User Manual

Digital Storage Oscilloscope

Version NO: V 1.1

Declaration

Introduction

Description

This series Digital Storage Oscilloscope is a light-weight benchtop oscilloscope for viewing waveforms and taking measurements. Digital storage oscilloscope is an ideal education and training tool and also well suited for application in service and repair.

Characteristic:

- Real-time sampling rate up to 1GSa/s or 500Msa/s, equivalent sampling rate up to 50GSa/s
- Dual Channels, Each channel bandwidth: 25MHz～200MHz
- Vertical sensitivity ： 2mV～5V/div,Time base scope ： 2.5ns～50s/div.
- Memory depth: Each channel at least 4K/CH.
- Math arithmetic functions, Plus, Minus, multiplication, division
- FFT spectrum analyzer function
- Automatic setup of vertical, level and trigger control, rapid display of any activity signals to get the best waveform
- Many kinds of parameters automatic survey function
- X-Y function
- Edge, Video (odd field, even field, all lines,line num) pulse width and detention and so on many trigger ways.
- Multilingual menu display

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Connect the Probe Properly. The probe ground lead is at ground potential. Do not connect the ground lead to an elevated voltage.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and marking on the product. Consult the product manual for further ratings information before making connections to the product.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Use Proper Fuse. Use only the fuse type and rating specified for this

product.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Safety Terms and Symbols

Terms on the Product. These terms may appear on the product:

DANGER: indicates an injury hazard immediately accessible as you read the marking.

WARNING :indicates an injury hazard not immediately accessible as you read the marking.

CAUTION: indicates a hazard to property including the product. Symbols on the Product. These symbols may appear on the product:

Symbols on the Product. These symbols may appear on the product:

Warning high voltage	Protective Ground (Earth) Terminal	Caution Refer to Manual	Double Insulation

Preface

This manual contains operating information for Digital Storage Oscilloscopes. The manual consists of the following chapters:

◆“Accidence” chapter describes Functional Check and Probe Compensation briefly.

◆“Functions Instruction”chapter describes functions of the Oscilloscope systemically.

◆“Operating Basics” chapter covers operating principles of the Oscilloscope and displayed information on the screen.

◆“ Application Examples ”chapter includes examples of a wide variety of measurements to give you ideas on how to solve your measurement problems.

◆ “Prompting messages and Troubleshooting ” chapter describes prompting messages and describes some ways of troubleshooting.

◆ “Service and Support” chapter introduce warranty and technology of products.

◆ “Appendix A :Specifications” chapter introduce specifications of oscilloscopes.

◆“Appendix B: Accessories” chapter briefly describes standard and optional accessories.

◆“Appendix C: Default Setup ”chapter contains a list of the menus and controls with the default (factory) settings that are recalled when you push the DEFAULT SETUP front-panel button.

◆“AppendixD: General Care and Cleaning ” chapter describes how to take care of the oscilloscope.

Catalogue

Chapter 1 Accidence

This Series Digital Storage Oscilloscope is a minitype and portable bench type instruments, which could be used for measuring as the GND voltage.

This Chapter shows you how to operate following tasks:

- Accidence of the front panel and user interface
- Simple checking of functions
- Probe compensation
- Matching probes attenuation coefficient
- Auto self calibration program

1.1 Accidence of the front panel and user interface

It is important for you to understand the DSO's front panel before operating it. The following contents are the brief introduction for the front panel function, which is useful to be familiar with the operation of the Digital Storage Oscilloscope in short time.

This series oscilloscopes provides an easy-to-use front panel to convenience users to operate them, the panel contains knobs and buttons. There is a list of five ashen buttons as menu operational buttons on the right of display screen. You can set different options of the current menu in virtue of them. Other buttons are function buttons, you can enter different function menus or obtain given function application in virtue of them.

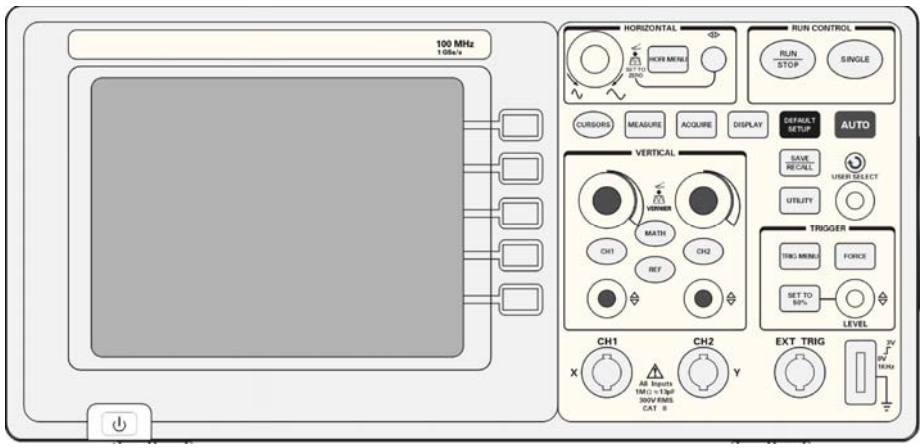


Figure 1-1 Monochrome Oscilloscope's Front Panel

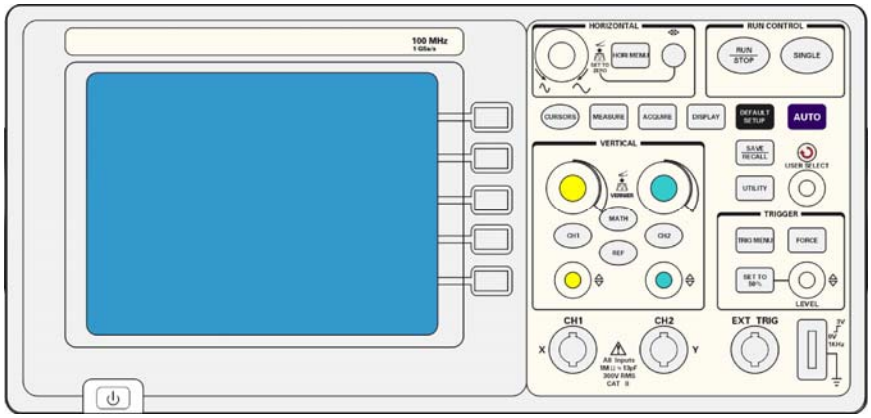


Figure 1- 2 Color Oscilloscope's Front Panel

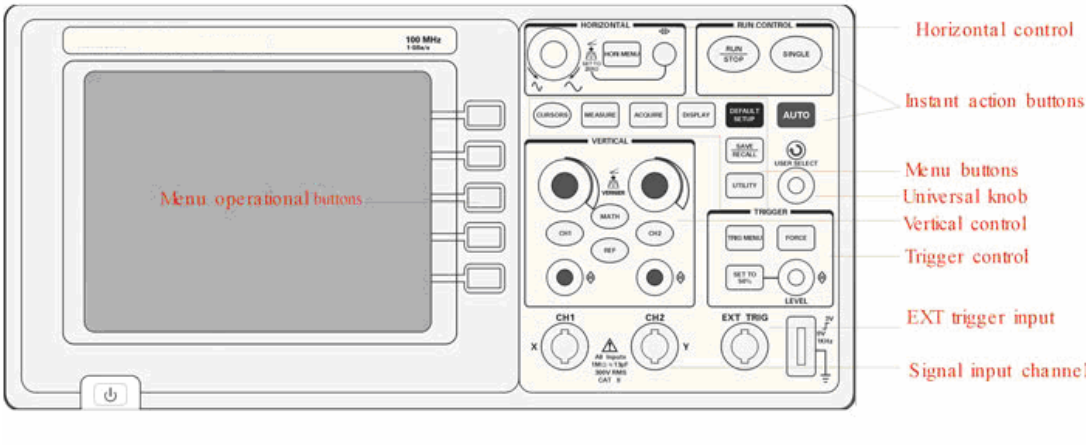


Figure 1- 3 Front Panel Controls

1.2 Function checking

When you check whether or not the oscilloscope could work smoothly, please operate as following:

1. Power On the oscilloscope.

Press “DEFAULT SETUP” to show the result of the self check. The probe default attenuation is 10X.

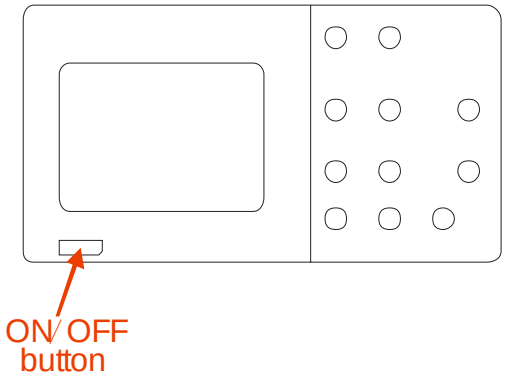


Figure 1- 4

2. Set the switch to 10X on the probe and connect the probe to channel 1 on the oscilloscope. To do this, align the slot in the probe connector with the key on the CH 1 BNC, push to connect, and twist to the right to lock the probe in place. Connect the probe tip and reference lead to the PROBE COMP connectors

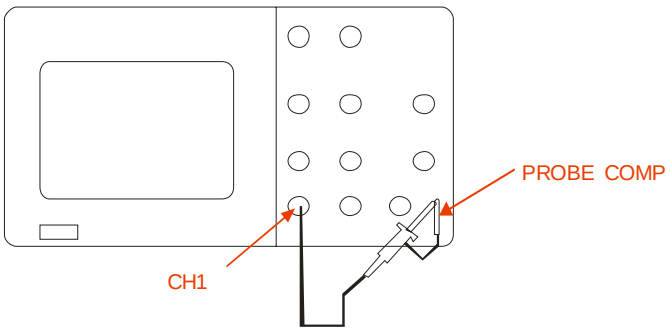


Figure 1-5

3. Press “AUTO” to show the 1KHz frequency and about 3V peak-peak square wave in couple seconds

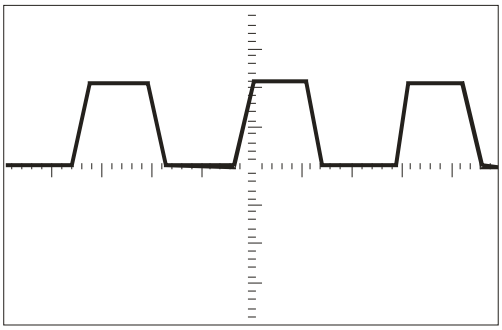


Figure 1- 6

Press “CH1” two times to cancel the channel 1, Press“CH2” to change screen into channel 2, reset the channel 2 as step 2 and 3.

1.3 Probe

1.3.1 Probe Safety

A guard around the probe body provides a finger barrier for protection from electric shock.

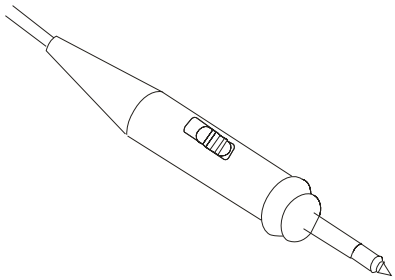


Figure 1-7

Connect the probe to the oscilloscope and connect the ground terminal to ground before you take any measurements.

Note:
- To avoid electric shock when using the probe, keep fingers behind the guard on the probe body.
- To avoid electric shock while using the probe, do not touch metallic portions of the probe head while it is connected to a voltage source. Connect the probe to the oscilloscope and connect the ground terminal to ground before you take any measurements.

1.3.2 Probe Compensation

As an alternative method to Probe Check, you can manually perform this adjustment to match your probe to the input channel.

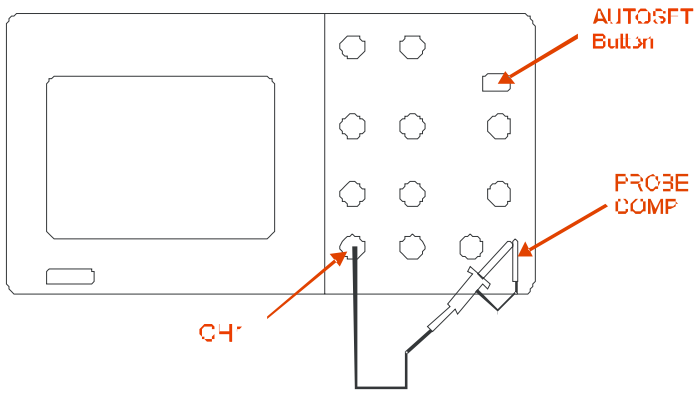
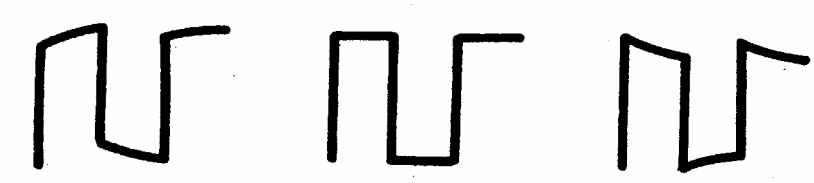


Figure1-8

1. Set the Probe option attenuation in the channel menu to 10X. Set the switch to 10X on the probe and connect the probe to channel 1 on the oscilloscope. If you use the probe hook-tip, ensure a proper connection by firmly inserting the tip onto the probe.

2. Attach the probe tip to the PROBE COMP～3V connector and the reference lead to the PROBE COMP Ground connector. Display the channel and then push the“AUTOSET” button.

3. Check the shape of the displayed waveform.



Overcompensated Compensated correctly Undercompensated

Figure 1-9

4. If necessary, adjust your probe. Repeat as necessary.

1.3.3 Probe Attenuation Setting

Probes are available with various attenuation factors which affect the vertical scale of the signal. The Probe Check function verifies that the Probe attenuation option matches the attenuation of the probe.

you can push a vertical menu button (such as the CH 1 MENU button), and select the Probe option that matches the attenuation factor of your probe.

Note. The default setting for the Probe option is 10X.

Be sure that the Attenuation switch on the probe matches the Probe option in the oscilloscope. Switch settings are 1X and 10X.

Note. When the Attenuation switch is set to 1X, the probe limits the bandwidth of the oscilloscope to 6MHz. To use the full bandwidth of the oscilloscope, be sure to set the switch to 10X.

1.4 Self Calibration

The self calibration routine lets you optimize the oscilloscope signal path for maximum measurement accuracy. You can run the routine at any time but should always run the routine if the ambient temperature changes by 5℃ or more.

To compensate the signal path, disconnect any probes or cables from the front-panel input connectors. Then, push the UTILITY button, select the “Do Self Cal” option and follow the directions on the screen.

Chapter 2 Functions instruction

To use your oscilloscope effectively, you need to learn about the following oscilloscope functions:

- ◆ Vertical System
- ◆ Horizontal System
- ◆ Trigger System
- ◆ Acquiring signals System
- ◆ Display System
- ◆ Measuring waveforms System
- ◆ Utility System
- ◆ Storage System

2.1 Vertical System

Showing as follow picture, the buttons and knobs are useful in the vertical system.

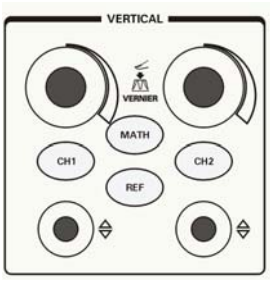


Figure 2-1

The vertical control, which each channel has, could be used for displaying waveform, rectify scale and position.

Table 2-1 Functional Menu of the vertical system

Option	Setting	Introduction
Coupling	DC AC GND	DC passes both AC and DC components of the input signal AC blocks the DC component of the input signal and attenuates signals below 10 Hz GND disconnects the input signal
Bw limit	On Off	Limits the bandwidth to reduce display noise; filters the signal to reduce noise and other unwanted high frequency components
Volts/Div	Coarse Fine	Selects the resolution of the Volts/Div knob Coarse defines a 1-2-5 sequence. Fine changes the resolution to small steps between the coarse settings
Probe	1X 10X 100X 1000X	Set to match the type of probe you are using to ensure correct vertical readouts
Invert	On Off	Open invert function Close invert function

■ **Vertical"POSITION"knob**：Use the VERTICAL POSITION knobs to move the channel waveforms up or down on the screen.

■ **“Volts/Div” knob** ： Use the VOLTS/DIV knobs to control how the oscilloscope amplifies or attenuates the source signal of channel waveforms. When you turn the VOLTS/DIV knob, the oscilloscope increases or decreases the vertical size of the waveform on the screen with respect to the ground level； when you press the“Volt/div” Knob ， you can switch Volt/div option between “Coarse” and“ Fine”.

■**“GND” Coupling:** Use GND coupling to display a zero-volt waveform. Internally, the channel input is connected to a zero-volt reference level.

