LILLIPUT

LDS201M-2

Hand-held Type Digital Storage Oscilloscope

Users Manual

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Warning:

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Contents

General Safety Information

Carefully read the following safety information in order to avoid any personal injury and damage on this product or any products connected with it. This product can only be used in the specified applications to prevent any possible dangers.

Only qualified technical personnel can be permitted to perform maintenance.

To avoid fire or personal injury:

Use proper power line. Use only the power line that is provided for this product specially and subject to approval of being used in the user state.

Make a connection or disconnection correctly. When a probe or test cord is connected to the power supply, do not connect or disconnect it at random.

Connect the probe properly. The ground terminal of the oscilloscope probe is connected to the ground phase potential, and do not connect it to the positive phase potential.

Pay attention to the nominal values of all terminals. To avoid fire or electric shock, please keep a watchful eye on all nominal values and marks specified for this product. Before any connection performed on this product, carefully read the user manual of the product for further information on nominal values.

No operation is allowed without the instrument cover plate. If the cover plate or panel has been removed, do not perform any operation on this product.

Use proper fuse. Use only the fuse complying with to the specified type and normal value for this product.

No touch is allowed on bare conductors. When the product is powered on, do not touch on the bare joints or parts.

Operation is prohibited in case of any undetermined failure. When in doubt any damage on this product, consult the qualified personnel for checking on it.

Keep ventilation in good condition. Refer to the user manual for detail installation instructions in order to fix this product correctly and provide it with good ventilation conditions.

No operation is allowed under a humid environment.

No operation is allowed under an explosive environment.

Keep clean and dry on the product surface.

Safety Terms and Symbols

Specific warning and caution terms, where they apply, appear throughout the manual.

Warning. "Warning" identifies conditions and actions that pose hazards to the users.

Caution. "Caution" identifies conditions and actions that may damage the product or other properties.

Terms used on the product. The following terms appears possibly on the product.

Danger: The term "Danger" is used in this manual to indicate that when you read this mark, personal injury may be caused to you immediately.

Warning: The term "Warning" is used in this manual to indicate that when you read this mark, immediate personal injury may not be caused to you.

Notice: The term "Notice" is used in this manual to indicate that damages may be caused on this product or other properties.

Symbols used on the product. The following symbols appear possibly on the product.

High voltage

Refer to user manual

Protective ground

Measurement ground

Case ground

Performing the General Inspection

When you have got a new LDS series oscilloscope, it is suggested that you should perform a general inspection on the instrument according to the following steps.

1. **Check whether there is any damage on it due to transportation.**

   If the packing boxes or foam cushions are found in serous damage, keep them in a proper place till the complete instrument and accessories have passed the electrical and mechanical tests.

2. **Make a check on accessories**

   The accessory list has been described in the Appendix B " Accessory" of this manual. You can make a check and find whether there is any accessory loss with reference to the Appendix. In case of any accessory loss or damage, consult the LILLIPU dealer responsible for such a business or the local office of LILLIPUT.

3. **Make a check on the complete instrument**

   If the instrument is damaged in its appearance or it fails in normal operation or performance test, consult the LILLIPU dealer responsible for such a business or the local office of LILLIPUT. If the instrument is damaged due to transportation, keep the packing in a proper place and consult the transportation department and the LILLIPUT dealer responsible for such business, who will provide an instrument replacement or maintenance.

Connected to PC :

The oscilloscope has a RS-232 port and 2 USB ports.

Firmware of the oscilloscope can be updated through RS-232 port when connect the instrument to PC. If users need to update or repair the firmware, please contact the sales agency. The storaged data of the instrument could be storaged to PC through the mini USB ports.

Using The Scope

About this Chapter

This chapter provides a step-by-step introduction to the scope functions of the test tool. The introduction does not cover all of the capabilities of the scope functions but gives basic examples to show how to use the menus and perform basic operations.

Powering the Test Tool

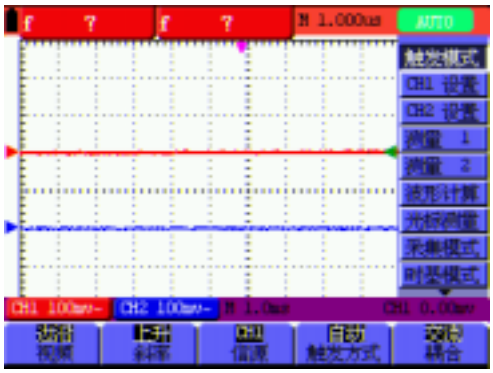
Follow the procedure (steps 1 through 3) in Figure 2 to power the test tool from a standard ac outlet.
Turn the test tool on with the on/off key.
The instrument performs all self-check items and determines whether it passes the self -check. Then, press any key and the instrument is under operation condition.
The test tool is powered up in its last setup configuration.

Figure 2. Powering the Test Tool

Navigating a Menu

The following example shows how to use the tool's menus to select a function, as shown in the following figure.

1. Press the MENU key to display the functions menu on the right of the screen and the function menu on the bottom responding to the optional settings. Again, press the MENU to hide the function menu.
2. Press the MENU Up or MENU DOWN key to select different function menu.
3. Choose one key from F1 through F5 and press it to change function setting.



Manually Setting the Vertical System, horizontal System and Trigger Position

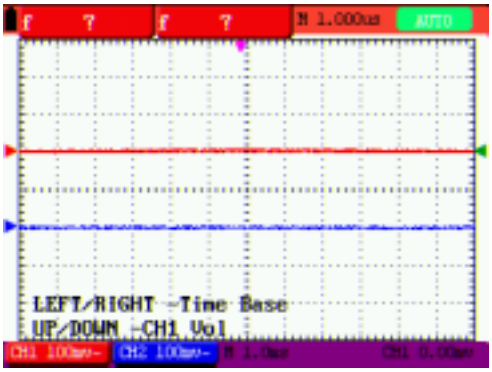
The **OSC OPTION** key is a key letting you step through the optional settings repeatedly, with which you can make a selection repeatedly between setting options such as CHI VOL (for setting the vertical scale of Channel 1), CH2 VOL（for setting the vertical scale of Channel 2）, **CH1 ZORE**（for the zero position setting of **Channel 1** in vertical direction）, **CH2 ZORE**（for the zero position setting of **Channel 2** in vertical direction ）, TRIG （ for the trigger position setting）, TIME BASE（for the horizontal time scale setting） and TIME (for the horizontal position setting).

The following example shows how to use the test tool's OSC OPTION key to make a setting.

1. Press once the **OSC OPTION** key; the following is displayed at the bottom left side of the screen, as shown in the figure below.

   LEFT/RIGHT – Time Base

   UP/DOWN – CH1 Vol

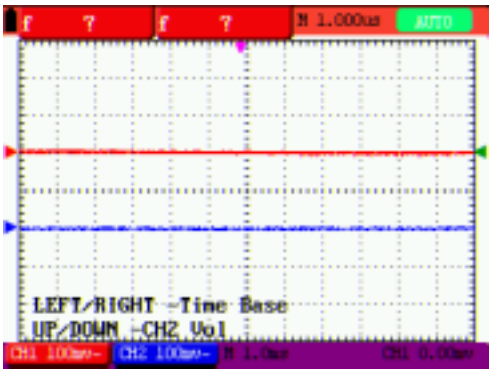


2. Press the key **OSC UP** or **OSC DOWN** to adjust the vertical scale of Channel 1 and press **OSC LIFT OSC RIGHT** to adjust the horizontal time scale.

