User Manual

March 2005

6800 Series

Digital Storage Oscilloscope

6810, 6806, 6804

General-Purpose Oscilloscopes

The **Protek 6800-Series** Digital Storage Oscilloscopes offer exceptional waveform viewing and measurements in a small, lightweight package. The 6810, 6806, and 6804 are suited for production, field service, research and design labs, applications involving digital circuit test and troubleshooting, and education applications. Each of these oscilloscopes gives you:

- 100-MHz bandwidth (6810)
  60-MHz bandwidth (6806)
  40-MHz bandwidth (6804)
- 16K/Channel Memory Depth
- 100MS/s Real-time Sample Rate on all Channels
- 10GS/s equivalent Sample Rate
- Automatic setup of the front panel
- Automatic and cursor measurements of frequency, time, and voltage
- Auto Calibration
- Waveform storage
- Save and recall of 5 front-panel setups
- XY-PLOT
- Built-in FFT function
- Dual Language User Interface (English, Chinese)

These oscilloscopes are easy to use with familiar controls and high display update rate, but with none of the viewing problems that are associated with analog oscilloscopes. A Color LCD or a Mono LCD is used for bright and clear display. Storage is as simple as pressing a button. Negative time allows the viewing of events that occur before the trigger event. Cursors and automatic measurements greatly simplify the analysis of these events. You can upgrade this oscilloscope for communication with PC or remote control with the addition of an interface module. The FFT math function is built-in the 6810 oscilloscopes.

Bring your scope and PC together with Ultrascope software. Ultrascope, which runs under Windows, allows easy transfer of scope traces and waveform data to your PC for incorporation into documents or storage, enables remote control with PC through RS-232 or GPIB (IEEE 488) port.

Accessories already included in the package

- Two 1.5 meter, 10:1 probes
- Power cable for country of destination
- This *User Manual*
- Warranty and Registration Form

Options available

- UltraScope Software for Win95/98/NT/2000/XP
- Communications Extension Module (RS-232)
- Communications Extension Module (GPIB&RS-232)
- Accessories Case: (already included in 6810)

Contents

This manual is the user guide for the 6810-series Digital Storage Oscilloscopes
and contains six chapters.

Chapter 1: The Oscilloscope at a glance

This chapter is a quick start guide that gives you a brief overview of the oscilloscope.

Chapter 2: Operating your oscilloscope

This chapter introduces how to operate 6800 Series oscilloscope in detail.

Chapter 3: Application & Examples

This chapter is a series of exercises and examples that guide you through the operation of
the oscilloscope.

Chapter 4: Prompting messages and Troubleshooting
This chapter gives solutions to frequently encountered problems or failures when testing.
And it lists all the system prompting messages and their meanings.

Chapter 5: Support & Service

This chapter contains the service information for the oscilloscope.

Chapter 6: Reference

This chapter lists the characteristics of the oscilloscope.

List

Chapter 1 : The Oscilloscope at a glance

This chapter covers the following topics:

- The front panel and user interface

- To inspect the instrument

- To take a functional check

- To compensate probes

- To display a signal automatically

- To set up the vertical window

- To set up the horizontal system

- To trigger the oscilloscope

The front panel and the user interface

One of the first things you will want to do with your new oscilloscope is to become acquainted with its front panel. Therefore, we have written the exercises in this chapter to familiarize you with some of its controls.

The front panel has knobs and keys. The knobs are used most often and are similar to the knobs on other oscilloscopes. The keys bring up softkey menus on the display that allow you access to many of the oscilloscope features and menus associated with channels, math, and reference or instant action features.
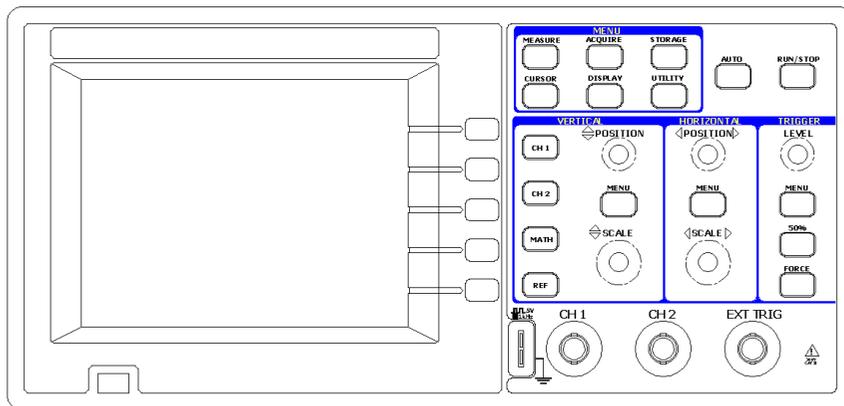
Figure 1-1

6800-Series Oscilloscope's Front Panel

6800 series oscilloscopes provide an easy-to-use front panel, the definitions of the keys and the knobs are listed as follows:

Menu keys: Associate with MEASURE, CURSOR, ACQUIRE, DISPLAY, STORAGE, and UTILITY menus.

Vertical keys: Associate with CH1, CH2, MATH and REF menus, the OFF key can set waveform which currently active off.

Horizontal key: Associate with horizontal menu.

Trigger keys: Associate with trigger menu, instant action to set 50% trigger level and force trigger.

Action keys: Include Instant action keys for AUTO and RUN/STOP.

Function keys: Five gray keys from top to bottom on the right to the screen, which set choice of operation in the currently active menu.

Knobs: For the adjustment of vertical or horizontal position, scale, and trigger level.
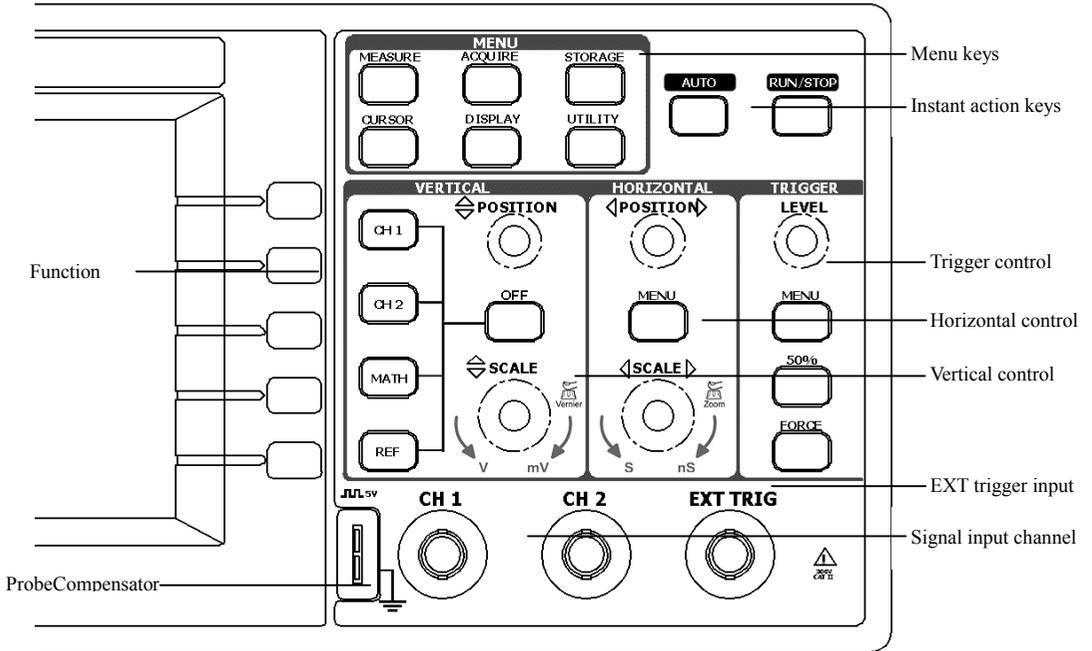
Figure 1-2
Front Panel Controls

Throughout this book, the front-panel keys are denoted by a box around the name of the key, and softkeys are denoted by a drop shadow. For example, CH1 is a front-panel key labeled **CH1** under the vertical portion of the front panel, and Coupling is a softkey. The word **Coupling** is on the top of the menu, directly on the left of an unlabeled softkey (which is also gray).

The position of current window in memory   Trigger position in memory   Trigger position in current window

Execute status

Trigger source and trigger type symbol

Channel 1 symbol

Operation menu

Channel 2 symbol

Waveform display

CH1 status   CH2 status   Timebase status   Trigger position
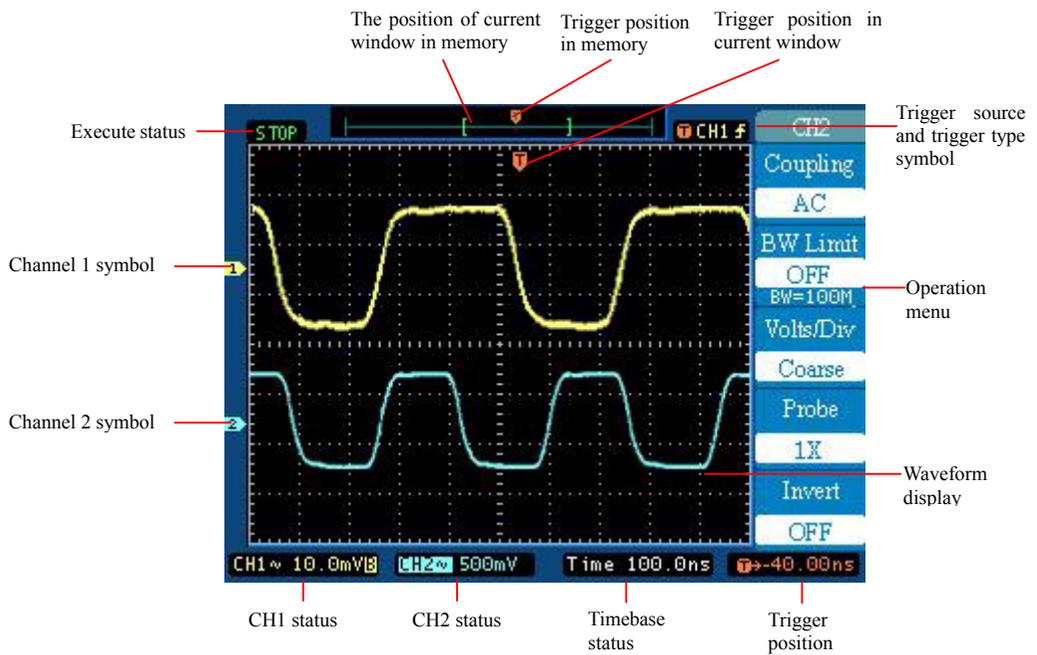
Figure 1-3
User Interface

To inspect the instrument

After you get a new 6800 series oscilloscope, please inspect the instrument according to the following steps:

1. **Inspect the shipping container for damage.**
    Keep a damaged shipping container or cushioning material until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically.

2. **Check the accessories.**
    Accessories supplied with the instrument are listed in "Accessories available" in the front of this manual.
   • If the contents are incomplete or damaged notify your Protek sales office.

3. **Inspect the instrument.**
    • If there is mechanical damage or defect, or if the instrument does not operate properly or pass performance tests, notify your Protek sales office.
    • If the shipping container is damaged, or the cushioning materials show signs of stress, notify the carrier as well as your Protek sales office. Keep the shipping materials for the carrier's inspection. The Protek office will arrange for repair or replacement at Protek's option without waiting for claim settlement.

To take a functional check

Perform this quick functional check to verify that your instrument is operating correctly.

1. Turn on the instrument.

Wait until the display shows that all self-tests passed. Push the STORAGE button, select Setups in the top menu box and push the Factory menu box.
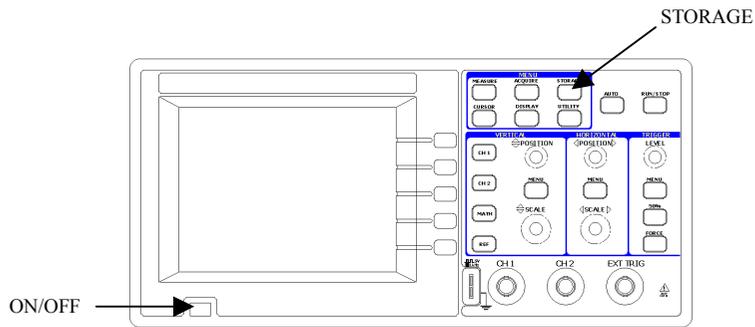
Figure 1-4

2．Input a signal to a channel of the oscilloscope

① 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.
Attach the probe tip and reference lead to the PROBE COMP connectors.

Figure 1-5

Probe comp
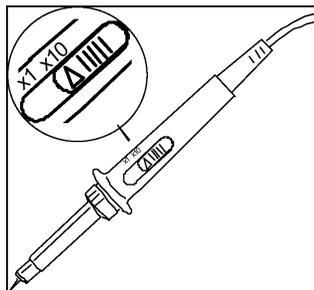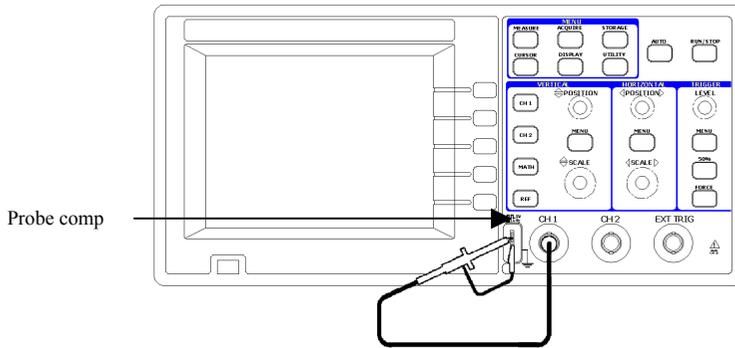
Figure 1-6

② Set the probe attenuation to 10X. To do this, push CH1->Probe->10X.

Probe attenuation
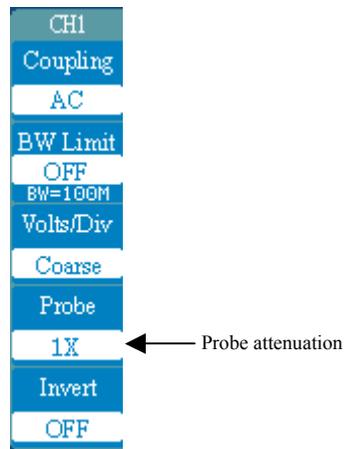
Figure 1-7

③ Push the AUTO button. Within a few seconds, you should see a square wave in the display (approximately 5 V at 1 kHz peak- to- peak).
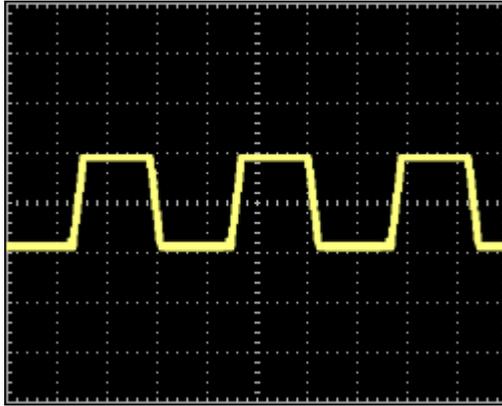
Figure 1-8

④ Push the OFF key to turnoff channel 1, push the CH 2 key to turn on channel 2, repeat steps 2 and 3.

To compensate probes

Perform this adjustment to match your probe to the input channel. This should be done whenever you attach a probe for the first time to any input channel.

1. Set the Probe menu attenuation 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.
   Attach the probe tip to the PROBE COMP connector and the reference lead to the PROBE COMP Ground connector, turn on channel 1, and then press AUTO.

2. Check the shape of the displayed waveform.

| Overcompensated | Compensated correctly | Undercompensated |
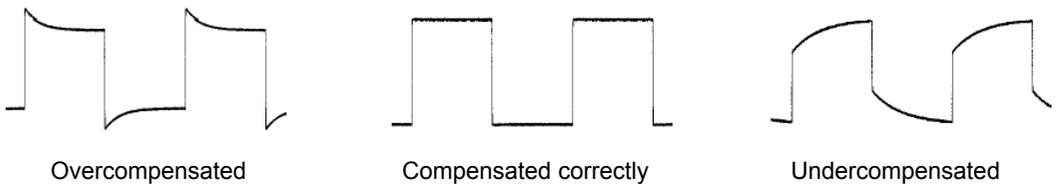
Figure 1-9

3. If necessary, use a nonmetallic tool to adjust the trimmer capacitor on the probe for the flattest pulse possible as displayed on the oscilloscope.

L
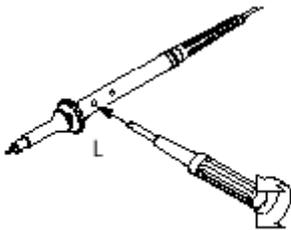
4. Repeat as necessary.

To display a signal automatically

The oscilloscope has an Auto feature that automatically sets up the oscilloscope to best display the input signal. Using Auto requires signals with a frequency greater than or equal to 50 Hz and a duty cycle greater than 1%.

When you press the AUTO key, the oscilloscope turns on and scales all channels that have signals applied, and it selects a time base range based on the trigger source. The trigger source selected is the lowest numbered input that has a signal applied.

The 6800 series are two-channel oscilloscopes with an external trigger input. In this exercise you connect a signal to the channel 1 input.
To avoid damage to your new oscilloscope, make sure that the voltage level of the signal you are using is less than or equal to 400 V (dc plus peak ac). For a complete list of the characteristics see chapter 6, "Performance Characteristics."