■ **Fine Resolution**： The vertical scale readout displays the actual Volts/Div setting while in the fine resolution setting. Changing the setting to coarse does not change the vertical scale until the VOLTS/DIV control is adjusted.

■ **Wave Cancel**： Push the menu button for the channel to display its vertical menu. Push the menu button again to remove the waveform.

Note：
- The oscilloscope vertical response rolls off slowly above its bandwidth (60 MHz, 100 MHz,150 MHz or 200 MHz, depending on the model, or 20 MHz when the Bandwidth Limit option is set to On). Therefore, the FFT spectrum can show valid frequency information higher than the oscilloscope bandwidth. However, the magnitude information near or above the bandwidth will not be accurate.
- If the channel is DC coupling，you can quickly measure the DC component of the signal by simply nothing its distance from the ground symbol.
- If the channel is AC coupling，the DC component of the signal is blocked allowing you to use greater sensitivity to display the AC component of the signal.

2.2 Horizontal System

As follow figure, there are one button and two knobs in the HORIZONTAL area.

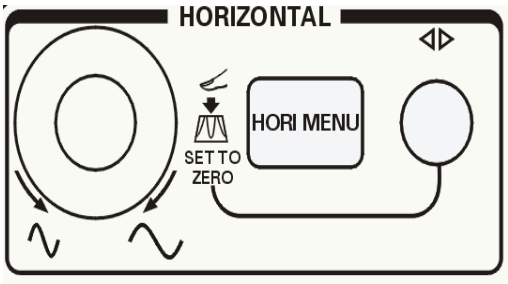


Figure 2- 2

Table 2- 2 Functional Manu of Horizontal：

Option	Introduction
Main	Display the waveform
Win Zone	Two Cursors define one window, the horizontal " POSITION" and "S/div" could adjust the window
Window	Change the display so that the waveform could be displayed in the window（ expanded to screen width)
Holdoff	Using the"universal"knob to adjust holdoff time(sec)，the holdoff value is displayed
Holdoff Reset	Reset holdoff time to 100ns

■ **"HORI MENU"button:** Press the"HORI MENU"button to display the horizontal Menu . In this menu，you can select " ON/OFF "window mode. Otherwise, you could set the horizontal position knob to Trig-offset.

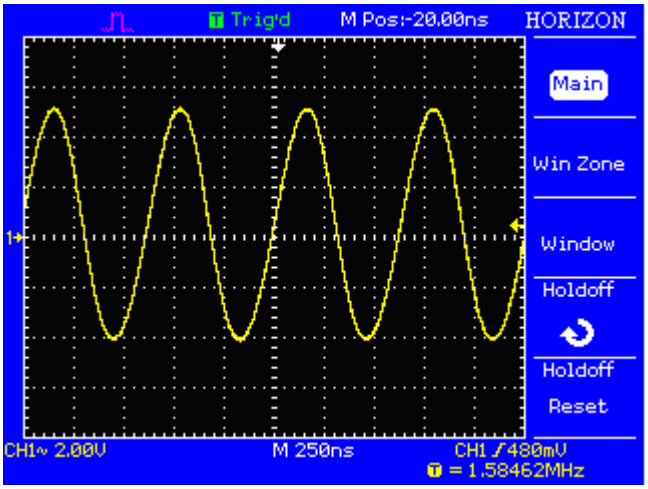


Figure 2-3

The axis of the vertical scale is GND level. The readout on the top right corner ，which unit is sec, show us the horizontal position. “M” Mean main time base，“W ”mean window time base。It is also a arrow on the scale top to show the vertical position.

■ **Horizontal“POSITION”Knob:** Use to control the position of the trigger relative to the center of the screen.

■ **“S/div (Sec/div)”Knob:** Using to change the horizontal time scale to magnify or compress the waveform. If waveform acquisition is stopped (using the RUN/STOP or SINGLE button), the SEC/DIV control expands or compresses the waveform； When you press the “S/div” Knob，you can set the horizontal position to zero.

■ **Window Zone:** Using“Window Zone”to define one wave sect, it is useful to reap the details. The Window time base setting cannot be set slower than the Main time base setting.

■ **Window**：Expand the window to cover the whole screen.

■ **Holdoff**：You can use the Trigger Holdoff function to produce a stable display of complex waveforms, Holdoff is time between when the oscilloscope detects one trigger and when it is ready to detect another. The oscilloscope will not trigger during the holdoff time. For a pulse train, you can adjust the holdoff time so the oscilloscope triggers only on the first pulse in the train.

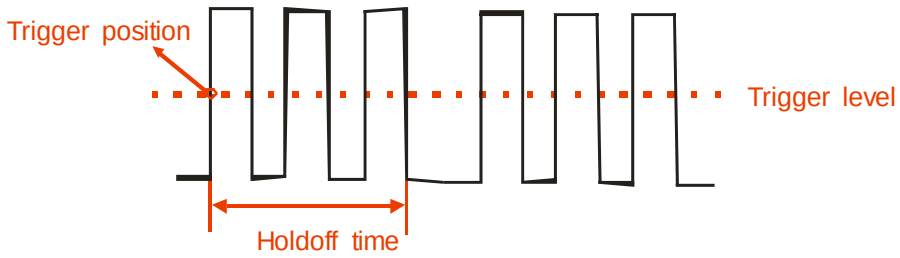


Figure 2-4

Note: ● When you change between the Main, Window Zone, and Window views, the oscilloscope erases any waveform saved on the screen through persistence.

● Use holdoff to help stabilize the display of aperiodic waveforms.

2.3Trigger System

Here are three buttons and one Knob in the Trigger area. Showing as follow picture.

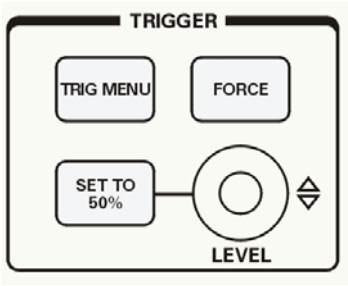


Figure 2-5

■"**TRIG MENU" Button：** press the "TRIG MENU" Button to display the TRIG MENU.

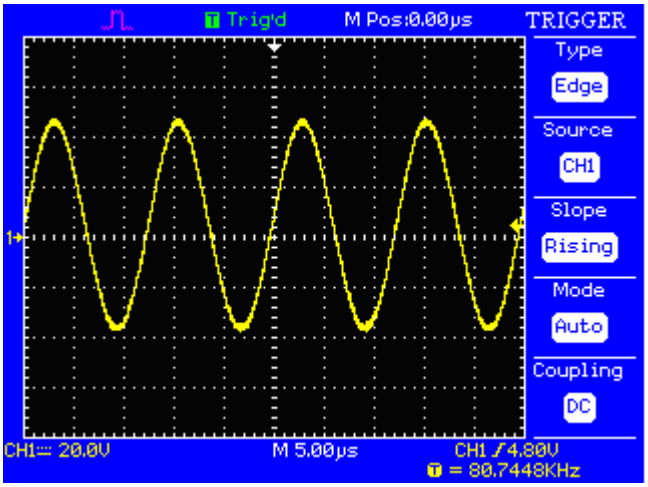


Figure 2-6

■**"LEVEL"Knob：** For setting up the 'TRIG LEVEL'.

■ **"SET TO 50%"Button：** Use the "SET TO 50%" button to stabilize a waveform quickly. The oscilloscope can set the Trigger Level to be about halfway between the minimum and maximum voltage levels automatically. This is useful when you connect a signal to the EXT TRIG BNC and set the trigger source to Ext or Ext/5.

■**"FORCE"Button:** Use the FORCE TRIG button to complete the current waveform acquisition whether or not the oscilloscope detects a trigger. This is useful for SINGLE acquisitions and Normal trigger mode.

2.3.1 Signal Source

You can use the Trigger Source options to select the signal that the oscilloscope uses as a trigger. The source can be any signal connected to a channel BNC, to the EXT TRIG BNC or the AC power line (available only with Edge triggers).

2.3.2 Trigger Type

This Series have three types Trigger：Edge，Video，Pulse .

Edge Trigger：Use Edge triggering to trigger on the edge of the oscilloscope input signal at the trigger threshold.

Table 2-3 Edge Trigger Menu:

Option	Setting	Explain
Type	Edge	With Edge highlighted, the rising or falling edge of the input signal is used for the trigger
Source	CH1 CH2	Triggers on a channel whether or not the waveform is displayed.
	EXT	Does not display the trigger signal; the Ext option uses the signal connected to the EXT TRIG front-panel BNC and allows a trigger level range of -2.4V to +2.4V
	EXT/5	Same as Ext option, but attenuates the signal by a factor of five, and allows a trigger level range of +12V to -12V.This

		extends the trigger level range.
	AC Line	This selection uses a signal derived from the power line as the trigger source; trigger coupling is set to DC and the trigger level to 0 volts
	EXT （50Ω）	Select EXT TRIG（50Ω）as the trigger signal
Slope	Raising Falling	Select the Raise and Fall edges of the trigger signals
Mode	Auto	Use this mode to let the acquisition free-run in the absence of a valid trigger; This mode allows an untriggered, scanning waveform at 100 ms/div or slower time base settings
	Normal	Use this mode when you want to see only valid triggered waveforms; when you use this mode, the oscilloscope does not display a waveform until after the first trigger
	Single	when you want the oscilloscope to acquire a single waveform, press the “SINGLE ”button
Coupli ng	DC	Passes all components of the signal
	AC	Blocks DC components and attenuates signals below 10 Hz
	HF Reject	Attenuates the high-frequency components above 80 kHz.
	LF Reject	Blocks the DC component and attenuates the low-frequency. components below 300 kHz.

Pulse Trigger：Use Pulse Width triggering to trigger on aberrant pulses.

Table 2-4 Pulse Trigger Menu：

Option	Setting	Explain
Type	Pulse	Select the pulse to trigger the pulse match the trigger condition
Source	CH1 CH2 EXT EXT/5 EXT（50Ω）	
when	(Positive pulse width less than pulse width setting) (Positive pulse width larger than pulse width setting) (Positive pulse width equal to pulse width setting) (Negative pulse width less than pulse width setting) (Negative pulse width larger than pulse width setting) (Negative pulse width equal to pulse width setting)	Select how to compare the trigger pulse relative to the value selected in the Set Pulse Width option
set width	20.0ns～10.0s	Selecting this option can turn the universal to set up the pulse width.
Mode	Auto Normal single	Select the type of triggering; Normal mode is best for most Pulse Width trigger applications
Couplin g	DC AC HF Reject LF Reject	

Video Trigger：Trigger on fields or lines of standard video signals.

Table 2-5 Functional Manu of Video Trigger：

Option	**Setting**	**Instruction**
Type	Video	When you select the video type, put the couple set to the AC, then you could trigger the NTSC, PAL and SECAM video signal
Source	CH1 CH2	Select the input source to be the trigger signal
	EXT EXT/5	Ext and Ext/5 use the signal applied to the EXT TRIG connector as the source
	EXT（50Ω）	Select EXT TRIG（50Ω）as the trigger signal
Polarity	(Normal)	Normal triggers on the negative edge of the sync pulse
	(Inverted)	Inverted triggers on the positive edge of the sync pulse
Sync	Line Num All lines Odd field Even Field	Select appropriate video sync
Standard	NTSC Pal/Secam	Select the video standard for sync and line number count

2.3.3 Coupling

Using the “Coupling” to make sure the signal which pass the trigger circuit. It is useful for us to gather a steady wave form.

If you use the trigger coupling , you should press the “ TRIGGER” button and then select “ edge” or “Pulse” trigger. Then select the “coupling” option.

2.3.4 Position

The horizontal position control establishes the time between the trigger position and the screen center. You can adjust the HORIZONTAL POSITION control to view waveform data before the trigger, after the trigger, or some of each. When you change the horizontal position of a waveform, you are changing the time between the trigger and the center of the display actually. (This appears to move the waveform to the right or left on the display.)

2.3.5 Slope & Level

The Slope and Level controls help to define the trigger. The Slope option (Edge trigger type only) determines whether the oscilloscope finds the trigger point on the rising or the falling edge of a signal.

The TRIGGER LEVEL knob controls where on the edge the trigger point occurs.

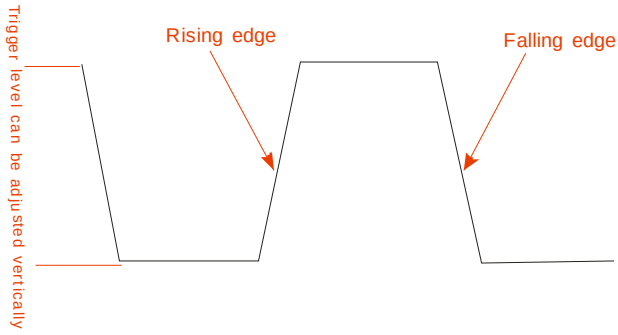


Figure 2-7

Note: ● Press the SINGLE button when you want the oscilloscope to acquire a single waveform

● . Trigger coupling affects only the signal passed to the trigger system. It does not affect the bandwidth or coupling of the signal displayed on the screen.

● Normal Polarity Sync triggers always occur on negative-going orizontal sync pulses. If the video waveform has positive-going horizontal sync pulses, use the Inverted Polarity selection.

● Source-EXT（50Ω）：This function is only in models that the bandwidth is 200MHZ or 100MHZ.And normally used ONLY for a signal source that requires 50Ωtermination.

2.4 Acquiring Signals system

Showing as the follow picture，the“ACQUIRE”button for Acquiring Signals system is at the menu.

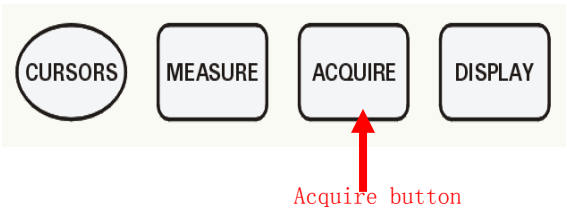


Figure 2-8

Table 2- 4 The Function manual of the Acquiring Signals:

Options	**Set up**	**Introduction**
Sampling		Use for sampling and accurately display most of the waveform
Peak Check		Detect the noise and decrease the possibility of aliasing.
Average		Use to reduce random or uncorrelated noise in the signal display.
Averages	4 16 32 64 128 256	Select number of averages
Mode	Equ time Real time	Set up the Sampling form

When you acquire a signal, the oscilloscope converts it into a digital form and displays a waveform. The acquisition mode defines how the signal is digitized and the time base setting affects the time span and level of detail in the acquisition.

■ **Sampling:** In this acquisition mode, the oscilloscope samples the signal in evenly spaced intervals to construct the waveform. This mode accurately represents signals most of the time.

Advantage： You can use this mode to reduce random noise.

Disadvantage： This mode does not acquire rapid variations in the signal that may occur between samples. This can result in aliasing may cause narrow pulses to be missed. In these cases, you should use the Peak Detect mode to acquire data.

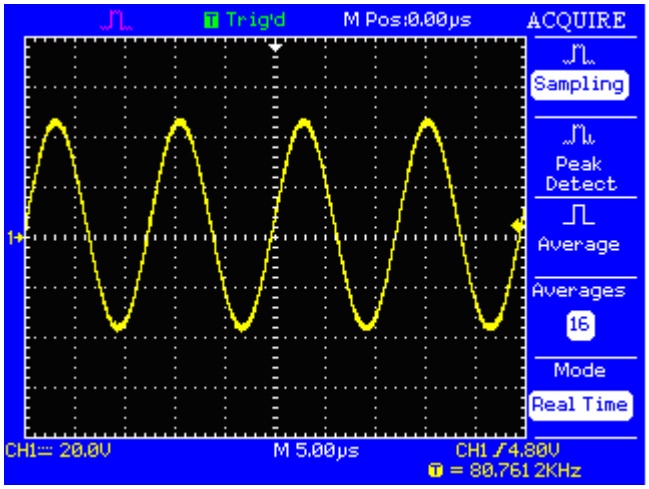


Figure 2-9 Sampling modes

■ **Peak Detect:** Peak Detect mode capture the maximum and minimum values of a signal Finds highest and lowest record points over many acquisitions. **Advantage：** In this way, the oscilloscope can acquire and display narrow pulses, which may have otherwise been missed in Sample mode.

Disadvantage: Noise will appear to be higher in this mode.