3. Again, press once the **OSC OPTION** and the following display is visible at bottom left side of the screen, as shown in the following figure:

   LEFT/RIGHT – Time Base

   UP/DOWN – CH2 Vol

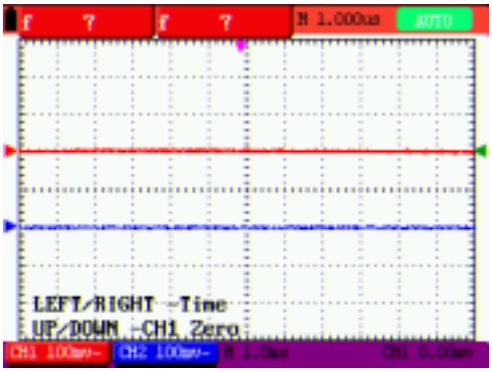


4. Press the **OSC UP** or **OSC DOWN** key to adjust the vertical scale of Channel 2 and press the **OSC LIFT OSC RIGHT** key to adjust the horizontal time scale.

5. Press the **OSC OPTION** key one more and the following display is visible at the bottom left side of the screen, shown as the following figure.

   LEFT/RIGHT – Time

   UP/DOWN – CH1 Zero

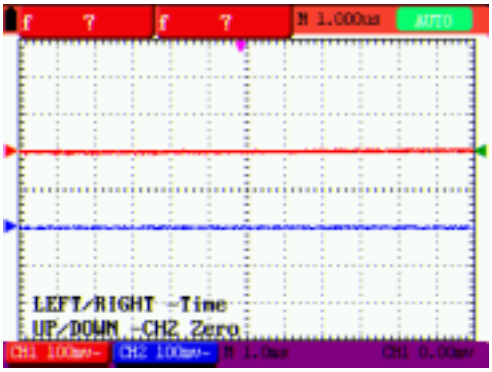


6. Press **OSC UP** or **OSC DOWN** key to adjust the zero position of Channel 1 in vertical direction and press **OSC LIFT OSC RIGHT** key to adjust the horizontal position.

7. Again, press **OSC OPTION** key and the following appears at the bottom left side of the screen, shown as the following figure,

   LEFT/RIGHT – Time

   UP/DOWN – CH2 Zero

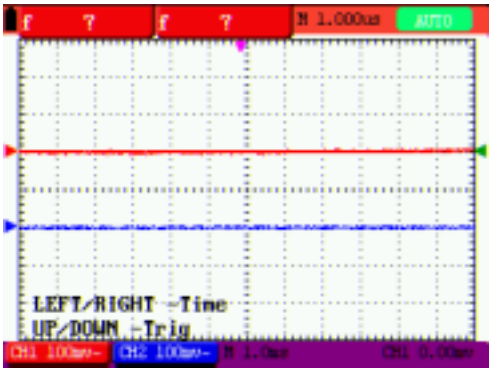


8. Press the **OSC UP** or **OSC DOWN** key to adjust the zero position of Channel 2 in the vertical direction and press OSC LIFT OSC RIGHT key to adjust the horizontal position.

9. Press OSC OPTION key once more and the following appears at the bottom left of the screen, shown as the following figure.

   LEFT/RIGHT – Time

   UP/DOWN – Trig



10. Press the **OSC UP** or **OSC DOWN** key to adjust the trigger position of Channel 2 and press **OSC LIFT OSC RIGHT** key to adjust the horizontal position.

11. Press the **OSC OPTION** key again and return back to step 1.

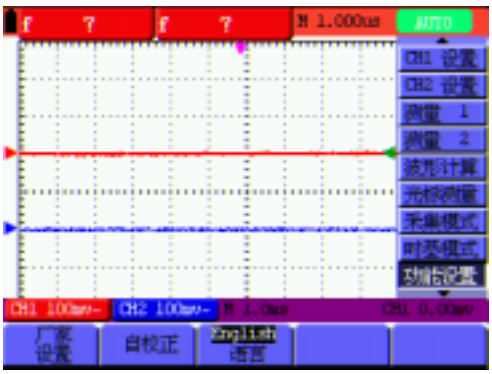
Resetting the Test Tool

If you want to reset the test tool to the factory settings, do the following:

1. Press **MENU** key and the function menu appears on the right side of the screen

2. Press the **MUNU UP** or **MENU DOWN** key to select function setting and three options are visible at the bottom of the screen.

3. Press F1 key to select the factory settings. The test tool is set to be the factory settings.



Input Connections

Look at the bottom and the right of the test tool. The test tool has seven signal inputs: two safety BNC jack inputs (CH1 and CH2) for scope measurements, three safety 4-mm banana jack inputs for universal meter R, V and A measurements, and two quadratic jack inputs for universal meter capacitance measurements.

Isolated input architecture allows independent floating measurements with universal meters and scopes.

See the following figure:

Displaying an Unknown Signal with Auto Set

The Auto-Set feature lets the test tool display and measure unknown signals automatically. This function optimizes the position, range, time base, and triggering and assures a stable display of virtually any waveform. If the signal changes, the setup is automatically adjusted to maintain the best display result. This feature is especially useful for quickly checking several signals.

To enable the Auto-Set feature, do the following:

1. Connect the test probe to the tested signals.

2. Press the **AUTO** key and the test tool is under the automatic measurement condition. The tested signals appear on the screen.

Making Automatic Scope Measurements

The test tool offers 5 ranges of automatic scope measurements. Your can display two numeric readings: READING 1 and READING 2. These readings are selectable independently, and the measurements can be done on the input CH1 or input CH2 waveform.

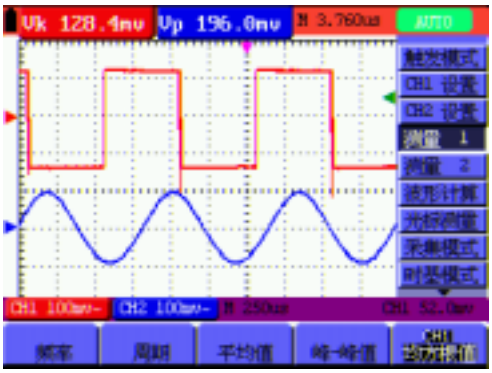
To choose a mean square root value for CHI1, do the following:

1. Press **MENU** key and the function menu appears on the right side of the screen.
2. Press **MUNU UP** or **MENU DOWN** key to select **measurement 1**. Five items selectable are visible at the bottom of the screen.
3. Press F5 key and select CH1 from the mean square root value item. The READING 1 window turns its color into red and shows the mean square root value for input CHI.

To choose a Peak-Peak measurement for Input CH2, do the following:

1. Press **MENU** key and the function menu is displayed on the right side of the screen.
2. Press **MUNU UP** or **MENU DOWN** key and select **Measurement 2**, with 5 items selectable displayed at the bottom of the screen.
3. Press F4 key to select CH2 from Peak-Peak item. The READING 2 window turns its color to be blue and shows the peak-peak value for input CH2.

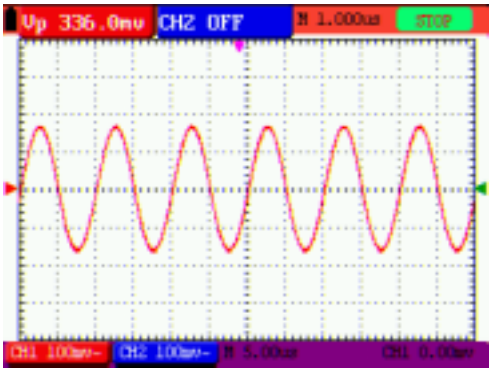
The following figure shows an example of the screen.



Freezing the Screen

You can freeze the screen (all readings and waveforms)

1. Press the **RUN/STOP** key to freeze the screen and **STOP** appears at top right side of the screen.
2. Press the **RUN/STOP** key once more and resume your measurement.



