform inversion setup**

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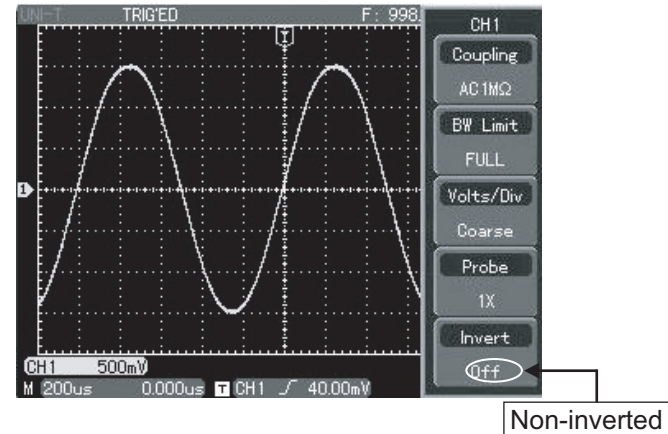


Non-inverted

Figure 2-8  Inversion setup for vertical

channel inversion (non-inverted)

Inverted waveform

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

**I.  Operating Math Functions**

Math functions are displays of +, -, ×, ÷ , FFT mathematical results and digital filtering function of CH1 and CH2 waveforms. (This function is disabled in the dual time base)The menu is as follows :



Math range

Figure 2-10  Math functions

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Table 2-2   Explanatory notes for the Math menu

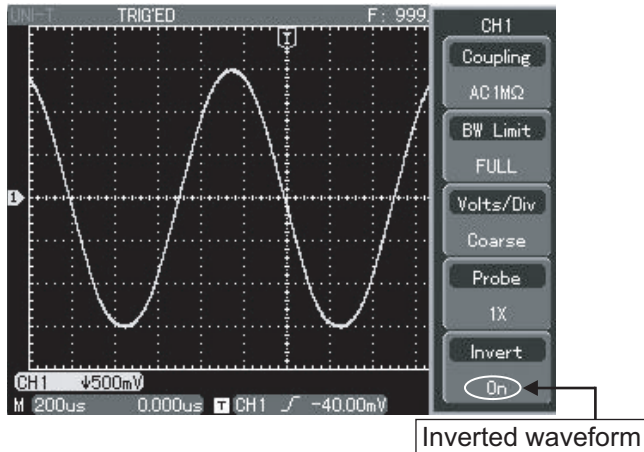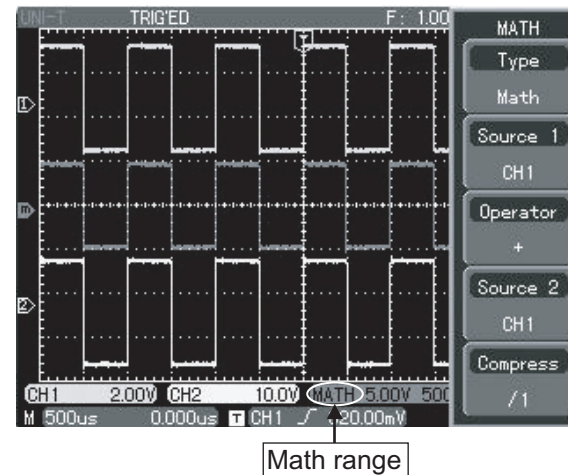| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Type | Math | To carry out +, -, ×, ÷functions. |
| Source 1 | CH1 | Set operand 1 as CH1 waveform. |
| | CH2 | Set operand 1 as CH2 waveform. |
| Operator | + | Operand 1 + Operand 2 |
| | - | Operand 1 - Operand 2 |
| | × | Operand 1 x Operand 2 |
| | ÷ | Operand 1 ÷ Operand 2 |
| Source 2 | CH1 | Set operand 2 as CH1 waveform. |
| | CH2 | Set operand 2 as CH2 waveform. |
| Compress | /1 | Scale the waveform by ratio. There are four ratios to choose from : 1/1, 1/10, 1/100, 1/1000. |
| | /10 | |
| | /100 | |
| | /1000 | |

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

Table 2-3  Explanatory notes for the FFT menu

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Type | FFT | To carry out FFT algorithm functions. |
| Source | CH1 | Set CH1 as math waveform. |
| | CH2 | Set CH2 as math waveform. |
| Windows | Hamming | Set Hamming window function. |
| | Blackman | Set Blackman window function. |
| | Rectangle | Set Rectangle window function. |
| | Hanning | Set Hanning window function. |

**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 | 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 poorest frequency recognition rate. | Mainly for single-frequency signals to search for higher-order harmonic wave. |

**Definition :**

**FTT recognition rate :** It 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.

### Digital Filtering Function

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Type | Filter | Digital filtering |
| Signal source | CH1 | Set CH1 as filter target. |
| | CH2 | Set CH2 as filter target. |
| Filtering Type | Low pass | Set the filter to low-pass filtering. |
| | High pass | Set the filter to high-pass filtering. |
| | Band pass | Set the filter to band-pass filtering. |
| Minimum Frequency | _____ | Set the minimum frequency with the multifunction control knob. |
| Maximum Frequency | _____ | Set the maximum frequency with the multifunction control knob. |

### II. Reference Waveform

Display of the saved reference waveforms can be set on 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 [CALL BACK]. Select the signal source by turning the multifunction 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 [SELECT] to recall the waveform which was originally stored in that position. For instructions on storing or recalling reference waveforms on the USB device, read "Storage and Recall".

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 UTD4000 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. For setup please refer to Table 2-5.

4. To close the reference waveform, press [OFF] in

the vertical zone.

Note : When [AUTO] is pressed after a reference waveform is recalled, that waveform will remain.

Table 2-5  Selecting the storage position

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Ref Wave | REF A | Select the REF A reference option. |
| | REF B | Select the REF B reference option. |
| Load... | | Recall a waveform stored in any of the 10 with the multifunction control knob, then press [SELECT] to confirm. |
| ⎯⎯ | | |
| Import | | Recall a reference waveform stored on the USB device. |

To select an internal storage position, choose between 1 and 10. In the case of external storage device, plug in the USB device, then press [F5], then press [F1] and the multifunction control knob to select the corresponding file name.

To save a reference waveform on the USB device, see the [STORAGE] menu.

**Setting Up the Horizontal System Horizontal Control Knobs**

There are two horizontal control knobs : The SED/DIV knob is for changing the horizontal time base, while the horizontal shift knob is for changing the relative position of the trigger point on the screen.

Horizontal control knob : Display the horizontal menu (see Table 2-6).

Table 2-6

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Window | Main Extended | Press [F1] to switch between "main window" and "window extension". |
| Dual Xbase | Mode | Main time base or dual time base. |
| | M1 Base | Select the channel to be displayed : CH1 or CH2. |
| | X Adjust | Select main time base M1 or delay time base M2. |
| | M2 Shift | Select fine tune or coarse tune shift. |
| Holdoff | —— | Adjust holdoff time with the multifunction control knob. |

Figure 2-11   Horizontal system control interface

**Definitions of Horizontal Parameter Icons**

① The signal frequency currently selected as the trigger source.

② Position of the current waveform triggering point.

③ Trigger level of the current waveform.

④ The distance between the triggering position and the horizontal centre point (time).
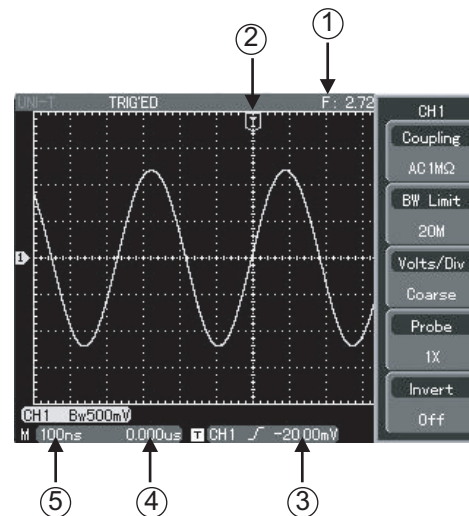
⑤ Time base of the main time base M1, i.e. SEC/DIV.



Figure 2-12   Definitions of horizontal parameter icons

**Window Extension**

Window extension can be used to zoom in a band of waveform to check image details, as shown in Figure 2-13.

Horizontal extension of the waveform



Main window

Extended window

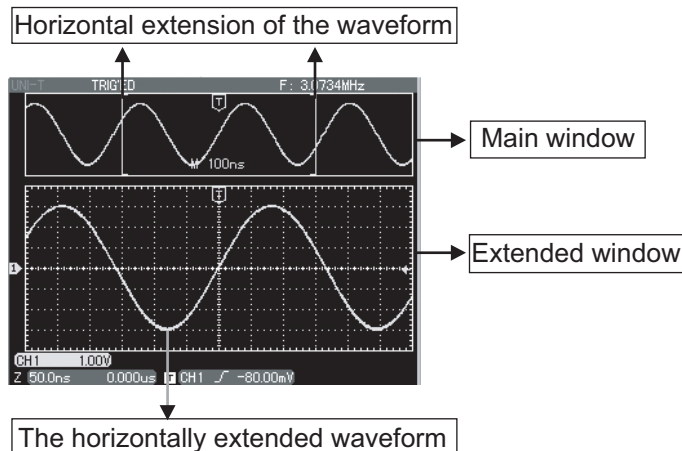The horizontally extended waveform

Figure 2-13   Display with the window extended

In the window extension mode, the display is divided into two zones as shown above. The upper part displays the original waveform, and the lower part displays the extended waveform. You select the waveform area to be magnified by turning the horizontal POSITION knob and SEC/DIV knob.

**Dual Time Base Function**

The dual time base function is similar to window extension but there is a fundamental difference. In the extension time base mode you can magnify the waveform 100 times, whereas in the dual time base mode you can magnify details of the waveform being observed by thousands of times. In effect, the main time base storage depth is increased by thousands of times.

Dual time base operation instructions :
Press the horizontal setup menu then press [F3] to enter the dual time base menu. Press [F1] to activate

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the dual time base function. To open CH1 or CH2 under the dual time base mode, select by pressing [F2]. To select M1 or M2 as the activated time base, press [F3] (M2 is the delayed scanning time base).
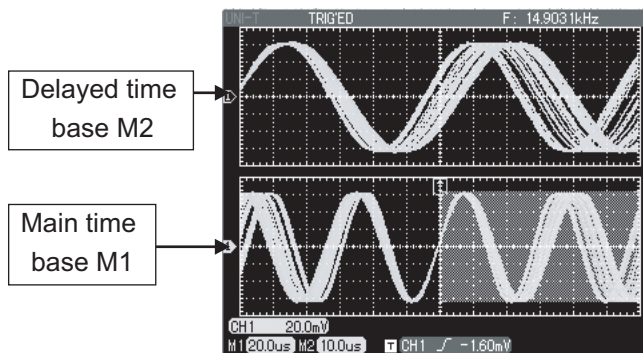


Figure 2-14   Dual time base

**Setting up the Trigger System**

Triggering decides when the oscilloscope collects data and display waveforms. Once the trigger is correctly set up, it offers stable display of the waveform being observed. When beginning to acquire data, the digital storage oscilloscope first collects data required for pre-trigger. When the trigger condition arises, it will continue to acquire the remaining data.