1 Connect a signal to the oscilloscope.
2 Press AUTO.
When you press the AUTO key, the oscilloscope changes the front-panel setup to display the signal. It automatically adjusts the vertical and horizontal scaling, as well as the trigger coupling, type, position, slope, level, and mode settings.

To set up the vertical window

Figure 1-10 shows the channels, math, ref, off keys and vertical position, scale knobs. The following exercise guides you through the vertical keys, knobs, and status bar. It will help you be familiar with the setting of the vertical parameters.
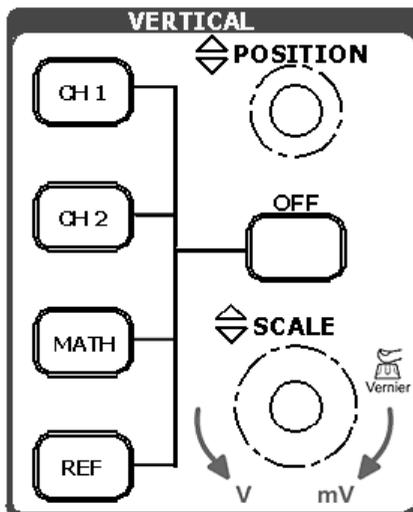
Figure 1-10

1 Center the signal on the display with the POSITION knob.

The POSITION knob moves the signal vertically, and it is calibrated. Notice that as you turn the POSITION knob, a voltage value is displayed for a short time indicating how far the ground reference is located from the center of the screen. Also notice that the ground symbol on the left side of the display moves in conjunction with the POSITION knob.

Measurement hints

If the channel is dc coupled, you can quickly measure the dc component of the signal by simply noting its distance from the ground symbol.

If the channel is ac coupled, the dc component of the signal is removed allowing you to use greater sensitivity to display the ac component of the signal.

2 Change the vertical setup and notice that each change affects the status bar differently.

You can quickly determine the vertical setup from the status bar in the display.

- Change the vertical sensitivity with the SCALE knob and notice that it causes the status bar to change.
- Press CH1.
  A softkey menu appears on the display, and the channel turns on (or remains on if it was already turned on).
- Toggle each of the softkeys and notice which keys cause the status bar to change. Channels 1 and 2 have a vernier softkey that allows the SCALE knob to change the vertical step size in smaller increments. To press Volts/Div softkey, you can change the step size into **Fine** or **Coarse** status.
- To turn the channel off, press OFF key.

Vernier Shortcut key

You can set the vernier not only on the Volts/Div item in the CH1 or CH2 menus but also by pressing the vertical SCALE knob.

Invert operating hint

When you are triggered on the signal you are inverting, the inversion also applies to the trigger signal. (what was a rising edge now is seemed as a falling edge). If the signal has a 50% duty cycle (square wave or sine wave), the displayed waveform appears not to invert. However, for signals with a duty cycle other than 50%, the displayed waveform does invert as you would expect.

To set up the horizontal system

Figure 1-11 shows the menu key, position and scale knobs of horizontal system. The following exercise guides you through these keys, knobs, and status bar.
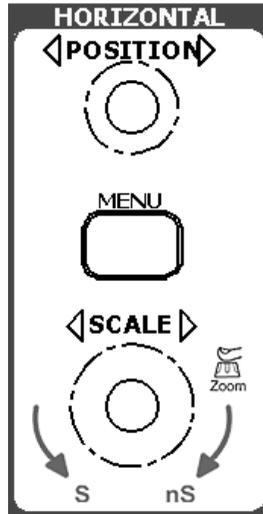
Figure 1-11

1. Turn the Time/Div knob and notice the change it makes to the status bar.

The horizontal SCALE knob changes the sweep speed in a 1-2-5 step sequence, and the value is displayed in the status bar. The time base ranges of the 6800 series are listed as follows.
6810, 6806, 6804: from 5 ns/div to 5 s/div and it can reach 2.5ns/div in Ultrazoom mode.

2. Press the MENU key to display the TIME menu.

In this menu, you can enter or exit the Ultrazoom mode, set the display to Y-T or X-Y format, and set the horizontal POSITION knob to **Mem Offset** or **Trig Offset** mode.

Horizontal position control

Trig Offset: In this setting, the trigger's position will be changed horizontally when you turn the POSITION knob.

Mem Offset: In this setting, the position of current waveform window will be changed horizontally in the memory when you turn the POSITION knob.

UltraZoom Shortcut key

To press the SCALE knob in the horizontal control area on the front-panel is another way to enter or exit "Ultrazoom" mode and it is equal to the following menu operations, MENU->Ultrazoom.

To trigger the oscilloscope

Figure 1-12 is the trigger control area on the front panel, it have a trigger level knob and three softkeys. The following exercise guides you through these trigger keys, knobs, and status bar.
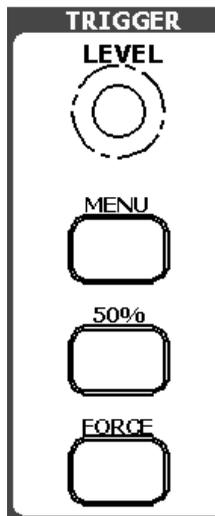
Figure 1-12

1 Turn the trigger Level knob and notice the changes it makes to the display.

On the   6800   series oscilloscopes, as you turn the LEVEL knob or press the 50% menu key, for a short time two things happen on the display. First, the trigger level is displayed at the bottom-left of the screen. If the trigger is dc coupled, it is displayed as a voltage. If the trigger is ac coupled or if LF reject was selected, it is displayed as a percentage of the trigger range. Second, a line is displayed showing the location of the trigger level (as long as ac coupling or low frequency reject are not selected).

2 Change the trigger setup and notice these changes affects the status bar differently.

· Press MENU key in the trigger control area.
A softkey menu appears on the display showing the trigger setting choices. Figure 1-13
displays this trigger menu.

· Press the trigger type key to notice the differences between Edge and Video.
· Press the trigger Slope key to notice the differences between Rising Edge and Falling Edge.
· Press the trigger Source key to select these five trigger source choices.
· Press the trigger Mode key to select these three trigger mode choices.
· Set the Coupling and notice that they affect the waveform display differently.

NOTE: The trigger type, slope and source change in conjunction with the status bar on the top-right of the screen.

Figure 1-13

3 Press 50%

This key is an action key. Every time you press the 50% key, the oscilloscope resets the trigger level to the center of the signal.

4 Press FORCE

Press this key starts an acquisition regardless of an adequate trigger signal. This button has no effect if the acquisition is already stopped.

Chapter 2 : Operating your oscilloscope

By now you get a brief understanding with the VERTICAL, HORIZONTAL, and TRIGGER groups of the front-panel keys. You should also know how to determine the setup of the oscilloscope by viewing the status bar.

This chapter takes you through all groups of front-panel keys, knobs, and menus. You will also add to your knowledge of the operation hints by reading this guide.

We recommend you perform all of the following exercises so you become familiar with the powerful measurement capabilities of the oscilloscope.

This chapter covers the following topics:

- ■ Understand the vertical system

- ■ Understand the horizontal system

- ■ Understand the trigger system

- ■ How to set up the sampling system

- ■ How to set up the display system

- ■ How to save and recall waveforms or setups

- ■ How to set up utility

- ■ How to measure automatically

- ■ How to measure with cursors

- ■ How to use instant execute keys

Understand the vertical system

Settings of the channels

Each channel of　6800　has an operation menu and it will pop up after pressing CH1 or CH2 key. The settings of all items in the menu are shown in the table below.

Table2-1

Menu	Settings	Comments
Coupling	AC DC GND	AC blocks the DC component of the input Signal DC passes both AC and DC components of the input signal GND disconnects the input signal
BW Limit	ON OFF	Limits the bandwidth to reduce display noise. To set "OFF" will get full bandwidth.
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 this to match your probe attenuation factor to make the vertical scale readout correct
Invert	ON OFF	Set "ON" to invert the waveform. Restore to original display of the waveform.

1. Channel coupling

To use CH1 as an example, input a signal which is a sinewave signal with DC shift

Press CH1 -> Coupling**->AC**, to set CH1's coupling as "AC". In this setting, it blocks the DC component of the input signal.

The waveform is displayed as Figure 2-1:

Figure 2-1

Set to AC Coupling

AC status
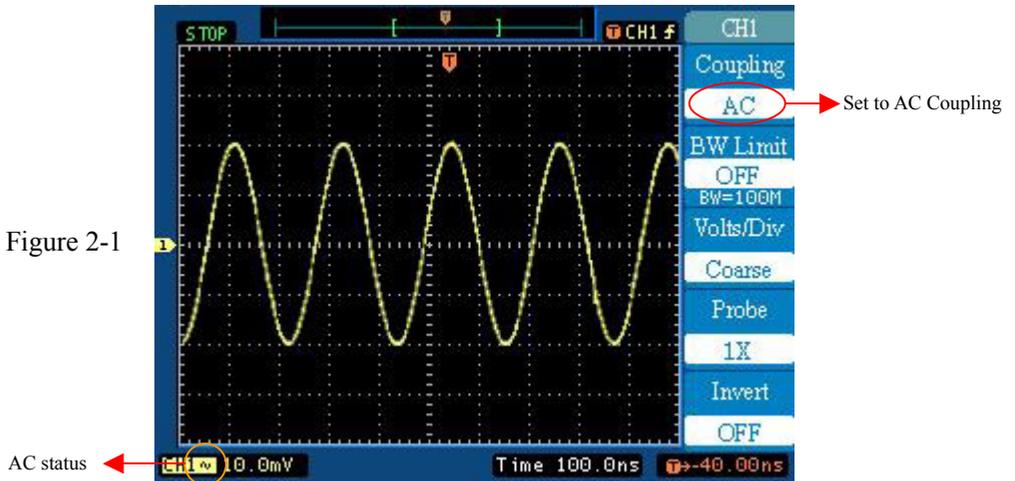
Press CH1 -> Coupling**->DC**, to set CH1's coupling as "DC". In this setting, it passes both AC and DC components of the input signal.

The waveform is displayed as Figure 2-2:

Figure 2-2

Set to DC Coupling

DC status
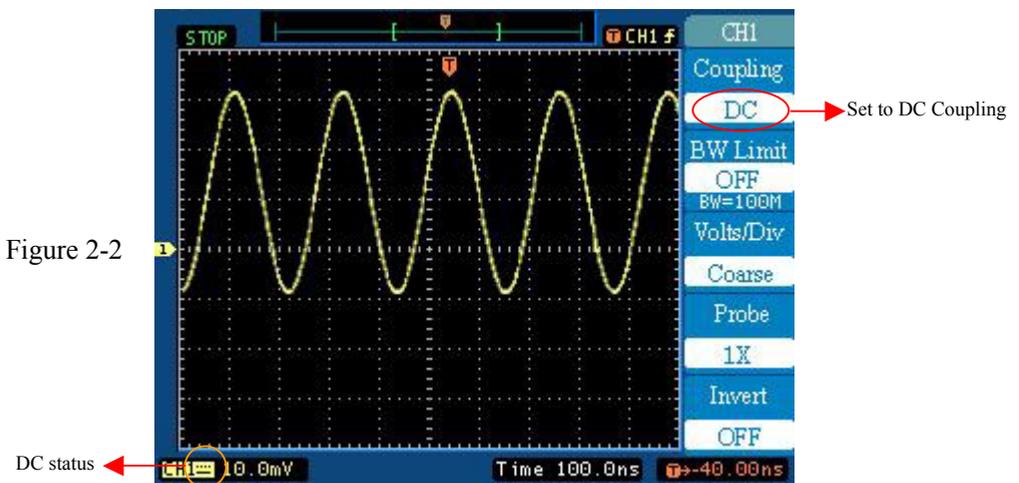
Press CH1 -> Coupling**->GND**, to set CH1's coupling as "GND". In this setting, it disconnects the input signal.

The screen displays as Figure 2-3:
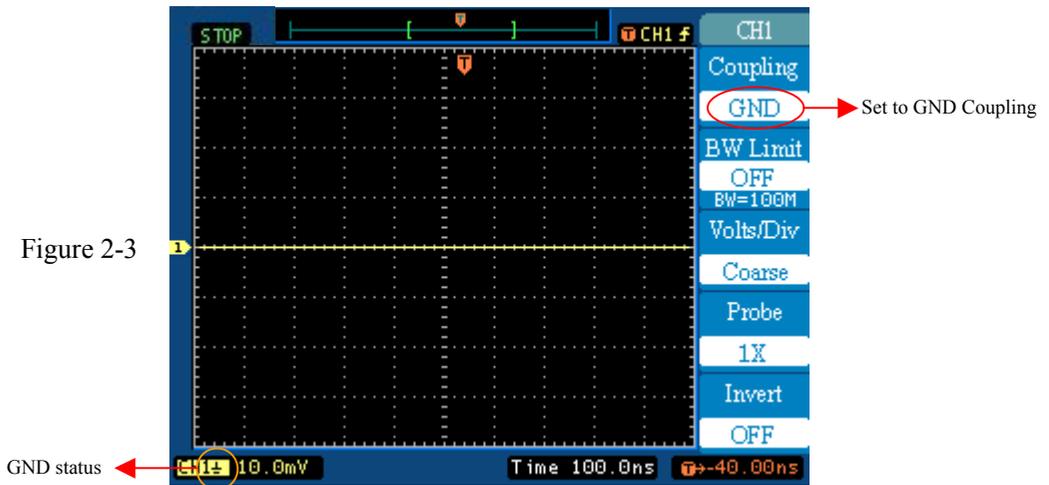
Figure 2-3

2．Set up the channel bandwidth limit

To use CH1 as an example, input a signal which contains high frequency component.
Press CH1 ->BW Limit**->OFF**, to set up bandwidth limit to "OFF" status. It will pass the high frequency component in the signal and the oscilloscope is set to full bandwidth.
The waveform is displayed as Figure 2-4:
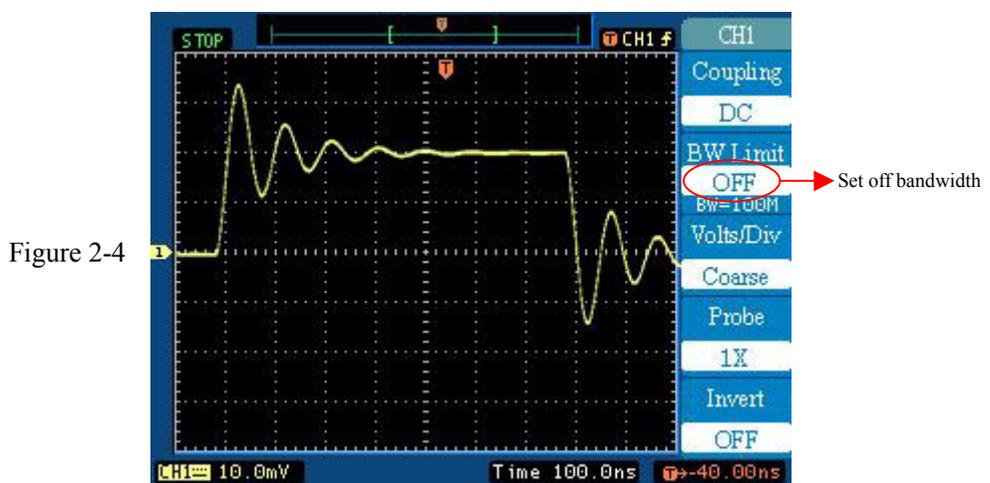
Figure 2-4

Press CH1->BW Limit**->OFF**, to set up bandwidth limit to "ON" status. It will reject the high frequency component above 20MHz.
The waveform is displayed as Figure 2-5:

Figure 2-5

Set bandwidth limit to 20M

Bandwidth limit symbol
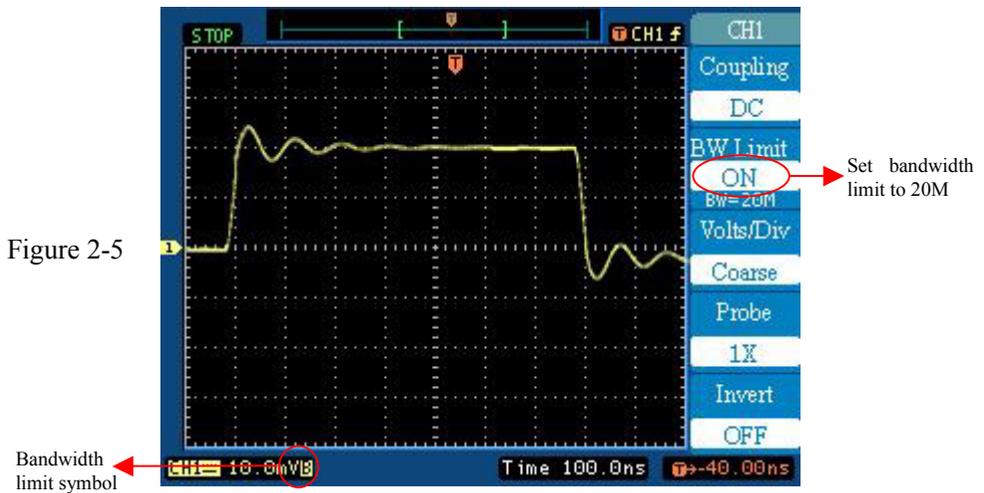
3．Volts/Div settings

You can set the Volts/Div into **Coarse** or **Fine** resolution.

Coarse: It is the default setting of Volts/Div, and it makes the vertical scaling in a 1-2-5 step sequence from 2 mV to 5 V.

Fine: This setting changes the vertical scale to small steps between the coarse settings. It will be helpful when you need to adjust the waveform's vertical size in smooth steps

Note: When the Volts/Div is set to "Fine", there will appear a question mark "?" in the status bar at the bottom of the screen. For more details, please see Figure 2-6.