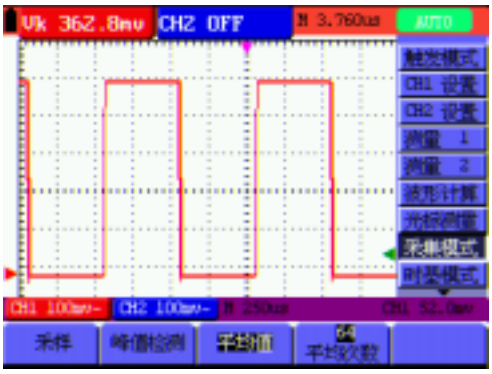
Using Average, Persistence and Glitch Capture

Using Average for Smoothing Waveforms

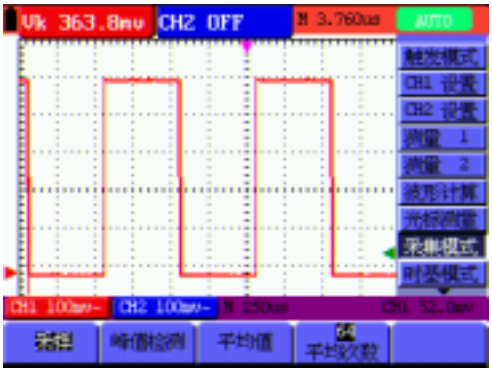
To smooth the waveform, do the following:

1. Press the **MENU** key and the function menu appears on the right side of the screen.
2. Press **MUNU UP** or **MENU DOWN** key to select **Collecting mode**, with four items selectable displayed at the bottom of the screen.
3. Press the F3 key to select **Average Factors**; then, press F4 key to jump to **Averaging 32** item. This averages the outcomes of 32 acquisitions and shows the final averaging result on the screen, shown as the following figures.

See the following figure:



Average factor sampling mode



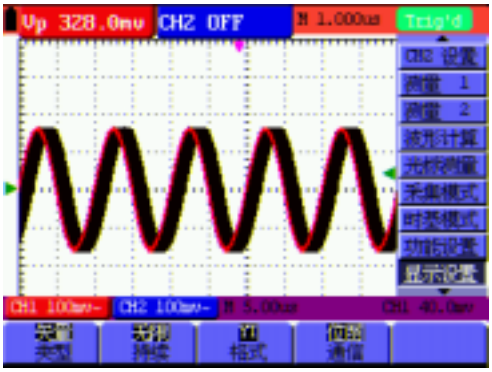
Normal sampling mode

Using Persistence to Display Waveforms

You can use Persistence to observe dynamic signals.

1. Press **MENU** key and the function menu appears on the right side of the screen.
2. Press **MUNU UP** or **MENU DOWN** key to select **Display setting.** Four items selectable are displayed at the bottom of the screen.
3. Press **F2** key to select **1s, 2s, and 5s, infinite or close**. In this case, jump to **Infinite** and the observed dynamic is kept on the screen continuously. When the item **Close** is selected, the **Persistence** function is closed.

Look at the display, a screen like the following figure can be shown.



Using Peak Detection to Display Glitches

You can use this function to display events (glitches or other asynchronous waveforms) of 50 ns or wider.

1. Press **MENU** key and the function menu appears at the right side of the screen.
2. Press **MUNU UP** or **MENU DOWN** key to select the **Collecting mode**. Four items selectable are displayed at the bottom of the screen.
3. Press **F3** key and jump to Glitch Detect. In this case, you can test the glitch.

Now, you can see a screen that looks like the following figure.

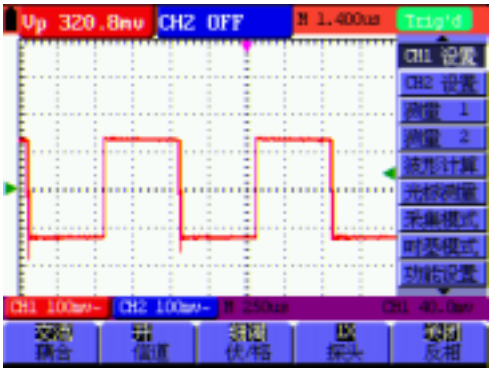
Acquiring Waveforms

Selecting AC-Coupling

After a reset, the test tool is dc-coupled so that ac and dc voltages appear on the screen, Use ac-coupling when you wish to observe a small ac signal that rides on a dc signal. To select ac-coupling, do the following:

1. Press **MENU** key and the function menu appears at the right side of the screen.
2. Press **MUNU UP** or **MENU DOWN** key to select the **CH1 Setting.** Five items selectable are visible at the bottom of the screen.
3. Press the F1 key and jump to AC. The bottom left side of the screen displays the ac-coupling icon.

Now, you can see a screen that looks like the following figure.

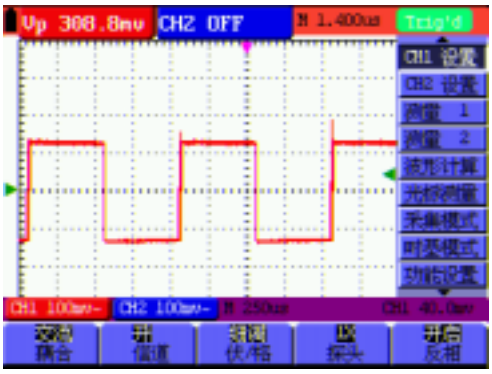


Reversing the Polarity of the Displayed Waveform

To invert the input CH1 waveform, do the following:

1. Press the **MENU** key and the function menu appears at the right side of the screen.
2. Press the **MUNU UP** or **MENU DOWN** key to select CH1 setting. Five items selectable are displayed at the bottom of the screen.
3. Press **F1** key to jump to **Inverted.** The inverted waveform of CHI1 is displayed on the screen.

Now, you can see a screen that looks like the following figure.



Using Waveform Mathematics Functions of *CH1 ± CH2,CH1 * ch2 and CH1* / CH1

When adding (CH1 + CH2), subtracting (CH1 –CH2, CH2-CH1), multiplying (CH1 * CH2) or dividing （CH1 / CH2） the input waveforms of CHI and CH2, the test tool will display the mathematical result waveform M and the input waveforms of CH1 and CH2 on the screen. The Mathematics functions perform a point-to-point calculation on the waveforms CH1 and CH2.

To use a Mathematics function, do the following:

1. Press the **MENU** key and the function menu is displayed at the right side of the screen.
2. Press the **MUNU UP** or **MENU DOWN** key to select the **Waveform Calculation.** Five items selectable appears at the bottom of the screen.
3. Press **F3** key to select **CH1+CH2** and the calculated waveform M (green) appears on the screen. Again, press the **F3** key to close Waveform Calculation.

4. In this case, press the **OSC OPTION** key and the following is visible at the bottom left side of the screen.

   LEFT/RIGHT Time

   UP/DOWN CHM Zero

   Then, press the **OSC UP** or **OSC DOWN** key to adjust the vertical position of the calculated waveform M displayed on the screen.

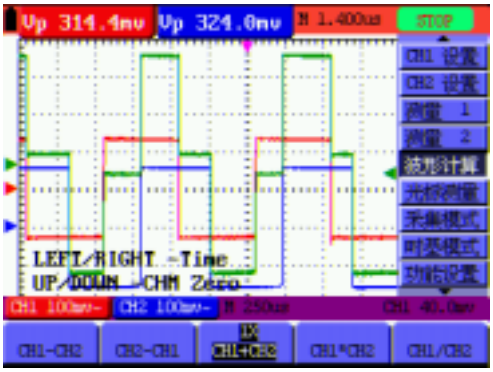
5. Press the **OSC OPTION** key and the following appears at the bottom left side of the screen.

   LEFT/RIGHT Time Base

   UP/DOWN CHM Vol

   Press the **OSC UP** or **OSC DOWN** key to adjust the displayed amplitude of the calculated waveform M.

Now, you can see a screen that looks like the following figure.



Using The Multimeter

About this chapter

This chapter provides a step-by-step introduction to the multi-meter functions of the test tool(hereafter called “meter”). The introduction gives basic examples to show how to use the menus and perform basic operations.

Making Meter Connections

Use the three 4-mm safety banana jack inputs for the Meter functions: COM, V/Ω, mA.