The trigger control zone on the operation panel of your digital storage 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 trigger point of the signal being tested.

[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, slew rate and logic analyzer (LA).

**Edge trigger :** Trigger is set to occur when the signal is at the rising or falling edge. You can set the trigger level to change the trigger point's vertical position on the trigger edge, i.e. the intersection point of the trigger level line and the signal edge on the screen.

**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.

**Slew rate trigger :** Trigger condition is the signal rising or falling rate.

**LA trigger :** Trigger condition is the pattern or duration input by the logic analyzer. To use this trigger mode you must have a LA probe installed and turned on.

Below are notes for various trigger menus.

**Edge Trigger :** For edge trigger menu setups please see Table 2-7.

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Type | Edge | |
| 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 | Divide the external trigger model by 5. |
| | LINE | Set grid trigger. |
| | CH1& CH2 | CH1 and CH2 trigger their respective signals alternately. |

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Table 2-7 (Con't)

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| | D0-D15 | Set one of the channels between D0-D15 as the signal source trigger signal (the LA function must be enabled). |
| Coupling | DC | Allow AC and DC quantities of the input signal to pass. |
| | AC | Intercept DC quantities of the input signal. |
| | LF Reject | Reject low frequency quantities below 80kHz of the signal. |
| | HF Reject | Reject high frequency quantities above 80kHz of the signal. |
| 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. |
| Slope | Fall | Set to trigger at the signal's falling edge. |
| | Rise | Set to trigger at the signal's rising edge. |
| | Rise-Fall | Set to trigger at the signal's rising and falling edges. |

**Pulse Trigger**

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

Table 2-8

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Type | Pulse | |
| 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 | Divide the external trigger source by 5 to extend the trigger level range. |
| | LINE | Set grid trigger. |
| | CH1 & CH2 | CH1 and CH2 trigger their respective signals alternately. |
| | D0-D15 | Set one of the channels between D0-D15 as the signal source trigger signal (the LA function must be enabled). |
| Coupling | DC | Allow AC and DC quantities of the input signal to pass. |
| | AC | Intercept DC quantities of the input signal. |
| | LF Reject | Reject low frequency quantities below 80kHz of the signal. |
| | HF Reject | Reject high frequency quantities above 80kHz of the signal. |

Table 2-8 (Con't)

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Mode | Auto | The system automatically acquires 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. |
| Pulse Setup | See Table 2-9 | Set the pulse width. |

Table 2-9  Pulse width setup

| Polarity | Positive | Set the positive pulse width as the trigger signal. |
|---|---|---|
| | Negative | Set the negative pulse width as the trigger signal. |
| When | < | Trigger occurs when pulse width is smaller than the set value. |
| | > | Trigger occurs when pulse width is larger than the set value. |
| | = | Trigger occurs when pulse width equals to the set value. |
| Setting | ——— | Set pulse width to 20ns-10s with the multifunction control knob on the front panel. |
| Back | —— | Return to Table 2-8. |

**Video Trigger**

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

Table 2-10   Video trigger setup          Table 2-10a    Video setup

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Type | Video | |
| 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. |
| | LINE | Set grid as the trigger signal. |
| | CH1 & CH2 | Set CH1 and CH2 as alternate trigger signals. |
| Video Setup | See Table 2-10a | |
| Standard | PAL | Suitable for PAL video signals. |
| | NTSC | Suitable for NTSC video signals. |
| Sync | Odd Field | Set the video odd field to synchronized trigger. |
| | Even Field | Set the video even field to synchronized trigger. |
| | All Lines | Set the line signal to synchronize with trigger. |
| | Lines Num | Set synchronized trigger on the specified line and adjust by turning the multifunction control knob on the upper front panel. |
| Back | | Return to Table 2-10. |

When PAL is selected for video and synchronization mode is line, you will see a screen display as shown in Figure 2-15. When synchronization mode is field, you will see a screen display as shown in Figure 2-16.

**Slew Rate Trigger**
When slew rate trigger is selected, trigger occurs if the slew rate of the signal's rising or falling edge is the same as the default value. Below is the trigger menu : Table 2-11
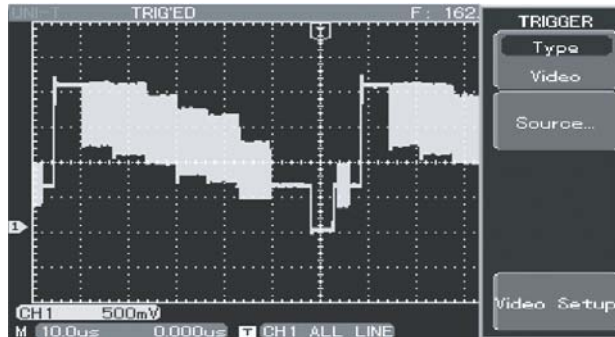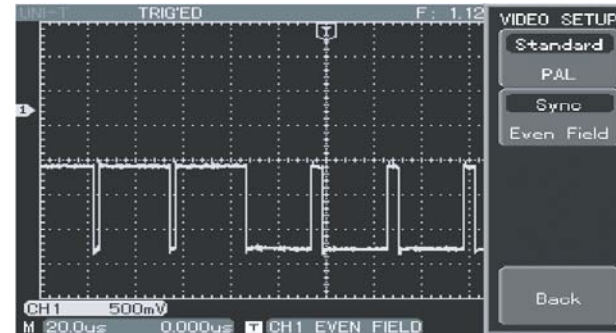


Figure 2-15  Video trigger : line synchronization



Figure 2-16  Video trigger : field synchronization Slew Rate Trigger

Table 2-11

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Type | Slope | |
| 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 | Divide the external trigger source by 5 times. |
| | LINE | Set grid trigger. |
| | CH1 & CH2 | CH1 and CH2 trigger their respective signals alternately. |
| Coupling | DC | Allow AC and DC quantities of the trigger signal to pass. |
| | AC | Intercept DC quantities of the trigger signal. |
| | LF Reject | Reject low frequency quantities and allow only high frequency quantities to pass. |
| | HF Reject | Reject high frequency quantities and allow only low frequency quantities to pass. |
| Mode | Auto | The system automatically acquires 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. |

Table 2-11 (Con't)

| Mode | 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. |
| Slope Setup | Polarity | Rise/fall setup. |
| | When | Set slew rate to : larger than/smaller than/equalling to with the multifunction control knob on the front panel. |
| | Slew Rate | |
| | Threshold | Low level/high level/High low level setup. |
| | Back | Return to the previous menu. |

**LA Trigger**
First enable the LA function, then select LA trigger. Trigger menu is as follows (Table 2-12):

Table 2-12

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Type | LA | Select LA trigger as the trigger type. |
| Sub Type | Code/Persist | Select pattern or duration as the sub-type. |
| Code... | | Turn the multifunction control knob and [SELECT] key to set the high and low levels for each of the 16-width values. |
| Mode | Auto | The system automatically acquires 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. |
| Persist Setup | When | Select above, below or equivalent. |
| | Setup | Set a duration that satisfies the "condition" with the multifunction control knob. |
| Clock Setup | Clk Source | Select the source with the multifunction control knob. |
| | Clk Edge | Select the rising or falling edge of the clock. |
| Back | —— | Return to the previous menu level. |

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**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 Alternate trigger menu can also be used to compare pulse widths.

**Adjusting the Holdoff Time**

You can adjust the holdoff time to observe complicated waveforms (e.g. pulse string series). Holdoff time means the data acquisition cycle of the digital storage oscilloscope. It is an exact multiple of the cycle of the complicated waveform being tested, thus synchronization is possible. For example, you can display one group of pulse series stably by adjusting holdoff time, as shown in Figure 2-17.

For the holdoff menu please see the table 2-13 :

Table 2-13

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Window | | Press [F1] to switch between "main window" and "window extension". |
| Dual Xbase | Mode | Main time base or dual time base. |
| | M1 Base | For the selection of displaying CH1 or CH2. |
| | X Adjust | Selecting main time base M1 or delay time base M2. |
| | M2 Shift | Selecting fine tune or coarse tune shift. |
| Holdoff | | Adjust holdoff time with the multifunction control knob. |
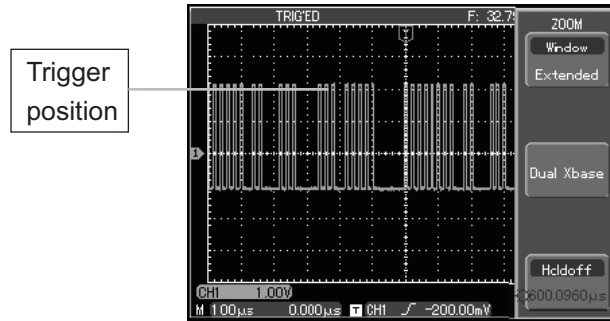
Figure 2-17  Use the holdoff function
to synchronize complicated waveforms

**Operation**

1.   Follow the normal signal synchronization proce-
dure and select the edge and trigger source 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 multifunction control knob in the upper
front panel. The holdoff time will change accordingly
until the waveform display is stable.

**Operation tips :** Holdoff time is usually shorter than
the "big cycle" time. When observing the RS232 com-
munication signal, it is easier to observe if the holdoff
time is slightly shorter than the starting edge time of
every datum.

**1.   Trigger source :** This means the signal for trigger.
Trigger can be obtained from various sources : Input
channel (CH1, CH2), external trigger (EXT, EXT/5),
grid, CH1 and CH2 alternate.

●    **Input Channel :** The most common trigger source
is input channel (choose CH1 or CH2). The selected
trigger source can operate normally whether the input
is displayed or not.

●    **External Trigger :** This type of trigger source can
be directly input through the external trigger input
terminal. 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

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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.

*Note: The trigger level range of the UTD4000 series varies from model to model.

● **Grid :** means the grid power source. This trigger mode is suitable for observing signals related to the grid - e.g. the correlation between lighting equipment and power source equipment - to achieve stable synchronization.

**2.** **Trigger mode :** To cause the digital storage oscilloscope to generate a trigger signal. 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 range is set to 50ms/div or slower, the "Auto" mode is a continuous

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scanning process.

● **Normal Trigger :** In this mode, your oscilloscope samples waveforms 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 acquired waveform will be displayed when the digital storage oscilloscope detects a trigger. 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 waveform and 5 divisions of post-trigger waveform. By turning the horizontal shift knob [POSITION] clockwise to adjust horizontal displacement of the waveform, you can see more pretrigger information, i.e see more waveform details before trigger occurs. For example, you can detect the glitch that occurs when the circuitry starts. Observation and analysis of pretrigger 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 up the sampling setup menu. You can use this menu to adjust the sampling mode.