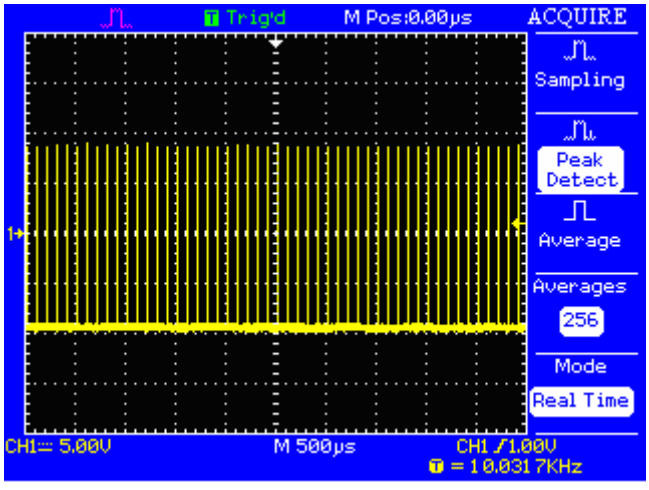


Figure 2-10 Peak Detect mode

■ **Average:** The oscilloscope acquires several waveforms, averages them, and displays the resulting waveform.

Advantage: You can use this mode to reduce random noise.

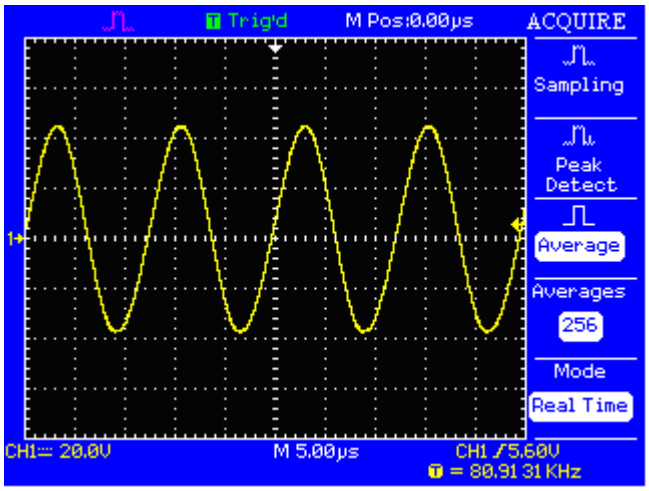


Figure 2-11 Average mode

■ **Equivalent Time Sampling：**

The equivalent time sampling mode can achieve up to 20 ps of horizontal resolution (equivalent to 50 GSa/s). This mode is good for observing repetitive waveforms.

■ **Real Time Sampling：** This series has the highest Real-time sampling rate up to 1GSa/s

■ **"RUN/STOP"Button：** Press the RUN/STOP button when you want the oscilloscope to acquire waveforms continuously. Press the button again to stop the acquisition.

■ **"SINGLE"Button：** Push the SINGLE button when you want the oscilloscope to acquire a single waveform and then stop. Each time you push the SINGLE button, the oscilloscope begins to acquire another waveform. After the oscilloscope detects a trigger it completes the acquisition and stops.

When you push the RUN/STOP or SINGLE buttons to start an acquisition, the oscilloscope goes through the following steps:

1. Acquires enough data to fill the portion of the waveform record to the left of the trigger point. This is also called the pretrigger.

2. Continues to acquire data while waiting for the trigger condition to occur.

3. Detects the trigger condition.

4. Continues to acquire data until the waveform record is full.

5. Displays the newly-acquired waveform.

■ **Base time:** The oscilloscope digitizes waveforms by acquiring the value of an input signal at discrete points. The time base allows you to control how often the values are digitized.

To adjust the time base to a horizontal scale that suits your purpose,

use the SEC/DIV knob.

■ **Time Domain Aliasing:**

Aliasing occurs when the oscilloscope does not sample the signal fast enough to construct an accurate waveform record. When this happens, the oscilloscope displays a waveform with a frequency lower than the actual input waveform, or triggers and displays an unstable waveform.

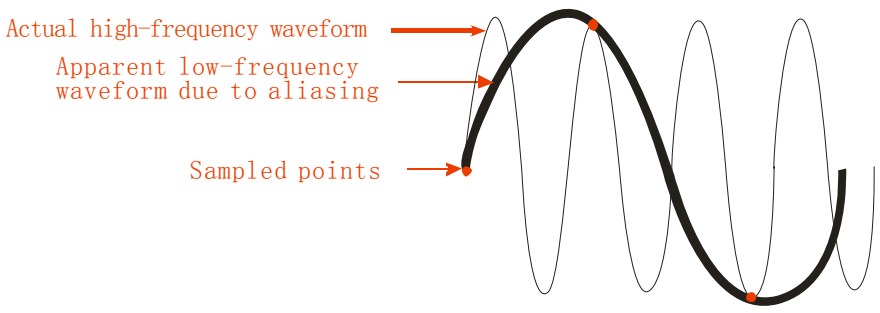


Figure 2-12

2.5 Display System

The display function could be expressed by the “DISPLAY” Button.

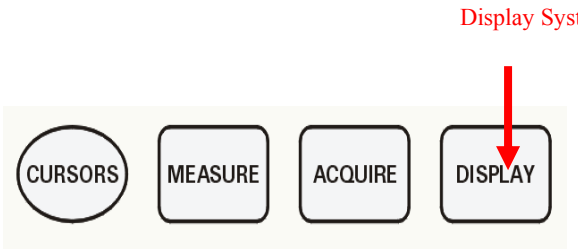
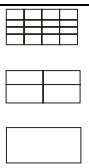


Figure 2-13

Table 2-7

Options	**Set up**	**Introduction**
Type	Vectors Dots	Vectors fills the space between adjacent sample points in the display Dots:display sample points directry
Persist	Off 1 sec 2 sec 5 sec Infinite	Sets the length of time each displayed sample point remains displayed
Contrast	＋ —	Increase the display contrast Decrease the display contrast
Format	YT XY	YT format displays the vertical voltage in relation to time (horizontal scale) XY format displays a dot each time a sample is acquired on channel 1 and channel 2
Screen	Normal	set to normal mode

	Inverted	set to invert color display mode
Grid		Display grids and axes on the screen Turn off the grids Turn off the grids and axes

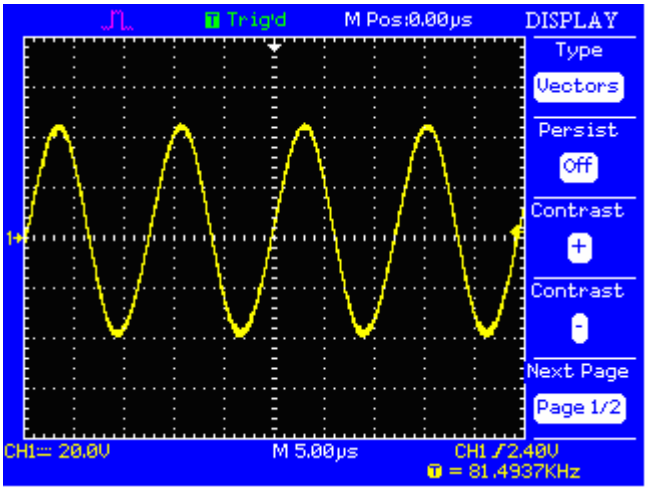


Figure 2-14

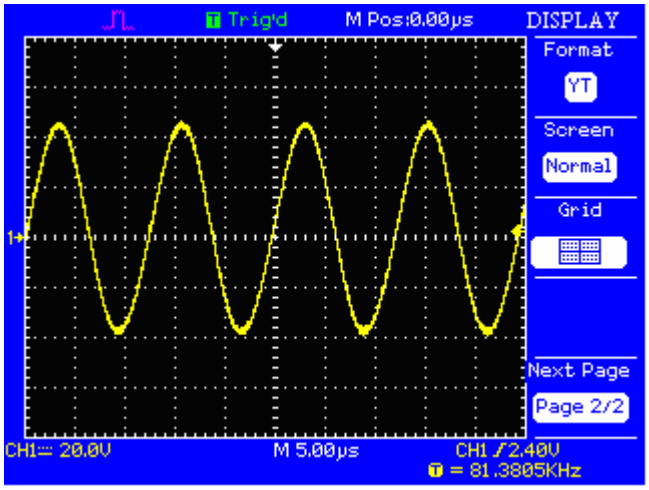


Figure 2-15

2.5.1 X-Y Format

Use the XY format to analyze phase differences, such as those represented by Lissajous patterns. The format plots the voltage on channel 1 against the voltage on channel 2, where channel 1 is the horizontal axis and channel 2 is the vertical axis. The oscilloscope uses the untriggered Sample acquisition mode and displays data as dots.

XY mode has a breakthrough that trad oscilloscopes restrict sampling rate at 1MSa/s，support 5KSa/s～200MSa/s (1-2-5 sequence).

> **Note**：The oscilloscope can capture a waveform in normal YT mode at any sampling rate. You can view the same waveform in XY mode. To do so, stop the acquisition and change the display format to XY.

Operation steps ：

- Channel 1“Volt/div”and vertical“POSITION”set up the horizontal scale and position.
- Channel 2“Volt/div”and vertical “POSITION”set up the horizontal scale and position.

The following functions are forbidden at XY display form:

- Benchmark wave form and wave mathematic
- Cursor
- Autoset（resets display format to YT）
- Trigger Control
- Horizontal Position Knob
- Vector Display Type
- Scan Display

Note： When the display Type is set to Vectors, the oscilloscope connects the sample points by using digital interpolation.Interpolation mode contain linearity interpolation and sin(x)/x interpolation. Sin(x)/x interpolation is suitable for real time mode.when the real time rating is 500MSa/s,it is effective at 250ns/div or at faster time base.when the real time rating is 1GSa/s,it is effective at 25ns/div or at faster time base.

2.6 Measure system

The Oscilloscope display the voltage in relation to time and test the wave form displayed. There are scale, Cursor and auto measure modes.

2.6.1 Scale Measurement

This method allows you to make a quick, visual estimate. For example, you might look at a waveform amplitude and determine that it is a little more than 100 mV. You can take simple measurements by counting the major and minor graticule divisions involved and multiplying by the scale factor. For example, if you counted five major vertical graticule divisions between the minimum and maximum values of a waveform and

knew you had a scale factor of 100 mV/division, then you could easily calculate your peak-to-peak voltage as follows:

5 divisions x 100 mV/division = 500 mV.

2.6.2 Cursor Measurement

Figure 2-16 displays the cursor button on the front-panel for this menu .

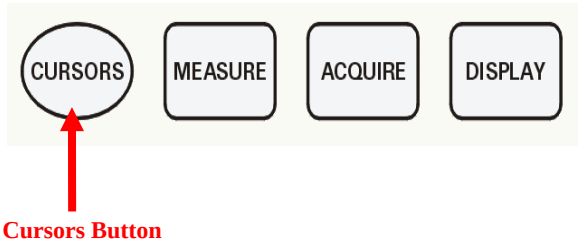


Figure 2-16

Press the“CURORS”button to display the “Cursor” Menu.

Table 2-5 Functional Menu of the Cursor

Option	SET	Introduction
Type	Voltage Time off	Select and display the measure cursor; Voltage measures amplitude and Time measures time and frequency
Source	CH1 CH2 MATH REFA REFB	Select the wave form which is measured by the cursor measure
Cur1		select Cur1 and turn the universal knob to adjust Cur1
Cur2		Select Cur2 and turn the universal knob to adjust Cur2

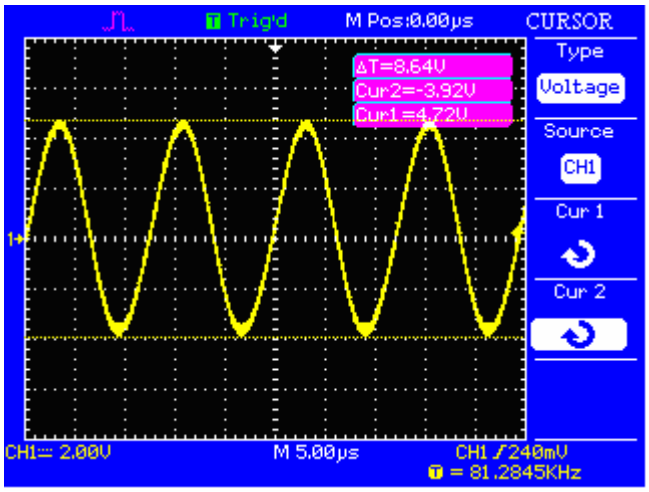


Figure 2-17

This method allows you to take measurements by moving the cursors, which always appear in pairs, and reading their numeric values from the display readouts.

■ **Voltage Cursor:** Voltage cursors appear as horizontal lines on the display and measure the vertical parameters.

■ **Time Cursor:** Time cursors appear as vertical lines on the display and measure the horizontal parameters.

■ **Cursor Moving:** Use the “universal” knob to move cursor1 and cursor2 。They could be moved when the cursor menu displayed

■ **Level and the div of the reading in the increment:** Vertical sensitivity should match on waveforms used for math operations. If they do not match, and you use cursors to measure the waveform, div is the unit of the result of math operation.

2.6.3 Auto Measurement

“MEASURE”: Automatic measure function button.

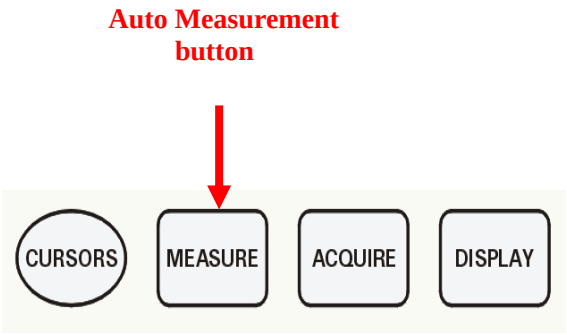


Figure 2-18

When you take automatic measurements, the oscilloscope does all the calculating for you. Because the measurements use the waveform record points, they are more accurate than the graticule or cursor measurements.

Press the ‘MEASURE’ for the Automatic Test. There are eleven types of measurements available. You can display up to five at a time.

Voltage Measure: MAX、Min、Peak-Peak、Average、Vrms.

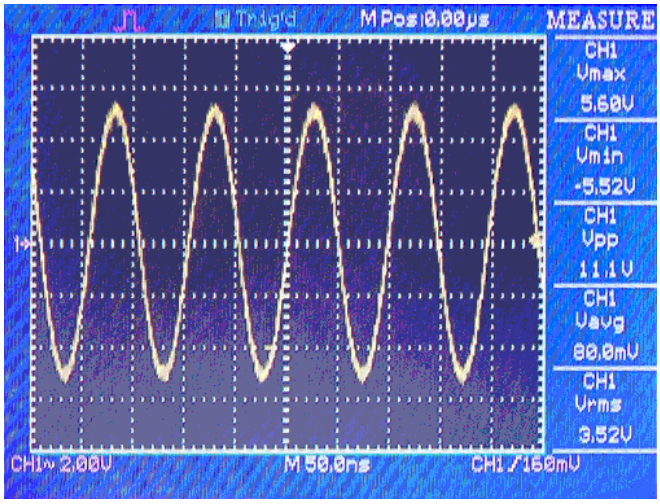


Figure 2-19

■ **Time Measure:** Rise time, Fall time, Frequency, Cyc RMS positive pulse width, negative pulse width.

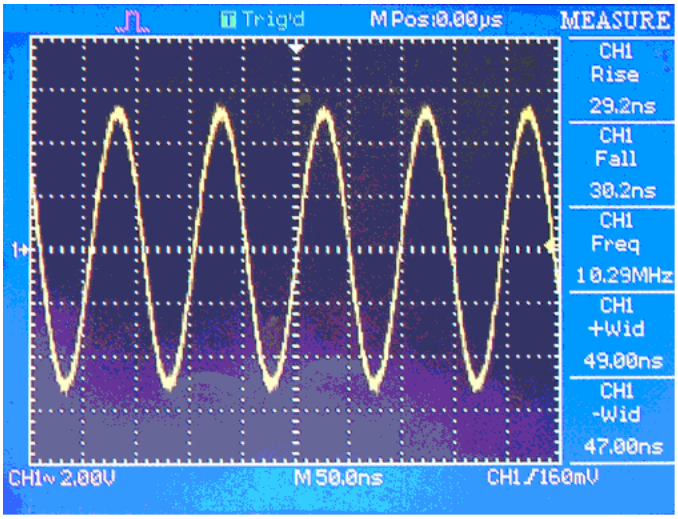


Figure 2-20

2-6 Introduction of the Measure Type:

Measure Type	**Introduction**
Vmax	Vmax Examines the entire 2500 point waveform record and displays the maximum value
Vmin	Vmin Examines the entire 2500 point waveform record and displays the minimum value

Vpp	Vpp Calculates the absolute difference between the maximum and minimum peaks of the entire waveform.
Vavg	Count the arithmetic average Voltage in the record
Vrms	Calculates a true RMS measurement of the first complete cycle of the waveform
Rise	Rise Time Measures the time between 10% and 90% of the first rising edge of the waveform.
Fall	Fall Time Measures the time between 90% and 10% of the first falling edge of the waveform.
+ Width	+ Width Measures the time between the first rising edge and the next falling edge at the waveform 50% level.
- Width	-Width Measures the time between the first falling edge and the next rising edge at the waveform 50% level.