Two quadratic capacitance jacks: CX

See the following figure for the connections:

Making Multimeter Measurements

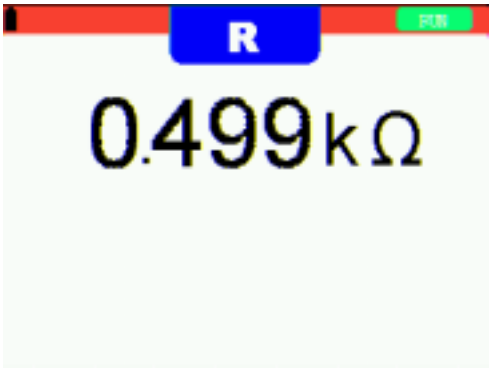
Press the **DMM/OSC** key and the multi-meter interface appears on the screen.

Measuring Resistance Values

To measure a resistance, do the following:

1. Press the **R** key and **R** appears at the top of the screen.
2. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω** banana jack input.
3. Connect the red and black test leads to the resistor. The resistor value readings are shown on the screen in Ohm.

Now, you can see a screen that looks like the following figure.



Making a Diode Measurement

To make a measurement on the diode, do the following:

1. Press the **R** key and **R** appears at the top of the screen..
2. Press **DMM OPTION** key once and the following is displayed on the screen.
3. Insert the black lead into the **COM** banana jack input and the red lead into the V/Ω banana jack input.
4. Connect the red and black leads to the resistor and the diode resistor readings are displayed on the screen in **V**.

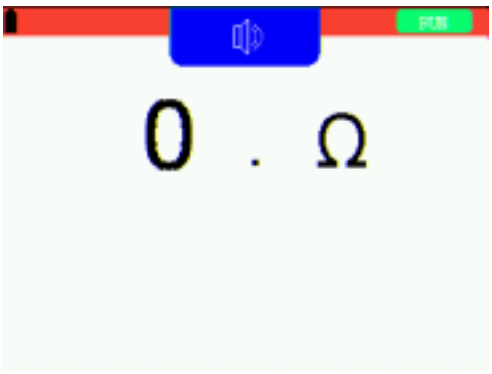
Now, you can see a screen that looks like the following figure.

On-off test

To perform an On-off test, do the following:

1. Press the **R** key and **R** appears on the top of the screen.
2. Press the **DMM OPTION** key three times and the following is shown on the screen.
3. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω** banana jack input.
4. Connect the red and black leads to the test point. If the resistance value of the tested point is less than 30Ω, you will hear beep sound from the test tool.

Now, you can see a screen that looks like the following figure.

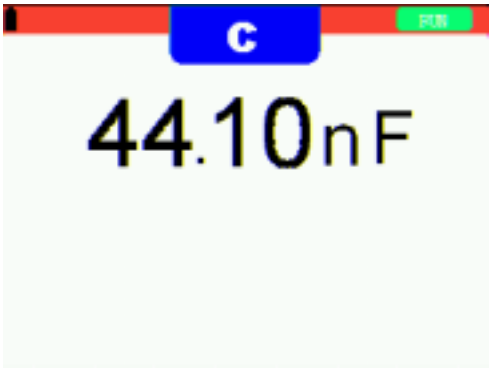


Making a Capacitance Measurement

To measure a capacitance, do the following:

1. Press the **R** key and **R** appears on the top of the screen
2. Press the **DMM OPTION** key four times and **C** appears at the top of the screen.
3. Insert the measured capacitance into the quadratic jack and the screen shows the capacitance reading.

Now, you can see a screen that looks like the following figure.

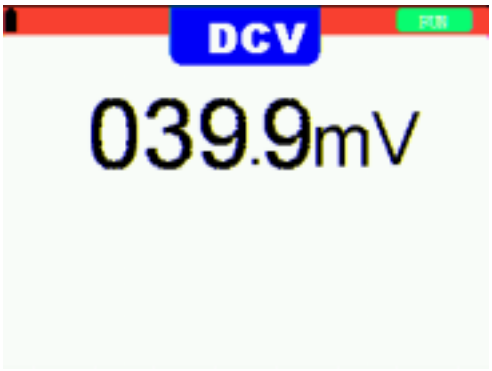


Making a DC voltage Measurement

To measure a DC voltage, do the following:

1. Press the **V** key and **DCV** appears at the top of the screen.
2. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω** banana jack input.
3. Connect the red and black leads to the measured point and the measured point voltage value is displayed on the screen.

Now, you can see a screen that looks like the following figure.

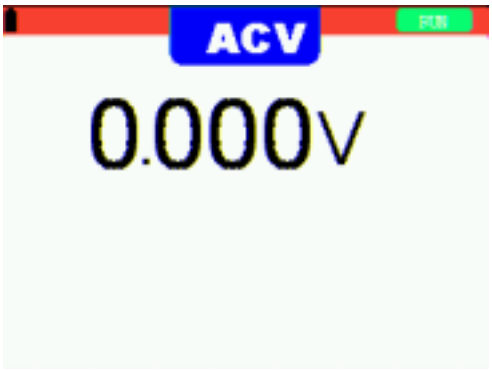


Making a AC voltage Measurement

To measure the AC voltage, do the following:

1. Press the **V** key and **DCV** appears at the top of the screen.
2. Press the **DMM OPTION** key and **ACV** appears at the top of the screen.
3. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω** banana jack input.
4. Connect the red and black leads to the measured points and the AC voltage values of measured points will be displayed on the screen.

Look at the display; you can see a screen that looks like the following figure.



Making a DC current Measurement

To measure a DC current, do the following:

1. Press the A key and DCA appears at the top of the screen.
2. Insert the black lead into the **COM** banana jack input and the red lead into the **mA** banana jack

input.

3. Connect the red and black leads to the measured points and the DC current values of measured points will be displayed on the screen.

Look at the display; you can see a screen that looks like the following figure.

Making an AC Current Measurement

To measure an AC current, do the following:

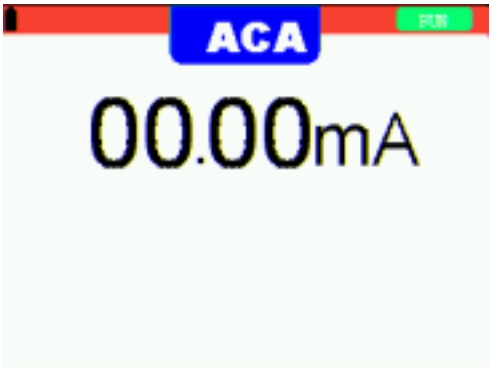
1. Press the **A** key and **DCA** appears at the top of the screen.

2. Press the **DMM OPTION** key once and ACV is visible at the top of the screen.

3. Insert the black lead into the **COM** banana jack input and the red lead into the **mA** banana jack input.

4. Connect the red and black leads to the measured point and the **AC** current value of the measured point will be displayed on the screen.

Look at the display; you can see a screen that looks like the following figure.



Freezing the Readings

You can freeze the displayed readings at any time.

1. Press the **RUN /STOP** key to freeze the screen and **STOP** will be displayed at the top right of the screen.

2. Again, press the **RUN /STOP** key, you can resume your measurement.

Look at the display; you can see a screen that looks like the following figure.

Setting the Oscilloscope

About this chapter

This chapter will detail the oscilloscope function of the test tool.

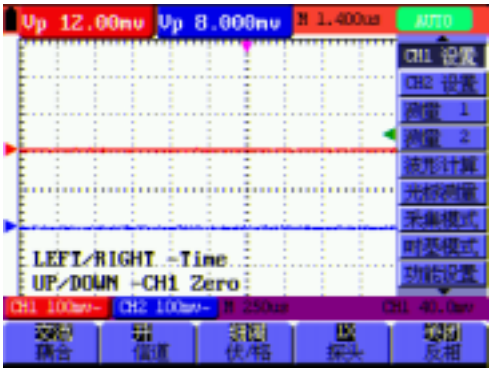
Setting the Vertical CH1 and CH2

Each channel has its own independent vertical menu and each item can be set respectively based on the specific channel.