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Table 2-14   Sampling menu

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Acquisition | Normal | Turn on the ordinary sampling mode. |
| | Peak | Turn on the peak detect mode. |
| | Average | Set to average sampling and display the average number of times. |
| | Envelop | Use the peak detect mode for every independent acquisition. |
| Averages (when average sampling is selected) | 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 multifunction control knob shown in Figure 2-18. |
| Mem Length | Normal | Set normal length of samping data |
| | Long Mem | Set long length of samping data (long storage is disabled when the logic analyzer is on and dual time base is in operation). |
| Fast ACQ | On | Acquire at a high screen refresh rate for more realistic reflection of waveform status. |
| | Off | Close the quick acquisition function. |

By changing sampling 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.
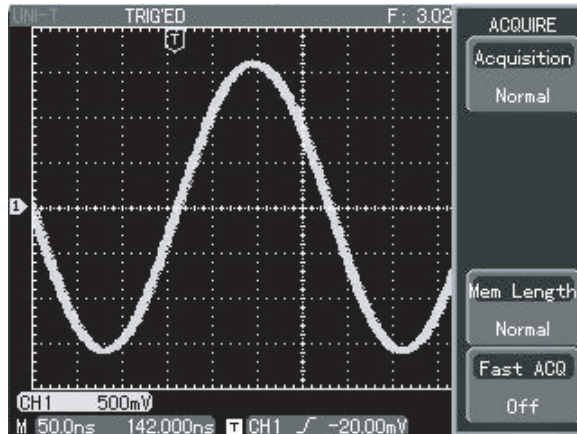


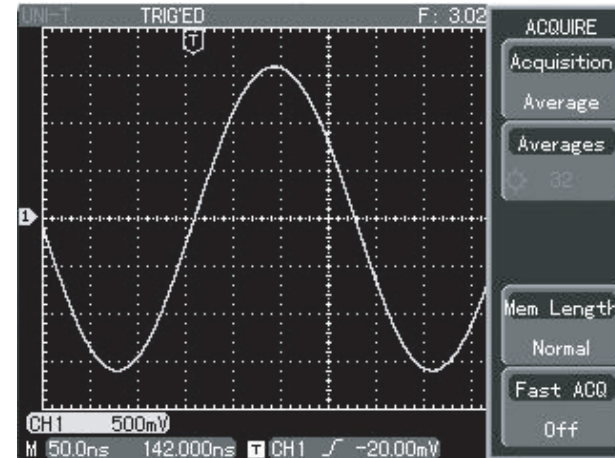Figure 2-19  Waveform without average sampling



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

**Definitions :**

**Normal mode :** The digital storage oscilloscope acquires signal sample at equal and regular intervals to reconstruct the waveform.

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**Peak detect mode :** In this acquisition mode, the digital storage oscilloscope identifies the biggest and smallest values of the input signals at each sampling interval and uses these values to display the waveform. In effect, it 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 digital storage oscilloscope acquires several waveforms and takes the average value to display the final waveform. You can use this mode to reduce random noise.

**Envelop mode :** Waveforms of different amplitudes are acquired. Sampling points of all relative triggering points recorded at the same time are calculated, and the maximum value and minimum value are displayed. In the envelop mode, peak detection is carried out for every single acquisition.

**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.

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Table 2-15   Display menu

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Format | YT | Operating mode of the oscilloscope. |
| | XY | X-Y is the display mode; CH1 is X input, CH2 is Y input. |
| Type | Vectors | Sampling points are linked for display. |
| | Points | Sampling points are directly displayed. |
| Graticule | Full | |
| | Grid | Set the grid display mode of the waveform zone to full, grid, cross-hair or frame. |
| | Cross Hair | |
| | Frame | |
| Persist | Auto | Waveform on the screen is refreshed at normal rate. |
| | 1s | Waveform on the screen is maintained for 1 second and then refreshed. |
| | 2s | Waveform on the screen is maintained for 2 seconds and then refreshed. |
| | 5s | Waveform on the screen is maintained for 5 seconds and then refreshed. |
| | Infinite | Waveform on the screen remains on display. New data will be added continuously until this function is disabled. |
| Intensity | 1-32 | In "quick acquisition" mode, intensity of the waveform can be adjusted with the multifunction control knob. |

**X-Y Mode**

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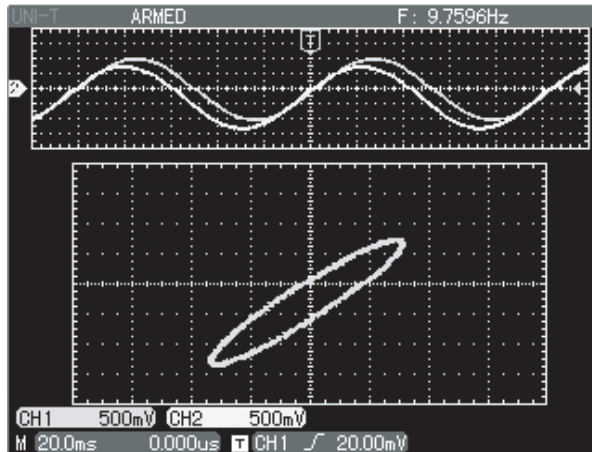


Figure 2-22  Waveform display in X-Y mode

**Caution :**

In the normal X-Y mode, you can adjust waveform amplitude with VOLTS/DIV of the two channels. Adjusting the SEC/DIV time base knob will result in a lissajous figure of better display quality.

The following functions are disabled in the X-Y display mode :

- Automatic measurement mode
- Cursor measurement mode
- Reference or maths waveform
- Vector display type
- Horizontal [POSITION] knob
- Trigger control

**Key points :**

**Display Type :** Vector display fills the space between adjacent sampling points in display. The dot mode displays 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.

**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 50ms/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.

**Storage and Recall**

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



Figure 2-23  Function key for
the sampling system (storage)

Press the [STORAGE] button to display the setup menu. You can use this menu to save and recall waveforms or setup document stored on the oscilloscope built in memory or a USB device.

**Steps :**

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

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1.　Select reference waveform to go to the waveform storage menu shown below (see Table 2-16). A stored reference waveform can be recalled with the [REF] key (see "Reference waveform", page 29). For specific steps please see [REF] operation instructions

Table 2-16　Reference waveform storage menu

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Type | Wave | Select the waveform storage and recall menu. |
| Siource | CH1 | Select the waveform from CH1. |
| | CH2 | Select the waveform from CH2. |
| Save... | 1~10 | With the multifunction control knob, set and select the position in which the reference waveform is to be stored in the built-in memory. |
| Export | Filename | Select the default name "UNI T0000" for the reference waveform file being exported to the USB device with the multifunction control knob. |
| | Format | Set the format as : internal or CSV. |
| | OK | Export the reference waveform to the USB device. |

2. Select setup to enter the setup storage menu. See Table 2-17.

Table 2-17   Storage menu setup

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Setting | —— | Save the current front panel setup status. |
| Save... | —— | Select a save position with the multifunction control knob on the front panel (total 10 sets) and save the setup. |
| Load... | —— | Recall the saved setup status. |
| Import | Filename | Name the reference waveform file being imported from the USB device with the multifunction control knob. |
| | OK | If the document exists on the USB device, it will be imported. Otherwise the system will indicate "I/O operation failure". |
| Export | Filename | Name the reference waveform file being exported to the USB device with the multifunction control knob. |
| | OK | The current front panel setup status is exported. |

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

Note : This function can be recalled and used only when the USB device is inserted.

Table 2-18    Bitmap storage menu

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Bitmap | | Export the display data to the USB device in bmp format. |
| Export | Filename | Default name of the file being exported to the USB device is "UNI T0000.BMP". |
| | OK | Press this key to export to the USB device. |

About INTERNAL and CSV formats : You can select Internal or CSV format when you export the reference waveform to the USB device. In Internal format, it can only be imported to the oscilloscope in REF and not any other interface. In CSV format, it can be opened in EXCEL as it is a set of 2-dimensional data of voltage and time correlation.

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**Setting up Utility Functions**

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



Figure 2-24  Function key for

the sampling system (function)

Press the [UTILITY] button to pop up the setup menu for utility functions. See Table 2-19.

Table 2-19  Utility functions menu (1)

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Configure | Self Cal | Run auto system calibration. |
| | Version | Display information like oscilloscope software and hardware versions. |
| | Erase | Clear all saved reference waveforms and front panel status setups. |
| | RTC Setup | Set time and date. |
| | Default Set | Recall factory setup. |
| Preference | Language... | Select one of the languages. |
| | Skin | Classic, traditional, modern. |
| | Menu Display | Set the waiting time for automatic menu shutoff : 5s, 10s, 20s and manual. |
| | Brightness | Adjust the brightness of the waveform style zone with the multifunction control knob. |
| Pass/Fail | Enable | Turn the testing function on or off (this function is disabled in the dual time base and roll operation modes). |
| | Output | Set to output signal to pass or fail. The signal is output through the PASS/FAIL interface at the rear of the oscilloscope. |

Table 2-19  Utility functions menu (2)

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| | Source | Designate testing type as CH1 or CH2. |
| | Message | Open or close the test result. |
| | Operate | Run or stop the "PASS/FAIL" test. |
| | Stop Setup | Set the stop testing conditions. |
| | Mask Setup | Create a module of test conditions. |
| Recording waveform | See Table 2-21 | Setup for waveform recording. |
| Next page 1/2 | | Go to the next page. |

Table 2-20  Utility functions menu (3)

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Cymometer | On | Turn the frequency counter on. |
| | Off | Turn the frequency counter off. |
| Interface | | Select LAN or GPIB interface; To set address by multipurpose knob and select key; then press close key to save new address |
| Next page 2/2 | ____ | Return to the previous menu. |

Table 2-21  Waveform recording menu

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| ■ (F2) | | Stop recording |
| ▶ (F1) | | 1.  Playback button.<br>2.  When you press this button the system plays back and displays the number of the rewinding screen in the top centre area. 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.<br>3.  If you wish to continue full playback, press [F2] to stop and then press [F1].<br>4.  You can record as many as 100 screens data (If [AUTO] is pressed after a waveform is recorded, it will be deleted). |
| ● (F3) | | Record button. Press this button then the [MENU ON/OFF] key to record. The number of screens recorded is displayed in the top centre area (This function is disabled in dual time base, average, envelop, roll and long storage modes). |

**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 UTD4000 can be operated in many languages. To select a display language, press the [UTILITY] menu button and then [LANGUAGE] in "Interface setup" to 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 UTD4000.

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Figure 2-25  Function keys of the
sampling system (auto measurement)

**Application Examples**

The measurement menu of your oscilloscope is capable of measuring 27 waveform parameters.
Press [MEASURE] to enter the parameter measurement display menu which has 4 options that correspond to function keys F1~F4. To operate any individual option, press the assigned function keys [F1~F4] to enter the setup menu for that function.
You can measure voltage or time measurement. You can select with the "Customize Parameters" option. To enter the menu press [F2] and select the required parameters with the multifunction control knob, then

press [SELECT] to confirm (you can display up to 4 parameters). You can also press [F1] and select "All Parameters" to show all voltage and time measurement parameters of the current channel. To quit "All Parameters", press [CLOSE].