"All measurements"menu has a "All measurements"option, you can use this option display all of these eleven options on the screen once.

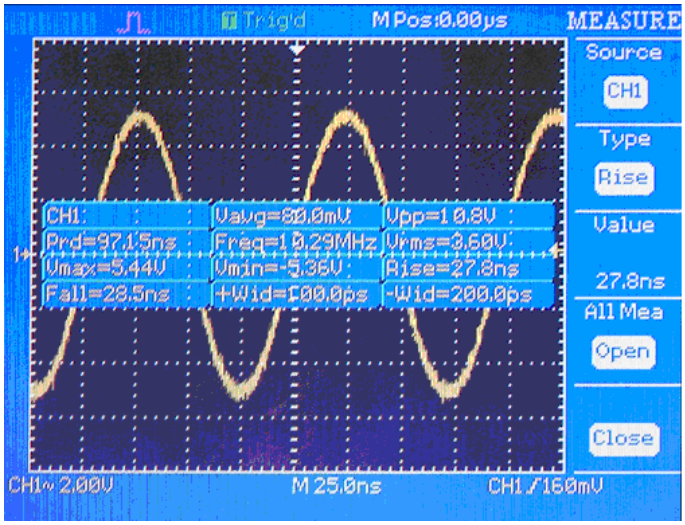


Figure 2-21

2.7 Utility System

"UTILITY": The Utility System Button.

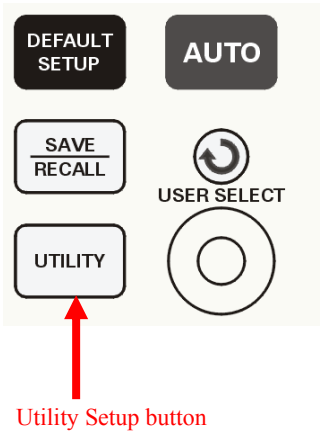


Figure 2-22

Table 2- 7 Functional Menu of the Utility System:

Option	SET	Introduction
System Status		Displays summaries of the oscilloscope settings
Sound		Set up the button voice
Counter	On Off	Turn on Frequency Counter Turn off Frequency Counter
Language	Chinese English	Set up the menu in Chinese Set up the menu in English
DO self cal		Auto self emendation
Do Self Test	Screen Test KeyboardTest LED Test	RUN the screen detect program Run the keyboard detect program Run the dot lighten detect program

Press the UTILITY button to see the “Utility menu”.

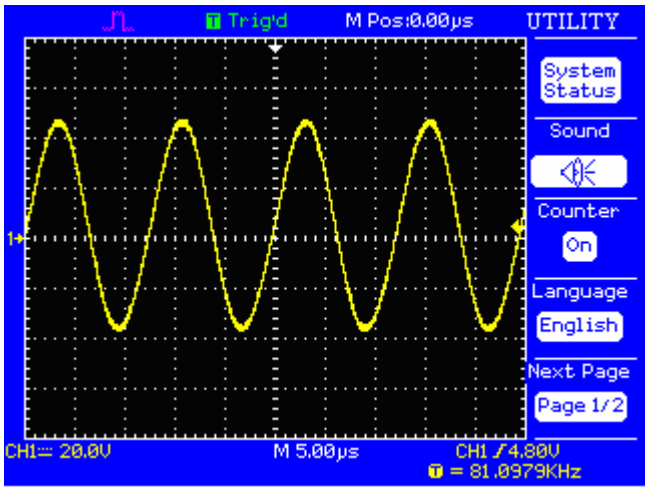


Figure 2-23

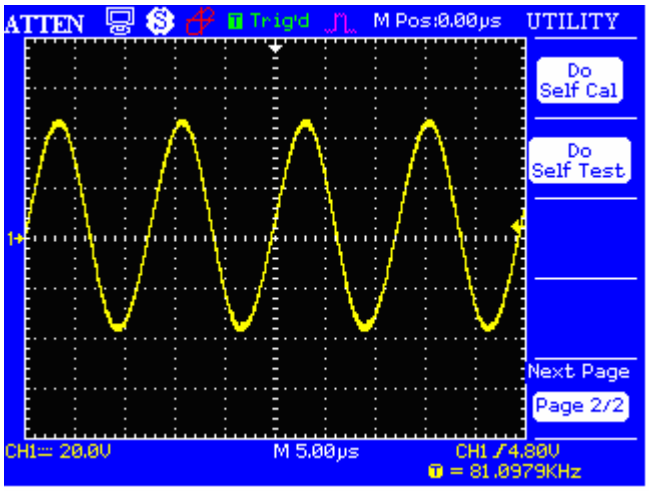


Figure 2-24

2.7.1 system status

Selecting “System Status” from the Utility Menu to display a series of information about this oscilloscope.

Table 2-8

Option	**Introduction**
Starup Times	List the open times
Software version	list the software version
Hardware	List the hardware version

Version	
Product type	List the product type
Serial No.	List the product serial number

2.7.2 Language

Eleven languages could be selected as the operation language in this series.

Press the " Utility" button to select the "language" and you can choose English or Chinese.

2.7.3 Self Calibration

When you operate the self Calibration, you should cut all the probes and lead. Then press the "Utility" button to choose the "Do self cal" to show the self Calibration Menu.

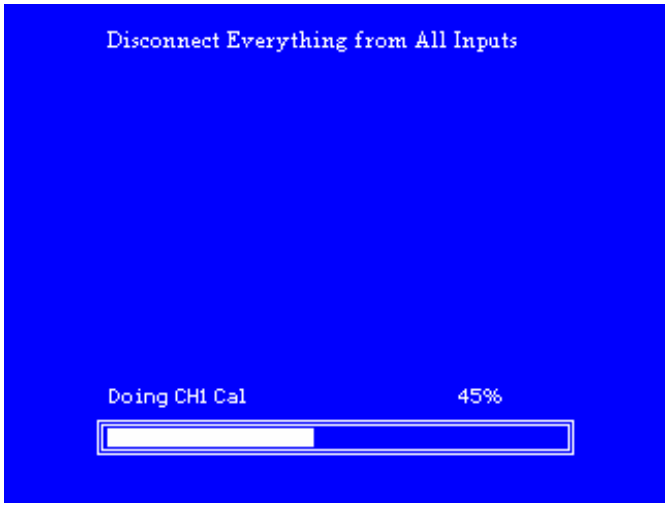


Figure 2-25

2.7.4 Self Test

Table2-12 Press“UTILITY”→“Do Self Test”

Option	**Introduction**
Screen Test	Run Screen Test Program
Keyboard Test	Run Keyboard Test Program
LED Test	Run LED Test Program

Operation Steps:

1. Screen Test:

Select “Screen Test” to enter the screen test interface. The clew words “Press ‘SINGLE’Key to continue，Press ‘RUN/STOP’ Key to exit”is displayed, you could press the “Single” for test.

2. Keyboard Test

Select “keyboard Test” to enter the key test interface, The on-screen lathy rectangle shapes represent the front panel keys. The shapes with two arrows beside them represent the front panel knobs. The squares represent the knob presses for scale knobs. Test all keys and knobs and you should also verify that all the backlit buttons illuminate correctly.

Note:

- When you operate, the screen would display the white (Color LCD) and black (single LCD) repose.
- The tested button or knobs corresponding area would display the green(Color LCD) or white(single LCD).
- At the bottom of the screen display “Press‘ RUN/STOP’ Key Three Times to exit”information prompt to show that press “RUN/STOP”3 times for quite the test .

3. LED test

- Select “LED Test” to enter the lighten interface, the on-screen lathy rectangle

shapes represent the front panel keys；the lathy rectangle shapes represent the front panel knobs. The squares represent the knob presses for scale knobs. The clew words “Press ‘SINGLE’Key to continue , Press ‘RUN/STOP’ Key to exit”is displayed, you could press the “Single” continuously for test, when buttons are lighted ,the corresponding area on the screen would display the white(LCD).

2.8 Storage System

Showing as follow picture, The SAVE/RECALL is the Storage System Functional Button.

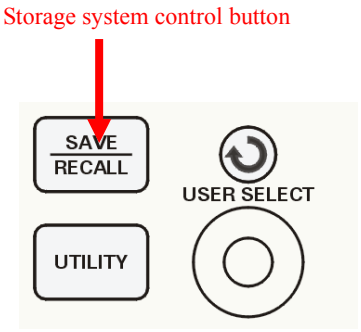


Figure 2-26

Press“SAVE/RECALL”button to save or recall the oscilloscope set or waveforms

SAVE/RECALL SETUP

■ **SAVE/RECAL Setup：** The complete setup is stored in nonvolatile memory. When you recall the setup, the oscilloscope will be in the mode from which the setup was saved.

The oscilloscope saves the current setup if you wait three seconds after the last change before you power off the oscilloscope. The oscilloscope recalls this setup the next time you apply power.

Table 2-13

Option	Setup	Introduction
Type	Setups	Menu for the Storage/Recall setting in the oscilloscope
Setup	NO.1 to NO.10	Save/Recall the setup in the currently position
Save		Accomplish the storage
Recall		Recall the storage in the “Setup” operation

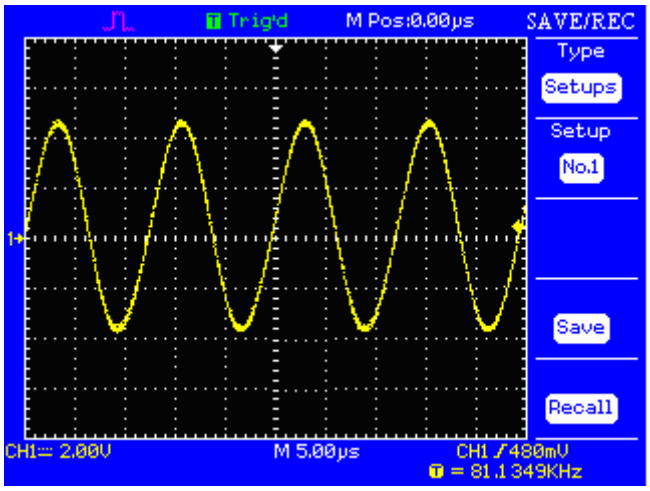


Figure 2-27

■ **RECALL FACTORY**

You can use this option to recall the factory setup.

Table 2-14

Option	**Setting**	**Instruction**
Type	Factory	To view the Factory setup
	Load	Recall the Factory setup

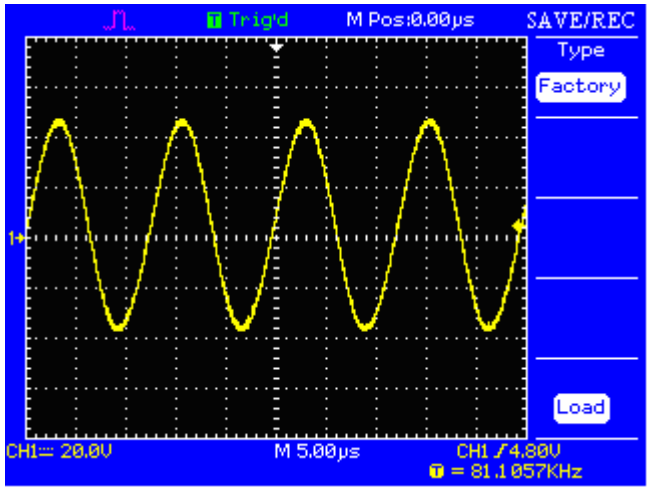


Figure 2-28

SAVE/RECALL WAVEFORM

■ **SAVE/RECALL CAPTURED WAVEFORM:** The oscilloscope must display any waveform that you want to save. The oscilloscopes can store ten captured waveforms in nonvolatile memory.

Table 2-15

Option	Setup	Introduction
Type	waveforms	Menu for the Storage/Recall waveforms in the oscilloscope
waveform	NO.1 to NO.10	Save/Recall the waveforms in the currently position
Save		Accomplish the storage
Recall		Recall the storage in the "waveform" operation

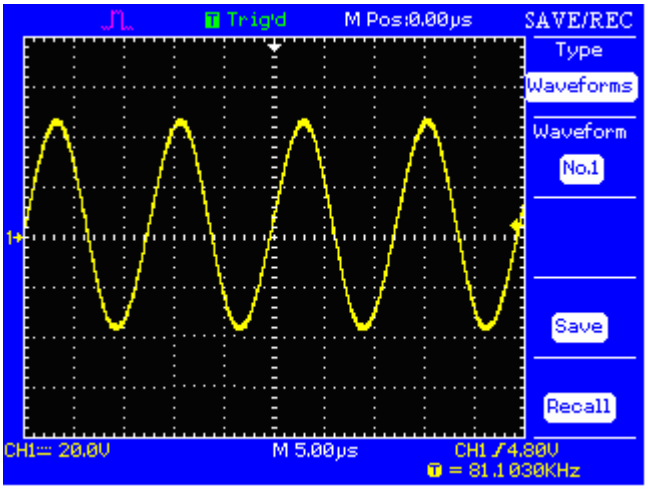


Figure 2-29

■ **SAVE/RECALL REFERENCE WAVEFORM:**

The oscilloscopes can store two reference waveforms in nonvolatile memory.

The oscilloscope can display reference waveforms at a time.

Reference waveforms are not adjustable, but the oscilloscope does display the horizontal and vertical scales at the bottom of the screen.

Chapter 3 Operation Basics

The front panel is divided into several easy-to-use functional areas. This chapter provides you with a quick overview of the controls and the information displayed on the screen.

- Display and Information Area
- Using the Menu System
- Using the Default Setup
- Using the Auto Setup
- Using the Universal knob
- Set up the Vertical System
- Set up the Horizontal System
- Set up the Trigger System
- Menu and Control Button
- Connector

3.1 Display Area

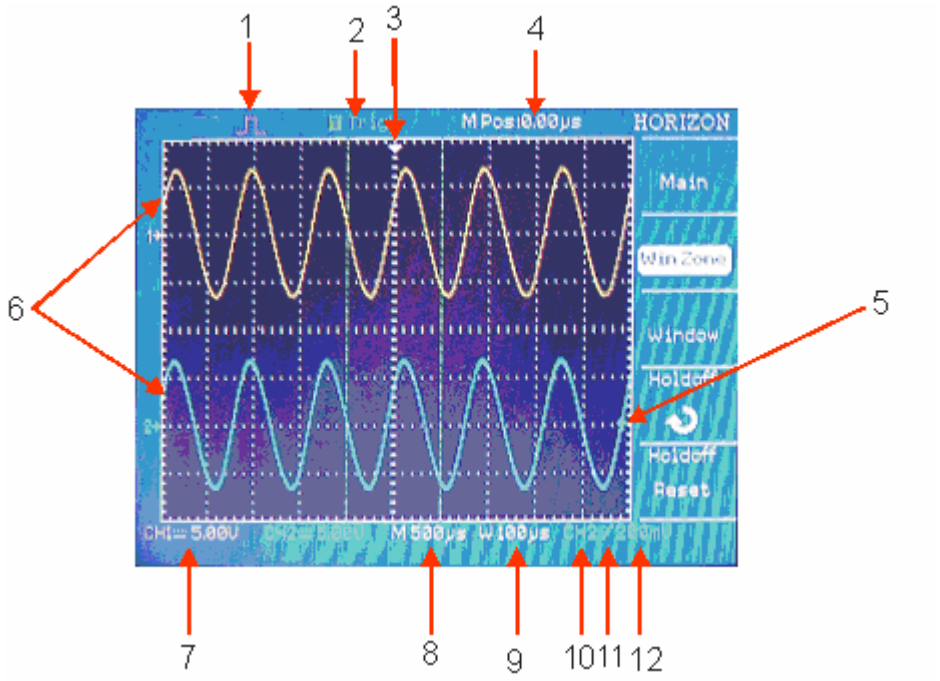


Figure 3-1

1. Icon display show acquisition mode
Sample mode

Peak detect mode

Average mode

2. Trigger status

☐ Armed. The oscilloscope is acquiring pretrigger data. All triggers are ignored in this state.

R Ready. All pretrigger data has been acquired and the oscilloscope is ready to accept a trigger.

T Trig'd. The oscilloscope has seen a trigger and is acquiring the posttrigger data.

Stop. The oscilloscope has stopped acquiring waveform data.

Acq. Complete. The oscilloscope has completed a Single Sequence acquisition.

R Auto. The oscilloscope is in auto mode and is acquiring waveforms in the absence

of triggers.

□ Scan. The oscilloscope is acquiring and displaying waveform data continuously in scan mode.

3. Marker shows horizontal trigger position. Turn the HORIZONTSL POSITION knob to adjust the position of the marker.

4. Read out show the time at the center graticule.

5. Marker shows Edge and pulse width trigger level. And select the video line or field

6. On-screen markers show the ground reference points of the displayed waveforms. If there is no marker, the channel is not displayed.