To make vertical CH1 and CH2 settings, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the **MUNU UP** or **MENU DOWN** key to jump to **CH1 Setting** and 5 options appears at the bottom of the screen.
3. Select and press key from **F1 through F5** keys to make different settings.

Now, you can find a screen that looks like the following figure:



The following Table describes the **Vertical Channel** menu:

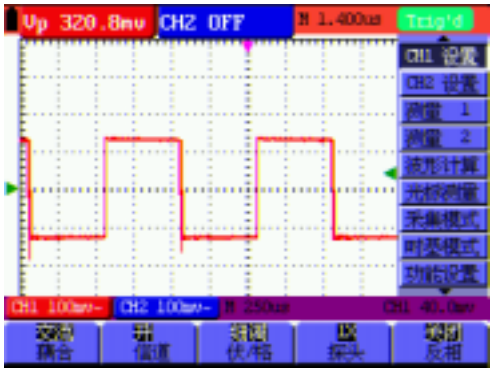
Function menu	Setting	Description
Coupling	AC DC	The dc component in the input signal is blocked.. The ac and dc components of the input signal are allowed.
Channel	Close Open	Close the channel. Open a channel.
V/div.	Coarse Fine	With Coarse selected, the vertical sensitivity is set in the “1-2-5” stepping form; With Fine selected, make a further division within the range of Coarse setting to improve the resolution.
Probe	1X 10X 100X 1000X	Select one according the probe attenuation factor to ensure a correct vertical scale reading.
Invert	Close Open	Waveform is displayed normally. Open the **Invert** function of the waveform setting.

1. Setting the Channel Coupling

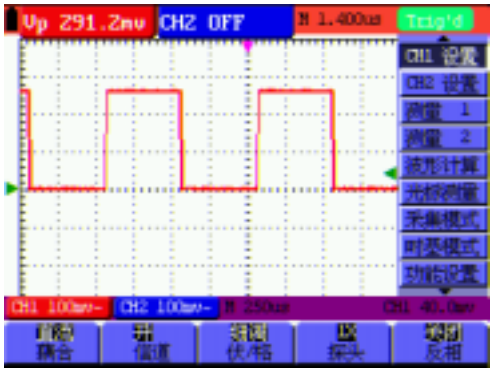
With CH1 taken for example, the measured signal is a sine wave signal containing a dc offset. Press **F1 Coupling** first and then **AC** to make an ac coupling setting. The dc component contained in the tested signal is blocked.

Press **F1 Coupling** first and then **DC** to make a dc coupling setting. Both dc and ac components contained in the tested signal are permitted.

The waveform is displayed as the following figure.



AC coupling



DC coupling

2. Make Open and Close Settings on Channel

With CH1 taken for example**,**

Press **F2 Channel** first**,** then **Close** to make a Close setting on CH1;

Press **F2 Channel** key first**,** then **Open** to make an Open setting on CH1.

3. Make a V/div. Adjustment Setting

The vertical **V/div** adjustment includes Coarse and Fine modes. The vertical sensitivity ranges from **5mV/div to 5V/div.** The **Coarse** defines the sensitivity of the vertical **V/div** in the **1—2—5** stepping form**,** that is, it steps in test in the form of **5mV/div, 10mV/div, 20mV/div…5 V/div.**

Fine means a further adjustment within the present vertical **V/div** range. If the input waveform amplitude is slightly larger than the full range in the present **V/div** range while the displayed

waveform amplitude is somehow lower with the next **V/div** stepped, the **Fine** mode can be applied to improve the displayed waveform amplitude and benefit the specific observation of signals.

4. Adjusting the Probe Scale

It is necessary to adjust the probe attenuation scale factor correspondingly in the channel operation menu in order to comply with the probe attenuation scale. If it is a 10:1 probe, the scale of the input channel of the oscilloscope should be selected as **10X** to avoid any error occurring in the displayed scale factor information and tested data.

Press **F4 Probe** to jump to the relative probe.

Table: Probe attenuation factor and the corresponding menu setting

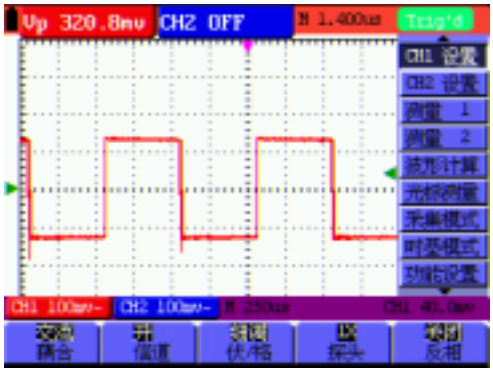
Probe attenuation factor	Corresponding Menu Setting
1:1	1X
10:1	10X
100:1	100X
1000:1	1000X

5. Setting of Inverted Waveform

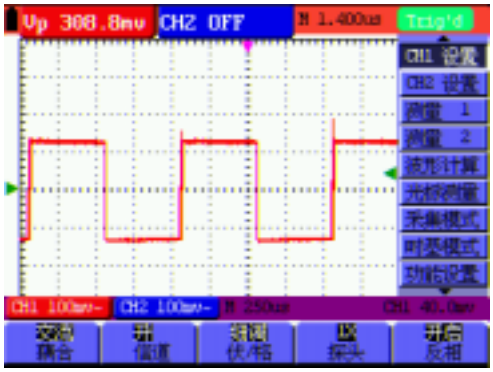
Inverted waveform: The displayed signal reverses 180 degrees relatively to the ground potential.

Press **F5 Invert** to start Invert; again press **F5 Invert** to close Invert.

You can see a screen that looks like the following figure:



Close Invert



Start Invert

Make the MATH function menu Setting

The **MATH** functions in showing the result of adding, subtracting, multiplying or dividing calculation on CH1 and CH2 channel waveforms. Also, the result of arithmetic operation can be measured with grid or cursor. The amplitude of the calculated waveform can be adjusted with CH1 VOL or CH2 VOL vertical scale, which is displayed in the scale factor form. The amplitude ranges from 0.001 through 10 and steps in the 1-2-5 form, that is, it can be expressed as 0.001X, 0.002X, 0.005X⋯10X. The position of the calculated waveform can be adjusted up and down with the **CHM ZORE** key used.

The corresponding operation function table

Setting	**Description**
CH1-CH2	CH1 waveform minus CH2 waveform.
CH2-CH1	CH1 waveform minus CH2 waveform
CH1+CH2	Add CH1 waveform into CH2 waveform.
CH1*CH2	Multiply CH1 waveform and CH2 waveform.
CH1/CH2	Divide CH1 waveform by CH2 waveform.

To perform the **CH1+CH2** waveform calculation, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the MUNU UP or MENU DOWN key to select MATH and 5 options are displayed at the bottom of the screen.
3. Press the **F3 CH1+CH2** key and the obtained waveform **M** appears on the screen. Again, press the F3 key and Close the waveform **M**.
4. Press the **OSD OPTION** key and the following is displayed on the screen:

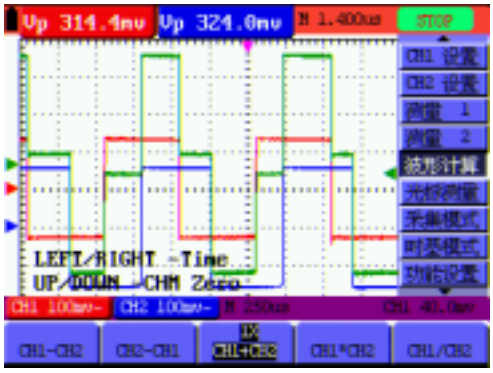
   LEFT/RIGHT – Time Base

   UP/DOWN – CH1 Vol
5. Press the **OSD UP or OSD DOWN** key to adjust the amplitude of the waveform **M**.
6. Again, press the **OSD OPTION** key twice and the screen shows the following:

   LEFT/RIGHT – Time

   UP/DOWN – CHM Zero
7. Press the **OSD UP or OSD DOWN** key to adjust the position of the waveform M.