Example 1 : To display the measurement peak-to-peak value of CH2, follow the steps below :
1.   Press [CH2] to select channel 2.
2.   Press [MEASURE] to enter the measurement functions menu.
3.   Press [F2] to enter the measurement parameters options.
4.   Turn the multifunction control knob to the peak-to-peak value.
5.   Press [SELECT] to confirm, then press [CLOSE] to exit.

The peak-to-peak value is displayed in the left bottom corner.

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.   As shown in the previous example, select rising delay in the measurement parameters menu.
2.   Press [SELECT] to display the rising delay parameter.
3.   Press [CLOSE] to exit the parameter options.
4.   The rising delay parameter is displayed in the left bottom corner.

**Automatic measurement of voltage parameters**
Your UTD4000 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.

Mean(Vmid): Half of the sum of waveform top and bottom voltage.

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 of the waveform.

Preshoot : The ratio value of the difference between minimum value and base value to the amplitude value of the waveform.

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 UTD4000 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 :

RiseTime : The time taken by the waveform amplitude to rise from 10% to 90%.

FallTime : The time taken by the waveform amplitude to fall from 90% to 10%.

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

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

Rising delay (Rise) : Delayed time of the rising edge of CH1, CH2.

Falling delay (Fall) : 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 4 function options, as shown in the table below.

Table 2-22

| Function Menu | Setup | Explanatory Note |
|---------------|-------|------------------|
| All | | Display all parameters. To close press [CLOSE]. |
| Select | | Up to 4 parameters can be displayed on screen. |
| Indicators | | Visual indication of the measurement value's physical properties by lines. |
| Clear | | Clear the finished parameters. |

Note : Customized parameters are for quick parameter measurement. This device has 27 measurement parameters. In general use, the user is not required to measure all parameters. Only a few have to be tested. In this case, set the parameters you require as customized parameters. All such parameters will be displayed on the screen.

Figure 2-26  Measurement parameters

**Cursor Measurement**

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

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

There are two cursor measurement modes to choose from the [CURSOR] menu : voltage and time. When measuring voltage, press [SELECT] on the front panel and the multifunction control knob to adjust the positions of the two cursors for △V measurement. Likewise, by selecting time, you can measure △t. The [CURSOR] menu has two other modes. In the independent mode, you can adjust the positions of the two cursors independently. In the tracking mode, you press [SELECT] and multifunction control knob to move two cursors simultaneously.

1.   Measuring voltage/time : Cursor 1 or cursor 2 will appear simultaneously. Adjust their positions on the screen with the multifunction 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.    When the cursor function is enabled, measurement value is automatically displayed in the top left corner.

Table 2-23

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Type | Time | Set time as the measurement parameter. |
| | Amplitude | Set amplitude as the measurement parameter. |
| | Off | Close the automatic measurement function. |
| Mode | Independent | Adjust the difference between two cursors with the multifunction control knob. |
| | Tracking | Adjust the difference between two cursors with the multifunction control knob or fix the difference and adjust the cursor positions. |
| V Units | Sec | Select time as the measurement parameter. |
| | Hz | Select frequency as the measurement parameter. |

**Using the Run Button**

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



Figure 2-28  RUN/STOP button

**Auto Setup :**

As shown above, Auto Setup can simplify operation. Press [AUTO] and the oscilloscope can automatically adjust the vertical deflection factor and horizontal time base range according to the amplitude and frequency of the waveform, so as to ensure stable waveform display. When the oscilloscope is in auto setup mode, the system setup is as shown by Table 2-24 :

Table 2-24    Auto setup

| Function Menu | Setup |
|---|---|
| Acquisition mode | Adjust to "sampling" or "peak detect". |
| Display format | Set to YT. |
| SEC/DIV | Adjusted according to signal frequency. |
| Trigger coupling | AC |
| 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 | Adjusted 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.

**Menu Display ON/OFF:** To display or hide the current menu

With the "menu ON/OFF" key, you can display or hide the menu currently on screen. When the menu is hidden, a vertical yellow band will appear on the right side of the screen

**Logic Analyzer (LA) Measurement**

There are 16 LA channels.

Maximum sampling rate : 250Msaps.

Storage depth : 512K.

Maximum input voltage : ±40Vpp.

Minimum voltage swing : 1.2 Vpp.

Trigger types available are : edge, pattern, duration.

The following is the LA operation menu.

| Function | Explanatory Note |
|----------|-----------------|
| Function | LA functions ON/OFF. |
| LA Setup | See Table 2-26. |
| Threshold | Select threshold type : TTL, CMOS, ECL or any user defined threshold type. |
| Order | Sequence of channels currently open, from small to large. |

Table 2-26

| Function | Setup | Explanatory Note |
|---|---|---|
| LA Setup | Select | Select the LA channel. |
| | Move | Move the selected channel. |
| | Display | Display or close the selected channel. |
| | D7-D0 | Open D7-D0 channels. |
| | Next page | Go to the next page. |
| | D15-D8 | Open D15-D8 channels. |
| | Height | Enlarge or restore the designated channel. |
| | Previous page | Return to the previous page. |
| | Back | Return to the previous menu. |



Figure 2-29   Composite display of the logic analyzer and CH1 channel

**Caution :**

To use the LA function, connect the probe of the logic analyzer (including connector, interface box, connecting cable for the test point being measured and needle) and insert it into the LA interface at the rear of the oscilloscope. The LA function is then activated.

When the message "LA module installation failure" appears when the LA function is enabled, check if the LA probe is well connected.

**Multimeter Measurement**

Operation instructions : Open the multimeter function menu (Table 2-27) by pressing the DMM button.

| Function Menu | Setup | Explanatory Note |
|---|---|---|
| Functions | | DMM functions ON/OFF. |
| Mode | Voltage | Activate the voltage measurement function. Maximum measurement value for DC voltage is 400V. Maximum measurement value for AC voltage is 400V. |
| | Resistance | Activate the resistance measurement function. Maximum measurement value for resistance is 40MΩ. |
| | On-off | Activate the on/off measurement function. When on/off measuring is lower than 70Ω, the beeper will sound. |
| | Diode | Activate the diode measurement function. |
| | Current | Activate the DC current measurement function. Current range : 4mA/40mA/400mA/4A. |
| Win shift | | Set the horizontal shift or vertical shift of the window (with the multifunction control knob). |

**Notes :**

If it is necessary to test electric current, follow these steps :

Insert the current/voltage converter module (UT-M03 or UT-M04) that comes with the oscilloscope into the digital multimeter port, and move the switch of the current/voltage converter so that it is consistent with the selected DMM current. Proceed with testing.

**Cautions :**

1.　Please select a suitable current/voltage converter that fits the measurement range, and select an appropriate range. If you are not certain about the current being tested, make an estimation, then select a suitable current/voltage converter and set the range to maximum.

2.　The multimeter cannot be used to measure AC current directly.

3.　In order to keep the accuracy of the testing, when test heavey current with UT-M04 module,the test should be kept less than 10 seconds at intervals of every 15 minutes.

# 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 :**

● 　In the probe menu, set the attenuation factor to 10X and set the switch on the probe to 10X.

● 　Connect the CH1 probe to the circuitry to be mea sured.

● 　Press [AUTO].

● 　The oscilloscope will carry out auto setup to optimise waveform display. In this status, you can further adjust the vertical and horizontal range until you get the desired waveform display.

**2.    Voltage and time parameters for automatic measurement**

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

● Press [MEASURE] to display the automatic mea surement menu.

● Press [F2] to enter the measurement type selection menu.

● Use the multifunction control knob in the top left corner of the front panel to select peak-to-peak value, then press [SELECT] to confirm. Next use the multifunction control knob to select frequency then press [SELECT] to confirm.

● Press [MENU ON/OFF] to exit the selection menu. Peak-to-peak and frequency measurements will now appear in bottom left corner of the screen.
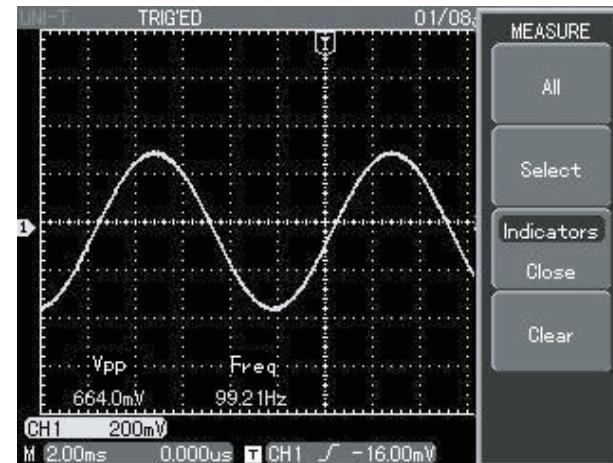


Figure 3-1  Automatic measurement

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

As in the previous scenario, set the probe attenuation factor of the probe and oscilloscope channel to 10X. Connect the CH1 to the circuit signal input terminal. Connect CH2 to the output terminal.

**Steps :**

**1. To display CH1 and CH2 signals :**

● Press [AUTO].

● Continue to adjust the horizontal and vertical range until you get the desired waveform display.

● Press [CH1] to select CH1. Adjust vertical position of the CH1 waveform by turning the vertical position control knob.

● 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.**

● When measuring channel delay automatically, press [MEASURE] to display the automatic measurement menu. Press [F2] to enter the measurement type selection menu. Use the multifunction control knob to select "rising delay". You can see the delay value in the bottom left corner of the screen.

● Observe waveform changes (see the figure below)
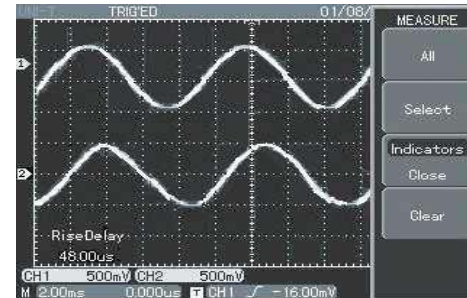


Figure 3-2  Waveform delay

**Illustration 3 : Acquiring single signals**

The advantage and special feature of your digital storage oscilloscopes lie in its ability to acquire non cyclical signals like pulse and glitch. To acquire a single signal, you must have transcendental knowledge of that signal to set the trigger level and trigger edge. For example, if the pulse is a logical signal of TTL level, the trigger level should be set at about 2V and the trigger edge should be set to rising edge trigger. If you are not certain about the signal, you can observe it by automatic or normal trigger to determine the trigger level and trigger edge.

**Steps :**

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

2.    Carry out trigger setup.

●    Press [MENU] in the trigger control zone to display the trigger setup menu.

●    In this menu, use [F1]~[F5] menus to set the trigger type to edge, set trigger source to CH1, set trigger coupling to AC, set trigger type to single and set edge type to rising.

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

●    Turn the TRIGGER LEVEL control knob to get the desired level.