Set Vernier toFine

Symbol for "Fine" setting
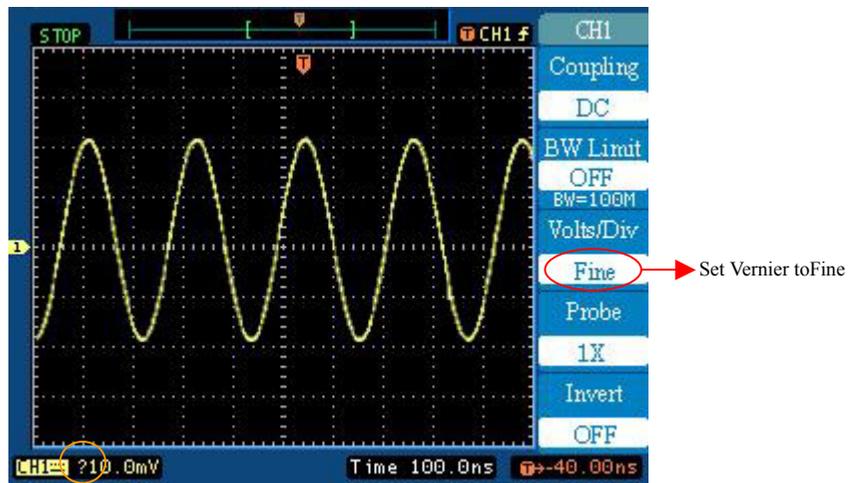
Figure 2-6

4．Probe Attenuation Setting

If you are using a probe, the oscilloscope allows you to enter the attenuation factor for the probe. The attenuation factor changes the vertical scaling of the oscilloscope so that the measurement results reflect the actual voltage levels at the probe tip.

To change (or check) the probe attenuation setting, press the CH1 or CH2 key (according to which channel you are using), Next toggle the Probe softkey to change the attenuation factor to match the probe you are using.

This setting remains in effect until changed again.

Figure 2-7 gives an example for using a 1000:1 probe and it's attenuation factor.

Probe attenuation factor.

Status changes with the probe attenuation
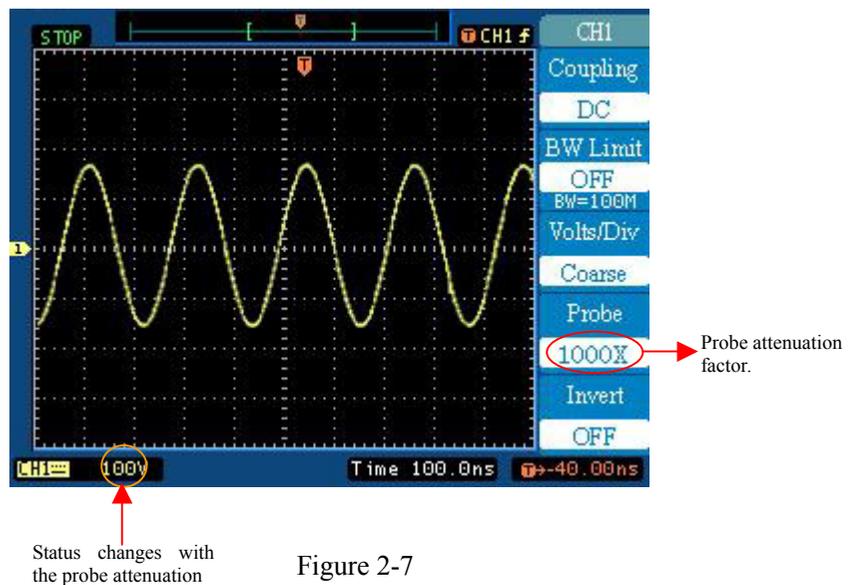
Figure 2-7

Table 2-2

Probe attenuation factors	Corresponding settings
1:1	1X
10:1	10X
100:1	100X
1000:1	1000X

5．To invert a waveform

Invert turns the displayed waveform 180 degree, as respect to the ground level, and is available for channels 1 and 2 only. When the oscilloscope is triggered on the inverted signal, the trigger is also inverted.

Push the CH1 or CH2 key and then press the Invert menu box button to invert the signal on this activated channel.

Figure 2-8 and 2-9 show the changes after inversion.

Figure 2-8

The waveform before inversion

Figure 2-9

The waveform after inversion
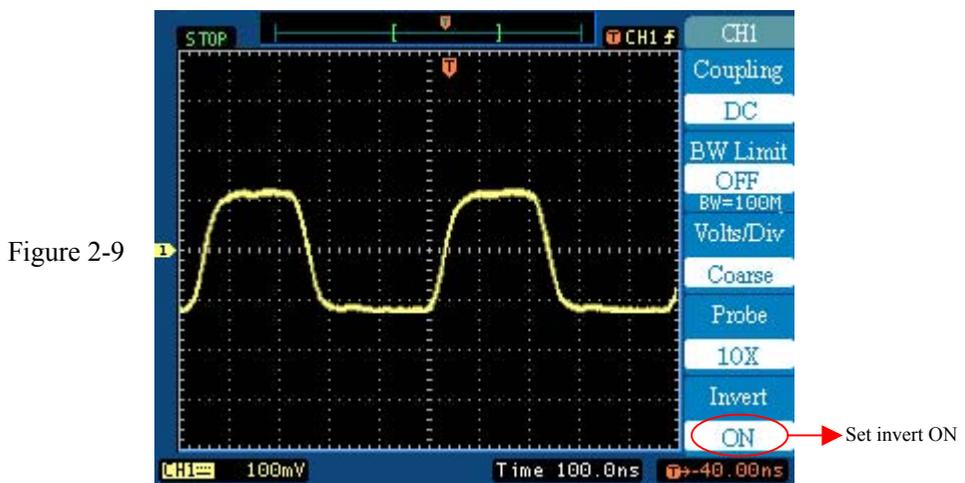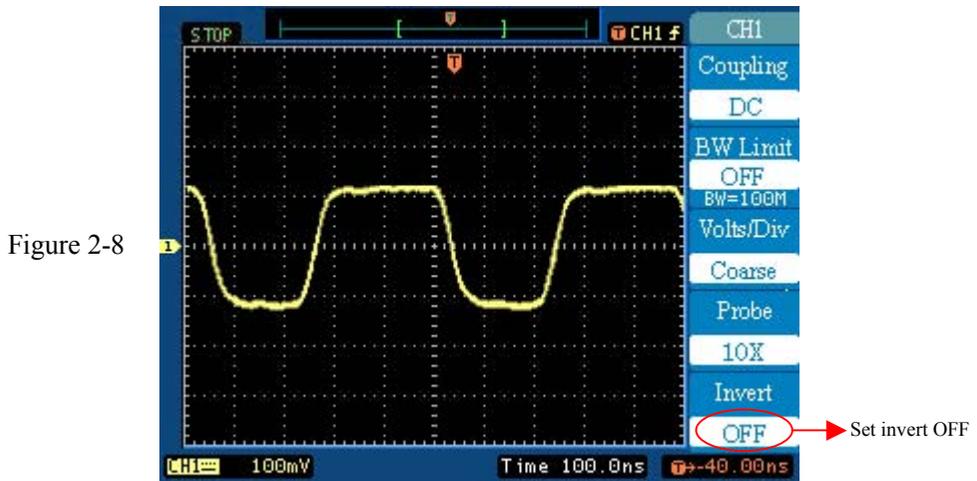
Math functions

The 6800 series oscilloscopes have the mathematic functions of "add", "subtract", "multiply" and "divide" for the two channels. The oscilloscopes also provide FFT (Fast Fourier Transform) function without extension module installed.

Press MATH key to display the MATH menu, the settings of this menu are shown in the table below.

Table2-3

Menu	Settings	Comments
Operation	A+B A-B A×B A÷B FFT	Add source A to source B Subtract source B from source A Multiply source B by source A Source A divided by source B Fast Fourier Transform
Source A	CH1 CH2	Define CH1 or CH2 as source A
Source B	CH1 CH2	Define CH1 or CH2 as source B
Invert	ON OFF	Set "ON" to invert the MATH waveform. Restore to original display of the waveform.

You can change the amplitude with the SCALE knob in a 1-2-5 step from 0.1% to 1000%. And the scale will be displayed on the status bar.

Figure 2-10

MATH scale
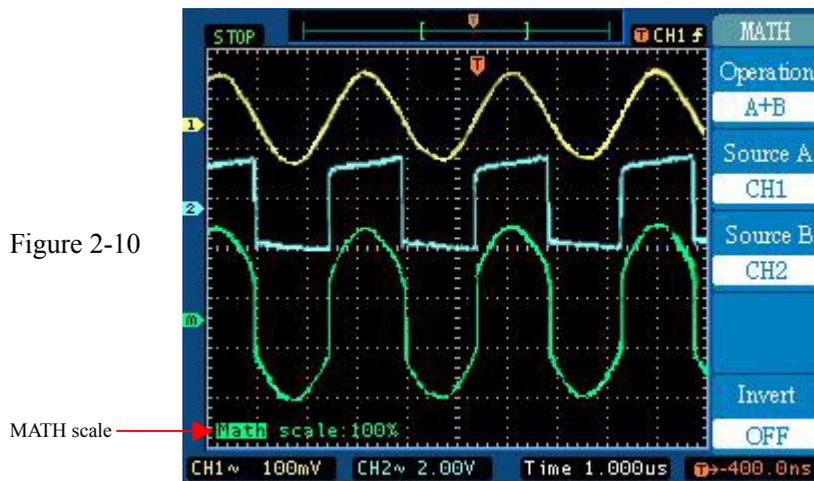
Using the FFT

The FFT process mathematically converts a time-domain signal into its frequency components. FFT waveforms are useful in the following applications:
- Testing impulse response of filters and systems
- Measuring harmonic content and distortion in systems
- Characterizing noise in DC power supplies
- Analyzing vibration
- Analyzing harmonics in 50 and 60 Hz power lines

There are five steps to using the FFT:
1. Set up the source (time-domain) waveform
2. Display the FFT waveform
3. Select the FFT window type
4. Adjust the sample rate to display fundamental frequency and harmonics without aliasing
5. Use cursors to measure the FFT waveform

Setting Up the Time-Domain Waveform
It is important to correctly set up the time-domain (YT) waveform to produce a useable FFT waveform. Follow these steps to set up the YT waveform:
1. Press AUTO to display a YT waveform.
2. Position the YT waveform horizontally so that the waveform area of interest is contained in the display. The 6800 series use 1024 points of the time-domain waveform to transform into an FFT waveform.
4. Use the vertical SCALE key to set the YT waveform Volts/Div so that the signal does not go off screen. (Off screen waveform peaks can result in FFT waveform errors).
5. Use the horizontal SCALE to set the resolution you want in the FFT waveform. It is important to show a number of signal cycles if possible. Setting the time/division to a faster setting means the FFT waveform shows a larger frequency range, has less frequency resolution and reduces aliasing.
In many cases, you can produce a useful FFT waveform even if the YT waveform is not triggered. This is especially true if your signal is periodic or random (noisy). However, transient or burst waveforms should be triggered and positioned as close as possible to center screen.

Displaying the FFT Waveform

You can get the FFT menu below by pressing MATH ->Operation->**FFT**.

Figure 2-11

Table2-4

Menu	Settings	Comments
Operation	FFT	Select FFT function
Source FFT	CH1 CH2	Define CH1 or CH2 as FFT source
Window	Rectangle Hanning Hamming Blackman	Select window for FFT
SCALE	Vrms DBVrms	Set "Vrms " as vertical unit Set "dBVrms " as vertical unit
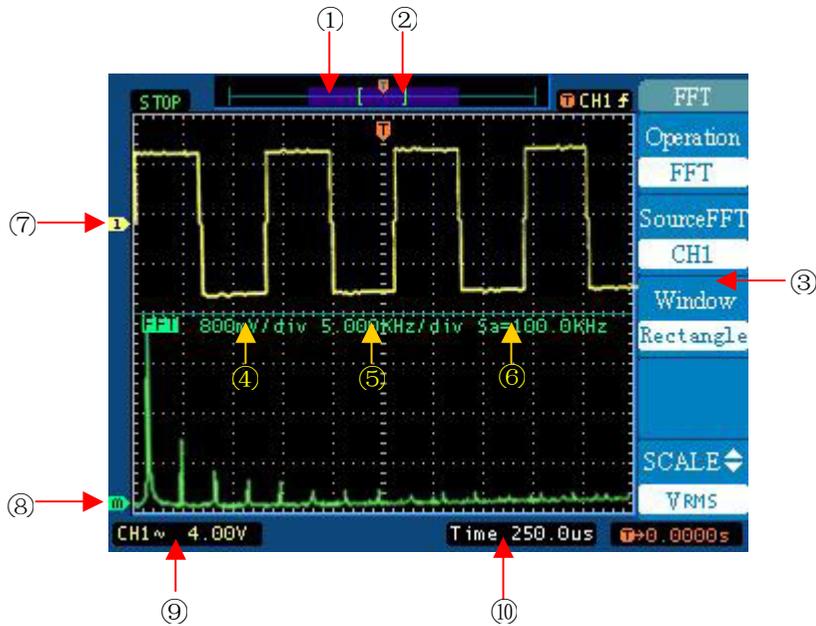
Figure 2-12

The Figure 2-12 shows the FFT operation interface. The speciation of the numbered area are listed below:

1. This block with transparent blue color displays the 1024 points for FFT and it's position in the whole memory.

2. The symbol "[   ]" represents the current YT window displayed.

3. Operation menu for FFT.

4. The vertical scale for FFT.

5. The horizontal scale for FFT.

6. Current sampling rate.

7. The channels mark for YT display.

8. The MATH channel's mark for FFT.

9. The vertical scale for YT display.

10. The horizontal scale for YT display.

Key points for FFT

• Using FFT slows down the oscilloscope's response time in Normal acquisition mode (16k record length).

• A waveform acquired in Normal acquisition mode has a lower noise floor and better frequency resolution than a waveform acquired in Fast Trigger mode.

• Signals that have a DC component or offset can cause incorrect FFT waveform component magnitude values. To minimize the DC component, choose AC Coupling on the source signal.

• To reduce random noise and aliased components in repetitive or single-shot events, set the oscilloscope acquisition mode to average over 16 or more samples. Average mode attenuates signals not synchronized with the trigger.

• Do not use the Average acquisition mode if the source signal contains frequencies of interest that are not synchronized with the trigger rate.

• Do not use Envelope mode with FFT. Envelope mode can add significant distortion to the FFT results.

• For transient (impulse, one-shot) signals, set the oscilloscope to trigger on the transient pulse in order to center the pulse information in the waveform record.

• To display FFT waveforms with a large dynamic range, use the dBVrms scale. The dBVrms scale displays component magnitudes using a log scale, expressed in dB relative to 1 Vrms, where 0 dB =1 Vrms, or in source waveform units (such as amps for current measurements).

• To display FFT waveforms with a small dynamic range, use the Vrms scale. The Vrms scale lets you display and directly compare components with similar magnitude values.

Nyquist Frequency
The highest frequency that any real-time digitizing oscilloscope can measure without errors is one-half the sample rate. This frequency is called the Nyquist frequency. Frequency information above the Nyquist frequency is undersampled, causing a situation known as aliasing.

Selecting an FFT Window

The 6800 series oscilloscopes provide four FFT windows. Each window is a trade-off between frequency resolution and amplitude accuracy. What you want to measure and your source signal characteristics help determine which window to use. Use the following guidelines to select the best window.

Table2-5

Window	Characteristics	Best for measuring
Rectangle	Best frequency, worst Magnitude resolution. This is essentially the same as no window.	Transients or bursts where the signal levels before and after the event are nearly equal. Equal-amplitude sine waves with frequencies that are very close. Broad-band random noise with a relatively slow varying spectrum.
Hanning, Hamming	Better frequency, poorer magnitude accuracy than Rectangular. Hamming has slightly better frequency resolution than Hanning.	Sine, periodic, and narrow-band random noise. Transients or bursts where the signal levels before and after the events are significantly different.
Blackman	Best magnitude, worst at resolving frequencies.	Predominantly single frequency waveforms to look for higher order harmonics.

Measuring FFT Waveforms Using Cursors

You can take two measurements on FFT waveforms: magnitude (in dB or Vrms) and frequency (in Hz).

Press CURSOR-> Mode->**Manual** and select Source as **FFT**. Then choose measurement Type to **Time** or **Voltage**. Use the vertical POSITION knob to move cursors A and use horizontal POSITION knob to move cursor B.