Now, look at the display and you will find a screen that looks like the following figure:


Vp 314.4mv
Vp 324.0mv
M 1.400us
STOP
CH1 设置
CH2 设置
测量 1
测量 2
波形计算
光标测量
采集模式
时基模式
功能设置
LEFT/RIGHT -Time
UP/DOWN -CHM Zero
CH1 100mv~
CH2 100mv~
M 250us
CH1 40.0mv
CH1-CH2
CH2-CH1
CH1+CH2
CH1*CH2
CH1/CH2

Setting the Trigger System

The **Trigger** defines the time when the acquisition of data and display of waveform start. If it is set correctly, the trigger can turn an unstable display into a significant waveform.

When starting the acquisition of data, the oscilloscope collects sufficient data to draw the waveform at the left side of the triggering point. With waiting for the triggering condition, the oscilloscope is gathering data continuously. After a trigger is detected, the oscilloscope gathers enough data continuously to draw the waveform at the right side of the triggering point.

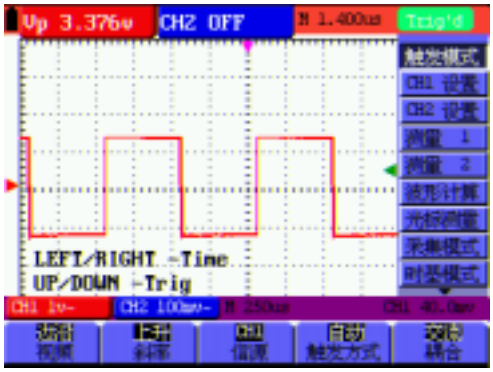
To make a trigger mode setting, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the MUNU UP or MENU DOWN key to select MATH and five items selectable are displayed at the bottom of the screen.
3. Select and press one from **F1 through F5** key to make a different setting.
4. Press the **OSD OPTION** key and the following is shown on the screen:

   LEFT/RIGHT – Time

   UP/DOWN – Trig
5. Press the **OSD UP or OSD DOWN** key to adjust the trigger level position.

Now, look at the display: you can see a screen in the following figure:



Triggering Control

There are two triggering modes including Edge triggering and Video triggering. Each trigger mode is set by different function menu.

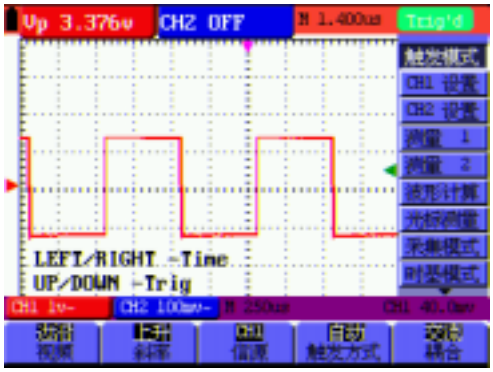
Edge triggering: It occurs when the trigger input passes through a given level along the specified direction.

Video triggering: Perform video field trigger or line trigger on the standard video signals.

The following describes the Edge triggering and Video triggering menus respectively.

Edge triggering

The Edge triggering is a mode by which trigger occurs at the triggering threshold value of the input signal edge. With the **Edge triggering** selected, the trigger happens on the rise or fall edge of the input signal, shown as the following figure.



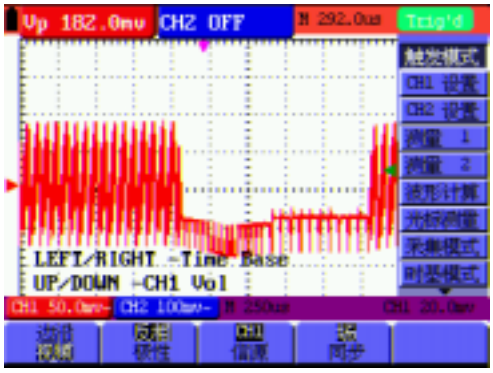
The **Edge triggering** menu is described in the following table.

Function menu	Settings	Description
Slope	Rise	Triggering on the rise edge of the signal.
	Fall	Triggering on the fall edge of the signal.
Signal source	CH1	CH1 is used as the trigger source.
	CH2	CH2 is used as the trigger source.
Trigger mode	Auto	Acquisition of waveforms is possible even if there is no triggering condition detected.
	Normal	Acquisition of waveforms can only be done when the triggering condition is satisfied.
	Single shot	The sampling is performed on a waveform when one trigger is detected, then stop sampling. .
Coupling	AC	With this mode selected, the DC component is prevented from passing-though.
	DC	All dc components are allowed.
	Noise suppression	Noise signals are prohibited.
	HF suppression	The HF part of the signal is prohibited and only the HF component is allowed.
	LF suppression	The LF part of the signal is prohibited and only the LF component is allowed.

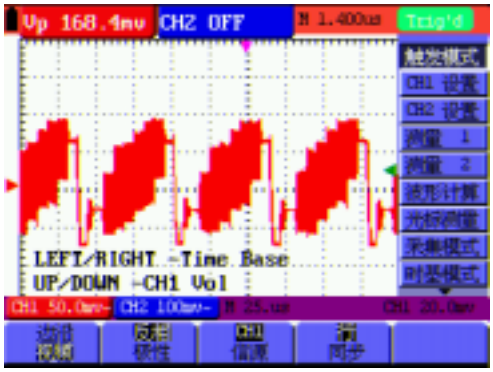
Video triggering

With **Video triggering** selected, the oscilloscope performs the **NTSC, PAL** or **SECAM** standard video signals field or line trigger.

Now, you can see a screen that looks like the following figure:



Video field trigger



Video line trigger

The Video triggering menu is described in the following table

Function menu	Settings	Description
Polarity	Normal	Applicable to the video signal in which the black level is of low level.
	Invert	Applicable to the video signal of which the black level is of high level.
Signal source	CH1	Select CH1 as the trigger source.
	CH2	Select CH2 as the trigger source..
SYNC	Line	Make a video line trigger synchronization setting
	Field	Make a video field trigger synchronization setting..

Acquiring Mode Setting

The **Acquiring Mode** menu is described in the list shown as below:

Function menu	Settings	Description
Sampling		Normal sampling mode.
Peak Detection		Used to detect the jamming glitch and reduce the possible blurring.
Average value		Used to reduce the random and unrelated noises. Several average factors are available for being selected.
Average factor	4, 16, 64 or 128	Select the average factor.

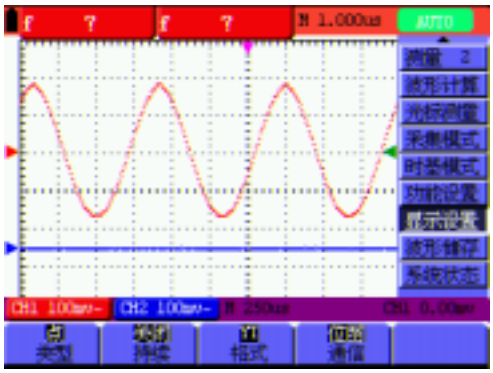
Display Setting

The Display Setting menu is described in the following table:

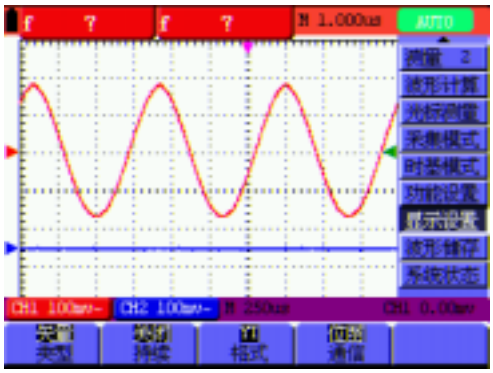
Function menu	Settings	Description
Type	Vector Dot	The vector is filled up spaces between neighboring sampling points in the display. Only sampling points are displayed.
Persistence	Close 1s 2s 5s Infinite	Setting persistence time for each sampling point.
Display format	YT XY	Display the relative relationship between vertical voltage and horizontal time. Display CH1 on the horizontal axis and CH2 on the vertical axis.
Communication	Bitmap Vector	The data transmitted in communication are bitmaps. The data transmitted in communication are vectors.