●    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.
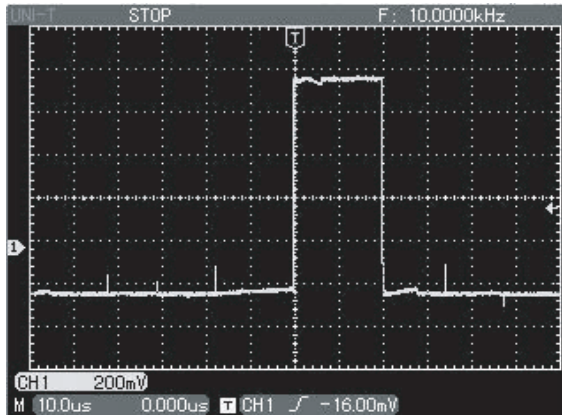
Figure 3-3  Single signal

**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)

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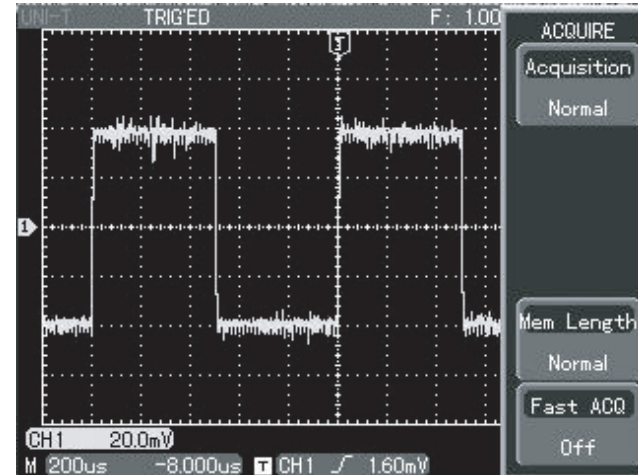


Figure 3-4  Reducing random noise of signals

**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 acquisi-tion 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 acquisition 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 control zone of the front panel to display the sampling setup menu. Press [F1] then [F3] to set acquisition mode to ADVERAGE, then turn the multifunction control knob to adjust the average number of times in multiples of 2, i.e. 2 to 256, until you get the desired waveform display that meets observa-tion and measurement requirements. (See the figure below)
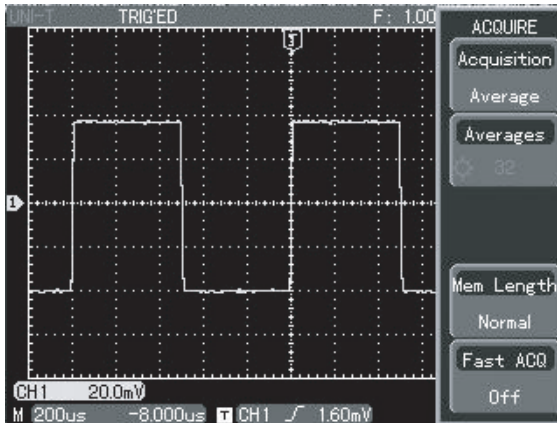
Figure 3-5  Signal noise suppressed

(2)   You can also lower waveform brightness to reduce display noise.

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

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**Illustration 5 : Using cursors for measurement**

Your oscilloscope can measure 27 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 measure ment menu.
2.   Press [F1] to activate the cursor measurement function.
3.   Press [F1] again to set cursor type to time.
4.   Press [F3] to set the vertical cursor unit to Hz.
5.   Turn the multi-function control knob to set cursor 1 at the Sinc first peak.
6.   Press [SELECT] to select cursor 2, then turn the multifunction control knob again to set cursor 2 at the Sinc second peak.

See the figure below.

**Note : When using the cursor to measure voltage, follow step 3 only and set the cursor type to voltage.**
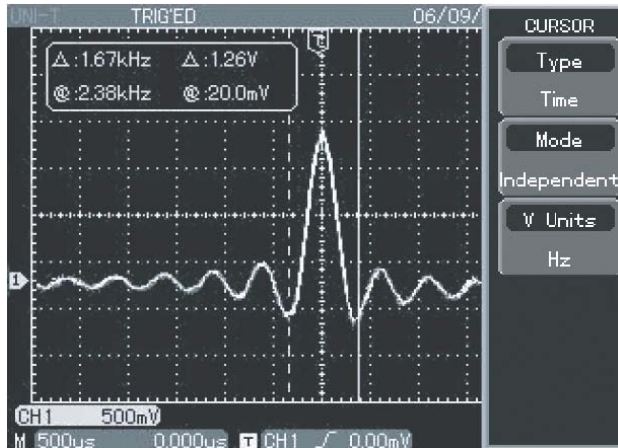


Figure 3-6   Frequency of the
cursor measurement signal

**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.

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7. Press [F1] 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)



The signal must be in the centre
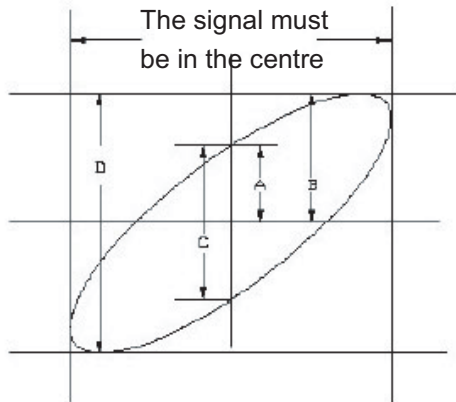
Figure 3-7

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

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

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 $(0\sim\dfrac{\pi}{2})$ or $(\dfrac{3\pi}{2}\sim 2\pi)$.

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

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

10:  Table of  X and Y phase difference
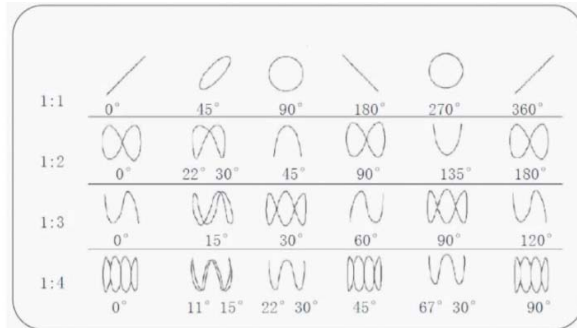


**Illustration 7 : Video signal triggering**

To observe an individual video circuit, 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] then [F3] to set the type to video.
3. Press [F2] then turn the multifunction control knob to set trigger source to CH1. Next press [SELECT] to confirm.
4. Press [F5] then [F1] to select PAL as the video standard.
5. Press menu operation key [F2] to select odd field or even field synchronization.
6. Turn the SEC/DIV knob in the horizontal control zone to adjust horizontal time base for a clear wave-form display.
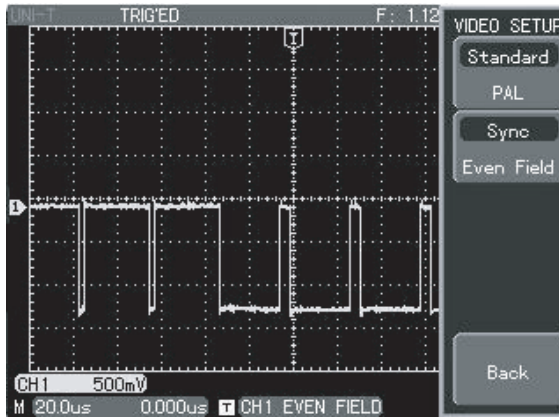
**Figure 3-8     Video field triggering**

**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 [F1] then [F3] to set the type to video.
3.      Press [F2] then turn the multifunction control knob to set trigger source to CH1. Next press [SELECT] to confirm.

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4.      Press [F5] then [F1] to select PAL as the video standard.
5.      Press [F2] then [F4] to select specified line synchronization.
6.      Use the multifunction control knob to select triggering on any line.
7.      Turn the horizontal SEC/DIV knob in the horizontal control zone to adjust horizontal time base for a clear waveform display.
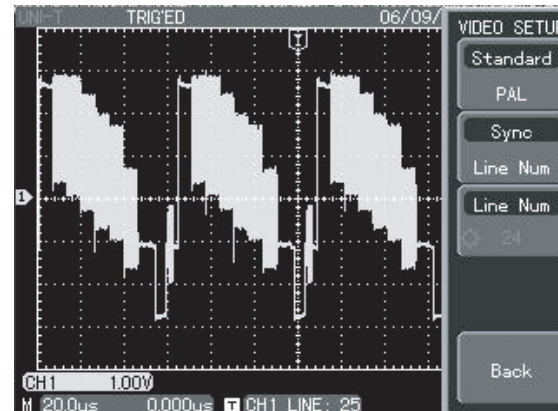


**Figure 3-9     Video line triggering**

**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 [F3] to enter the pass/fail menu.
2.  To set the signal source : Enter the pass/fail menu and press [F3] for setup.
3.  Mask setup : Press next page then [F1] to select "?" operation. Press [F3] to enter the mask setup menu. Press [F1] to select the reference waveform. Press [F3] then the multifunction control knob to set the maximum horizontal capacitance, then [F4] and the multifunction control knob to set the vertical capacitance (i.e. horizontal 1-100; vertical 1-100). Finally press [CREATE MASK] and return to the previous menu.
4.  To stop setup : press [F2] to enter the stop setup menu. Press [F1] to select the stop type. Press [F2] to set the stop condition. Press [F3] then turn the multifunction control knob to set the threshold.
5.  Set the output condition : Press [PREVIOUS PAGE] then [F2] to set the output condition.
6.  Begin checking : Press [F1] to enable check., then press [F4] to open the display information. (This function is disabled in dual time base and roll operation modes)
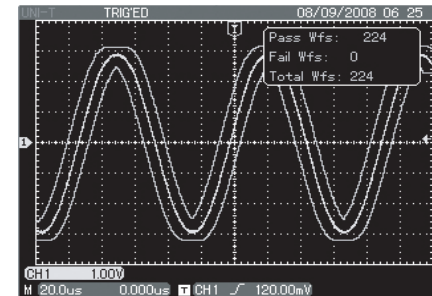


**Figure 3-10   Stop condition not satisfied**
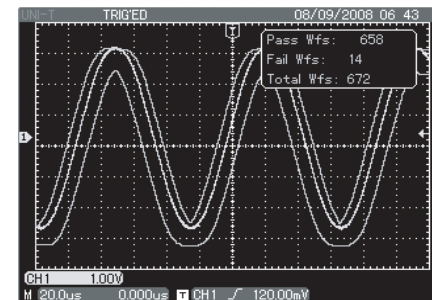


**Figure 3-11   Stop condition satisfied**

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**Illustration 9 : Quick acquisition**

In the [ACQUIRE] menu, [F5] is the key for quick acquisition. To observe the rapidly changes of a waveform, activate this function. The oscilloscope will depicts waveform strength with dark and light colour tones.



**Figure 3-13    Quick acquisition (ON)**

**Illustration 10 : Using the dual timebase function**

In the dual time base mode, you can enjoy unrivaled detailed observation of a waveform. For example, you can observe the colour synchronized signal of the video signal (clear observation is impossible with ordinary oscilloscopes).