The menu boxes display the delta between the two cursors, the value at cursor A position, and the value at cursor B position. Delta is the absolute value of cursor 1 minus cursor 2.
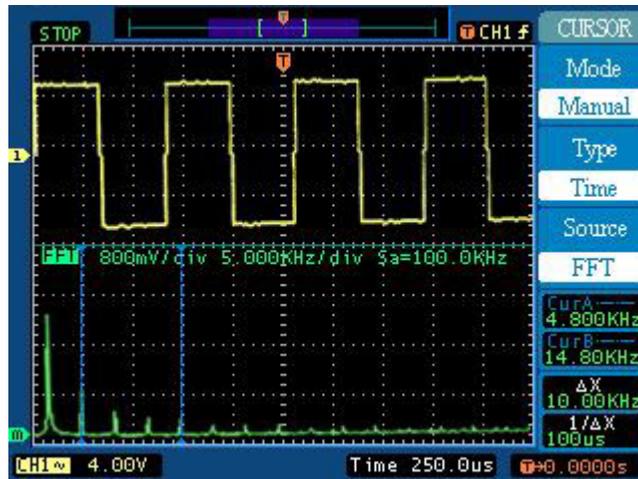
Figure 2-13: Use cursor to measure frequency
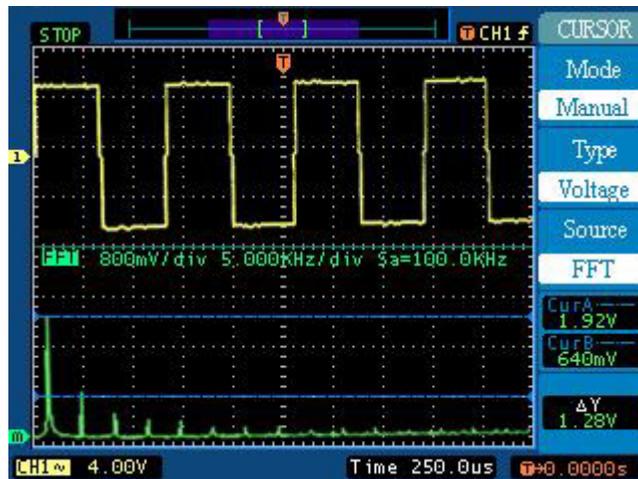
Figure 2-14: Use cursor to measure magnitude

Using REF

Reference Waveforms are saved waveforms to be selected for display. The reference function will be available after saving the selected waveform to nonvolatile memory.

Displaying a Reference Waveform.
- To display a waveform stored in nonvolatile memory, do these steps:
- Push REF key to show the reference waveform menu.
- Select Storage section "No.1", "No.2", "No.3", "No.4", or "No.5" associated with saved waveforms.
- Select Source CH1 or CH2 to display the channel you want.

When a reference waveform is selected, it appears in white color.

Table2-6

Menu	Settings	Comments
Storage	NO.1 NO.2 NO.3 NO.4 NO.5	Select stored waveform for REF display
Status	Valid Invalid	Display reference status
Source	CH1 CH2	Select channel for REF
Invert	ON OFF	Set "ON" to invert the REF waveform. Restore to original display of the waveform.

Figure 2-15
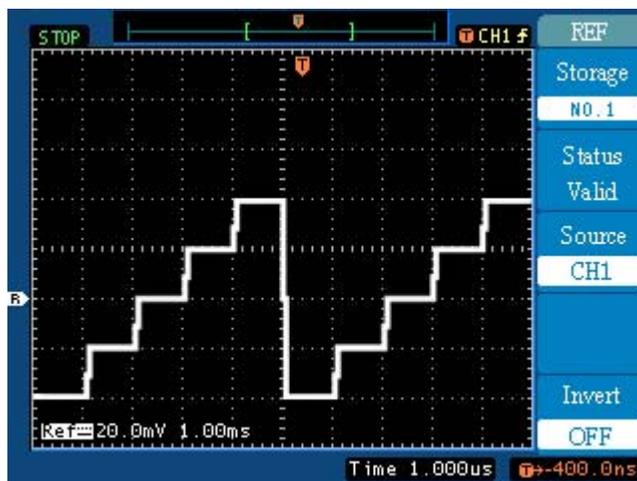
Removing Reference Waveforms from the Display.
To remove a reference waveform from the display, select that reference waveform and then push the waveform OFF key.

Scaling and Positioning a Reference Waveform
You can position and scale a reference waveform independently from all other displayed waveforms. Select the reference waveform and then adjust it with a vertical POSITION or SCALE knob. You can do this whether acquisition is running or is stopped.
If a reference waveform is selected, scaling and repositioning of the reference waveform operates the same way whether Ultrazoom is turned on or off.

Note:

1. The reference function will not be available in X-Y mode.

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

Remove Waveforms from the Display

The CH1, CH2 are channels to input signals. The operations for MATH and REF are also regarded as independent channels.

Press MATH and REF keys to select these channels, to press OFF key to remove the selected waveform from the screen.

Table2-7

Channel	Status	Symbol
Channel 1 (CH1)	Selected ON OFF	CH1 CH1 No status symbol
Channel 2 (CH2)	Selected ON OFF	CH2 CH2 No status symbol
Mathematic operation (MATH)	Selected ON OFF	Math Math No status symbol
Reference waveforms (REF)	Selected ON OFF	Ref Ref No status symbol

Using Vertical POSITION and SCALE

You can use the vertical controls to display waveforms, adjust vertical scale and position, and set input parameters.

1. Using vertical POSITION knob.

You can change the vertical position of waveforms (including MATH and REF) by moving them up or down on the display. To compare data, you can align a waveform above another or you can align waveforms in superposition.

2. Using vertical SCALE knob.

You can change the vertical scale of a waveform (including MATH and REF). The waveform display will contract or expand about the ground level.

If the Volts/Div is set to "Coarse", the waveform scales in a 1-2-5 step sequence from 2 mV to 5 V. If the Volts/Div is set to "Fine", it scales to small steps between the coarse settings.

When scaling MATH waveform, you can change the amplitude with the SCALE knob in a 1-2-5 step from 0.1% to 1000%.

You can set the vernier by pressing the vertical SCALE knob.

3. You can adjust the vertical position and scale only when the waveform is selected.

4. When you change the vertical position, the position message is displayed on the bottom-left of the screen.

Understand the Horizontal System

The oscilloscope shows the time per division in the scale readout. Since all active waveforms use the same time base, the oscilloscope only displays one value for all the active channels, except when you use Ultrazoom.

You can use the horizontal controls to change the horizontal scale and position of waveforms. The horizontal center of the screen is the time reference for waveforms. Changing the horizontal scale causes the waveform to expand or contract around the screen center.

Horizontal position changes the point, relative to the trigger, where the waveform appears on the center of the screen.

The Horizontal Knobs

POSITION: The horizontal POSITION knob adjusts the horizontal position of all channels and math waveforms. The resolution of this control varies with the time base.

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.

SCALE: To adjust the time base to a horizontal scale that suits your purpose, use the horizontal SCALE knob.

The SCALE selects the horizontal time/div (scale factor) for the main or the Ultrazoom time base. When Ultrazoom is enabled, it changes the width of the window zone by changing the Ultrazoom time base.

Horizontal Menu.

Push the horizontal MENU key to display the horizontal menu. The settings of this menu are listed in the following table.

Table2-8

Menu	Settings	Comments
Ultrazoom	OFF ON	Enter Ultrazoom mode when set "ON"
Format	Y-T X-Y	Select to enter Y-T mode Select to enter X-Y mode
◁POS▷ Knob	Mem Offset Trig Offset	Set the horizontal POSITION knob to adjust the trigger's position in memory. Set the horizontal POSITION knob to adjust the current window's position in memory.
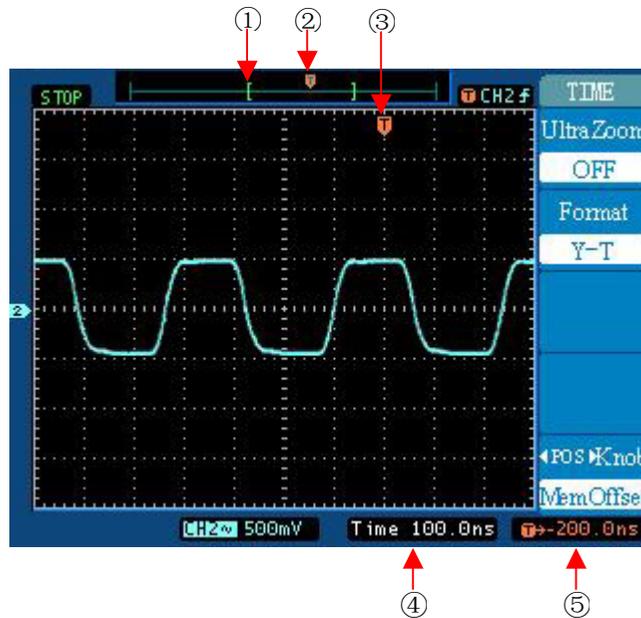
Figure 2-16 Status bar and mark for Horizontal control

Marks and status bar

① The mark "[   ]" represent the current waveform window's position in the memory.

② This mark displays the trigger's horizontal position in the memory.

③ This mark displays the trigger's horizontal position in the waveform windows.

④ It is a status bar displays the horizontal time base (main time base).

⑤ It is a status bar display the trigger's horizontal offset according to the center of the window.

Key Points

Y-T: The conventional oscilloscope display format. It shows the voltage of a waveform record (on the vertical axis) as it varies over time (on the horizontal axis).

X-Y: XY format displays channel 1 in the horizontal axis and channel 2 in the vertical axis.

Time/Div: If the waveform acquisition is stopped (using the RUN/STOP key), the Time/Div control expands or compresses the waveform.

Roll Mode Display: When the Time/Div control is set to 100 ms/div or slower and the trigger mode is set to Auto, the instrument enters the rolling acquisition mode. In this mode, the waveform display updates from left to right. There is no trigger or horizontal control of waveforms during rolling mode.

Ultrazoom: Use the Ultrazoom to expand a segment of a waveform to see more detail. The Ultrazoom time base setting cannot be set slower than the Main time base setting.

UltraZoom: The Ultrazoom is a magnified portion of the main waveform window. You can use Ultrazoom to locate and horizontally expand part of the main waveform window for a more detailed (high resolution) analysis of signals.
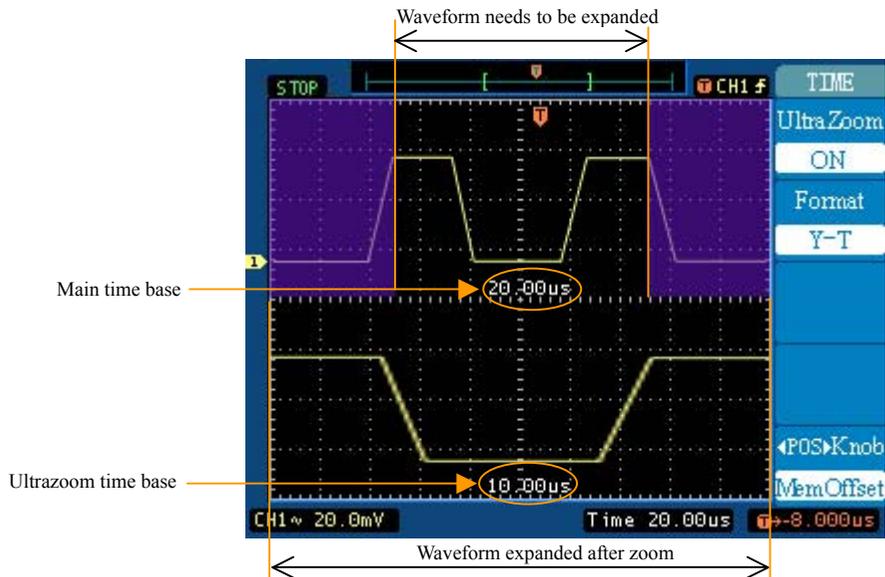
Figure 2-17: Ultrazoom window

The following steps show you how to use Ultrazoom.

1 Connect a signal to the oscilloscope and obtain a stable display.

2 Press horizontal MENU->Ultrazoom->**ON** or press horizontal SCALE knob to enter Ultrazoom mode.

The screen divides in half. The top half displays the main waveform window, and the bottom half displays an expanded portion of the main waveform window. This expanded portion of the main window is called the Ultrazoom window. Two transparent blue blocks shadow the top half, the portion unshadowed is expanded in the lower half. The horizontal POSITION and SCALE knobs control the size and position of the Ultrazoom. The symbol in the middle of the screen is the main time base and the symbol on the center bottom is the Ultrazoom time base.

- You can use the horizontal $\boxed{\text{POSITION}}$ knob to change the position of the expanded portion.

- You can turn the horizontal $\boxed{\text{SCALE}}$ knob to increase the Ultrazoom's resolution.

- To change the main time base, you must turn off the Ultrazoom mode.

- Since both the main and Ultrazoom are displayed, there are half as many vertical divisions so the vertical scaling is doubled. Notice the changes in the status bar.

The 6800 series oscilloscopes have two sampling mode: **Realtime** and **Equivalent**. The realtime sampling will be available at 50 ns/div or slower, and the equivalent sampling is effective at 200ns/div or faster. For the time base from 200 ns/div to 50 ns/div, according to different sampling mode, the same main time base will get different Ultrazoom resolution. In another words, the realtime and the equivalent sampling mode have different horizontal resolutions.

Moreover, the **Fast trigger** status may also results different Ultrazoom resolutions under the same main time base. (Table 2-9, 2-10, 2-11 and 2-12 in details)

Table 2-9: Under the state of the Fast trigger OFF

Main time base	UltraZoom time base (Realtime sampling)	UltraZoom time base (Equivalent sampling)
5.0ns		2.5ns
10.0ns		5.0ns, 2.5ns
20.0ns		10.0ns, 5.0ns, 2.5ns
50.0ns	Ultrazoom not available	25.0ns, 12.5ns, 6.25ns
100.0ns	50.0ns	50.0ns, 25.0ns, 12.5ns
200.0ns	100ns, 50.0ns	100ns, 50.0ns, 25.0ns

Table 2-10: Under the state of the Fast trigger ON

Main time base	UltraZoom time base (Realtime sampling)	UltraZoom time base (Equivalent sampling)
5.0ns		2.5ns
10.0ns		5.0ns, 2.5ns
20.0ns	Ultrazoom not available	10.0ns, 5.0ns
50.0ns	Ultrazoom not available	25.0ns, 12.5ns
100.0ns	50.0ns	50.0ns, 25.0ns
200.0ns	100ns, 50.0ns	100ns, 50.0ns

For the main time base at 500 ns/div or slower, the oscilloscopes only have Realtime sampling mode. Therefore there are only differences between the status Fast trigger "ON" and "OFF".

And for the main time base at 100 ms/div or slower, the system enters the Roll Mode. Under this mode, the Ultrazoom function is not available.

Table 2-11: Under the state of the Fast trigger OFF

Main time base	UltraZoom time base
500.0ns	250ns
1.0us	500ns, 250ns
2.0us	1.0us, 500ns, 250ns
5.0us	2.5us, 1.25us
10.0us	5.0us, 2.5us, 1.25us
20.0us	10us, 5.0us, 2.5us, 1.25us
50.0us	25us, 12.5us
100.0us	50us, 25us, 12.5us
200.0us	100us, 50us, 25us, 12.5us
500.0us	250us, 125us
1.0ms	500us, 250us, 125us
2.0ms	1.0ms, 500us, 250us, 125us
5.0ms	2.5ms, 1.25ms, 625us, 312.5us, 156.3us
10.0ms	5.0ms, 2.5ms, 1.25ms, 625us, 312.5us, 156.3us
20.0ms	10ms, 5.0ms, 2.5ms, 1.25ms, 625us, 312.5us
50.0ms	25ms, 12.5ms, 6.25ms, 3.125ms, 1.563ms, 781.3us

Table 2-12: Under the state of the Fast trigger ON

Main time base	UltraZoom time base
500.0ns	250ns
1.0us	500ns, 250ns
2.0us	1.0us, 500ns
5.0us	2.5us, 1.25us
10.0us	5.0us, 2.5us
20.0us	10us, 5.0us
50.0us	25us, 12.5us
100.0us	50us, 25us
200.0us	100us, 50us
500.0us	250us, 125us
1.0ms	500us, 250us
2.0ms	1.0ms, 500us
5.0ms	2.5ms, 1.25ms
10.0ms	5.0ms, 2.5ms, 1.25ms
20.0ms	10ms, 5.0ms, 2.5ms
50.0ms	25ms, 12.5ms, 6.25ms

X-Y Format

This format compares the voltage level of two waveform records point by point. It is useful for studying phase relationships between two waveforms.

This format only applies to channels 1 and 2. Choose X-Y display format to display channel 1 in the horizontal axis and channel 2 in the vertical axis. The oscilloscope uses the untriggered sample acquisition mode and data displays as dots. The sampling rate is from 4 KS/s to 100 MS/s, and the default sampling rate is 1 MS/s.
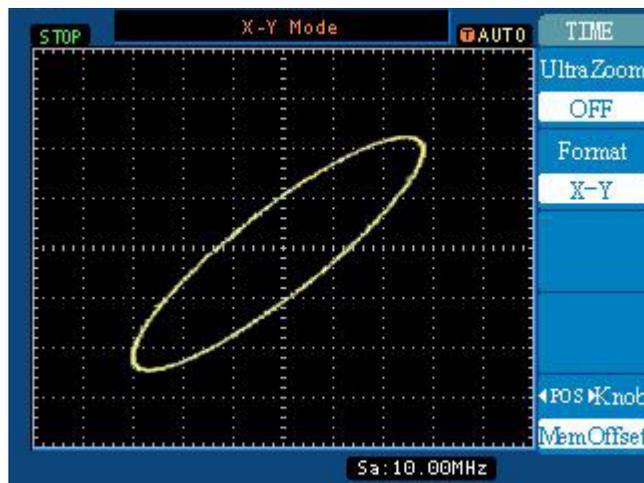

Figure 2-18: X-Y display format

The following modes or functions will do not work in X-Y format.

■ The Automatic Measurements

■ The Cursor Measurements

■ REF and MATH Operations

■ The Ultrazoom Mode

■ The Vector Display Mode

■ Horizontal POSITION knob

■ Trigger Controls

Understand the Trigger System

The trigger determines when the oscilloscope starts to acquire data and display a waveform. When a trigger is set up properly, it can convert unstable displays or blank screens into meaningful waveforms.

When the oscilloscope starts to acquire a waveform, it collects enough data so that it can draw the waveform to the left of the trigger point. The oscilloscope continues to acquire data while waiting for the trigger condition to occur. After it detects a trigger, the oscilloscope continues to acquire enough data so that it can draw the waveform to the right of the trigger point.