Display Style

The display style includes **Vector** and **Dot** displays, shown as the following figure:



Dot style



Vector style

Persistence

With **Persistence** function selected, the displayed saved original data gradually decay in color and the new data are bright in color; with infinite persistence mode selected, the recorded points will be kept on the screen till the controlled value is changed.

XY mode:

This mode is only applicable to CH1 and CH2. With the XY mode selected, CH1 is displayed on the horizontal axis and CH2 is on the vertical axis; when the oscilloscope is under the sampling mode in which no trigger is found, the data appear in light spots.

Operations for various control keys are shown as below:

- The **CH1 VOL** and **CH1 ZORE** for CH1 are used to set the horizontal scale and position.
- The **CH2 VOL** and **CH2 ZORE** for CH2 are used to set the vertical scale and position continuously.

The following functions do not work in the XY display mode:

- Reference or digital value waveform
- Cursor
- Auto Setting
- Time base control
- Trigger control

Waveform Saving Setups

The oscilloscope can save 4 waveforms, which can be displayed on the screen with the present waveform. The recalled waveform saved in the memory cannot be adjusted,

The **waveform saving /recalling menu** is described in the following list:

Function menu	Setups	Description
Signal source	CH1 CH2 MATH	Select the displayed waveform which you want to save.
Address	A, B, C and D	Select the address for saving or recalling a waveform.
Saving		Store the waveform of a selected signal source into the selected address.
Addresses A, B, C and D	Close Start	Close or start displaying the waveforms stored in address A, B, C or D.

To save a waveform on CH1 in address A, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the **MUNU UP** or **MENU DOWN** key to select the Waveform Saving. Four items selectable are displayed at the bottom of the screen.

3. Press the **F1** key to select the signal source CH1.

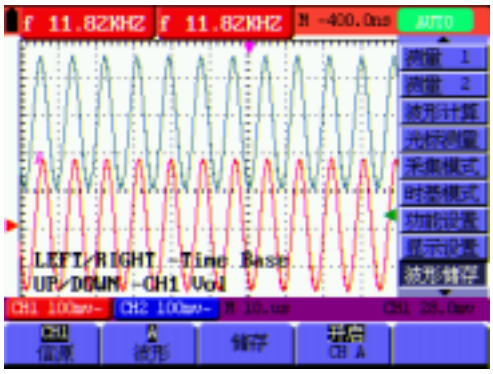
4. Press the **F2** key to select the address A.

5. Press the F3 key to save the waveform on CHI1 in address A.

To display the saved waveform on the screen, do the following:

6. Press the **F4** key to select Start for the address A. The waveform saved in address A will be displayed on the screen in green color.

Now, you can see a screen that looks like the following figure.



Function Setting Menu

The function setting menu is described in the following list:

Function menu	Setting	Description
Factory setting		Resume the instrument to its factory settings.
Self-correcting		Perform the self-correcting procedure.
LANGUAGE	CHINESE ENGLISH	Select the display language of the operation system.

Self-correcting:

The self-correcting program can improve the accuracy of the oscilloscope under the ambient temperature to the maximum. If the ambient temperature variation is equal to or larger than 5 Celsius degrees, the self-correcting program should be performed to gain the maximum accuracy.

Before the self-correcting program is performed, the probe or lead should be disconnected with the input connector, then, select **Self-correcting** item. After confirming that everything is ready, press the "**Self-correcting**" key and enter into the self-correcting program.

Making Automatic Measurements

The oscilloscope can perform 5 types automatic measurements such as frequency, cycle, average value, peak-to-peak value and root mean square value. And gives two kinds of measurement results simultaneously on the screen,

The function menu for automatic measurements is described in the following list:

Function menu	Settings	Description

Frequency	CH1 CH2	Measure the frequency of CH1 Measure the frequency of CH2
Cycle	CH1 CH2	Measure the cycle of CH1. Measure the cycle of CH1
Average value	CH1 CH2	Measure the average value of CHI. Measure the average value of CH2.
Peak-to-Peak value	CH1 CH2	Measure the peak-to-peak value of CH1. Measure the peak-to-peak value of CH2.
RMS value	CH1 CH2	Measure root mean square (RMS) value of CH1. Measure root mean square (RMS) value of CH2.

To measure the frequency of CH1 with **Measurement 1** and the frequency of CH2 with **Measurement 2**, do the following:

1. Press the **MENU** key and the function menu is shown at the right of the screen.
2. Press the **MUNU UP** or **MENU DOWN** key to select **Measurement 1**. Five options appear at the bottom of the screen.
3. Press the **F1** key to select the frequency measurement as **CH1.** The measurement window 1 on the screen turns into one red in color and shows the frequency of CH1.
4. Press the **MUNU UP** or **MENU DOWN** key to select **Measurement 2**. Five options appear at the bottom of the screen.
5. Press the **F4** key to jump to the peak-to-peak measurement as **CH2**. The measurement window on the screen turns into one blue in color and shows the peak-to-peak value of CH2.

Now, you can see a screen that looks like the following figure:

Setting the Cursor Measurements

This oscilloscope allows you to make manual cursor measurements on time and voltage. The signal sources include Channel 1(CH1), Channel 2 (CH2), MATH, storage address A and storage address B.

The cursor measurement menus are listed and described in the following table:

Function menus	Settings	Description
Type	Close Voltage Time	Close the cursor measurement. Display the voltage measurement cursor and menu. Display the time measurement cursor and menu.
Signal sources	CH1, CH2, ATH, address A and address B.	Select the waveform channel on which the cursor measurement will be performed.

To make a voltage measurement on CH1, doing the following:

1. Press the **MENU** key and the function menus are displayed at the right of the screen.
2. Press the **MUNU UP** or **MENU DOWN** key to select **Cursor Measurement**. Two options are shown at the bottom of the screen.
3. Press F1 key to select the measurement type Voltage. Two purple crossing dashed lines V1

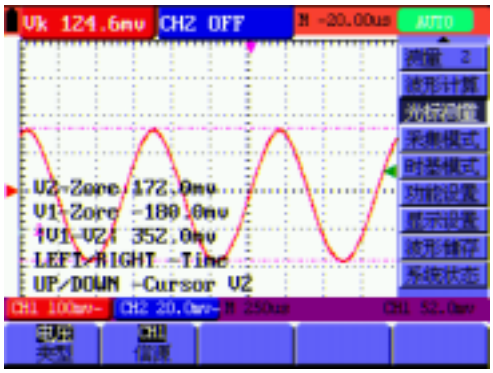
and V2 are shown on the screen.

4. Press the **F2** key to select the measured channel **CH1**.

5. Press and hold the **OSD OPTION** key till the **UP/DOWN CURSOR V1** is visible on the screen. At this time, adjust **OSE UP** or **OSD DOWN** and you can see that the dashed line V1 is moving up and down while the measured voltage value of V1 relative to the zero position of CH1 appears on the screen.

6. Press and hold the OSD OPTION key till UP/DOWN CURSOR V2 appears on the screen. Now, adjust the OSE UP or OSD DOWN and you can observe the dashed line V2 moving up and down while the measured voltage value of V2 relative to the zero position of CH1 is displayed on the screen. Also, the absolute values of V1 and V2 can be shown on the screen.