1. To access a signal in CH1, follow the "Video signal



**Figure 3-12    Quick acquisition (OFF)**

trigger" instructions in "Illustration 7 : Video signal triggering".
2. Press [MENU] in the horizontal control zone to display the time base setup menu.
3. Press [F3] to enter dual time base setup.
4. Press [F1] to select dual time base, then press [F2] to select CH1. Press [F3] to set time base graticule to M1. Adjust the M1 time base range with the SEC/DIV knob as shown in Figure 3-14. Then press [F3] to select M2 and adjust the M2 time base range with the SEC/DIV knob as shown in Figure 3-14.
5. Shift the M2 time base with the multifunction control knob to show the parts you require to observe in detail. When shifting M2, press [F5] to choose coarse or fine tune.

**Illustration 11 : Using the Logic  Analyzer**

**1.  Setting the LA channel :**
(1)  Insert the LA probe into the interface at the rear of the oscilloscope.
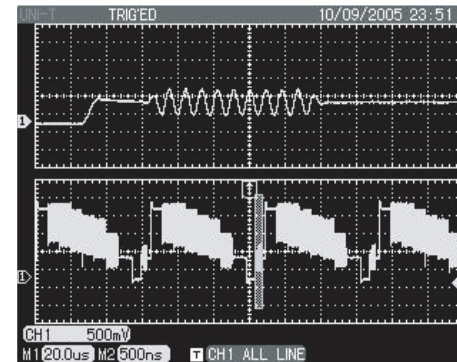


**Figure 3-14 Dual time base function**

(2)  Press the LA function key to access the LA menu.
(3)  Press [F1] to activate the LA function, then press [F2] for channel setup.
(4)  Press [F1] and then the multifunction control knob to select channel. Press [F3] to open that channel, and then press [F2] and turn the multifunction control knob to shift that channel.
(5) Repeat step 4 until all required channels are displayed.

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(6)   Press [F5] to go to the next page. Press [F2] to set waveform height to "High" then press [F5] to return to the LA menu.

The above channel selection and shifting operations must be set with the multifunction control knob. If you have to open more than one channels, press [F4] in the channel setup menu to open channels D0-D7, then press [F5] to go to the next page and press [F1] to open channels D8-D15. In the LA menu, you can press [F5] to automatically arrange the channels on display in sequence.

**2.  Using LA functions :**

Set all LA channels as explained above. Input a signal to one or several channels, then press [MENU] in the trigger zone. Press [F1] to select trigger type to LA trigger, then press [F2] to select sub-type. By pressing [F3], you can set the trigger qualifier status. Press [F4] to select trigger mode and [F5] to set the clock (When the sub-type is "pattern") or duration (when sub-type is "duration"). The LA can be used concurrently with the analog channel.
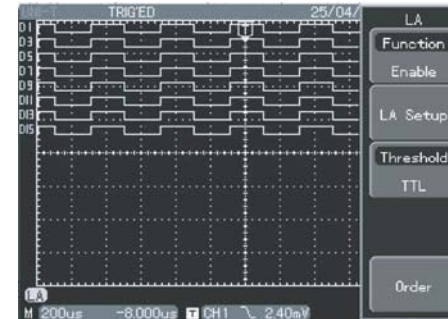


**Figure 3-15  LA channel setup**
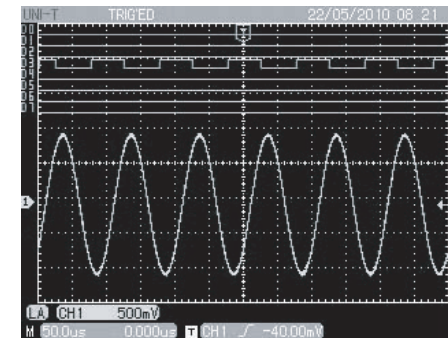


**Figure 3-16  Composite display of the logic analyzer and CH1**

**Illustration 12 : Using the multimeter**

The multimeter of this digital storage oscilloscope can measure 5 parameters : voltage, resistance, on/off, diode and DC current. The following example shows the steps for DC current measurement :

1. Assuming the size of the current to be measured is unknown, a current-voltage converter module of 4A range should be used. Connect it to the multimeter port of the oscilloscope then connect the multimeter pen.
2. Press the [DMM] key and [F1] to open the multimeter function table. Press [F2] then [F5] to select measurement parameter "DC current'. Press [F5] then [F4] to set current range to "4A".
3. Connect the multimeter pen to the circuit being tested.
4. If the signal being tested is relatively small, follow step 2 to select an appropriate current range and use a suitable current-voltage converter module. Adjust the current range of the current-voltage converter module so it is consistent with that of the oscilloscope. Next follow step 3 to measure.



**Figure 3-17  Selecting a large range for measurement**
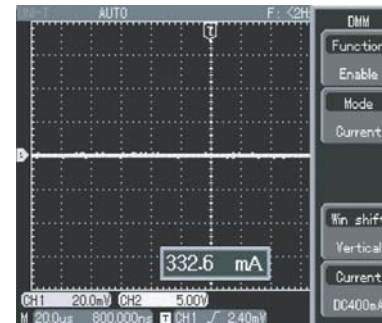


**Figure 3-18  Selecting a suitable range for measurement**

# *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 knob, time base knob, horizontal shift, vertical shift and trigger level adjustments have reached their ultimate limits, this prompt will appear.

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

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

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

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**Waiting :** This prompt appears on the screen during auto calibration. A progress bar appears at the bottom.

**I/O Failure :** When USB communication fails or no document meeting specific requirements is found on the USB device, this prompt appears.

**Function Disabled :** When closing the LA function in the LA menu, this prompt appears if the LA trigger key in the trigger [MENU] is pressed.

**Troubleshooting**

1. If the screen of your oscilloscope remains black without any display after powering on, follow the steps below to find the cause :
  ● Check the power cable connection and check if there is normal power supply.
  ● Check if the power switch is properly pressed.
  ● Restart the unit after performing the above checks.
  ● 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 :
● Check whether the probe is properly connected to the signal lead.
● Check whether the signal lead is properly connected to the BNC (channel adaptor).
● Check whether the probe is connected properly to the object for measurement.
● Check whether the object for measurement is generating signals (connect the channel with signals to the questionable channel to find the cause).
● 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 :
● Check the trigger source setup in the trigger menu. See whether it is the same as the actual signal input channel.
● 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.
● 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] :
● 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.
● Press [AUTO] to complete the setup.

6.　Display speed is slower after average sampling time is enabled :
● If average sampling is carried out for more than 32 times, the display speed will drop. This is normal.
● You can reduce the intervals of average sampling.

7.　Trapezoidal waveform display :
● 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.
● 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 (UTD4000 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.

**Using the USB Upgrade Program**

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

1. The model name, software version and hardware version of your oscilloscope are listed in Table 2-19.
2. The software that corresponds with the model and hardware version of this oscilloscope, i.e the update document, is available for download online. Save the document on a USB device (preferably a USB device recommended by us).
3. Power off the oscilloscope then insert the USB device. Then power on the oscilloscope again. The prompt "Please press [F5] to continue or [F1] to cancel", as shown Figure 5-1, will appear on the screen.
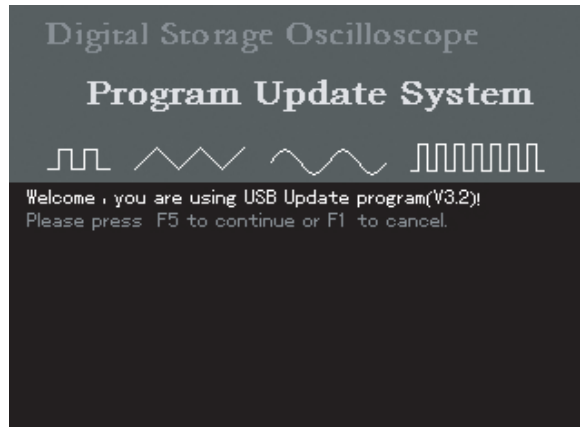
**Figure 5-1  USB upgrade confirmation**

After pressing [F5], you will be prompted to select the upgrade document, as shown in the figure below. You can use the multifunction control knob to select the upgrade document you require, then press [F5] to go to the next step. (If there is only one program upgrade document on the USB device, this prompt will not appear and you can go straight to the next step)
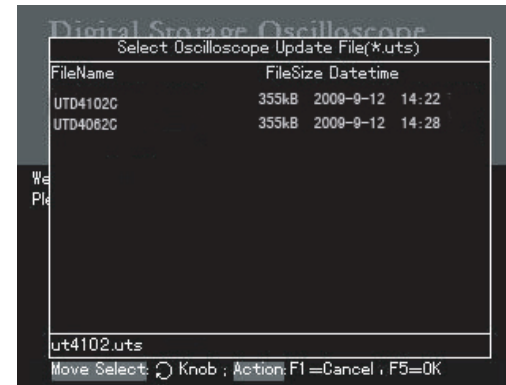


**Figure 5-2   Selection of the USB upgrade document**

4.   When [F5] is presses as shown in Figure 5-2, the following prompt will appear : Are you sure  to update? (F5=Yes,F1=No)

5.   When the USB document is confirmed the following prompt will appear : "Please waitting for update...". (This process may take 3 to 5 minutes)
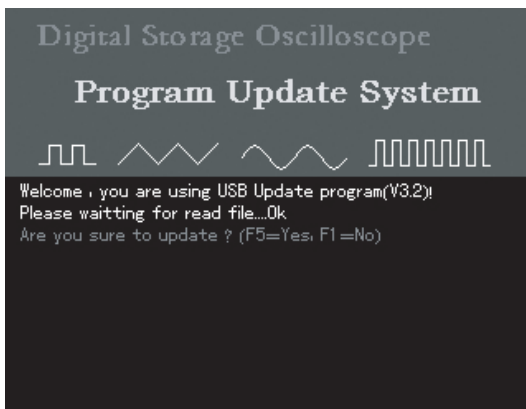


**Figure 5-3   Confirming the USB upgrade document**
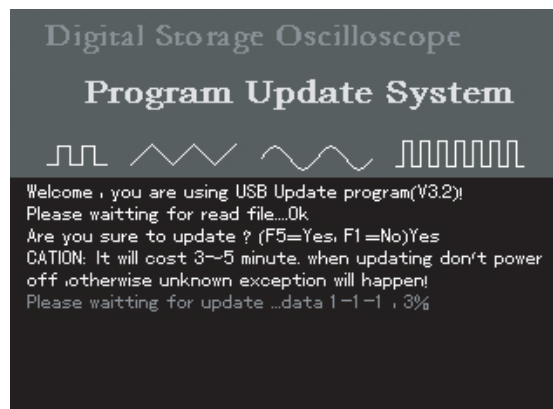


**Figure 5-4   USB upgrade in progress**

6.  When upgrade is complete, a successful upgrade prompt will appear : "Congratulation,Update process Success! Pleases pull out U-disk and reboot" The oscilloscope program is now updated and system upgrade is complete. In the event of upgrade failure, follow the steps below.
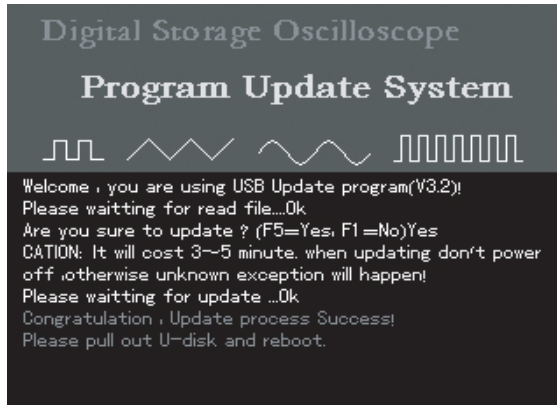