The trigger control area on the front panel includes a knob and three keys:

LEVEL: The knob that set the trigger level

50%: The instant executes key setting the trigger level to the vertical midpoint between the peaks of the trigger signal

FORCE: Starts an acquisition regardless of an adequate trigger signal. This button has no effect if the acquisition is already stopped.

MENU: The key that shows the trigger controls menu.
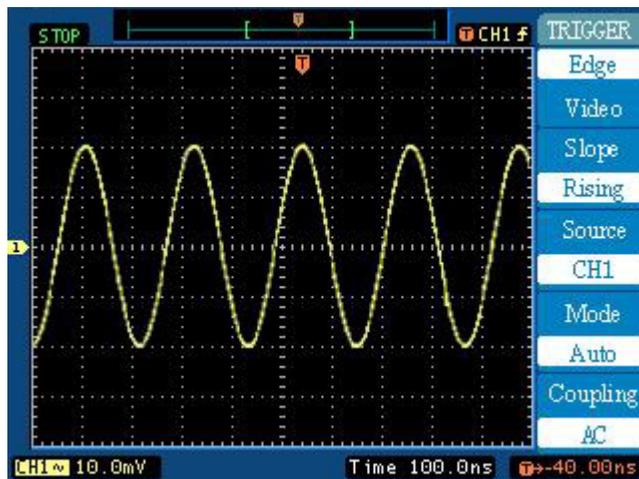
Figure 2-19: Trigger controls

Trigger Types

The oscilloscope provides two types of triggers: Edge and Video.

Edge: You can use the edge trigger with analog and digital test circuits. An edge trigger occurs when the trigger input passes through a specified voltage level in the specified direction.

Video: You can use the video trigger on fields or lines of standard video signals.

Settings for Edge Trigger

The Slope and Level controls help to define the trigger. The Slope control determines whether the oscilloscope finds the trigger point on the rising or the falling edge of a signal. To access the trigger slope control, press the MENU key, select Edge, and use the Slope button to select Rising or Falling.

Table 2-13:

Menu	Settings	Comments
Slope	Rising Falling	Select to trigger on either the rising or falling edge of the signal
Source	CH1 CH2 EXT EXT/5 AC Line	Select the input source as the trigger signal
Mode	Auto Normal Single	Select the type of triggering
Coupling	AC DC LF Reject HF Reject	Selects the components of the trigger signal applied to the trigger circuitry

Settings for Video Trigger

Choose video triggering to trigger on fields or the lines of an NTSC, PAL, or SECAM standard video signal.

Table 2-14:

Menu	Settings	Comments
Source	CH1 CH2 EXT EXT/5	Selects the input source as the trigger signal EXT and EXT/5 use the signal applied to the EXT TRIG connector as the source
Polarity	Normal polarity （⎍） Inverted polarity （⎍）	Normal triggers on the negative edge of the sync pulse and Inverted triggers on the positive edge of the sync pulse
Sync	Line	Select to trigger on lines
	Field 1 Field 2	Select to trigger on Field 1 or Field 2
HF Reject	ON OFF	Set to reject high frequency Close the high frequency reject function

Key points

Sync Pulses: When you choose Normal Polarity, the trigger always occurs on negative-going sync pulses. If your video signal has positive-going sync pulses, use the Inverted Polarity selection.

HF Reject: Use HF Reject to block the high frequency components in the video signal.

The figure 2-20 and 2-21 display the waveforms with Line and Field synchronization.
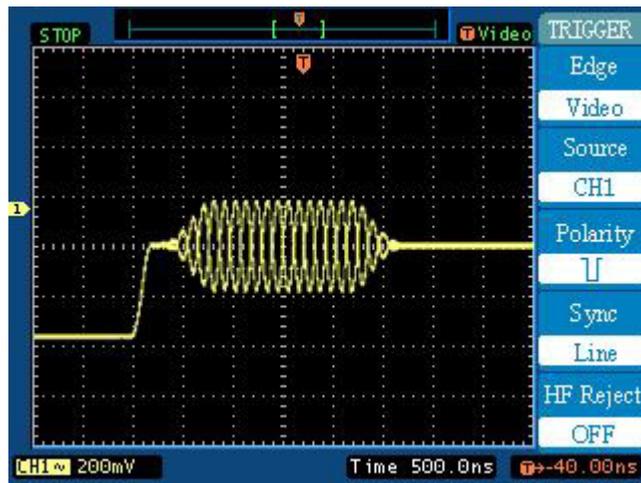

Figure 2-20: Line synchronization
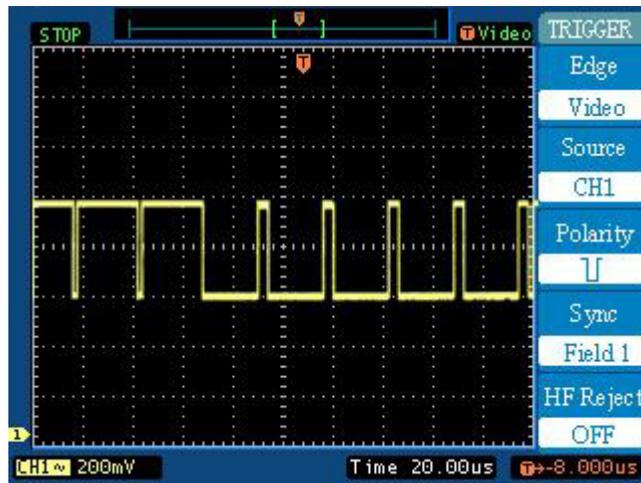
Figure 2-21: Field synchronization

Trigger Key Points

1. Source:

You can derive your trigger from various sources: Input channels (CH1 or CH2), AC Line, Ext, Ext/5.

CH1 or CH2: The most commonly used trigger source is any one of the input channels. The channel you select as a trigger source will function whether it is displayed or not.

Ext and Ext/5: You can use this trigger source when you want to acquire data on two channels and trigger from a third. For example, you might want to trigger from an external clock or with a signal from another part of the test circuit.

The Ext and Ext/ 5 trigger sources both use the external trigger signal connected to the EXT TRIG connector. Ext uses the signal directly; you can use Ext on signals with a trigger level range of +1.6 V to -1.6 V.

The EXT/ 5 trigger source divides the signal by 5, which extends the trigger level range from +8 V to -8 V. This allows the oscilloscope to trigger on a larger signal.

AC Line: You can use this trigger source when you want to look at signals related to the power line frequency, such as lighting equipment and power supply devices. The oscilloscope generates the trigger, so you do not have to input a trigger signal.

2. Mode:

The trigger mode determines how the oscilloscope behaves in the absence of a trigger event. The oscilloscope provides three trigger modes: Auto, Normal, and Single.

Auto: This trigger mode allows the oscilloscope to acquire a waveform even when it does not detect a trigger condition. If no trigger condition occurs while the oscilloscope waits for a specific period (as determined by the time-base setting), it will force itself to trigger.

When forcing invalid triggers, the oscilloscope cannot synchronize the waveform, and the waveform seems to roll across the display. If valid triggers occur, the display becomes stable on the screen.

You can use Auto mode to monitor an amplitude level, such as a power supply output, which may cause the waveform to roll across the display.

Normal: The Normal mode allows the oscilloscope to acquire a waveform only when it is triggered. If no trigger occurs, the oscilloscope will not acquire a new waveform, and the previous waveform, if any, will remain on the display.

Single: The Single mode allows the oscilloscope to acquire one waveform each time you press the RUN/STOP key, and the trigger condition is detected.

3. Coupling:

Trigger coupling determines what part of the signal passes on to the trigger circuit. Coupling types include AC, DC, LF Reject and HF Reject.

AC: AC coupling blocks DC components.

DC: DC coupling passes both AC and DC components.

LF Reject: LF Reject coupling does the opposite of high frequency rejection.

HF Reject: HF Reject coupling blocks the high frequency portion and passes on only the low frequency components.

4. Pretrigger:

All events displayed left of the trigger point happened before the trigger occurred, and these events are called pretrigger information. The trigger position is typically set at the horizontal center of the screen. Adjusting the horizontal POSITION of the waveform allows you to see more or less pretrigger information.

You will find this feature very useful because you can now see the events that led up to 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.

How to Set Up the Sampling System

As Figure 2-22 displays, the ACQUIRE button at the MENU control area is the function key for sampling system.

Acquire Menu Key
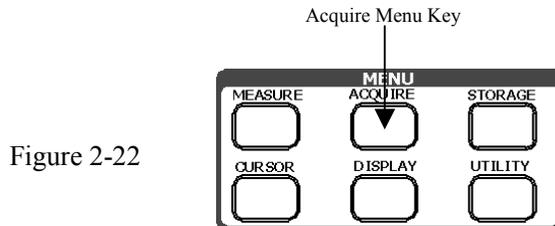
Figure 2-22

Using ACQUIRE key to pop up the menu as follows:

Figure 2-23   Table 2-15

Menu	Settings	Comments
Sampling	Real-Time Equ-Time	Set to Realtime sampling mode Set to Equivalent sampling mode
Fast trigger	ON OFF	Set fast trigger "ON" Set fast trigger "OFF"
Persistence	10ms 25ms 50ms 75ms 100ms 150ms 200ms 300ms 400ms 500ms	The waveform will be kept on the screen for the time you set. The Persistence time is from 10ms to 500ms.
Acquisition	Normal Average Envelope	Set to Normal Acquisition mode Set to Average Acquisition mode Set to Envelope Acquisition mode
Averages	2 4 8 16 32 64 128	Only after you set the average acquisition mode, this item will be available. Select Number of Averages from 2 to 128 with the step of 2.

Key Points

Realtime Sampling: The sampling rate for Realtime is up to 100MS/s. At the timebase 200 ns/div or faster, the oscilloscopes use the sine interpolation to expand the horizontal timebase.

Equivalent sampling: Also be known as Repetitive sampling. In this mode, you can get up to 100 ps of horizontal resolution. This mode is good for observing periodic signal, and it will not be available for single-shot or pulse.

Fast Trigger Acquisition: In this mode, the memory depth is set to 2K, so that the waveform refreshes rapidly. You could see rapidly changing signals or intermittent signal irregularities.

Persistence: Turn on waveform persistence to slow the decay of waveform points. You can set the persistence to a specific time. With persistence on, you can simulate the function of an analog storage oscilloscope.

Average Acquisition: Apply averaging to your signal to remove uncorrelated noise and improve measurement accuracy. Reduces random or uncorrelated noise in the signal display. The averaged waveform is a running average over a specified number of acquisitions from 2 to 128. This mode is only available when Fast trigger is "ON".

Envelope: Use envelope to capture and display the maximum variation of a signal. Finds highest and lowest record points over many acquisitions.

Stopping the Acquisition: While acquisition is running, the waveform display is live. Stopping the acquisition freezes the display. In either mode, the waveform display can be scaled or positioned with the vertical and horizontal controls.

The waveform displayed on the screen will change in conjunction with the setting of ACQUIRE menu.
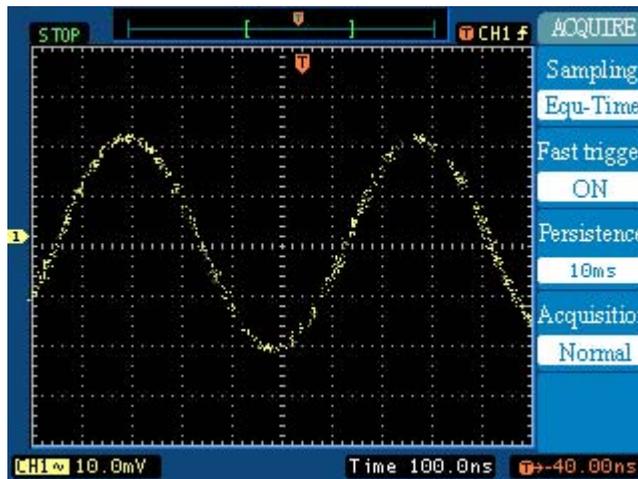
Figure 2-24: Signal that contains noise, and without average sampling
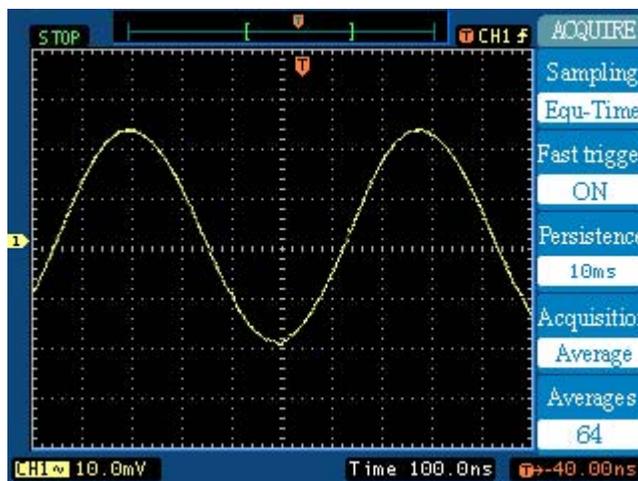
Figure 2-25: Display signal after average sampling

Note:

- *Choose **Realtime** acquisition to observe the single-shot or pulse, and select the **Equ-Time** to observe high frequency periodic signal.*

- *To reduce the display of the random noise, please choose the **Averages** Acquisition. And this mode would make the screen refresh rate slow.*

- *To reduce the signal confusion, select **Envelope** Acquisition.*

Figure 2-26: Signal with Envelope Acquisition

The envelope is shown as the figure above, and the signal is displayed with the diagonal between the envelopes.

To use roll mode

Roll mode continuously moves data across the display from left to right. It allows you to see dynamic changes (like adjusting a potentiometer) on low frequency signals. Two frequently used applications are transducer monitoring and power supply testing.

The oscilloscope is now untriggered and runs continuously. You can also make automatic measurements in the roll mode. Notice that the oscilloscope briefly interrupts the moving data while it makes the measurement. The acquisition system does not miss any data during the measurement. The slight shift in the display after the measurement is complete is that of the display catching up to the acquisition system.

Roll mode operating hints

• Roll mode operates on channels 1 and 2 only.

• Roll mode is available at time base up to 100 ms/div.

How to Set Up the Display System

Figure 2-27 shows the menu button for the display system on the front panel.

Figure 2-27

Display Setting Menu
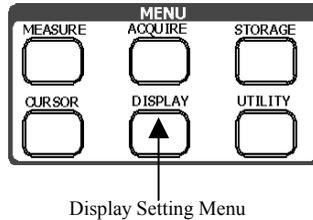
Press the DISPLAY key to pop up the menu for the settings of the screen.
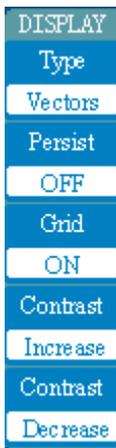
Figure 2-28   Table 2-16

Menu	Settings	Comments
Type	Vectors Dots	Vectors fills the space between adjacent sample points in the display Dots displays only the sample points
Persist	Infinite OFF	Set the sample point remains displayed until turn the persistence "OFF". Turn off the persistence
Grid	ON OFF	Display the grids on the screen Turn off the grids
Contrast Increase		Press the function key to increase the contrast of the screen
Contrast Decrease		Press the function key to decrease the contrast of the screen

NOTE: The vector display is available at the time base of 50ns/div or slower.

How Save and Recall Waveforms or Setups

Figure 2-29 shows the menu button for the storage system on the front panel.
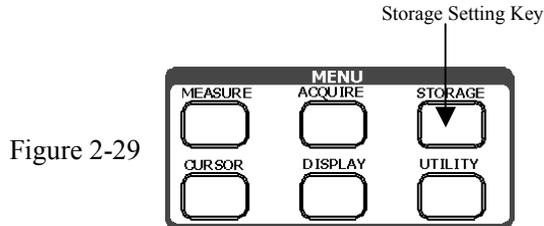
Figure 2-29

Press the STORAGE key to pop up the menu for the settings of the storage system.

Figure 2-30   Table 2-17

Menu	Settings	Comments
Waveforms Setups		Set the operation to save or load the waveforms. Set the operation to save or load the instrument settings
Factory		Sets the instrument controls to the default factory settings, and this item will appear after select **Setups**.
Storage	No.1 No.2 No.3 No.4 No.5	Specifies the memory location in which to save the current instrument settings or waveforms and from which to recall the settings
Load		Recalls the settings or waveforms stored in the location chosen in the Storage field
Save		Completes the save action

Key Points for Storage System

Factory Setup: The oscilloscope is set up for normal operation when it is shipped from the factory. You can recall the factory default setup any time you want to operate the oscilloscope using or starting from the factory default settings.

Save: You can save five waveforms with two channels or five settings in the nonvolatile memory of the oscilloscope and overwrite setups as needed. By default, the oscilloscope saves the setup each time it is powered off. The oscilloscope automatically recalls this setup the next time it is powered on.

Load: The oscilloscope can recall any of the saved waveforms, setups or the factory default setup. The recalled waveform can be measured with Cursor or Automatic Measurement.

NOTE:

• *When you save the waveforms, the current settings of the oscilloscope will be saved at the same time*

• *You should wait at least five seconds after your last change to the setup before you turn off the power. This ensures that the setup is saved properly.*

• *The waveform can be saved in memory except that in the X-Y mode.*

How to Set Up the Utility

Figure 2-31 shows the menu button for the Utility on the front panel.