7.Readout shows the vertical factor of the channels

8.Readout shows the main time base setting

9. Readout shows window time base setting if it is in use.

10.Readout shows the trigger source for the triggering

11.Icon shows the selected trigger types

12.Readout shows the Edge and pulse width trigger levels

3.2 Using the Menu System

When you press a front-panel button, the oscilloscope displays the corresponding menu on the right side of the screen. The menu shows the options that are available when you press the unlabeled option buttons directly to the right of the screen.

The oscilloscope uses three methods to display menu options:

■ **Circular List:** The oscilloscope sets the parameter to a different value each time you press the option button.

■ **Action:** The oscilloscope displays the type of action that will immediately occur when you push an Action option button. For example, when you push the DISPLAY Menu button and then push the Contrast Increase option button, the oscilloscope changes the contrast immediately.

■ **Radio:** The oscilloscope uses a different button for each option.

The currently-selected option is highlighted.

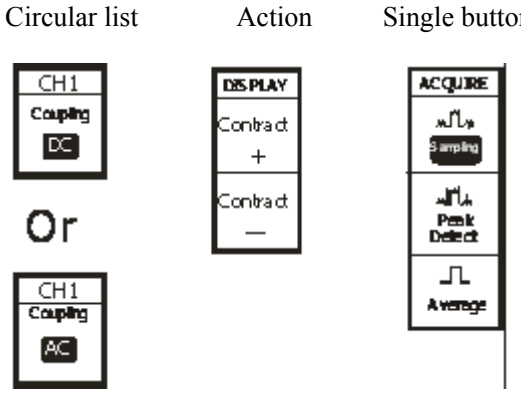


Figure 3-2

3.3 Using the default setup

The oscilloscope is set up for normal operation when it is shipped from the factory.

This is the default setup. To recall this setup, press the DEFAULT SETUP button.

The options, buttons and controls that change settings when you press the DEFAULT SETUP button, refer to appendix C.

The DEFAULT SETUP button does not reset the following settings:

- Language option
- Saved reference waveform files
- Saved setup files
- Display contrast
- Calibration data

3.4 Using the auto setup

This Series Digital Storage Oscilloscopes have auto setup function, they can identify the type of waveform and adjust controls to produce a usable display of the input signal.

“AUTO”is the auto Set up button

Table 3-1 Auto set the function Menu:

Option	Set Up	Introduction
（Multi-cycle sine）		Auto set the screen and display several cyc signal
（Single-cycle sine）		Set the screen and auto display single cyc signal
（Rising edge）		Auto set and show the rising time
（Falling edge）		Auto set and show the falling time
（Undo Setup）		Causes the oscilloscope to recall the previous setup

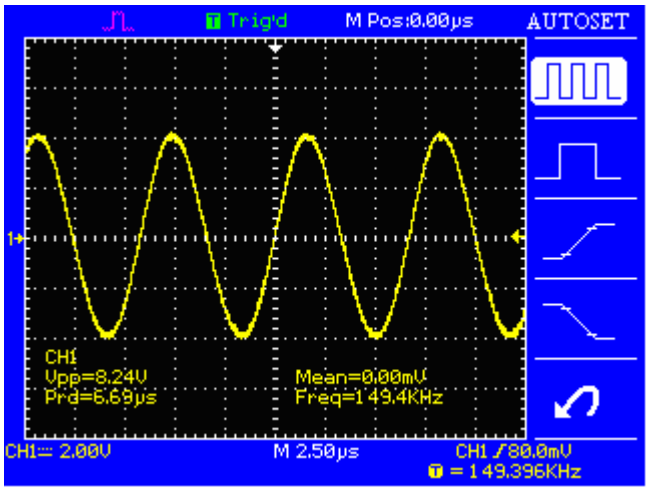


Figure 3-3

When you press the AUTO button, the oscilloscope identifies the type of waveform and adjusts controls to produce a usable display of the input signal.

Autoset determines the trigger source based on the following conditions:

- If multiple channels have signals, channel with the lowest frequency signal
- No signals found, the lowest-numbered channel displayed when Autoset was invoked
- No signals found and no channels displayed, oscilloscope displays and uses channel 1

Table 3-2 Auto set the function item

Function	**Setting**
Acquire Mode	Adjusted to Sampling
Acquire Type	Equ time Acquire
Display Format	Y-T
Display Type	Set to Dots for a video signal, set to Vectors for an FFT spectrum; otherwise, unchanged
Vertical Coupling	Adjusted to DC or AC according to the input signal,
Bandwidth Limit	Close(full)
V/div	Adjusted
VOLTS/DIV adjustability	Coarse
Signal inverted	off
Horizontal position	mediacy
S/div	Adjusted
Trigger type	Edge
Trigger source	Auto detect the channel which has the input signal
Trigger slope	Rising
Trigger mode	Auto
Trigger coupling	DC
Trigger holdoff	Minimum
Trigger level	Set to 50%

3.5Using the universal knob

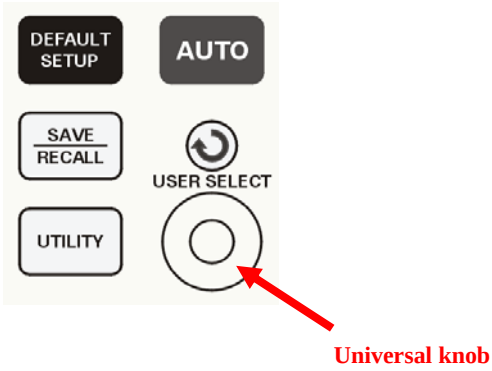


Figure 3-4

This Series Digital Storage Oscilloscopes have a special knob-the universal knob, Using this knob can set up the holdoff time, cursors measure, set up the pulse width and Set the Video Linage

Adjust holdoff time

1. Press the“HORI MENU”button to show the “Hori Menu”.
2. Press the“ holdoff”option button
3. Turn the universal knob to adjust the holdoff time。

Cursor Measure

1. Press the“CURSORS”button to display “cursor” Menu.
2. Press the“Source”option button to select the source.
3. Press the“Cur1”option button, turn the universal knob to adjust“Cur1”.
4. Press the“Cur2”option button, turn the universal knob to adjust“Cur2”.
5. The value of Cursor1 ，the value of Cursor2 and increment display on the top right of the screen.

Pulse Setup

1. Press the“TRIG MENU”button to display the “Trigger Menu”.
2. Press the“Type”Option and choose the “Pulse”.
3. Press the “ Set Width” button.
4. Turn the universal knob to adjust the pulse width.

Set the Video Linage

1. Press the “TRIG MENU”to show the “ Trigger Menu ”.
2. Press the “Type” button and select the “ Video” trigger.
3. Press the “Sync” operation button, select the “line num”.
4. Turn the universal knob to adjust video Line num.

3.6 Setting up the Vertical System

3.6.1 Setting up the CH1、CH2 Channels

Each channel has its own separate Menu. The items are set up separately according to each channel.

1. Set up the channel couple

Take the CH1 for example, the tested signal is a sine wave signal with DC deflection：

Press“CH1”→“Coupling”→“AC”，Set to AC couple mode. it blocks the DC component of the input signal.

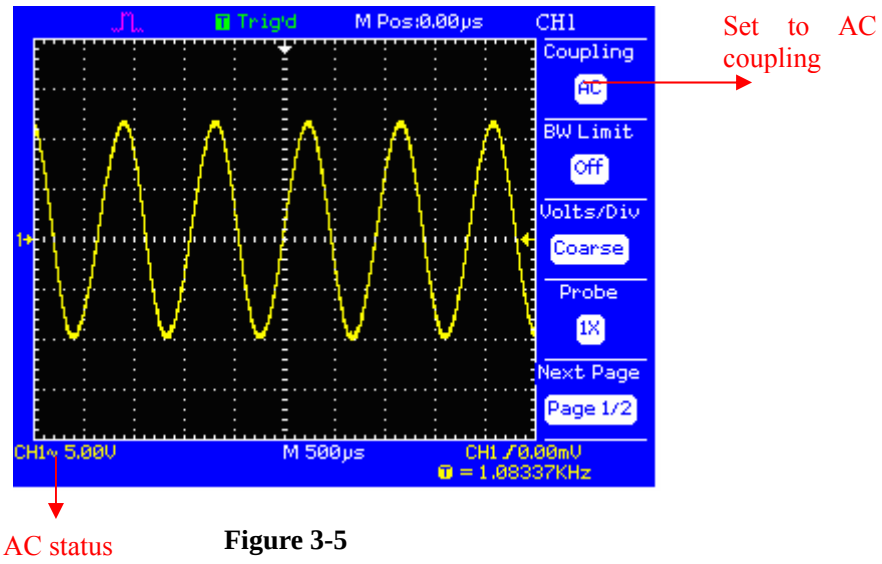


Figure 3-5

- Press“CH1”→“Coupling”→“DC”，Set to DC couple mode. Both DC and AC component could be obstructed.

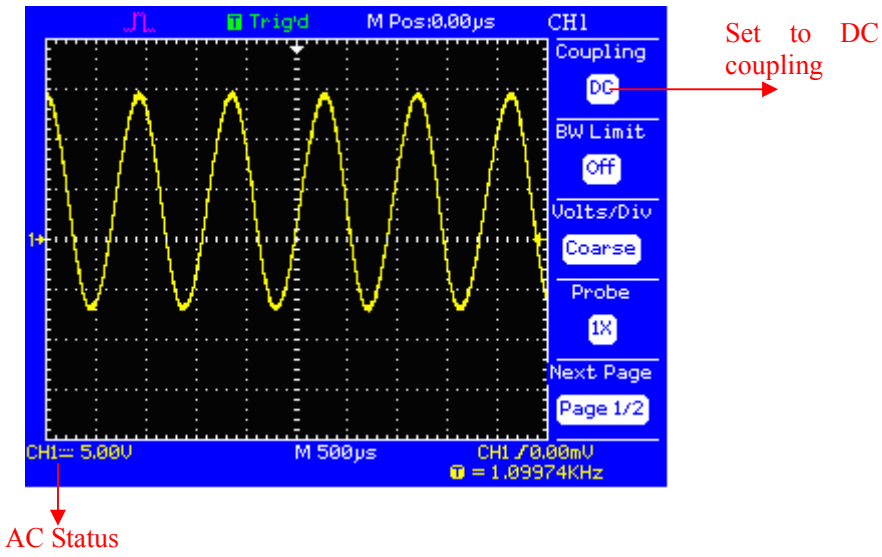


Figure 3-6

Press“CH1”→“Coupling”→“GND”，Set to GOUND mode. it disconnects the input signal.

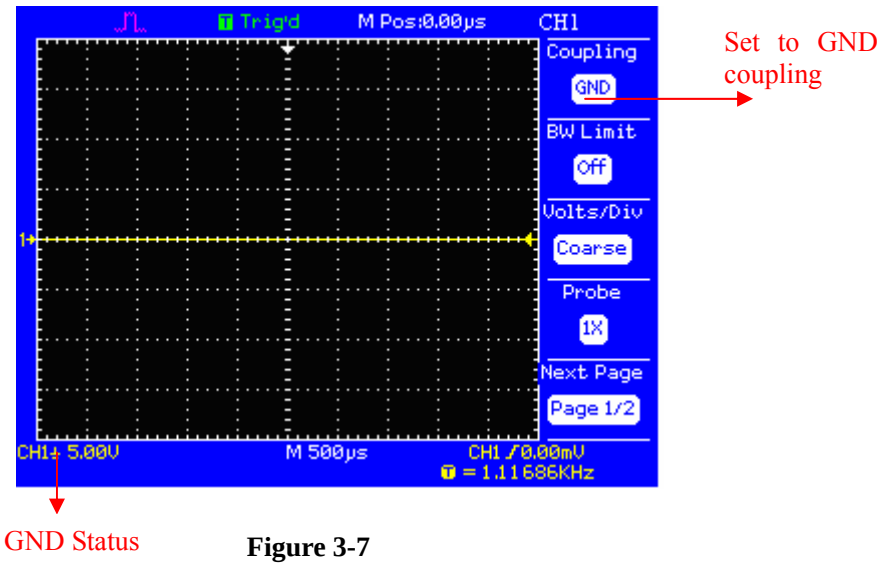


Figure 3-7

2. Set up the channel bandwidth limit

Take the CH1 for example, the tested signal is a pulse signal with the high frequency surge：

Press “CH1”→“BW Limit”→“On”，Set the band width Limited to open state. The high frequency component, which higher than 20MHz is obstructed.

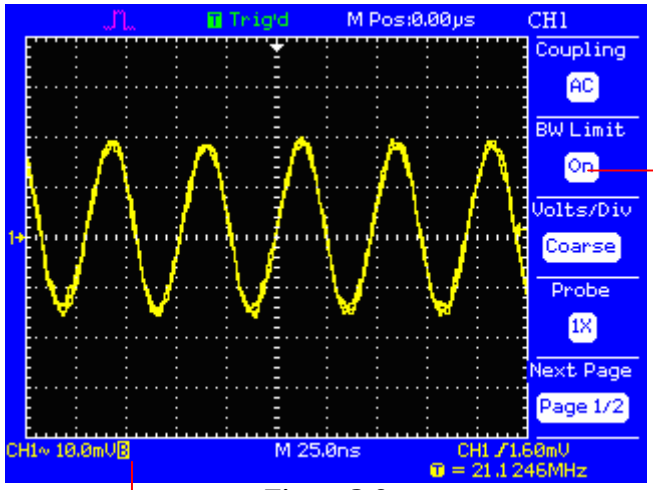


Figure 3-8

Press“CH1”→“BW Limit”→“off”，Set bandwidth Limited to close state, the High Frequency component in the tested signal could pass.

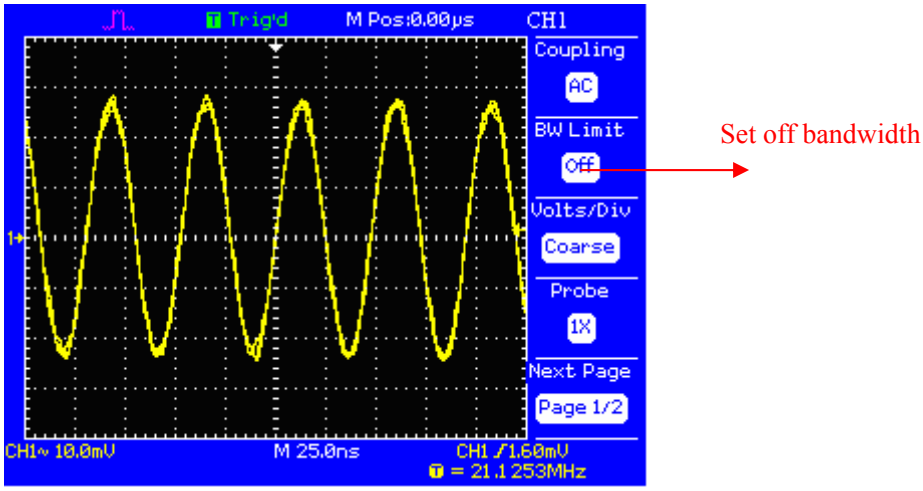


Figure 3-9

3.Volts/Div settings

Vertical scale adjust have Coarse and fine two modes, Vertical sensitivity range is 2mV/div～5V/div scale.

Take the CH1 for example：

- Press“CH1”→“Volts/Div”→“Coarse”，It is the default setting of Volts/Div，and it makes the vertical scaling in a 1-2-5-step sequence from 2mv/div， 5mv/div， 10mv/div to 5v/div.

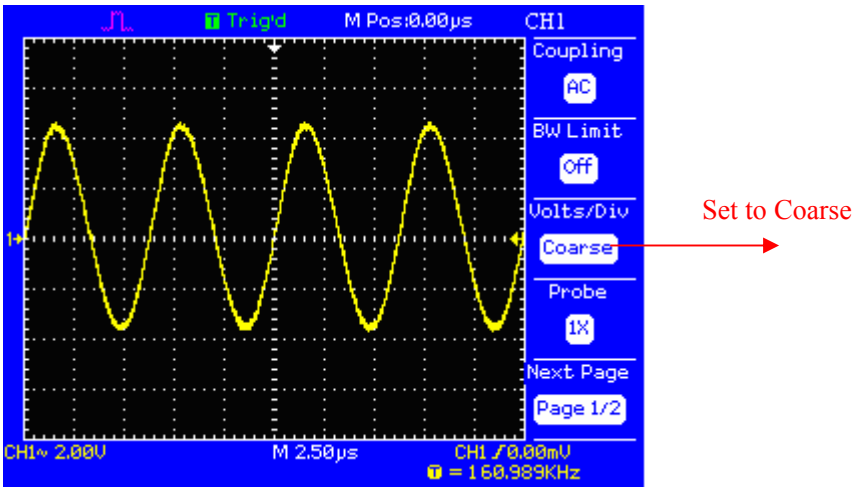


Figure 3-10

● Press“CH1”→“Volts/Div”→“Fine”. This setting changes the vertical to small steps between the coarse settings. It will be helpful when you need to adjust the waveform vertical size in smooth steps.