**Figure 5-5   USB upgrade success**

Caution : If upgrade fails due to power interruption, power off the oscilloscope and repeat all the USB upgrade steps.
Below are some common causes for upgrade failure :
1.  No upgrade document.
    If there is no document with the suffix "uts", the following message will appear when [F5] is pressed after powering on : "Can't find the valid update file at U-disk root directory! Please Sure there is update file at U-disk's root directory.Please pull out U-disk and reboot"
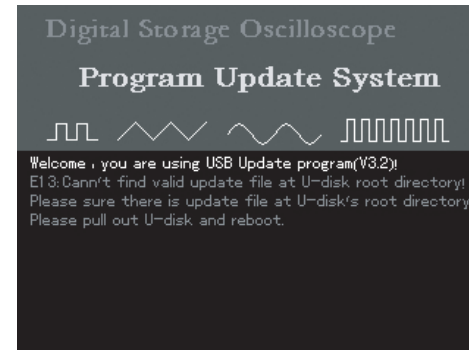


**Figure 5-6   No valid upgrade file**

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2.  The user cancels the upgrade process.
(1) When the oscilloscope is restarted with the USB device plugged in, you can cancel upgrade by pressing [F1]. To cancel upgrade and operate your oscilloscope normally, follow the on-screen instructions : "Please pull out U-disk and reboot"
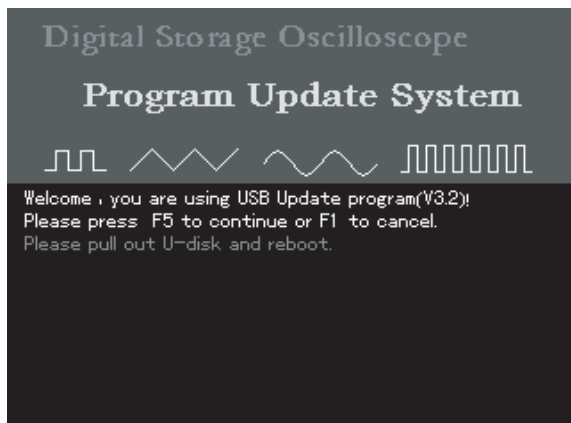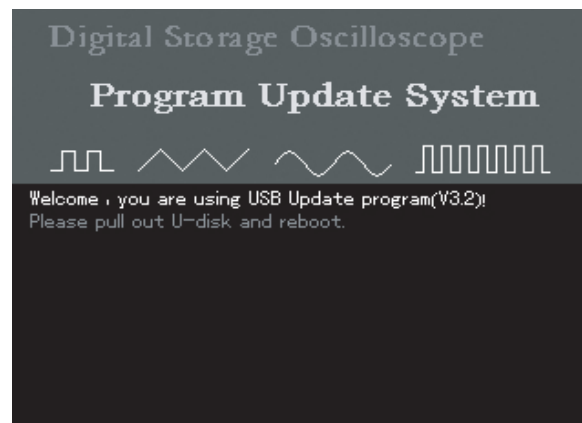
(2)   During the upgrade process, you can cancel upgrade by pressing [F1]. To cancel upgrade and operate your oscilloscope normally, follow the on-screen instructions : "Please pull out U-disk and reboot"



**Figure 5-7   Cancel upgrade (1)**



**Figure 5-8   Cancel upgrade (2)**

(3)   You can still cancel upgrade when the oscilloscope is ready for the process. Simply press [F1] to return to normal operation. Please follow the on-screen instructions : "Please pull out U-disk and reboot"
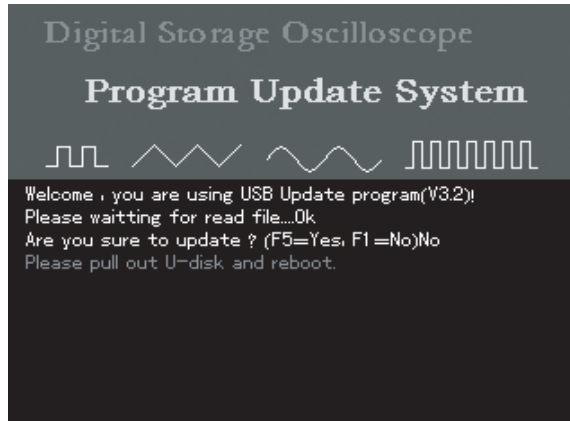
3.  The USB device is removed before upgrade begins.
    If the USB device is removed when the update document is being read before commencement of upgrade, the following prompt will appear : "U-disk has pull out ! Please reboot" To resume normal operation, power on the oscilloscope with the USB device unplugged.
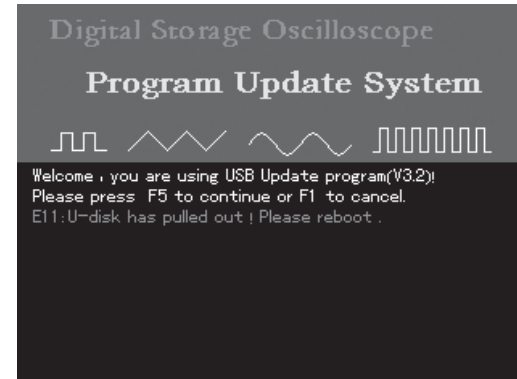


**Figure 5-9   Cancel upgrade (3)**



**Figure 5-10   USB device is removed before upgrade**

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4. Incorrect upgrade document

If the upgrade document on the USB device is incorrect, update will fail upon selecting the upgrade document by pressing [F5] (Figure 5-2). You will see the prompt : "Sorry, the package format isn't correct". Save a correct document on the USB device and repeat the previous steps for upgrade.
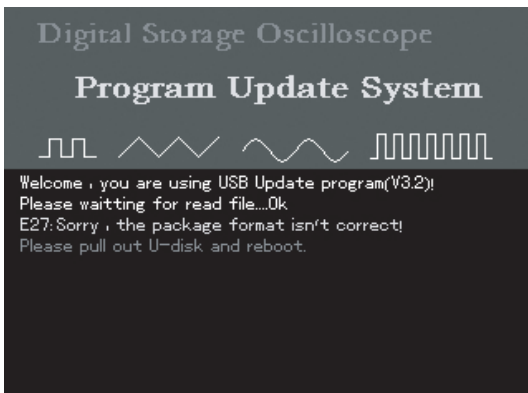


**Figure 5-11   Incorrect upgrade document**

5. Failure in reading upgrade document

After selecting the upgrade document, press [F5] to read. If the document cannot be read, you will see the prompt : "We are sorry for this case, please contact with us". It may be that our oscilloscope does not support your USB device, or document reading is unsuccessful due to other reasons. You can retry and see if the problem can be solved, or use a USB device we recommend. If the problem persists, contact our after-sales service department. To resume normal operation, power off your oscilloscope and then reboot.
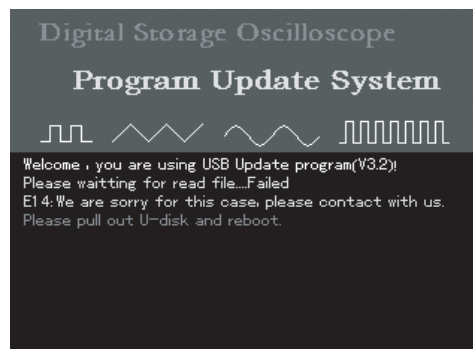


**Figure 5-12   Reading failure**

6. Low software version

If the version of USB document is lower than that of the oscilloscope, upgrade will fail. You will be prompted that, "Sorry, this package's version is too low to update.Please read operating manual,get system infomation in detail." This indicates that the software version you have saved on to the USB device is lower than the existing one on the oscilloscope. You should acquire the correct version either online or through our after-sales service department. To see version information, press [UTILITY] ? [SYSTEM CONFIGURATION] ? [SYSTEM INFORMA-TION]. Please download the suitable upgrade document.
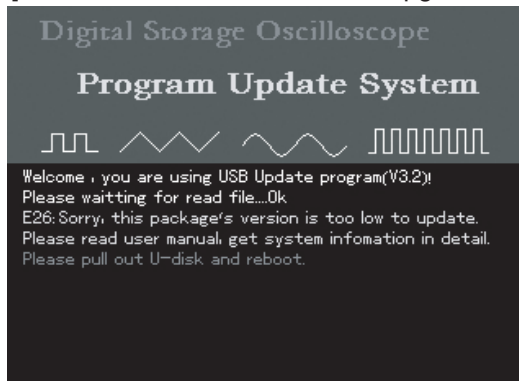


**Figure 5-13   Low software version**

7. Software document incompatible with product model

If the USB upgrade document is incompatible with the oscilloscope model, upgrade will fail. You will be prompted that, "The package's model No.isn't same with this DSO.Please read operating manual,get system infomation in detail." You should download an upgrade document which corresponds with your oscilloscope model, e.g. UTD4102C, then repeat the USB upgrade steps.
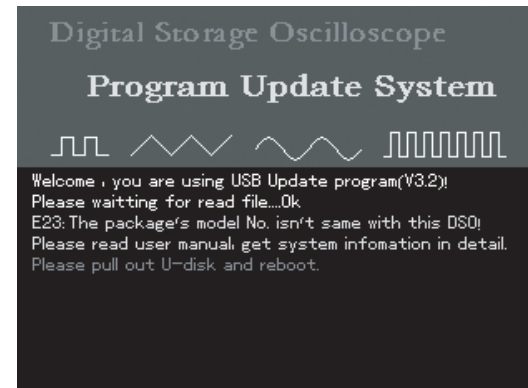