Figure 2-31

Utility function setting
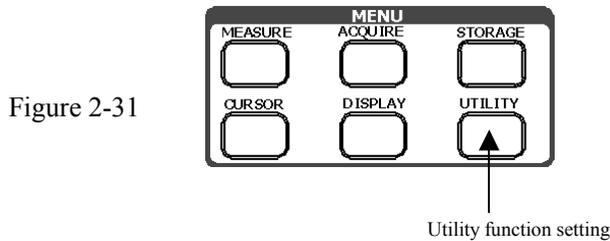
Press the UTILITY key to pop up the menu for the settings of the Utility system.

Figure 2-32   Table 2-18
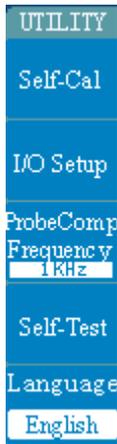
Menu	Settings	Comments
Self-Cal	Vertical System Calibration Horizontal System Calibration	Calibrate the Vertical System automatically Calibrate the Horizontal System automatically
I/O Setup	RS-232 Baud GPIB Address	Set the baud rate of RS-232 Set the GPIB address
Probe Comp Frequency	1 KHz 2 KHz 6 KHz	Set the frequency of Probe Comp at 1 KHz, 2 KHz or 6 KHz
Self-Test	Screen Test Keyboard Test	Execute the screen test Execute the keyboard test
Language	Simplified Chinese English	Set the system displays in simplified Chinese Set the system displays in English

Auto Calibration

The Auto-Calibration adjusts the oscilloscope to get the best accuracy. Use these functions to calibrate the oscilloscope's vertical and horizontal systems.

For maximum accuracy at any time, run the routine if the ambient temperature changes by 5° C or more.

Before you run the procedure, do these steps:

1. Disconnect any probes or cables from the channel inputs, otherwise failure or damage to the oscilloscope may occur.
2. Push the UTILITY key to select Self-Cal

The self-calibration menu is displayed as Figure 2-33.

Figure 2-33   Table 2-19

Menu	Comments
Vertical System Calibration	Select to run the vertical system calibration procedure
Horizontal System Calibration	Select to run the horizontal system calibration procedure

NOTE:

• *The instrument is self-calibrated at the factory. However, it should be self-calibrated again in its working environment after a 30-minute warm-up to obtain the best accuracy.*

• *When you calibrate the instrument, you must follow the steps below:*

> *Step 1: Vertical System Calibration*
> *Step 2: Horizontal System Calibration*

• *The routine takes several minutes to complete.*

Vertical Calibration:

Press the softkey to select Vertical System Calibration and start the calibration procedure. Please pay attention to unplug the cables or probes connected with the channels, and make sure that there is no signal input to the oscilloscope before calibration.

Press RUN/STOP key to begin the routine. The white blocks in the progress bar will be going while calibrating. You can cancel the progress by pressing the AUTO key. After the progress bar is full, the system will pop up a message "Mission Accomplished", and then press the RUN/STOP key to finish the calibration routine.
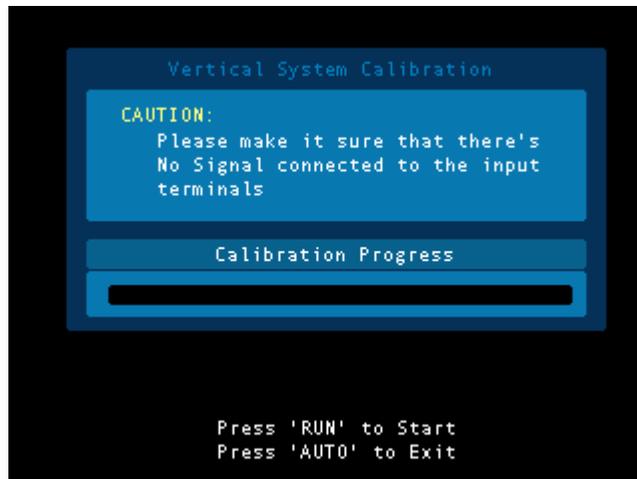

Figure 2-34: Interface before the start of vertical calibration
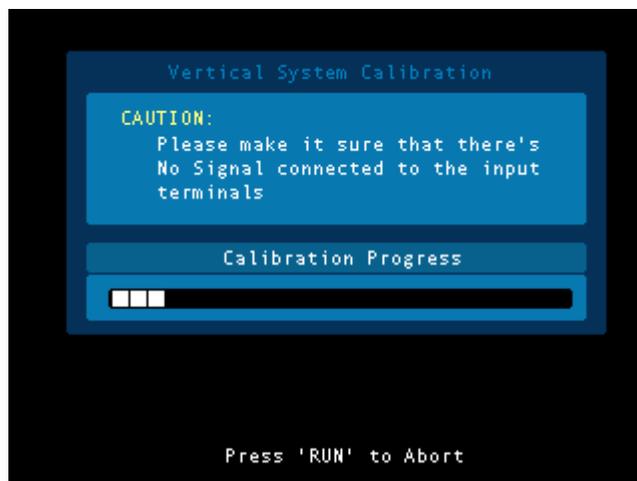
Figure 2-35: Interface while vertical calibrating

Horizontal Calibration

Before the horizontal calibration begins, you must confirm that you have finished the vertical calibration first.

Press the softkey to select Horizontal System Calibration and start the calibration procedure. The operation and the prompting message are similar with the vertical system calibration.
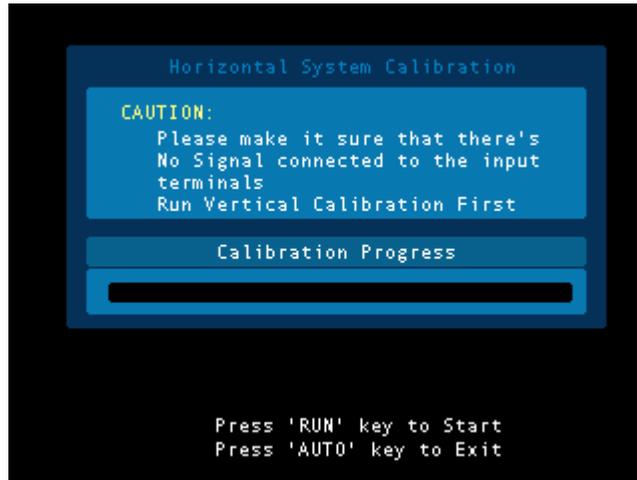

Figure 2-36: Interface before the start of horizontal calibration

Figure 2-37: Interface while horizontal calibrating

The I/O setup:

Press UTILITY -> I/O Setup to enter the following menu

Figure 2-38   Table 2-20

Menu	Settings	Comments
RS-232 Baud	******	The oscilloscope doesn't link to a extension module that has the RS-232 communication function
GPIB Address	****	The oscilloscope doesn't link to a extend module that has the GPIB communication function

Figure 2-39   Table2-21

Menu	Settings	Comments
RS-232 Baud	300 2400 4800 9600 19200 38400	Set the baud rate of RS-232 as 300, 2400, 4800, 9600, 19200 or 38400.
GPIB Address	0 1 . . . 30	Set the GPIB address from 0 to 30, steps 1.

NOTE:

• *Before install or uninstall the extension module, you must confirm that the oscilloscope powers off.*

• *You could find more details in the user manual for extension module.*

Self-test

Press [UTILITY]-> Self-Test to enter the following menu.

Figure 2-40   Table 2-22

Menu	Settings
Screen Test	Execute the screen test program.
Keyboard Test	Execute the keyboard test program.

1. Screen Test:

Press softkey to select Screen Test and begin the screen test procedure. Fellow the prompt message on the screen "Press 'RUN' Key to Continue the Test". The screen turns red, green and blue in sequence when pressing the [RUN/STOP] key. You could check the screen for color or other display failures.

2. Keyboard Test:

Press softkey to select Keyboard Test and start the keyboard test routine. The white boxes represent the buttons on the front-panel; the rectangular boxes with two arrows beside represent the knobs on the front-panel; the square boxes represent the pressing function for the [SCALE] knobs. Test all keys and knobs, and look the boxes on the screen response whether or not.

NOTE:

• *The boxes will turn red while test the keys and knobs, and they will turn green after tested.*

• *You could follow the prompting message of " <<Press 'RUN' Key Three Times to Exit The Test>>" to exit the test.*

Probe comp frequency:

The voltage of signal for Probe Comp is about 5V, and you can adjust its frequency to 1KHz, 2KHz and 6KHz according to the following steps:

Press UTILITY->Probe Comp Frequency, and press softkey to set the frequency.

Language:

The oscilloscopes have a user interface of two languages: Simplified Chinese and English. And the user could set it.

Press UTILITY -> Language to select the language.

NOTE: The menus and the prompt messages will both be changed into the language you selected.

How to Measure Automatically

The automatic measurement capability of the oscilloscope makes voltage and time measurements easy.

Figure 2-41 shows the menu key for automatic measurements on the front panel.

Menu for Auto Measure
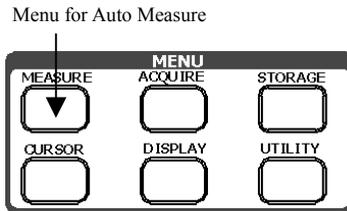
Figure 2-41

Press the MEASURE key to display the menu for the settings of the Automatic Measurements.

The oscilloscopes provide 15 parameters of auto measurement, including Vpp, Vmax, Vmin, Vtop, Vbase, Vaverage, Vrms, Frequency, Period, RiseTime, FallTime, +Width, -Width, delay 1->2 ⌐ and delay 1->2 ⌐. The selections for these parameters are divided into 6 pages to display. You can press the softkey Type to select these pages.

Page 1 for voltage measurements

Figure 2-42   Table 2-23

Menu	Settings	Comments
Source	CH1 CH2 None	Select CH1 or CH2 as source channel for measurement Go to the page to clear measurements
Type	Voltage 1-3	Select to measure voltage parameters on page 1
Vpp		Measure Vpp of the signal
Vmax		Measure Vmax of the signal
Vmin		Measure Vmin of the signal

Page 2 for voltage measurements

Figure 2-43   Table 2-24

Menu	Settings	Comments
Source	CH1 CH2 None	Select CH1 or CH2 as source channel for measurement Go to the page to clear measurements
Type	Voltage 2-3	Select to measure voltage parameters on page 2
Vtop		Measure Vtop of the signal
Vbase		Measure Vbase of the signal
Average		Measure Vaverage of the signal

Page 3 for voltage measurements

Figure 2-44   Table 2-25

Menu	Settings	Comments
Source	CH1 CH2 None	Select CH1 or CH2 as source channel for measurement Go to the page to clear measurements
Type	Voltage 3-3	Select to measure voltage parameters on page 3
Vrms		Measure Vrms of the signal

Page 1 for time measurements

Figure 2-45   Table 2-26

Menu	Settings	Comments
Source	CH1 CH2 None	Select CH1 or CH2 as source channel for measurement. Go to the page to clear measurements
Type	Time 1-3	Select to measure time parameters on page 1
Freq		Measure Frequency of the signal
Rise time		Measure RiseTime of the signal
Fall time		Measure FallTime of the signal

Page 2 for time measurements

Figure 2-46   Table 2-27

Menu	Settings	Comments
Source	CH1 CH2 None	Select CH1 or CH2 as source channel for measurement. Go to the page to clear measurements
Type	Time 2-3	Select to measure time parameters on page 2
Period		Measure Period of the signal
+Width		Measure +Width of the signal
-Width		Measure -Width of the signal

Page 3 for time measurements

Figure 2-47   Table 2-28

Menu	Settings	Comments
Source	CH1 CH2 None	Select CH1 or CH2 as source channel for measurement Go to the page to clear measurements
Type	Time 3-3	Select to measure time parameters on page 3
Delay1->2 ⌐		Measure the signals delay between two channels at the rising edge
Delay1->2 ⌐		Measure the signals delay between two channels at the falling edge

NOTE: The results of the automatic measurements will be displayed on the bottom of the screen, and the oscilloscope can display 3 results at the same time.

The oscilloscopes use rolling mode to display the results. If there are 3 results on the screen, the next measurement will make previous results moving left, so that the leftmost data on the screen will be cleared.

Using Automatic Measurement as the following steps demonstrate:

1. Select the signal channel for measuring. You could select CH1 or CH2 according to the signal channel you interest.

    Press softkeys as follows: MEASURE ->Source-> **CH1** or **CH2**.

2. Select parameters page for measuring. You could select voltage or time parameters pages by pressing softkey as follows: MEASURE ->Type-> **Voltage1-3**, **Voltage2-3**…

3. Acquire the measured value on the screen. You could select the parameters you are interested in by pressing the softkey on the right of the menu. You could read the data on the bottom of the screen after pressing the button.

    If the data is displayed as "*****", that means the parameter cannot be measured.

4. Clear the measure value: As the menu of the following figure shows, set the None under the option of "Source", and then press the No.2 menu operation key to select Clear All. Now, all of the auto measure values disappear from the screen.

Figure 2-48

Press the No1 key to enter the status of clear measure

Clear the display measure parameter
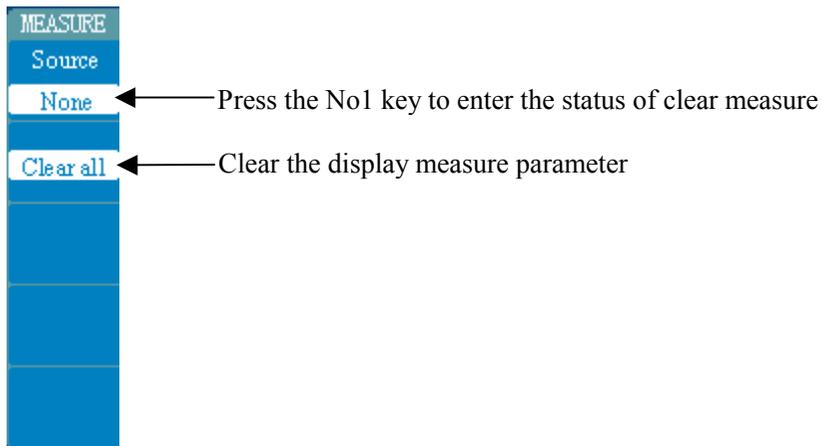
The automatic measurement of the voltage parameters

The 6800 series oscilloscopes provide voltage measurements including Vpp, Vmax, Vmin, Average, Vrms, Vtop and Vbase. Figure 2-49 below shows pulse with some of the voltage measurement points.
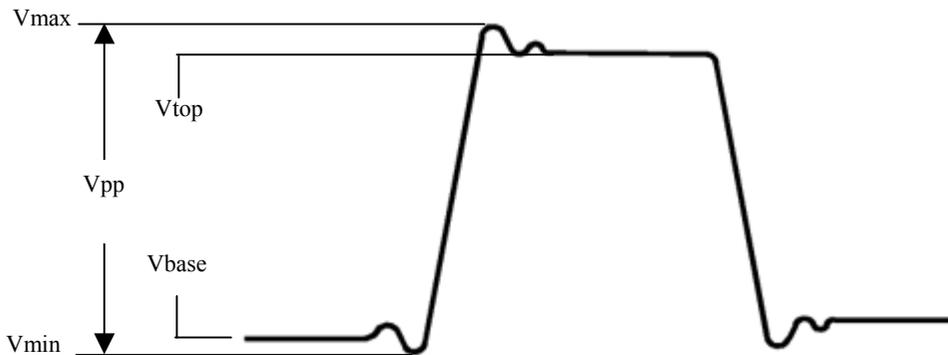

Figure 2-49

Vpp: Measured over the entire waveform.

Vmax: The maximum amplitude. The most positive peak voltage measured over the entire waveform.

Vmin: The minimum amplitude. The most negative peak voltage measured over the entire waveform.

Vtop: The value used as 100%. Calculated using either the min/max or the histogram method. Measured over the entire waveform.

Vbase: The value used as 0%. Calculated using either the min/max or the histogram method. Measured over the entire waveform.

Average: The arithmetic mean over the entire waveform.

Vrms: The true Root Mean Square voltage over the entire waveform.

The automatic measurement of the time parameters

The 6800 series oscilloscopes provide time measurements including Frequency, Period, RiseTime, FallTime, +Width, -Width, Delay 1->2 ꟻ and Delay 1->2 ꟷ . Figure 2-50 shows a pulse with some of the time measurement points.
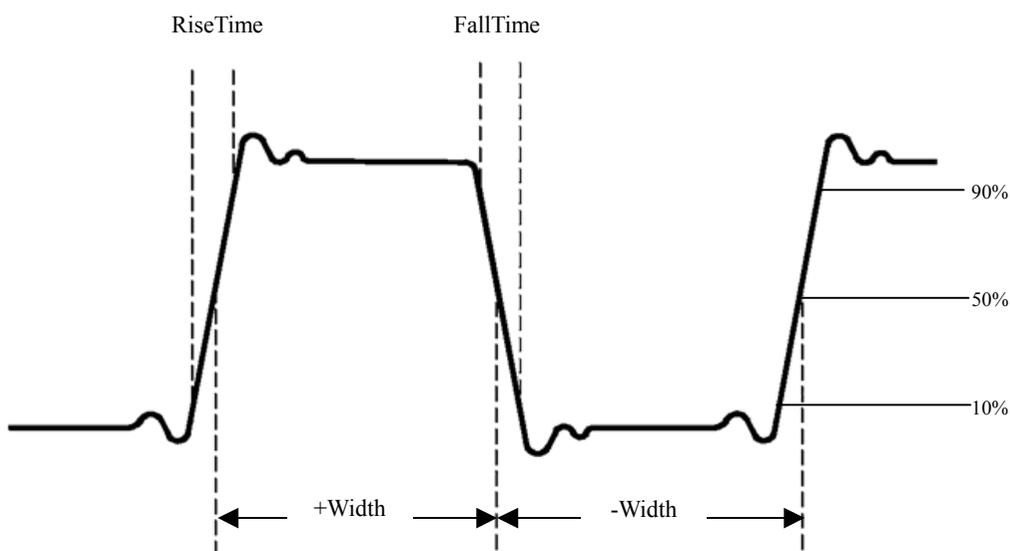

Figure 2-50

RiseTime: Time that the leading edge of the first pulse in the waveform takes to rise from 10% to 90% of its amplitude.