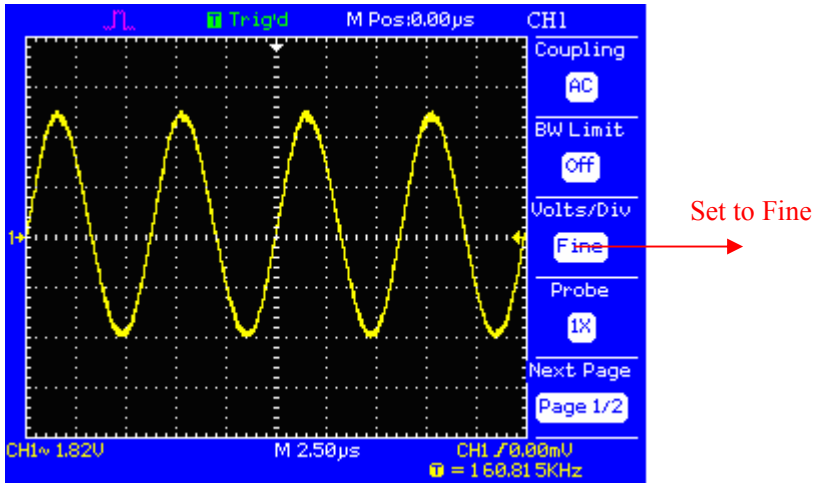


Figure 3-11

4.Probe Attenuation set

In order to assort the attenuation coefficient, you need to response in the channel operation Menu. If the attenuation coefficient is 10 :1, the input coefficient should be set to 10X, so that the mistake of the Volts/div information and measure testing should be forbidden.

Take the CH1 for example, when you use the 100:1 probe:

● Press“CH1”→“Probe”-“100X.

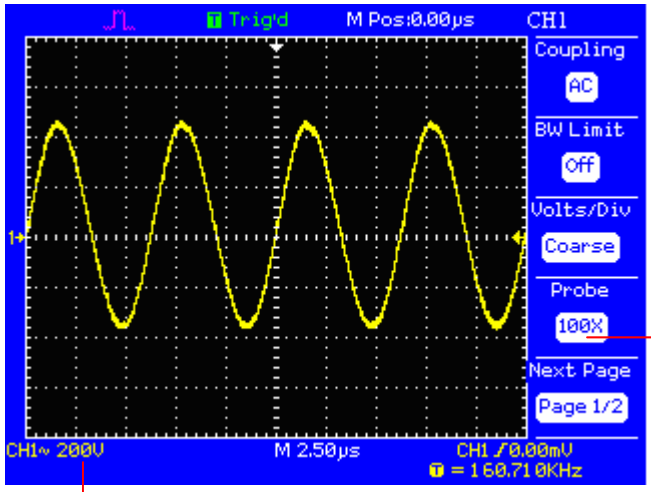


Figure 3-12

5. To invert a waveform

Take the CH1 for example：

- Press“CH1”→“Invert”→“off”.

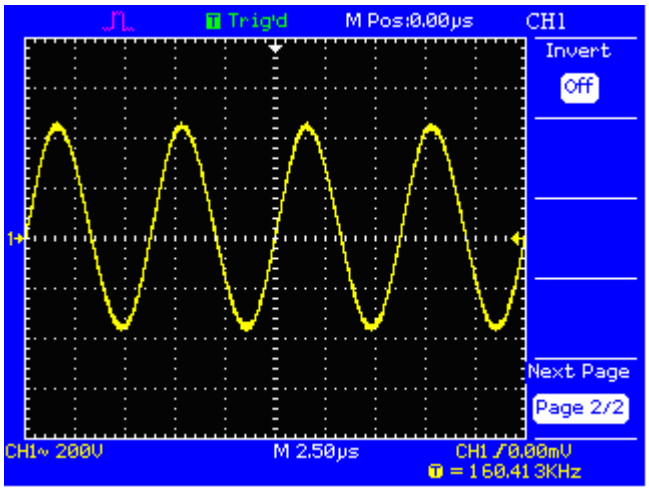


Figure 3-13

- Press“CH1”→“Invert”→“on”.

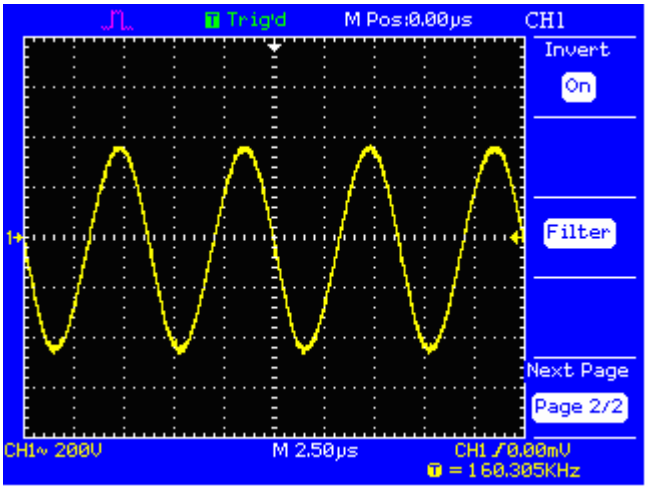


Figure 3-14

6. Select input impedance

Select channel input impedance as 1MΩ or 50Ω.If 50Ω is selected，the input coupling is automatically set to DC.

Note：● when 50Ω is selected，always ensure the input voltage at BNC does not exceed the maximum voltage（5Vrms）to avoid damaging channel input components.

- Do not use 50 with the standard probe.
- Only the frequency of the oscilloscope is 200MHZ or 150MHZ having this setup.

3.6.2Math Functions

Math shows the results after +,-,*,/ and FFT operation of the CH1 and CH2.

Press the MATH MENU button to display the waveform math operations. Press the MATH MENU button again to remove the math waveform display.

Table 3-3 MATH Menu

Function	Set up	Introduction
Operation	+、-、*、 /、FFT	Source 1 plus Source 2
CH1 Invert	on off	Invert the CH1 waveform Close CH1 opposite phase
CH2 Invert	on off	Invert the CH2 waveform Close CH2 opposite phase

Table 3-4

Operation	Set up	Introduction
＋	CH1+CH2	Wave form summation of Source 1 and Source 2
—	CH1-CH2 CH2-CH1	The channel 2 waveform is subtracted from the channel 1 waveform The channel 1 waveform is subtracted from the channel 2 waveform
*	CH1*CH2	Source 1 multiply source 2
/	CH1/CH2 CH2/CH1	Source 1 divide Source 2 Source 2 divide Source 1
FFT	Fast Fourier Transform	

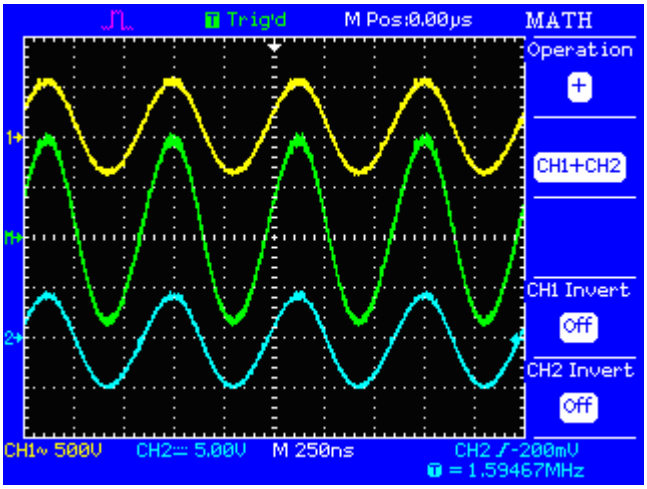


Figure 3-15

1.FFT Spectrum Analyzer

The FFT process mathematically converts a time-domain signal into its frequency components. You can use the Math FFT mode to view the following types of signals:

- Analyze the Humorous wave in the Power cable.
- Test the Humorous content and distortion in the system
- Show the Noise in the DC Power supply
- Test the filter and pulse response in the system
- Analyze vibration

Table 3-5

FFT Option	**Set**	**Introduction**
Source	CH1 CH2	Select this channel to the FFT source
Window	Hanning Hamming Rectangular Blackman	Select FFT window types
FFT ZOOM	1X 2X 5X 10X	Changes the horizontal magnification of the FFT display;
Scale	Vrms dBVrms	Set Vrms to be the Vertical Scale unit Set dBVrms to be the vertical Scale unit

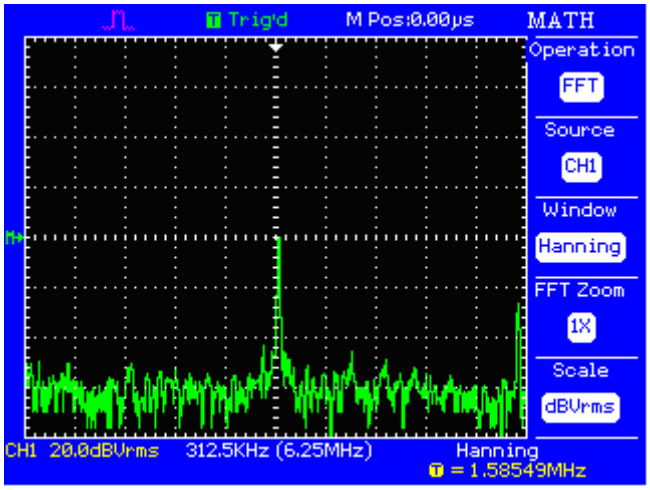


Figure 3-16

To use the Math FFT mode, you need to perform the following tasks:

1.Set up the source (time-domain) waveform.

● Press AUTOSET to display a YT waveform.

● Turn the VERTICAL POSITION knob to move the YT waveform to the center vertically (zero divisions).

● Turn the HORIZONTAL POSITION knob to position the part of the YT waveform that you want to analyze in the center eight divisions of the screen.

The oscilloscope calculates the FFT spectrum using the center 1024 points of the time-domain waveform.

● Turn the VOLTS/DIV knob to ensure that the entire waveform remains on the screen.

● Turn the SEC/DIV knob to provide the resolution you want in the FFT spectrum.

● If possible, set the oscilloscope to display many signal cycles.

To set up the FFT display, follow these steps:

1. Push the MATH MENU button.

2. Set the Operation option to FFT.

3. Select the Math FFT Source channel.

2. Displaying the FFT Spectrum

Press the MATH MENU button to display the Math Menu. Use the options to select the Source channel, Window algorithm, and FFT Zoom factor. You can display only one FFT spectrum at a time

3. Select FFT window

Windows reduce spectral leakage in the FFT spectrum. The FFT assumes that the YT waveform repeats forever. With an integral number of cycles ， the YT waveform starts and ends at the me amplitude and there are no discontinuities in the signal shape A non-integral number of cycles in the YT waveform causes the signal start and end points to be at different amplitudes. The transitions between the start and end points cause discontinuities in the signal that introduce high-frequency transients. According the tested options and source speciality, make sure the window you need to use.

Table 3-6

Window	**Speciality**	**Satisfied Test content**
Rectangular	Best frequency resolution, worst magnitude resolution. This is essentially the same as no window.	Symmetric transients or bursts. Equal-amplitude sine waves with fixed frequencies. Broadband random noise with a relatively slowly varying spectrum.
Hanning Hamming	Better frequency, poorer magnitude accuracy than Rectangular. Hamming has slightly better frequency resolutionthan Hanning.	Sine, periodic, and narrow-band random noise. Asymmetic transients or bursts.
Blackman	Best magnitude, worst frequency resolution.	Single frequency waveforms, to find higher order harmonics.

4. Magnifying and Positioning an FFT Spectrum

You can magnify and use cursors to take measurements on the FFT spectrum. The oscilloscope includes an FFT Zoom option to magnify horizontally. To magnify vertically, you can use the vertical controls.Horizontal Zoom and Position.

5. Measuring an FFT Spectrum Using Cursors

You can take two measurements on FFT spectrums: magnitude (in dB) and frequency (in Hz). Magnitude is referenced to 0 dB, where 0 dB equals 1 VRMS. You can use the cursors to take measurements at any zoom factor.

Use horizontal cursors to measure magnitude and vertical cursors to measure frequency. The options display the delta between the two cursors, the value at cursor 1 position, and the value at cursor position. Delta is the absolute value of cursor 1 minus cursor 2.

NOTE： ● The FFT of a waveform that has a DC component or offset can cause incorrect FFT waveform magnitude values. To minimize the DC component, choose AC Coupling on the source waveform.

● To display FFT waveforms with a large dynamic range, use the dBVrms scale. The dBVrms scale displays component magnitudes using a log scale.

●The Nyquist frequency is the highest frequency that any real-time digitizing oscilloscope can acquire without aliasing. This frequency is half that of the sample rate, provided it is within the analog bandwidth of the oscilloscope. Frequencies above the Nyquist frequency will be under sampled, which causes aliasing.

3.6.3 Using Ref

The reference control saves waveforms to a nonvolatile waveform memory. The reference function becomes available after a waveform has been saved.

Press the Ref button to display the reference waveform menu

Table 3-7

Option	Setup	Introduction
type	Waveform	displays the menu for storing or recalling waveforms.
Source	CH1 CH2 CH1off CH2off	Choose the waveform display to store.
REF	A B	Choose the reference location to store or recall a waveform.
save		Stores source waveform to the chosen reference location.
REFA/REFB	on off	Displays the reference waveform on the screen removes the reference waveform on the screen.

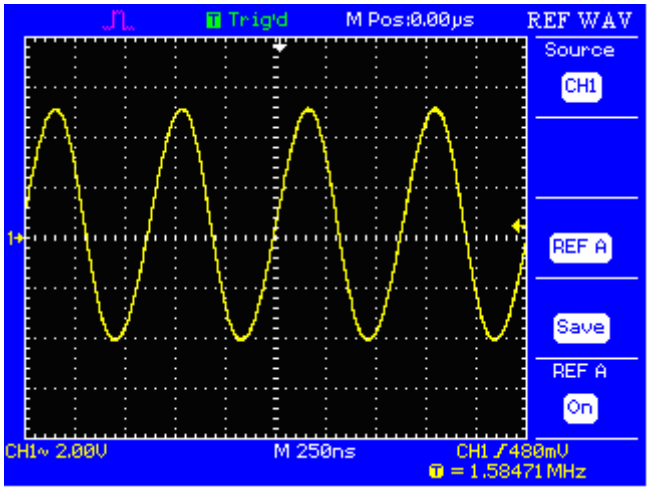


Figure 3-17

Operation step：

1. Press the “REF” menu button to display the reference waveform menu.
2. Choose the channel1 or channel2 of ref waveforms.

3. Turn the vertical “POSITION”knob and “Volt/div”knob to adjust the vertical position and scale to conformable positions.

4.press the save option to save waveforms on the current screen as ref waveforms.

Note: ● If you save waveforms in manner of X-Y, waveforms are not the same with ref waveforms

● You cannot adjust the horizontal position and scale of the reference waveform.

3.6.4 The Using of the Vertical “Position” knob and “Volt/div” knob in the vertical system

1. Vertical“POSITION”knob use for adjusting the vertical position of all the Channels(including MATH and REF)wave. This button’s resolution is variety as per the vertical scale.

2. “Volts/div”knob adjust the vertical resolution of all channels and(including the MATH and REF)waves. The vertical scale is made sure by the 1-2-5 step in the Coarse. Increase in the clockwise , reduce in the anticlockwise. In the fine mode, the knob changes the Volts/Div scale in small steps between the coarse settings. Increase in the clockwise , reduce in the anticlockwise.

When the “Volt/div” knob adjust the “MATH” wave amplitude range, take the 1-2-5 step, display in percentage form. Increase in the clockwise, reduce in the anticlockwise. There are no fine mode in this state.

3. Make sure the pitch on state of the channel (including MATH and REF), if not the vertical “ Position” and “ Volt/div” knob do not adjust this channel. Vertical scale of REF adjust the waveform location corresponding to the storage location.

4. when you adjust the vertical position of channels waveforms the vertical position information will display on the below left of screen.

3.7 Set up the Horizontal system

3.7.1 Horizontal control knob

You can use the horizontal controls to change the horizontal scale and position of waveforms. The horizontal position readout shows the time represented by the center of the screen, using the time of the trigger as zero. Changing the horizontal scale causes the waveform to expand or contract around the screen center.

■ **Horizontal "POSITION"knob**：Adjusts the horizontal position of all channel and math waveforms. The resolution of this control varies with the time base setting.