Now, you can see a screen that looks like the following figure.



To use the cursor for a time measurement on CH2, do the following:

1. Press the **MENU** key and the function menus are displayed at the right of the screen.

2. Press the **MUNU UP** or **MENU DOWN** key to select **Cursor measurement** key. Two key labels selectable are shown at the bottom of the screen.

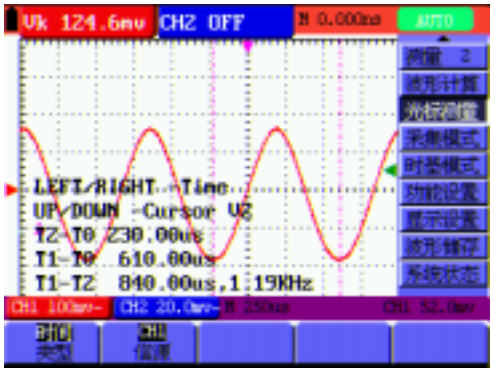
3. Press the **F1** key to the measurement type **Time.** Two vertical dashed lines T1 and T2 appear on the screen.

4. Press the **F2** key and jump to the measured channel **CH2**.

5. Press and hold the **OSD OPTION** key till the **UP/DOWN CURSOR T1** appears on the screen. Then, adjust the **OSE UP** or **OSD DOWN** and you can observe the dashed line moving left and right. At the same time, the time value of **T1** relative to the **screen middle point position** will be displayed on the screen.

6. Keep pressing on the **OSD OPTION** key till the **UP/DOWN CURSOR T2** is displayed on the screen. Then, adjust the **OSE UP** or **OSD DOWN** and you can find that the dashed line **T2** is moving right and left while the time value of **T1** relative to the **screen middle point position** appears on the screen. You can also observe the absolute time values and frequencies of **T1** and **T2.**

Now, you can see a screen that looks like the following figure.



System State Menu:

The system state menu is used to display information about the present horizontal system, vertical system, trigger system and others. The operation steps are shown as below.

1. Press the **MENU** key and the function menu is displayed at the right of the screen.
2. Press the **MUNU UP** or **MENU DOWN** key to select the **System State.** Four options appear at the bottom of the screen.
3. Sequentially press key **F1** through **F4** key and the corresponding state information will be shown on the screen.

The screen that looks like the following figure will be displayed.

Appendix A Specifications

Oscilloscope

Only if another instructions are provided, are all technical specifications applicable to the probe with the 10X attenuation switch setting and the DS 5000 series digital type oscilloscope. In order to be up to these specifications, the oscilloscope should meet the following requirement.

- The instrument should operate continuously for more than 30 minutes under the specified operating temperature.
- If the operating temperature range of variation is up to or larger than 5 Celsius degrees, the system function menu must be opened to make the system perform a "self- calibration" procedure.

Except those specifications marked with the word **"Typical"**, all specifications can be up to.

Sampling

Sampling modes	Normal sampling Peak detection Average value
Sampling rate	100 MSa/s

Input

Input coupling	DC, AC
Input impedance	1MΩ±2% connected in parallel with 20pF±3pF
Probe attenuation coefficient	1X, 10X, 100X, 1000X
Max. Input voltage	400V (peak)
Channel delay time（typical）	150ps

Horizontal

Sampling rate range	10S/s～100MS/s
Waveform interpolation	（sin x）/x
Record length	6K points on each channel
Scanning speed range（S/div）	5ns/div～5s/div, stepping in the "1-2.5-5" mode.
Sampling rate and relay time accuracy	±100ppm(any time interval which is equal to or larger than 1ms)
Time interval (△T)measurement accuracy（full bandwidth）	Single: ±(1 sampling interval time+100ppm×reading+0.6ns) >average 16 : ±(1 sampling interval time +100ppm × reading+0.4ns)

Vertical

Analog digital converter（A/D）	With the resolution of 8 bits, make sampling on both channels synchronously.
Sensitivity range （V/div）	5mV/div～5V/div（at the input BNC）
Displacement range	±20V(500mV～5V),±1V(5mV～200mV)

Analog bandwidth	20M（LDS20020-2）
Single bandwidth	Full bandwidth
Low frequency response（AD coupling, -3dB）	≤5Hz（at the BNC ）
Rise time（typical one at the BNC）	≤17.5ns（LDS20020-2）
DC gain accuracy	±5%
DC measurement accuracy （average value sampling mode）	The voltage difference (△V) between any two points on the waveform after averaging the captured waveforms more than16: ±(5% reading + 0.05 divisions).

Trigger

Trigger sensitivity （Edge triggering）	DC coupling	CH1 and CH2: 1div(DC～full bandwidth)
	AC coupling	Same as the DC coupling when it is equal to or larger than 50Hz.
Triggering lever range		±6 divisions from the screen center
Triggering level accuracy (typical) which is applicable to the signal with rise and fall time equal to or longer than 20ns	±0.3 divisions	
Trigger displacement	655 divisions for pre-triggering and 4 divisions for post- triggering	
Make a 50% level setting (Typical).	Operation with the input signal frequency equal to or larger than 50Hz.	
Trigger sensitivity (Video triggering and typical mode)	2 divisions of peak-to-peak value	
Signal system and line/field frequency (Video triggering mode)	Support the NTSC, PAL and SECAM broadcasting systems of any field or line frequency.	

Measurement

Cursor measurement	Voltage difference (△V) and time difference (△T) between cursors
Auto measurement	Peak-to-peak value, average value, root mean square value, frequency and cycle.

Probe

	1X position	10X position
Bandwidth	Up to 6 MHz (DC)	Up to full bandwidth (DC)
Attenuation rate	1: 1	10: 1
Compensation range	10pf～35pf	
Input resistance	1MΩ±2%	10MΩ±2%
Input impendence	85pf～115pf	14.5pf～17.5pf
Input voltage	150 V DC	300 V DC

Meter

Voltage (VDC)

Input Impedance: 10MΩ .

Max. Input Voltage: 1000V (DC or AC peak-to-peak value)

Range	**Accuracy**	**Resolution**
400.0mv	±0.5%±1 digit	100uV
4.000V		1mV
40.00V		10mV
400.0V		100mV
1000v	±0.8%±2 digits	1V

Voltage (VAC)

Input Impedance: 10MΩ .

Max. Input Voltage: 750V(AC, virtual value)

Frequency range: from 40Hz to 400Hz.

Display: Virtual value of the sine wave

Range	**Accuracy**	**Resolution**
4.000V	±0.8%±3 digits	1mV
40.00V		10mV
400.0V		100mV
750v	±1.2%±3 digits	1V

Direct Current (DC)

Range	Accuracy	Resolution
40.00mA	±0.8%±1 digit	10uA
400.0mA	±1.2%±1 digit	100uA

Alternating Current (AC)

Range	Accuracy	Resolution
40.00mA	±1.0%±3 digit	10uA
400.0mA	±1.8%±1 digit	100uA

Resistance:

Range	Accuracy	Resolution
400.0 Ω	±0.8%±3 digits	0.1Ω
4.000KΩ	±0.8%±1 digit	1Ω
40.00KΩ		10Ω
400.0KΩ		100Ω
4.000MΩ		1KΩ
40.00MΩ	±1%±1 digit	10KΩ

Capacitance

Range	Accuracy	Resolution
51.20nF	±2.5%±3 digits	10pF
512.0nF		100pF
5.120uF		1nF
51.20uF		10nF
100uF		100nF

Diode:

Voltage reading: 0 V ～1.5 V.

On-off Test:

You can a beep sound when the on-resistance is less than 30Ω.

General Specifications

Display:

Display type	3.8'' color liquid crystal display
Display resolution	320 (horizontal) ×240 (vertical) pixels
Display color	4096 colors

Power Adapter:

Power supply	100-240 VACRMS, 50Hz, CAT II
Power consumption	< 5W