FallTime: Time that the falling edge of the first pulse in the waveform takes to fall from 90% to 10% of its amplitude.

+Width: Measurement of the first positive pulse in the waveform. The time between the 50% amplitude points.

-Width: Measurement of the first negative pulse in the waveform. The time between the 50% amplitude points.

Delay1->2 ꟻ : Measurement of the delay between the two channels at the rising edge.

Delay1->2 ꟷ : Measurement of the delay between the two channels at the falling edge.

How to measure with cursors

The oscilloscopes provide cursors to measure the signals on the screen.

Figure 2-51 displays the CURSOR key on the front-panel for this menu.

Figure 2-51
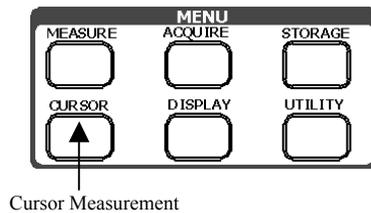
Cursor Measurement

The cursor measurements are divided into three modes: Manual, Track and Auto Measure.

1. **Manual:** In this mode, the screen displays two parallel cursors. You can move the cursors to make custom voltage or time measurements on the signal. The values are displayed on the black boxes below the menu. Before using cursors, you should make sure that you have set the Signal Source as the channel for measuring.

2. **Track:** In this mode, the screen displays two cross cursors. The cross cursor sets the position on the waveform automatically. You could adjust cursor's horizontal position on the waveform by turning the POSITION knob in conjunction with the cursor. The oscilloscope displays the values of the coordinates on the black boxes below the menu.

3. **AutoMeasure:** This mode will take effect with Automatic Measurements. The instruments will display cursors while measuring parameters automatically. These cursors demonstrate the physical meanings of these measurements.

NOTE: The AutoMeasure mode for Cursor measuring will be invalid without automatic measurements.

Menus and operations of Cursor Measurements

1. Manual Mode
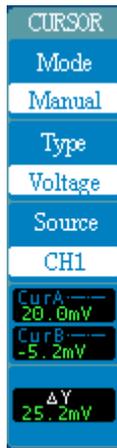
Figure 2-52   Table 2-29

Menu	Settings	Comments
Mode	Manual	Set to Manual mode in cursor measurement
Type	Voltage Time	Use cursors to measure the voltage parameters of the signal. Use cursors to measure the time parameters of the signal.
Source	CH1 CH2 MATH	Select the measurement source of the signal.

In this mode, the oscilloscope measures the cursors' coordinate values for voltage or time, and the increment between the two cursors.

Measuring to do these steps as follows:

(1). Select the **Manual** mode for cursor measurement by pressing softkey as:
CURSOR -> Mode-> **Manual**.

(2). Select channel **Source** for measurements by pressing softkey as:
CURSOR -> Source-> **CH1**, **CH2** or **MATH**.

NOTE: While measuring the channel of MATH, the results are valued with "d" (division) as units.

(3). Select the cursors type by pressing softkey as CURSOR -> Type-> **Voltage** or **Time**.

(4). Move the cursors to adjust the increment between the cursors: (Details in Table 2-28)

Table 2-30

Cursor	Increment	Operation
Cursor A	Voltage Time	Turn the vertical POSITION knob to move cursor A
Cursor B	Voltage Time	Turn the horizontal POSITION knob to move cursor B

Key Points

Voltage Cursors: Voltage cursors appear as horizontal lines on the display and measure the vertical parameters.

Time Cursors: Time cursors appear as vertical lines on the display and measure the horizontal parameters.

NOTE: Cursors will remain displayed (unless turned off) after leaving the cursor menu but are not adjustable.

2. Track Mode

Figure 2-53
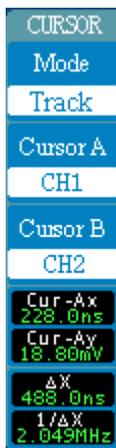
Table 2-31

Menu	Settings	Comments	
Mode	Track	Set to Track mode in cursor measurement	
Cursor A	CH1 CH2 None	Set Cursor A in conjunction with CH1, CH2 or turn off Cursor A	
Cursor B	CH1 CH2 None	Set Cursor B in conjunction with CH1, CH2 or turn off Cursor B	
Cur-Ax Cur-Ay		Display X or Y axes values of Cursor A	You can switch the values display of Cursor A and B by pressing the key beside the values
Cur-Bx Cur-By		Display X or Y axes values of Cursor B	
△X 1/△X		Display the X-axis increment and its reciprocal between the cursors	You can switch the values of X-axis and Y-axis by pressing the key beside the values
△Y		Display the Y-axis increment between the cursors	

In cursor track mode, the cursors move together with the waveform selected.

Measuring to do these steps as follows:

(1). Select the **Track** mode for cursor measurement by pressing softkey as:
CURSOR -> Mode-> **Track**.

(2). Select channel **Source** for Cursor A and Cursor B by pressing softkey as:
CURSOR -> Cursor A or Cursor B-> **CH1**, **CH2** or **None**.

(3). Move the cursors to adjust the positions of the cursors: (Details in Table 2-30)

Table 2-32

Cursor	Operation
Cursor A	Turn the vertical POSITION knob to move Cursor A
Cursor B	Turn the horizontal POSITION knob to move Cursor B

3. Auto Measure mode:

Figure 2-54   Table 2-33

| Menu	Settings	Comments
Mode	Auto Measure	Display the cursors applied by the current automatic measuring. (See the following figure)
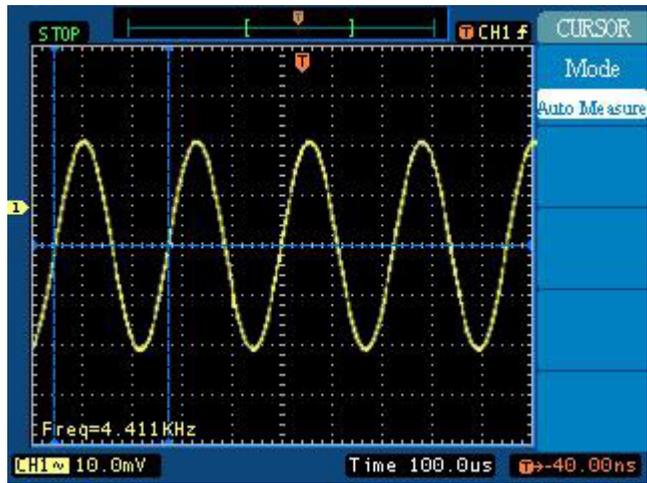
Figure 2-55: Auto Measure Mode of Cursor Measurement

4. Clear Cursors:

You could press softkey as CURSOR -> Mode-> **OFF** to erase the cursor readings and removes the cursors from the display.

How to use instant execute keys

The action keys include AUTO (autosetting) and RUN/STOP (run/stop).

The AUTO feature automatically adjusts the controls to produce a usable display of the input signal. Pushing AUTO adjusts or sets each of the following items listed.

Table 2-34

Function	Settings
Display format	Y-T
Sampling mode	Equ-sampling
Acquire mode	Normal
Vertical coupling	Adjust to AC or DC according to the signal.
Vertical "V/div"	Adjusted
Volts/Div	Coarse
Bandwidth limit	Full
Signal Invert	OFF
Horizontal position	Center
Horizontal "S/div"	Adjust to right position
Trigger type	Edge
Trigger source	Measure the channel with input signal automatically.
Trigger coupling	DC
Trigger voltage	Midpoint setting
Trigger mode	Auto
◁POS▷ knob	Memory offset

RUN/STOP : Start or stop the waveform acquiring.

Chapter 3：Application & Examples

Example 1: Taking Simple Measurements

You need to see a signal in a circuit, but you do not know the amplitude or frequency of the signal. You want to quickly display the signal and measure the frequency, period, and peak-to-peak amplitude.

To quickly display a signal，do these steps as follows:

(1) Set the probe and the channel attenuations to 10X
(2) Connect signal to CH1 with the probe
(3) Press the AUTO key

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

Selecting Automatic Measurements

The oscilloscope could take automatic measurements of most displayed signals. To measure the frequency and peak-to-peak amplitude, do these steps as follows:

(1). Measure peak-to-peak amplitude
Pressing MEASURE ->Source ->**CH1** to set measurement source
Pressing Type -> **Voltage 1-3** to select measurement page
Pressing Vpp to select peak-to-peak measurements and the result will be displayed on the screen.

(2). Measure frequency
Pressing Type -> **Time 1-3** to select measurement page
Pressing Freq to select frequency measurements

NOTE: The frequency, period, and peak-to-peak measurements are shown on the screen and are updated periodically.

Example 2: Viewing a signal delay through a circuit

You need to test the input and the output signals of a circuit with the oscilloscope. Before the test, you should set the probe and the channel attenuation to 10X and connect the CH1 to the input, CH2 to the output of circuit with the probes.

Do these steps as follows:

1. Display the signals (CH1 and CH2):

(1). Pressing the AUTO key
(2). Adjust the vertical and the horizontal scale by turning the SCALE knobs to appropriate ranges for display.
(3). Press the CH1 key to select CH1, and turn the vertical POSITION knob to adjust the vertical position of CH1's waveform.
(4). Press the CH2 key to select CH2, and turn the vertical POSITION knob to adjust the vertical position of CH2's waveform.

2．Measure the delay after the signal through the circuit

Auto-measuring the delay:
Pressing MEASURE ->Source ->**CH1** to set measurement source
Pressing Type -> **Time 1-3** to select measurement page.
Pressing Delay1->2 to display the result on the screen.
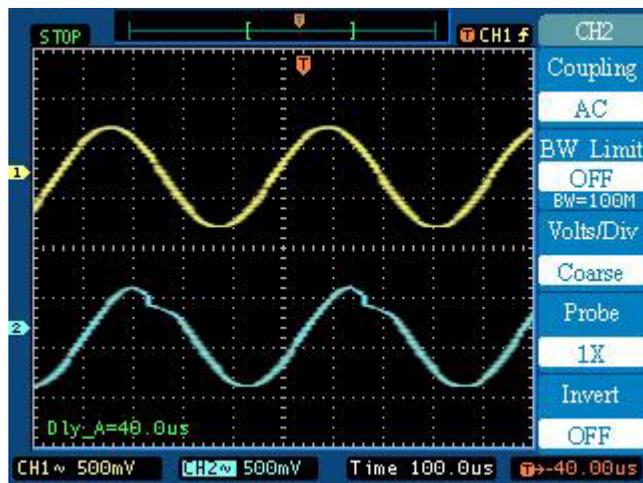
Figure 3-1: Delay of the signals

Example 3: Capturing a Single-Shot Signal

To capture a single event, you need previous knowledge of the signal in order to set up the trigger level and slope. For example, if the event is derived from TTL logic, a trigger level of 2 volts should work on a rising edge.

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

1 Connect a signal to the oscilloscope.

2 Set up the trigger.

- Press the MENU key in the Trigger control area to display the menu.

- Press softkey to select Edge

- Press softkey to select **Rising** Slope

- Press softkey to select Source as **CH1**

- Press softkey to select Mode as **Single**

- Press softkey to select Coupling as **DC**

- Turn the vertical and horizontal SCALE knobs to adjust the Volts/Div and the Timebase in a proper range for the signal

- Turn the LEVEL knob to adjust the trigger level

3 Press RUN/STOP key 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. Pressing the RUN/STOP key again rearms the trigger circuit and erases the display.

Example 4: To reduce the random noise on a signal

If the signal you are applying to the oscilloscope is noisy (Figure 3-2), you can set up the oscilloscope to reduce the noise on the waveform. First, stabilize the displayed waveform by removing the noise from the trigger path. Second, reduce the noise on the displayed waveform.
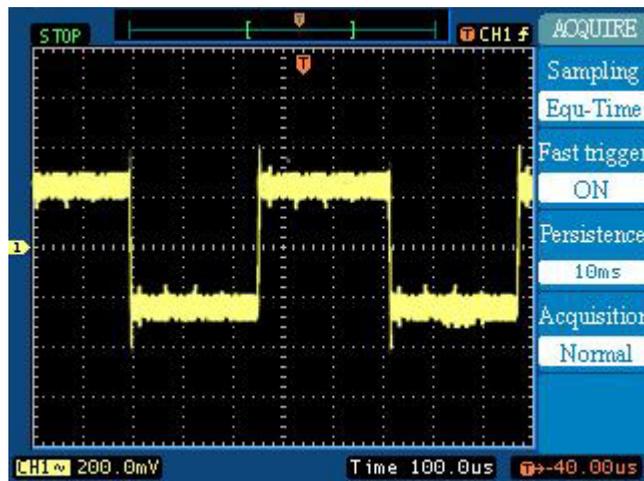

Figure 3-2

1 Connect a signal to the oscilloscope and obtain a stable display.

2 Remove the noise from the trigger path by turning on **HF Reject**.

    HF Reject (High frequency reject) adds a low pass filter with the 3 dB point at 150 kHz. You use **HF reject** to remove high frequency noise such as AM or FM broadcast stations from the trigger path.

    LF Reject (Low frequency reject) adds a high pass filter with the 3 dB point at 8 kHz. Use **LF Reject** to remove low frequency signals such as power line noise from the trigger path.

3 Use averaging to reduce noise on the displayed waveform.

To use averaging follow these steps.

- Press softkey as ACQUIRE -> Acquisition-> **Average**

- Toggle the Averages softkey to select the number of averages that best eliminates the noise from the displayed waveform. The higher the number of averages, the more noise that is removed from the display. However, the higher the number of averages, the slower the displayed waveform responds to waveform changes. You need to choose between how quickly the waveform responds to changes and how much noise there is on the signal. (See Figure 3-3)
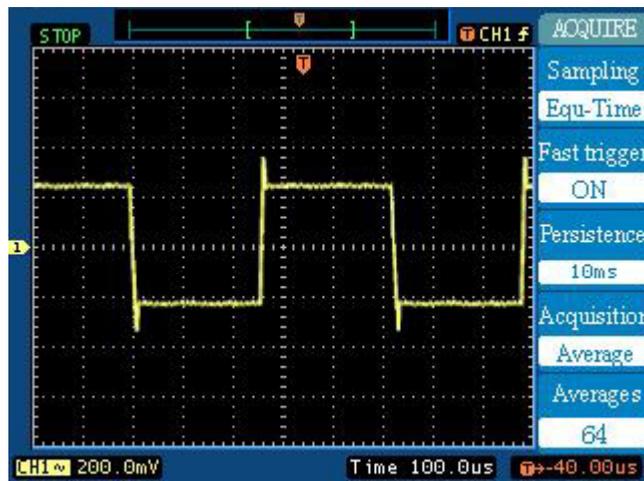
Figure 3-3

Example 5: Taking Cursor Measurements

You could measure 15 parameters automatically with the oscilloscope. These parameters also can be measured using cursors. You could use the cursors to quickly take time and voltage measurements on a waveform.

Measuring Ring Frequency

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

1. Press CURSOR key to see the Cursor menu.

2. Press softkey to select Cursor Mode as **Manual**.

3. Press softkey to select Cursor Type as **Time**.

4. Use the vertical POSITION knob to place a cursor on the first peak of the ring.

5. Use the horizontal POSITION knob to place a cursor on the second peak of the ring.

You can see the delta time and frequency (the measured ring frequency) in the Cursor menu.
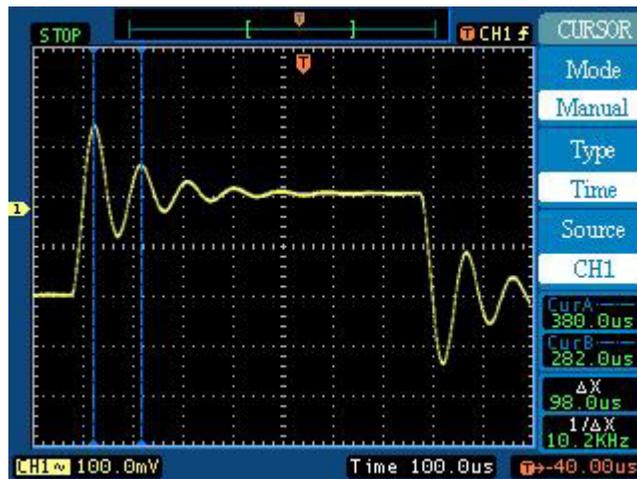
Figure 3-4

Measuring Ring Amplitude

You measured the ring frequency in the previous example. Now you want to measure the amplitude of the ringing. To measure the amplitude, do these steps:

1. Press CURSOR key to see the Cursor menu.

2. Press softkey to select Cursor Mode as **Manual**.

3. Press softkey to select Cursor Type as **Voltage**.

4. Use the vertical POSITION knob to place a cursor on the highest peak of the ring

5. Use the horizontal POSITION knob to place a cursor on the lowest point of the ring.

You can see the following measurements in the cursor menu: (See Figure 3-5)

■ The delta voltage (peak-to-peak voltage of the ringing)

■ The voltage at Cursor A

■ The voltage at Cursor B
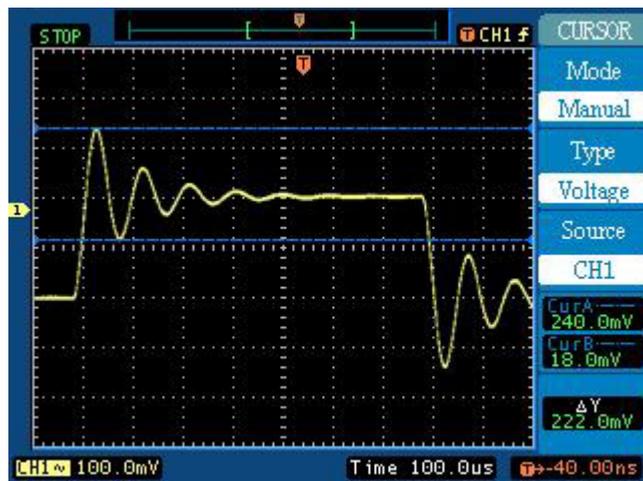
Figure 3-5

Example 6: The application of the X-Y function

Viewing Phase Changes through a Network

Connect the oscilloscope to monitor the input and output of the circuit and capture the phase changes through the circuit.