■**"S/div"knob**： Selects the horizontal time/div (scale factor) for the main or the window time base. When Window Zone is enabled, it changes the width of the window zone by changing the window time base.

■ **Display scan mode**：

When the SEC/DIV control is set to 100 ms/div or slower and the trigger mode is set to Auto, the oscilloscope enters the scan acquisition mode. In this mode, the waveform display updates from left to right. There is no trigger or horizontal position control of waveforms during scan mode.

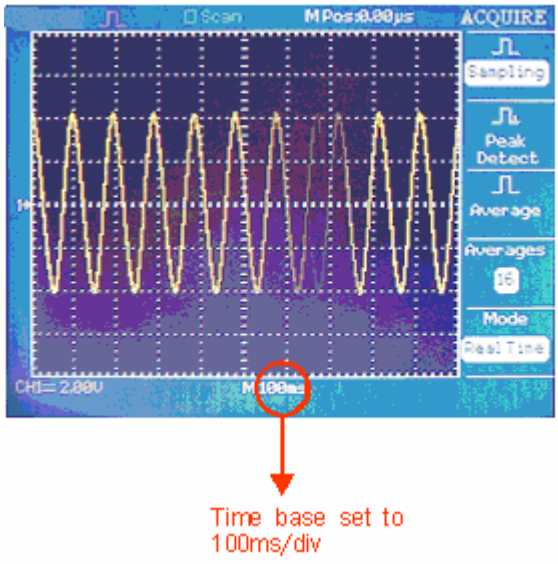


Figure 3-18　scan mode display

3.7.2 Window Zone

Use the Window Zone option to define a segment of a waveform to see more detail. The Window time base setting cannot be set slower than the Main time base setting. You can turn he Horizontal Position and SEC/DIV controls to enlarge or minish waveforms in the Window Zone

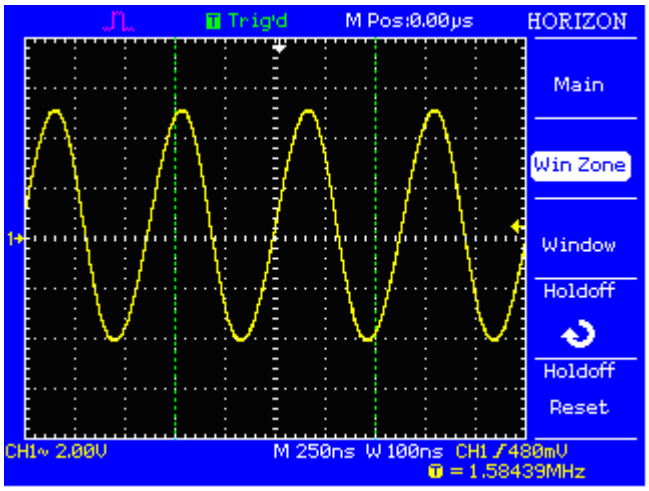


Figure 3-19 Window setup

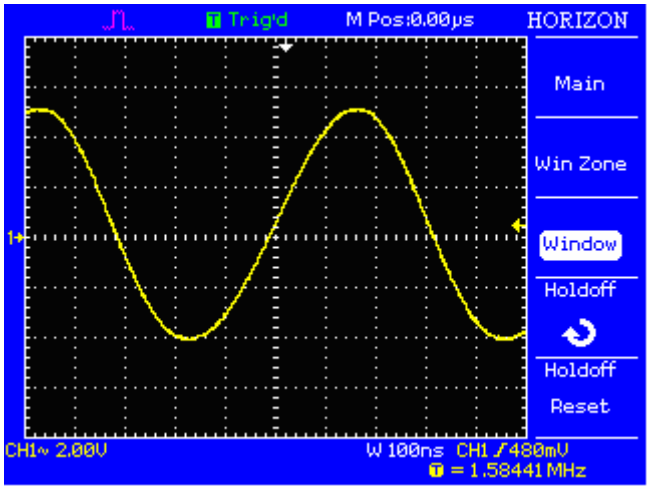


Figure 3-20 window zone

3.7.3 Trigger holdoff

If you want to change holdoff time, please follow next operations:

1. Press the“HORI MENU”button to show the “Hori Menu”.
2. Choose “Holdoff”function。
3. Adjust the universal knob to change the holdoff time up to waveforms trigger steadily .

3.8 Set trigger system

The trigger determines when the oscilloscope starts to acquire data and display a waveform. When a trigger is set up properly, the oscilloscope converts unstable displaysor blank screens into meaningful waveforms.

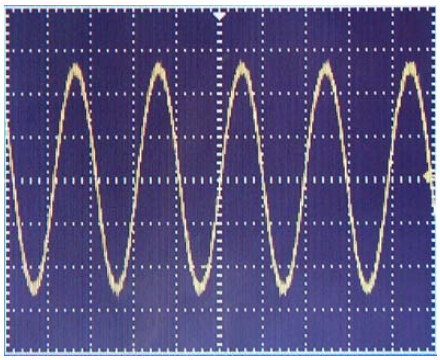


Figure 3- 21

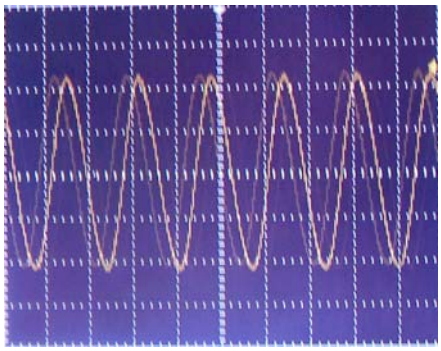


Figure 3-22

The trigger Control area on the front panel includes Level knob, "TRIG MENU"button, "SET TO 50%"button, "FORCE"button.

■ "**LEVEL"knob:**The LEVEL knob is to set the amplitude level the signal must cross to cause an acquisition.

■ **"SET TO 50％":** The trigger level is set to the vertical midpoint between the peaks of the trigger signal.

■ **"FORCE"button:** Completes an acquisition regardless of an adequate trigger signal. This button is usually used to normal mode and single mode

■ **"TRIG MENU"button:** Display" trigger menu".

■ **Pretrigger /delayed trigger:** The data before and after trigger the trigger position is typically set at the horizontal center of the screen, in the full-screen display the 6div data of pretrigger and delayed trigger can be surveyed. more data of pretrigger and 1s delayed trigger can be surveyed by adjusting the horizontal position.

The feature is very useful because you can see the events that led up the trigger point everything to the right of the trigger point is called posttrigger information the amount of delay range(pretrigger and posttrigger information) available is dependent on the sweep speed selected.

3.9 Menu and control button

Showing as the following picture:

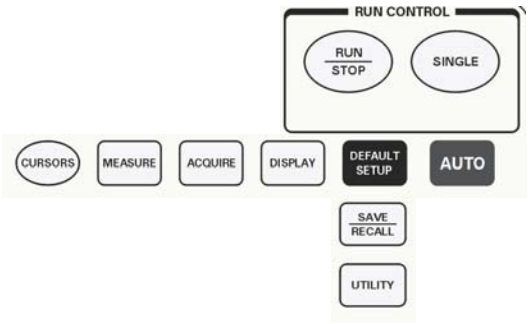


Figure 3-23

All models:

■ **CURSORS**：Display the Cursor Menu. Vertical Position controls adjust cursor position while displaying the Cursor Menu and the cursors are activated. Cursors remain displayed (unless the Type option is set to "Off") after leaving the Cursor Menu but are not adjustable.

■ **MEASURE**：Display the automated measurements menu.

■ **ACQUIRE**：Display the Acquire Menu.

■ **DISPLAY**：Display the Display Menu.

■ **UTILITY**：Display the Utility Menu.

■ **SAVE/RECALL**： Display the Save/Recall Menu for setups and waveforms.

■ **DEFAULT SETUP**：Recall the factory setup.

■ **AUTO**：Automatically sets the oscilloscope controls to produce a usable display of the input signals.

■ **RUN/STOP**：Continuously acquires waveforms or stops the acquisition.

Note：If waveform acquisition is stopped (using the RUN/STOP or SINGLE button), the SEC/DIV control expands or compresses the waveform.

■ **SINGLE**：Acquire a single waveform and then stops.

3.10 Connector

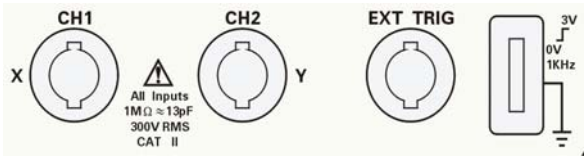


Figure 3-24

■ **CH1,CH2:** Input connectors for waveform display.

■ **Probe component:** Voltage probe compensation output and ground. Use to electrically match the probe to the oscilloscope input circuit.

■ EXT TRIG: Input connector for an external trigger source. Use the Trigger Menu to select the “Ext” , “Ext/5”or “EXT(50Ω) ” trigger source.

> **Note**：If you connect a voltage source to a ground terminal, you may damage the oscilloscope or the circuit under test. To avoid this, do not connect a voltage source to any ground terminals.

Chapter4 Application Examples

This section presents a series of application examples. These simple examples highlight the features of the oscilloscope and give you ideas for using it to solve your own test problems.

- Taking simple measurements
- Taking cursor measurements
- Capturing a single-shot signal
- Analyzing signal detail
- Triggering on a video signal
- Application of X-Y function
- Analyzing a differential communication signal using math functions

4.1 Taking Simple Measurements

Observe a unknown signal in a circuit, display the signal quickly and measure the frequency and peak-to-peak amplitude.

1.Using Auto set

To quickly display a signal, follow these steps:

1. Press the CH 1 button ,set the Probe option attenuation to 10X and set the switch to 10X on the probe.

2. Connect the channel 1 probe to the signal.

3. Press the AUTO button.

The oscilloscope sets vertical, horizontal, and trigger controls automatically. If you want to optimize the display of the waveform, you can manually adjust these controls.

> **NOTE**. The oscilloscope displays relevant automatic measurements in the waveform area of the screen based on the signal type detected.

2.Taking Automatic Measurements

The oscilloscope can take automatic measurements of most displayed signals. To measure signal frequency and peak-to-peak amplitude, follow these steps

(1)Measure signal frequency

- Input the signal to channel 1.
- Press the “AUTO”button.
- Press the “MEASURE ”button to see the Measure Menu.
- Press the top option button， the Measure 1 Menu appears.
- Press the “Type” option button and select “Freq”.
- Press the “off” option button.

The value below “freq”is the result of measurement .

⑵ Measure signal peak-to-peak amplitude

- Press the second option button from the top， the Measure 2 Menu

appears.

- Press the“ Type ”option button and select “Vpp”.
- Press the “off” option button.

The value below “Vpp”is the result of measurement

4.2 Taking Cursor Measurements

You can use the cursors to quickly take time and voltage measurements on a waveform.

4.2.1 Measuring Ring Frequency

To measure the ring frequency at the rising edge of a signal, follow these steps:

1. Press the “CURSORS” button to see the “Cursor Menu”.

2. Press the“ Type” option button and select “Time”.

3. Press the “Source” option button and select“ CH1”.

4. Press the “Cur1 ”button and turn the universal knob to place the cursor 1 on the first peak of the ring.

5. Press the “Cur 2” button and turn the universal knob to place the cursor 2 on the second peak of the ring.

You can see the delta time and frequency (the measured ring frequency) on the top right of the screen.

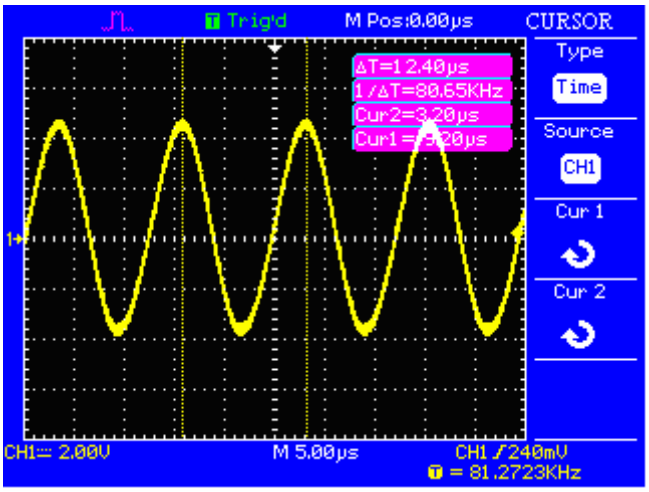


Figure 4-1

4.2.2 Measuring Ring Amplitude

To measure the amplitude, follow these steps:

1. Press the “CURSORS” button to see the Cursor Menu.

2. Press the“ Type” option button and select “Voltage”.

3. Press the “Source” option button and select“ CH1”.

4. press the“ cur1 ”option button and turn the universal knob to place the cursor 1 on the highest peak of the ring.

5. press the “cur2” option button and turn the universal knob to place the cursor 2 on the lowest peak of the ring.

You can see the following measurements on the top right of the screen :

- The delta voltage (peak-to-peak voltage of the ringing)
- The voltage at Cursor 1.
- The voltage at Cursor 2.

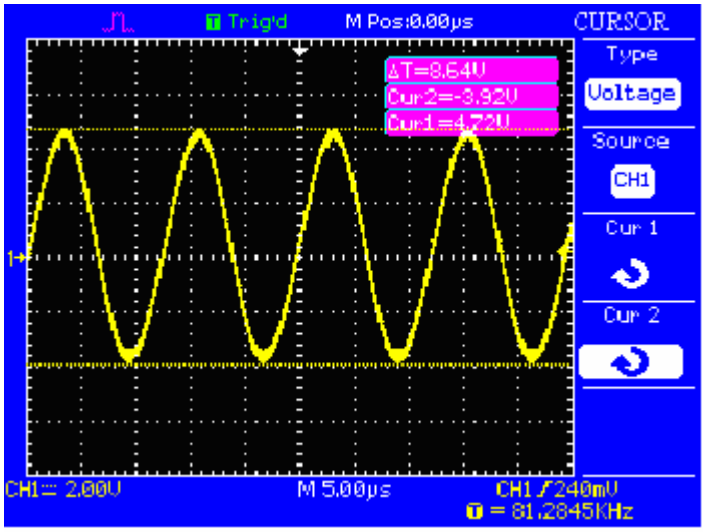


Figure 4-2

4.3 Catch the single signal

To capture a single event, you need to gather some pre-test knowledge of the signal in order to correctly set up the trigger level and slope .if you are not sure the instance of the signal, you can observe it through auto or normal trigger mode to ensure the trigger level and slope.

The following steps show you how to use the oscilloscope to capture a single event.

1. Set the Probe option attenuation to 10X and set the switch to 10X on the probe.

2. Trigger set up ：

⑴. Press “TRIG MENU” button to show the “ Trigger Menu”

⑵. Under this menu , set the trigger type to “edge”, Edge type is “ rising”, source is “CH1”, trigger mode is “Single”, couple is “DC”

⑶. Adjust the horizontal time base and vertical scale to the satisfied range

⑷. Turn the “LEVEL” knob to adjust the trigger level

(5) Press the “RUN/STOP” button to start capturing

when the trigger conditions are met. Data appears on the display representing, the data points that the oscilloscope obtained with one acquisition, press the RUN/STOP button again rearms the trigger circuit and erases the display.

4.4 Analyze the signal detail

You have a noisy signal displayed on the oscilloscope and you need to know more about it. You suspect that the signal contains much more detail than you can now see in the display.

4.4.1 Looking at a Noisy Signal

The signal appears noisy and you suspect that noise is causing problems in your circuit. To better analyze the noise, follow these steps：

1. Press the “ACQUIRE”button to see the acquire menu.
2. Press the “Peak Detect”option button.

3.If necessary, press the “DISPLAY”button to see display menu. Use “contract + ”or “contract –” option button to adjust contact to see the noise more easily.

4. Peak detect emphasizes noise spikes and glitches in your signal, specially when the time base is set to a slow setting.

4.4.2 Separating the Signal from Noise

To reduce random noise in the oscilloscope display, follow these steps:

1. Press the “ACQIURE”button to display the acquire menu.
2. Press the “vavg”option button.

3. Press the “Averages” option button to see the effects of varying the number of running averages on the waveform display.

Averaging reduces random noise and makes it easier to see detail in a signal.

4.5 Triggering on a Video Signal

Observe the video circuit in a piece of medical equipment and Use the video trigger to obtain a stable display.

4.5. 1Triggering on Video Field

To trigger on the video fields, follow these steps:

1 Press the “TRIGMENU”button to see “trig menu”

2.Press the top option button and select “Video”.

3.Press the “source” option button and select “CH1”.