**Figure 5-14   Incompatible software document and product model**

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**Contact Us**

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

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

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**

# *Chapter 6 — Appendixes*

**Appendix A : Technical Indicators**

Unless otherwise specified, all technical specifications apply to probes with a attenuation setting of 10X and the UTD4000 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 | 2GS/s | 50GS/s (UTD4302C/UTD4202C/UTD4152C) |
| Average | When all channels have made N acquisitions simultaneously, N is selectable from 2, 4, 8, 16, 32, 64, 128 to 256. | |

| Input | |
|---|---|
| Input coupling | DC, AC, GND |
| Input impedance | 1MΩ±1.5% in parallel with 24pF±3pF. |
| Probe attenuation factor | 1X, 10X, 100X, 1000X |
| Maximum input voltage | 400V (DC + AC Peak, 1 MΩ input impedance) (10:1 probe attenuation); 5V (Vrms, BNC). |
| Time delay between channels (Typical) | 150ps |

| Horizontal | |
|---|---|
| Waveform interpolation | Sin (x) / x |
| Storage depth | 24K (Max) |
| Equivalent storage depth (dual time base) | 60M |
| Recording length | 1024K |
| Scanning range (s/div) | 1ns/div-50s/div (300MHz);<br>2ns/div-50s/div (200MHz, 150MHz);<br>5ns/div-50s/div (100MHz, 80MHz, 60MHz, 40MHz);<br>At 1-2-5 increment. |
| Accuracy of sampling rate and delay time | ±50ppm (any time interval ≥1ms) |
| Time interval (△T)measurement accuracy (full bandwidth) | Single : ± (1 sampling time interval + 50ppm x reading + 0.6ns);<br>> 16 average values : ± (1 sampling time interval + 50ppm x reading + 0.4ns). |

| Vertical | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | UTD4302C | UTD4202C | UTD4152C | UTD4102C | UTD4082C | UTD4062C | UTD4042C |
| A/D converter (A/D) | 8-bit resolution, two channels sampling simultaneously | | | | | | |
| Deflection factor V/div Range (V/div) (at input BNC) | 1mV/div~10V/div(UTD4102C/UTD4082C/UTD4062C/UTD4042C)<br>2mV/div~5V/div(UTD4302C/UTD4202C/UTD4152C) | | | | | | |
| Displacement range | ≥ ± 10 div (UTD4102C/UTD4082C/UTD4062C/UTD4042C)<br>≥ ± 5 div   (UTD4302C/UTD4202C/UTD4152C) | | | | | | |
| Analog bandwidth | 300MHz | 200MHz | 150MHz | 100MHz | 80MHz | 60MHz | 40MHz |
| Single bandwidth | 100MHz | 100MHz | 100MHz | 100MHz | 80MHz | 60MHz | 40MHz |
| Selectable analog bandwidth limit (Typical) | 20MHz | | | | | | |
| Low frequency response (AC coupling-3dB) | ≤ 5Hz at BNC | | | | | | |
| Rise time (at BNC, typical) | ≤1.2ns | ≤1.8ns | ≤2.3ns | ≤3.5ns | ≤4.3ns | ≤5.8ns | ≤8.7ns |
| DC gain accuracy | When vertical sensitivity is 1mV/div : ±5% (sampling or average acquisition mode);<br>When vertical sensitivity is 2mV/div : ±4% (sampling or average acquisition mode);<br>When vertical sensitivity is 5mV/div~10V/div : ±3% (sampling or average acquisition mode). | | | | | | |
| DC measurement accuracy (average acquisition mode) | When vertical position is zero and N ≥16 :<br>± (5% x reading + 0.1 div + 1mV) and 1mV/div is selected;<br>± (4% x reading + 0.1 div + 1mV) and 2mV/div or 5mV/div is selected;<br>± (3% x reading + 0.1 div + 1mV) and 10mV/div~10V/div is selected.<br>When vertical position is not zero and N ≥16 :<br>± (5% x(reading + vertical shift reading) + (1% x vertical shift reading)]<br>+ 0.2div). Set from 1mV/div to 200mV/div plus 2mV;<br>Setup value > 200mV/div to 10V/div plus 50mV. | | | | | | |
| Voltage difference ( △V) measurement accuracy (average acquisition mode) | Under identical setup and environmental conditions, the voltage difference ( △V) between two points of the waveform after the average of ≥16 waveforms acquired waveforms is taken : ± (3% x reading + 0.05 div). | | | | | | |

| **Trigger** | | |
|---|---|---|
| Trigger sensitivity | ≤1 div | |
| Trigger level range | Internal | ± 8div from the centre of the screen(100MHz  80MHz  60MHz  40MHz)<br>± 5div from the centre of the screen (300MHz  200MHz 150MHz ) |
| | EXT | ± 3V(100MHz  80MHz  60MHz  40MHz )<br>± 800mV(300MHz  200MHz  150MHz ) |
| | EXT/5 | ± 15V(100MHz  80MHz  60MHz  40MHz )<br>± 4V(300MHz  200MHz  150MHz ) |
| 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) |
| Pretrigger capability | Normal mode/scanning mode, pretrigger/delayed trigger. Pretrigger depth is adjustable. | |
| Holdoff range | 96.0000ns – 1.5s | |
| Set level to 50% (Typical) | Input signal frequency ≥50Hz | |
| **Edge Trigger** | | |
| Edge type | Rise, Fall, Rise and Fall | |
| **Pulse Trigger** | | |
| Trigger mode | (Greater than, less than, or equal to) positive pulse; (Greater than, less than, or equal to) negative pulse. | |
| Pulse width range | 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<br>Line range : 1-525 (NTSC) and 1-625 (PAL) |
|---|---|---|
| **Alternate Trigger** | | |
| CH1 Trigger | | Edge, pulse, video, slew rate, LA |
| CH2 Trigger | | Edge, pulse, video, slew rate, LA |

| **Measurement** | | |
|---|---|---|
| Cursor | Manual mode | Voltage difference ( $\triangle$V) between cursors, time difference ( $\triangle$ T) between cursors, $\triangle$T countdown (Hz) (1/ $\triangle$ T). |
| | Tracking mode | Voltage and time of waveform dots. |
| | Automatic measurement mode | Allows cursor display during automatic measurement. |
| Automatic measurement | Measuring Maximum, minimum, top, bottom, mean, peak-to-peak, amplitude, average, root mean square, cycle average, cycle root mean square, area, cycle area, frequency, cycle, rising edge, falling edge, positive pulse, negative pulse, burst pulse, overshoot, preshoot, rise delay, fall delay, phase, positive duty ratio, negative duty ratio. | |
| Math functions<br>Saving waveforms | $+$, $-$, $\times$, $\div$<br>10 groups and 10 setups | |
| FFT | Window | Hanning, Hamming, Blackman, Rectangle |
| | Acquisition points | 1024 points |
| Lissajous Figure | Phase difference | ± 3 degrees |

| LA(UTD4000CA series without this feature) | | |
|---|---|---|
| Channels | D0～D15 | |
| Sample rate | 200MS/s | |
| Recording length | 512k | |
| Maximum input voltage | ±40Vpeak | |
| Minmum voltage slew | 1.2Vpp | |
| Trigger mode | Code | D0～D15，<br>Trigger code：H、L、X、<br>Clock edge：Rise、Fall |
| | Persist | D0～D15，<br>Trigger code：H、L、X; |
| | | condition：＞、＜、＝ |
| | | Persist setup：20ns～10s |

| DMM | | |
|---|---|---|
| DC voltage | | Range：400.0mV/4.000V/40.00V/400.0V<br>Accuracy：±（1％+5 Digital） |
| AC voltage （40Hz～400Hz） | | Range：4.000V/40.00V/400.0V<br>Accuracy：±（1.2％+5 Digital） |
| Resistance | | Range：400Ω/4kΩ/40kΩ/400kΩ/4MΩ/40MΩ<br>Accuracy：±（1.5％+5 Digital） |
| On/off | | <70.0Ω |
| Diode | | Forward Voltage Drop 0.5V-0.8V |
| DC current | UT-M03 | Range：4mA/40mA/400mA<br>Accuracy：±（1％+5 Digital) |
| | UT-M04 | Range:4A<br>Accuracy：±（1.5％+5 Digital） |

**General Specifications**

| Display | |
|---|---|
| Display  Type | 145 mm(5.7 in) diagonal LCD. |
| Display  Resolution | 320 horizontal x RGB x 240 vertical pixels (True colour LCD). |
| Contrast (typical) | Non-adjustable. |
| Backlight  Intensity (Typical) | 300 nit. |
| Display  Languages | Simplified Chinese, Traditional Chinese, English. |

| Probe Compensator Output | |
|---|---|
| Output Voltage (Typical) | about 3V into peak-to-peak at ≥ 1 MΩ load. |
| Frequency (Typical) | 1 kHz |

| Interface Functions | |
|---|---|
| Standard setup | 1 x USB (D);<br>1 x USB (H);<br>LA interface;<br>multimeter interface;<br>Pass/fail interface. |
| Optional | GPIB and LAN. |

| Power Source | |
| --- | --- |
| Source Voltage | 100 - 240VACRMS, 45-440Hz, CAT II |
| Power Consumption | Less than 50VA. |
| Fuse | F1.6AL, 250V.<br>On the power board inside the unit. |

| Environmental | |
| --- | --- |
| Temperature | Operating : 0 °C~+40 °C |
| | Non-operating : -20 °C~+60°C |
| Cooling Method | Forced fan cooling. |
| Humidity | <+35 °C (≤ 90% RH);<br>+35 °C~+40 °C (≤ 60%RH). |
| Altitude | Operating under 3,000m. |
| | Non-operating : under 15,000m. |

| Mechanical Specifications | | |
|---|---|---|
| Dimension | | UTD4000 |
| | Width | 336 mm |
| | Height | 177 mm |
| | Depth | 174mm |

| Weight | Unit only | 3.8kg |
|---|---|---|
| | Including package | 6.5kg |

| IP Protection |
|---|
| Ip2 X |

| Adjust the frequency |
|---|
| We recommend setting a one-year frequency |

**Appendix B : Accessories for UTD4000 Oscilloscopes**

**Standard Accessories :**
● Two 1.2m, 1:1 (10:1) passive voltage probes. For details please read the probe manual. EN61010-031: 2008 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 Operating Manual.
● One Product Warranty Card.
● UTD4000 communication control software (USB-Device).
● USB cable : UT-D06.
● Two multimeter pens and two current-voltage convertor modules : UT-M03/UT-M04.
● UTD4000 logic analyzer probe: UT-U01.

## Optional Accessories :
● UTD4000 LAN&GPIB modulel: UT-M06

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. When cleaning the LCD, 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 mild 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.

**Index**

This operating manual may be revised without prior notice.

**LINI-T** ®

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说明书菲林做货要求：

| 序号 | 项目 | 内容 |
|------|------|------|
| 1 | 尺寸 | 外形尺寸：（210x145）±1mm |
| 2 | 材质 | 封面、封底用230g铜版纸，内页用80g书纸， |
| 3 | 颜色 | 黑色 |
| 4 | 外观要求 | 印刷完整清晰，版面整洁. 无分层. 残损. 毛边等缺陷. |
| 5 | 装订方式 | 胶装 |
| 6 | 表面处理 | 封底和封面过光胶 |
| 7 | 修改 | 1. 修改前物料为：110401103495X<br>2. 第112页"删除成都公司名称和地址"增加"东莞公司名称和地址"<br>3. 改股份 |
| 版本 | | REV.3 |

| DWH<br>设计 | 李丹2018-5-28 | MODEL UTD4000系列<br>机型： 英文说明书 | Part NO.<br>物料编号：110401104799X |
|------|------|------|------|
| CHK<br>审核 | | | |
| APPRO.<br>批准 | | UNI-T® 优利德科技（中国）股份有限公司<br>UNI-TREND TECHNOLOGY (CHINA) CO.,LTD | |