To view the input and output of the circuit in an x-y display, do these steps:

1. Set the probe menu attenuation to 10X. Set the switch to 10X on the probes.

2. Connect the channel 1 probe to the input of the network, and connect the channel 2 probe to the output.

3. If the channels are not displayed, press the CH1 and CH2 keys.

4. Press the AUTO key

5. Adjust the vertical SCALE knob to display approximately the same amplitude signals on each channel

6. Press the MENU in horizontal control area to display the menu

7. Press the Format softkey to select **X-Y**

   The oscilloscope displays a Lissajous pattern representing the input and output characteristics of the circuit

8. Adjust the vertical SCALE and POSITION knobs to display a desirable waveform.

9. Apply the Ellipse method to observe the phase difference between the two channels.

   (See Figure 3-6)
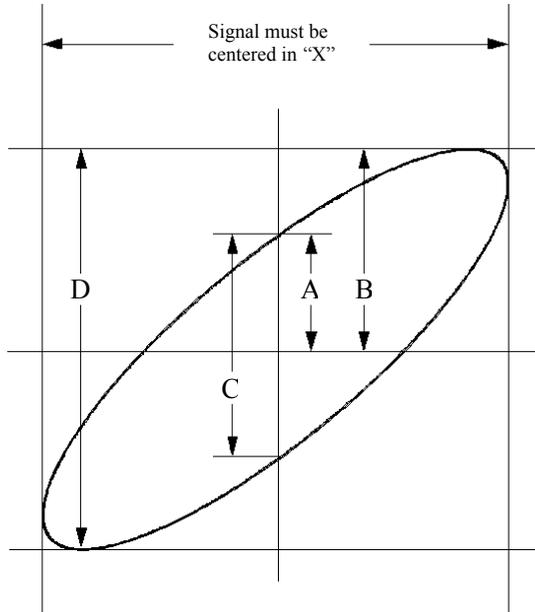
Figure 3-6

Sinθ=A/B or C/D   where θ= phase shift (in degrees) between the two signals.

From the formula above, you could get that **θ=±arcsin (A/B) or ±arcsin (C/D)**

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

Example 7: Triggering on a Video Signal

You are testing the video circuit and need to display the video output signal. Use the video trigger to obtain a stable display.

Triggering on Video Fields

To trigger on the video fields, do these steps:

1. Press the MENU key in the Trigger control area to see the Trigger menu.

2. Press softkey to select Video

3. Press softkey to select Source as **CH1**

4. Press softkey to select Polarity as ⊔

5. Press softkey to select Sync as **Field 1** or **Field 2**

6. Turn the horizontal SCALE knob to see a complete field on the screen.
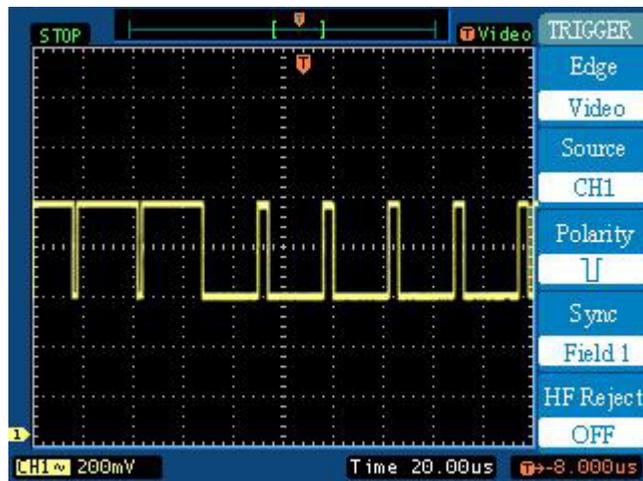

Figure 3-7

Triggering on Video Lines

To Triggering on Video Lines, do these steps:

2. Press the MENU key in the Trigger control area to see the Trigger menu.

3. Press softkey to select Video

4. Press softkey to select Source as **CH1**

5. Press softkey to select Polarity as ⌐⌐

6. Press softkey to select Sync as **Line**

7. Turn the horizontal SCALE knob to see a complete field on the screen.
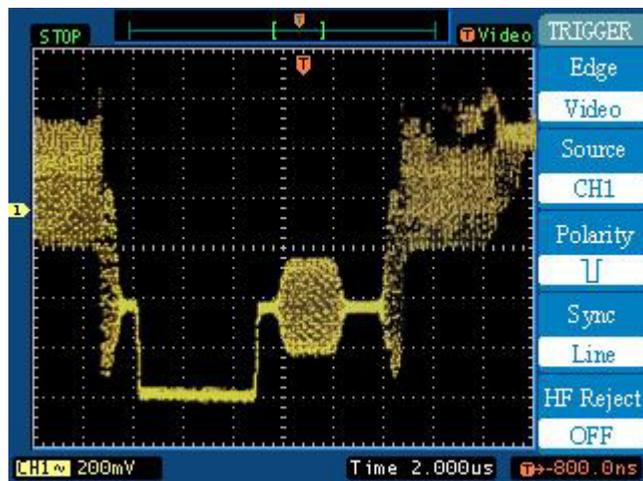
Figure 3-8

Chapter 4: Prompting messages and Troubleshooting

Prompting messages

Dot display only: Prompting that you could only use Dots type for display under this setting.

Function not used: Prompting that this function is not available under current setting.

Measurement already selected: Prompting that the parameter you need to measure is already displayed on screen.

Memory position at limit: Prompting that the Mem Offset is at the full range of the memory.

No active cursor: Prompting that you haven't set the cursor source while using the Track cursor measurements.

No signal found: Prompting that there is no signal connected to the instrument, or the signal is out of the AUTO range for detecting while pressing the AUTO key.

No zoom at this Time/Div: Prompting that under some timebases or X-Y mode, the Ultrazoom function is not available.

Position at limit: Prompting that the channel offset is at limit while turning the vertical POSITION knob to adjust the vertical position of the channel.

Real TimeDiv at limit: Prompting that the timebase is up to the highest horizontal resolution under the Real-Time sampling mode.

Sampling at limit: Prompting that the sampling rate is at limit under the X-Y mode.

Save finished: Prompting that the storage progress finished.

Time/Div at limit: Prompting that the Time/Div is at limit while turning the horizontal SCALE knob to adjust timebase.

The storage is empty: Prompting that current position of the memory is empty for waveforms or settings saved.

Trigger level at limit: Prompting that the trigger level is at limit while turning the LEVEL knob.

Trigger position at limit: Prompting that the trigger position is at the start or the end point of the memory while turning the horizontal POSITION knob to adjust the trigger offset.

Volts/Div at limit: Prompting that the Volts/Div is at full range while turning the vertical SCALE knob.

Zoom factor at limit: Prompting that it is at the full range of horizontal resolution under the Ultrazoom mode while turning the horizontal SCALE knob.

Zoom position at limit: Prompting that the horizontal position of the zoom window is at limit under the Ultrazoom mode while turning the horizontal POSITION knob.

Troubleshooting

1. After the oscilloscope is powered on, the screen remains black, please inspect the instrument according to the following steps:

（1）Check the power cable's connection
（2）Check the power switch turned on
（3）After the inspections above, restart the oscilloscope
（4）If the problem still remains, please contact Protek for help

2. After the signal acquisition the waveform does not appear, please check according to the following steps:

(1) Check the probes connected with the signals
(2) Check the probes connected to the channels firmly
(3) Check the circuit generates signal on the test point
(4) Repeat the acquisition

3. The measurement result is 10 times higher or lower than the value expected.

Check if the probe attenuation is the same as the channel attenuation.

4. If the oscilloscope does not get a stable waveform display, please check according to the following steps:

(1) Check the **Trigger Source** and notice if it is set to the channel you use
(2) Check the **Trigger Type**. You should use "Edge" for normal signals, and use "Video" for TV signals.

5. After pressing the RUN/STOP button, the oscilloscope does not display a waveform on screen.

Check whether the **Trigger Mode** is set to "Normal" or "Single" and the trigger level is out of the signal range or not.
If yes, you should set the trigger level in proper range by turning the LEVEL knob or pressing the 50% key. You could also set the Trigger Mode as "AUTO". Moreover, you could push AUTO key to display the waveform on screen.

6. After the Acquisition is set to "Averages" or longer Persistence, the waveform refreshes slowly.

It is normal in these settings.

7. The signal is displayed as ladderlike waveform.

The timebase maybe too slow. You should turn the horizontal SCALE knob to increase horizontal resolution to improve the display.
Maybe the display **Type** is set to "Vectors". You should set to "Dots" mode to improve the display.

Chapter 5: Support & Service

Warranty

Protek 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 Protek distributor. If a product or LCD proves defective within the respective period, Protek 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 Protek sales and service office.

Contact Protek

Product Support: For questions about using Protek measurement products, contact:
Tel: 201-760-9898, Fax: 201-760-9888
9:00 AM–5:00 PM, EST

Or contact us by e- mail:
support@protektest.com

For a listing of Protek Distributors, visit our web site.
Web site：www.protektest.com

Chapter 6: Reference

Appendix A: Specifications

All specifications apply to the 6800 Series Digital Oscilloscopes and a probe with the Attenuation switch set to 10X unless noted otherwise. To meet specifications, two conditions must first be met:

- The instrument must have been operating continuously for twenty minutes within the specified operating temperature.

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

All specifications are guaranteed unless noted "typical".

Specifications

Acquisition		
Acquisition Modes	Real-Time	Equivalent
Acquisition Rate	100 MS/s	10GS/s
Averages	N acquisition, all channels simultaneously, N is selectable from 2, 4, 8, 16, 32, 64 and 128.	

Inputs	
Input Coupling	AC, DC, GND
Input Impedance, DC Coupling	1M Ω ±2%，in parallel with 15pF±3pF
Probe Attenuation Factors	1X, 10X, 100X, 1000X
Maximum input voltage	400V （DC+AC Peak）
Time delay between channel (typical)	150ps

Vertical	
Digitizers	8-bit resolution, each channel sampled simultaneously
VOLTS/DIV Range	2mV/div-5V/div at input BNC
Position Range	±0.5 screen
Analog BandWidth	100MHz (6810), 60MHz (6806), 40MHz (6804)
Single-shot BandWidth	25MHz
Selectable Analog Bandwidth Limit (typical)	20MHz
Lower Frequency Limit (AC)	≤5Hz (at input BNC)
Rise Time at BNC, typical	<3.5ns (6810), <5.8ns (6806), <8.8ns (6804)
DC Gain Accuracy	2mV/div-5mV/div, ±4% (Sample or Average acquisition mode) ≥10mV/div, ±3% (Sample or Average acquisition mode)
DC Measurement Accuracy, Average Acquisition Mode	Average of ≥16 Waveforms with vertical position at zero: ±(4%×reading+0.1div+1mV) at 2mV/div or 5mV/div ±(3%×reading+0.1div+1mV) at settings ≥10mV/div Average of ≥16 Waveforms with vertical position not at zero: ±[3%×(reading+vertical position)+(1% of vertical position)+0.2div] Add 2mV for settings from 2mV/div to 200 mV/div Add 50mV for settings from 500mV/div to 5V/div
Delta Volts Measurement Accuracy (Average Acquisition Mode)	Delta Volts between any two averages of ≥16 waveforms acquired under same setup and ambient conditions: ±(3%×reading + 0.05 div)

Probe	1X position	10X position
Bandwidth	DC to 6 MHz	DC to 100MHz/60MHz/40MHz
Attenuation ratio	1:1	10:1
Compensation Range	10pf-35pf Oscilloscope with 1MΩ input	
Input resistance	1MΩ±2%	10MΩ±2%
Input capacitance	85pf-115pf	14.5pf-17.5pf
Input voltage	150V RMS CAT I or 150V DC CAT I 150V RMS CAT II or 150V DC CAT II 100V RMS CAT III or 100V DC CAT III	300V RMS CAT I or 300V DC CAT I 300V RMS CAT II or 300V DC CAT II 100V RMS CAT III or 100V DC CAT III

● The probe index of different models is following its attached specification.

Horizontal	
Sample Rate Range	10S/s-100MS/s (Real-Time), 10GS/s (Equivalent)
Waveform Interpolation	(Sin x)/x
Record Length	16K samples for each channel (Fast Trigger OFF) 2K samples for each channel (Fast Trigger ON)
SEC/DIV Range	5ns/div-5s/div in 1-2-5 steps UltraZoom to 2.5ns/div
Sample Rate and Delay Time Accuracy	±100ppm over any ≥1ms time interval
Delta Time Measurement Accuracy (Full Bandwidth)	Single-shot: ±(1 sample interval+100ppm×reading+0.6 ns) >16 averages: ±(1 sample interval+100ppm×reading+0.4 ns)

Trigger		
Trigger Sensitivity, (Edge Trigger Type)	DC	CH1, CH2: 1div(DC~10MHz) EXT: 100mV(DC~10MH), 200mV(10MHz~Full) EXT/5: 500mV(DC~100MHz)
	AC	Same as DC at 50Hz and above
	LF REJ	Same as the DC- coupled limits for frequencies above 100 kHz, attenuates signals below 8kHz.
	HF REJ	Same as the DC- coupled limit from DC to 10 kHz, attenuates signals above 150 kHz
Trigger Level Range	Internal	±8 divisions from center of screen
	EXT	±1.6V
	EXT/5	±8V
Trigger Level Accuracy, (typical)	Internal	±(0.3div×Volts/div) (±4 divisions from center of screen)
	EXT	±(6% of setting + 40 mV)
	EXT/5	±(6% of setting + 200 mV)
Set Level to 50%, (typical)	Operates with input signals ≥50 Hz	
Default Settings, Video Trigger	Trigger mode is Auto and Coupling is AC	
Sensitivity, (Video Trigger Type, typical)	Internal	Pk-pk amplitude of 2 divisions
	EXT	400mV
	EXT/5	2V
Signal Formats and Field Rates, Video Trigger Type	Supports NTSC, PAL, and SECAM broadcast systems for any field or any line	

Measurements		
Cursors Measure	Manual	Voltage difference between cursors (ΔV) Time difference between cursors (ΔT) Reciprocal of ΔT in Hertz ($1/\Delta T$)
	Trace	Voltage value for Y-axis waveform Time value for Y-axis waveform
	AutoMeasure	Cursors are visible for Automatic Measurement
AutoMeasure	Vpp, Vmax, Vmin, Vtop, Vbase, Vavg, Vrms, Freq, Period, Rise Time, FallTime, +Width, -Width, Delay1->2 ⅎ , Delay1->2 Ⅼ	

General Specifications

Display	
Display Type	5.7 in. (145 mm) diagonal liquid crystal
Display Resolution	320 horizontal by 240 vertical pixels
Display Color	VGA color, 256 colors
Display Contrast	Adjustable
Backlight Intensity, typical	60 cd/㎡

Probe Compensator Output	
Output Voltage, typical	5 V into ≥1 MΩ load
Frequency, typical	1KHz, 2KHz, 6KHz

Power	
Source Voltage	100-240 Vrms (± 10%) from 45Hz through 440Hz,CATII
Power Consumption	Less than 50W
Fuse	2 A, T rating, 250 V

Environmental	
Temperature	Operating 10℃~ 40℃
	Nonoperating -20℃~ +60℃
Cooling Method	Convection
Humidity	+40℃ or below: ≤90% relative humidity
	+40℃~ +50℃: ≤60% relative humidity
Altitude	Operating 3,000 m
	Nonoperating 15,000 m

Mechanical		
Size	Height	288 mm
	Width	350 mm
	Depth	145 mm
Weight (approximate)	Nonpackaged	4.5 kg
	Packaged	5.6 kg

Adjustment Interval
The recommended calibration interval is one year

Appendix B: 6800-Series Accessories

Standard Accessories:

- Probe×2 (1.5m), 1X, 10X Passive Probes

  The passive probes have a 6MHz bandwidth with a rating of 150V CAT II when the switch is in the 1X position, and a 100MHz/60MHz/40MHz bandwidth with a rating of 300 V CAT II when the switch is in the 10X position.

- Power Cable that fits the standard of destination country.

- This User Manual

- User Registration Form

Optional Accessories:

- Communications Extension Module (RS-232)

  The Communications module plugs directly into the rear panel of any 6800-Series Oscilloscope. The module provides RS-232 compatible interface.

- Communications Extension Module (GPIB&RS-232)

  The Communications module plugs directly into the rear panel of any 6800-Series Oscilloscope. The module provides full GPIB and RS-232 compatible interface.

- UltraScope for WIN95/98/NT/2000/XP software

- Accessories case

All accessories (standard and optional) are available by contacting your local Protek office.

Appendix C: General Care and Cleaning

General Care

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

CAUTION: 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. Take 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.

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

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