4. Press the“ Sync” option button and select “Odd Field” or “Even Field”.

5. Press the “Standard” option button and select “NTSC”.

6. Turn the horizontal “S/Div” knob to see a complete field across the screen.

7. Turn the vertical “Volts/Div” knob to ensure that the entire video signal is visible on the screen.

4.5.2 Triggering on Video Lines

To trigger on the video lines, follow these steps:

1.Press the “TRIGMENU”button to see the trig menu

2.Press the top “option” button and select “Video”.

3. Press the “Sync ”option button and select “Line Num” and turn the universal knob to set a specific line number.

4.Press the “ Standard” option button and select “NTSC”.

5. Turn the “S/Div ”knob to see a complete video line across the screen.

6. Turn the “Volts/Div” knob to ensure that the entire video signal is visible on the screen.

4.6.Application of X-Y function

Viewing Impedance Changes in a Network

Connect the oscilloscope to monitor the input and output of the circuit

To view the input and output of the circuit in an XY display, follow these steps:

1. Press the “CH 1” MENU button and set the Probe option attenuation to 10X.
2. Press the “CH 2” MENU button and set the Probe option attenuation to 10X.
3. Set the switches to 10X on the probes.
4. Connect the channel 1 probe to the input of the network, and connect the channel 2 probe to the output.
5. Press the “AUTO” button.
6. Turn the “VOLTS/DIV ”knobs to display approximately the same amplitude signals on each channel.
7. Press the DISPLAY button.
8. Press the Format option button and select “XY”.
   The oscilloscope displays a Lissajous pattern representing the input and output characteristics of the circuit.
9. Turn the VOLTS/DIV and VERTICAL POSITION knobs to optimize the display.
10. Press the “Persist” option button and select “Infinite”.
11. Press the“ Contrast －” or “Contrast + ”option buttons to adjust the contrast of the screen.
12. Apply the Ellipse method to observe the phase difference between the two channels

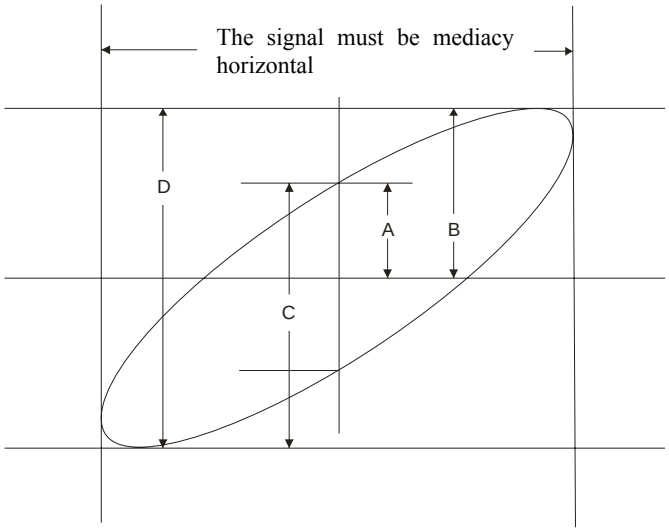


Figure 4-3

sinθ=A/B or C/D　where θ=phase shift (in degrees)between the two signals From the formula above, you could get:

θ=±arcsine (A/B) or ±arcsine (C/D)

If the main axis of the ellipse is at Ⅰ and Ⅲ quadrant , θmust be in the range of (0～π/2) or (3π/2～2π).if the main axis is at Ⅰ and Ⅲ quadrant, θmust be in the range of (π/2～π) or (π～3π/2).

4.7 Analyzing a Differential Communication Signal

You are having intermittent problems with a serial data communication link, and you suspect poor signal quality. Set up the oscilloscope to show you a snapshot of the serial data stream so you can verify the signal levels and transition times.

Because this is a differential signal, you use the math function of the oscilloscope to view a better representation of the waveform.

To activate the differential signals connected to channel 1 and channel 2, follow these steps:

1.Press the CH 1 button and set the Probe option attenuation to 10X.

2. Press the CH 2 button and set the Probe option attenuation to 10X.

3 . Set the switches to 10X on the probes.

4. Press the AUTO button.

5. Press the “MATH” button to see the Math Menu.

6. Press the “Operation” option button and select “－”.

7. Press the “CH1－CH2” option button to display a new waveform that is the difference between the displayed waveforms.

8. You can adjust the vertical scale and position of the Math waveform. To do so, follow these steps:

a. Remove the channel 1 and channel 2 waveforms from the display.

b. Turn the CH 1 and CH 2 VOLTS/DIV and VERTICAL POSITION knobs to adjust the vertical scale and position.

> **NOTE**. Be sure to first compensate both probes. Differences in probe compensation appear as errors in the differential signal.

Chapter 5 prompting messages and troubleshooting

5.1 Prompting messages:

■ **Trig level at limit** ：Mention you that the trigger Level is at a limit when you turn the Trig level knob.

■ **Horizon position at limit**：Mention you that the horizontal position is at a limit when you turn the horizon position knob.

■ **Volts/Div at limit**：Mention you that the vertical voltage have already touched the Min 2MV/div or Max 5V/div.

■ **Volts position at limit**：The system would display this information when the vertical position is at a limit.

■ **Sec/Div at limit**：prompts that the Volts/Div is at full range while turning the vertical scale knob.

■ **Functions isn't useable**：Under several special modes, the some functions could not be running.

■ **No signal!**：The system would clew this information when the signal could not match the auto set condition. (using in the auto set)

■ **Adjust at limit**: You could adjust the pulse width by the universal knob till the pulse width has reached min20.0ns or max 10.0s.

5.2 Troubleshooting

1. After the oscilloscope is powered on，the screen remains dark ， please do as following steps：

⑴ Check the power cable's connection.

⑵ Ensure the power switch is turned on.

⑶ After the inspections above，restart the oscilloscope.

⑷ If the oscilloscope is still not used after the checking , please connect with my company.

2.If there is no signal wave in the screen after gathering the signal, please do as following steps:

(1)Check the probe connecting with the signal cable or not

(2)Check the signal cable connecting with the BNC connector or not.

(3)Check the probe whether or not connect with the goods tested.

(4)Check the tested goods produce the signal or not.

(5)Gather the signal again.

3. The value of the tested voltage is 10 times higher/lower than the real one , please do as following steps:

Check the attenuation quotiety whether or not match the probe attenuation proportion.

4.Display the wave, but not steady , please do as following steps:：

⑴ Check the signal source on the trigger interface whether or not match the signal channel.

⑵ Check the trigger mode: normal signal should use the "edge "trigger mode. The video signal should use the "Video" Trigger mode. The signal would display steady, only using the matching trigger mode.

⑶ Attempt to change the " coupling" into "HF Reject" or "LF Rekect" display, so that the High/low frequency noise disturb the trigger should be filtrated

5. Press“RUN/STOP”button, but no display**.**

Check the trigger mode on the trigger interface whether or not in the “normal” or “single”, and check the trigger level is whether or not over the wave range. If yes, please put the trigger level to the middle position or set the trigger mode to the “Auto” position. In another hand, you could choose the “Auto” button to set up automatically.

6. After the Acquisition is set to Averages or Display Persistence is set ON, the waveform refreshes slowly .

It is normal in these settings

7. The signal is displayed as ladder like waveform

(1) This phenomena is normal. the time base maybe is too slow .you should turn the horizontal SCALE knob to increase horizontal resolution to improve the display.

(2)Maybe the display Type is set to Vectors ,You could set it to Dors mode to improve the display.

Chapter 6 Service and Support

6.1 Maintain summary

My company warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of three (3) years from the date of shipment from an authorized My company distributor. If a product or CRT proves defective within the respective period, My company will provide repair or replacement as described in the complete warranty statement.

To arrange for service or obtain a copy of the complete warranty statement, please contact your nearest My company sales and service office.

Except as provided in this summary or the applicable warranty Statement, My company makes no warranty of any kind, express Or implied, including without limitation the implied warranties Of merchantability and fitness for a particular purpose. In no Event shall My company be liable for indirect, special or Consequential damages

Appendix A: Specifications

All specification apply to 10X probe and All this series Digital Storage Oscilloscopes. To verify that the oscilloscope meets specifications, the oscilloscope must first meet the following conditions:

● The oscilloscope must have been operating continuously for twenty minutes within the specified operating temperature.

● You must perform the Do Self Cal operation, accessible through the Utility menu, if the operating temperature changes by more than 5° C.

● The oscilloscope must be within the factory calibration interval All specifications are guaranteed unless noted “typical.”

Specifications

Inputs	
Input Coupling	AC、DC、GND
Input Impedance	1MΩ || 13Pf，50Ω 1MΩ|| 13Pf
Probe Attenuator	1X、10X
Probe Attenuator Factors Set	1X、10X、100X、1000X

Vertical System	
Vertical Sensitivity	2mV - 5V/div (1-2-5 order)
Channel voltage offset range	2mV – 100mV: ±2V 200mV - 5V: ±40V
Vertical Resolution	8 bit
Channels	2
Analog Bandwidth	200MHz,150MHz,100MHz,60MHz,40MHz,25 MHz
Single-shot Bandwidth	Full bandwidth (1Gsa/s), 50MHz(500MSa/s)
Lower frequency limit (AC -3dB)	≤5Hz(at input BNC)
Vertical nicety error	±3.0%
Raise time	<1.8ns, <2.3ns, <3.5ns, <5.8 ns ，<8.8ns，<14 ns

	correspondingly at bandwidth of (200MHz, 150MHz, 100MHz, 60MHz,40MHZ,25MHZ)
Vertical input coupling	AC, DC, GND
Math operation	+, -, * , /, FFT
FFT	Window mode: Hanning,Hamming,Blackman, Rectangular
	Sampling points：1024
Bandwidth limited	20MHz (-3dB)(The oscilloscopes of which bandwidth are 25MHZ have no this function)

Trigger System	
Trigger Types	Edge, Pulse Width, Video
Trigger Modes	Auto, Normal, Single
Trigger Coupling	AC, DC, LF rej, HF rej
Trigger Level Range	CH1、CH2:±12 divisions from center of screen
	EXT: ±2.4V
	EXT/5: ±12V
Trigger Displacement	Pretrigger : 12 DIV, Delay Trigger: 130 DIV
Holdoff range	100ns – 1.5s
Edge Trigger	Trigger Polarity: Rise Edge, Fall Edge
Pulse Width Trigger	Trigger Modes: (＞、＜、＝)positive Pulse Width, (＞、＜、＝)Negative Pulse Width
	Pulse Width Range : 20ns – 10s
Video Trigger	Support signal Formats: PAL/SECAM、NTSC
	Trigger condition : odd field ,even field、all lines、line Num

Horizontal System	
Real Time Sampling Rate	Sampling rate 1GSa/s or 500MSa/s
Equivalent Sampling Rate	50GSa/s
Measure Display Modes	MAIN, WINDOW, WINDOW ZOOM, ROLL, X-Y
Horizontal nicety error	±0.01%
Horizontal Scan Range	2.5nS/DIV - 50S/DIV(100MHZ-200MHZ) 5nS/DIV - 50S/DIV(60MHZ) 10nS/DIV - 50S/DIV(40MHZ) 25nS/DIV - 50S/DIV(25MHZ)
	Roll: 100mS/DIV ～50S/DIV (1-2-5 order)
Delay range	Pretrigger : 12 DIV, Delay trigger: 130 DIV
When Sampling rate is at 1GSa/s, single channel is 1Gsa/s and double channel is 500Msa/s below 250ns/div; When the sampling rate is 500Msa/s, single channel is 500Msa/s and double channel is 250Msa/s below 250ns/div.	

Signal Catching System	
Sample Types	Real time , Random
Memory depth	Each channel at least 4k / CH
Peak Measure	When you see the signal at the slow speed（from 10μs/div start），you can capture high-frequency burr which are narrow to 10ns
Catch mode	Sample, Peak Measure， Average
Averages	4, 16, 32, 64, 128, 256

Hard Ware Frequency Counter	
Reading resolution	6 Bytes
Range	DC Couple , 10Hz to MAX Bandwidth
Signal Types	Satisfying all Trigger signals(Except Pulse width trigger and Video Trigger)

Control Panel Function	
Auto Set	Auto adjusting the Vertical, Horizontal system and Trigger Position
Set Storage/Recall	10 Group measuring Storage/Recall function
Waveform Storage/Recall	10 Group captured Waveforms Storage/Recall function 2 Group referenced Waveforms Storage/Recall function

X-Y Mode	
X-pole Input / Y-Pole Input	Channel 1 (CH1) / Channel 2 (CH2)
Phase Error	±3 degrees
Sample Frequency	XY mode has a breakthrough that trad oscilloscopes restrict sampling rate at 1MSa/s and support 5KSa/s～200MSa/s (1-2-5 sequence)

Measure System	
Auto Measure	Voltage Measure: MAX、MIN、Peak-Peak、Average 、vrms
	Time Measure: Rise time 、 Fall Time 、 Cycle Frequency、Positive Pulse width、Negative Pulse width
Cursor Measure	Voltage Differences between the Cursors (ΔV) Time/Frequency Differences between the Cursors (ΔT) Frequency/Time Differences between the Cursors (1/ΔT)

Generic Specification

Display System	
Display Mode	5.7in.(145mm)diagonal Liquid Crystal Display
Resolution	320 horizontal by 240 vertical pixels
Display Contrast	Adjustable
Backlight Intensity （Typical state）	60 can/Square meter
Wave display range	8 x 10 div
Wave Display Mode	Point, Vector
persist	close、1 sec、2 sec、5 sec、infinity
waveform interpolation	Sin(x)/x、Linear
Color model	Normal 、Opposite
Language	Simplified Chinese,TraditionalChinese, English,French, German,Portuguse,Spanish,Japanese,Korean,Russian,Arabic

Environmental	
Temperature	operating：10℃ to +40℃ Nonoperating ：-20℃ to +60℃
Humidity	operating：95%RH，40℃，24 hours Nonoperating：90%RH，65℃，24 hours
Height	operating：4,580m Nonoperating：15,266m
pollution	It Usually only have dry insulative pollution It must be prospective that it is instant electric because of icing once in a way

Power Supply	
Input Voltage	100-240 VAC, CAT II, Auto selection
Frequency Scope	47Hz to 440Hz
Power	50VA Max

Mechanical		
Dimension	length	300mm
	Width	290mm
	Height	150mm
Weight	4.6kg	

Appendix B: Accessories

Standard Accessories ：

- 1:1/10:1 probe (2 PCS)
- one cable
- USB Interface, USB Interface Cable
- User Manual
- EasyScope computer software system

Selected Accessories：

- GPIB Communication Module
- Pass/Fail Interface Module

Appendix C: Default setup

Menu or system	**options 、 knobs or buttons**	**Default setup**
CH1 CH2	Coupling	DC
	Bw limit	Off
	Volts/div	Coarse
	Probe	10X
	Invert	Off
	Volts/div	1.00V
MATH	Operation	CH1-CH2
	CH1 Invert	Off
	CH2 Invert	Off
	FFT operation: Source Window FFT Zoom Scale	 CH1 Hanning 1X dBVrms
HORIZONTAL	Window	Main
	Position	0.00μs
	Sec/div	500μs
	Window Zone	50.0μs
	Trigger knob	level
CURSOR	Type	off
	Source	CH1
	Horizontal (voltage)	+/-3.2divs
	Vertical (time)	+/-4divs

MEASURE	Source	CH1
	Type	Average
ACQUIRE	Three mode options)	Sample
	Averages	16
	Sample mode	Equ time
DISPLAY	Type	Vectors
	Persist	off
	Gird	
REF	Type	Waveform
	Source	CH1
	REFA	Off
TRIGGER (edge)	Type	Edge
	Source	CH1
	Slope	Rising
	Mode	Auto
	Coupling	DC
	LEVEL	0.00V
TRIGGER (pulse)	Type	Pulse
	Source	CH1
	When	=
	Set Pulse Width	1.00ms
	Mode	Auto
	Coupling	DC
TRIGGER (Video)	Type	Video
	Source	CH1
	Polarity	Normal
	Sync	All Lines
	Standard	NTSC

Appendix D: Daily Maintain and Cleaning

Daily Maintain

DO not store or leave the instrument in where the LCD display will be exposed to direct sunlight for long periods of time.

CAUTTON: To avoid damage to the instrument or probes , do not expose them to sprays, liquids, or solvents

Cleaning

If this instrument requires cleaning, disconnect it from all power sources and clean it with a mild detergent and water. Make sure the instrument is completely dry before reconnecting it to a power source.

To clean the exterior surface, perform the following steps:

1. Remove loose dust on the outside of the instrument and probes with a lint-free cloth. Use care to avoid scratching the clear plastic display filter.
2. Use a soft cloth dampened with water to clean the instrument.

Use an aqueous solution of 75% isopropyl alcohol for more efficient cleaning.

Note：

To avoid damage to the surface of the instrument or probes, do not use any abrasive or chemical cleaning agents.

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