TENMA®

72-2650
72-8705A
72-8710A
72-8225A
72-10510

OPERATING MANUAL

Digital Storage Oscilloscope

CE

Preface

Dear users:

Thank you for choosing the brand new Tenma device. In order to use the instrument correctly, please read the manual thoroughly, especially the safety notes, before using the device.
If you have read through the manual, it is recommended that you keep it safe along with the instrument, or in a place where it is easily accessible, should you require the information for future usages.

Copyright Information

General Safety Overview

The instrument is designed and manufactured under the safety requirement for GB4793 electric measuring instrument and IEC61010-1 safety standards. It conforms to insulation overvoltage standards CATII and safety standards of pollution level II. The following safety measures are set out to help avoid any personal injury or product damage, or damage to any products that connect with the instrument. In order to avoid any potential hazards, please be sure to use the product as stipulated.

Ensure personnel receive training before using the product.

Use correct power line: Only the dedicated power lines for the product recognized by host country can be adopted.

Correct plugging and unplugging: Do not plug in or unplug the unit while probes or testing leads are connected to a voltage source.

Product grounding: The ground lead of power supply.

In order to avoid electric shock, the ground connection must not be circumvented. Prior to connecting the input or output terminal of the product, ensure the product is grounded correctly.

Correctly connect the oscilloscope probe: The probe ground lead and the ground are of the same potential. Do not connect the ground lead with high voltage.

Check the rated values of all terminals: Check all rated values and marking on the product match local supply to avoid fire damage or electrical shock; check the product manual before connecting the product to view information on the rated values.

Do not open the cover plate of the case during operation: Do not turn on or operate the product when the external cover or panel is opened.

Use a proper fuse: Only fuse types and rated indexes designated for the product.

Avoid circuit exposure: Do not contact exposed contact or elements after powering on.

Do not operate the product if it is suspected to be malfunctioning: Seek qualified maintenance personnel for inspection.
Ensure proper ventilation.
Do not operate in a humid environment.
Do not operate in an inflammable and explosive environment.
Keep the surface of the product clean and dry.

Safety terms and symbols
The following terms may be present in the manual:

Warning: warning statements indicate conditions and actions that may endanger life.

Attention: attention statements indicate conditions and actions that may cause damages to the product and other properties.

Hazard: Indicates there is direct damage hazard close to the marking.
Warning: Indicates there is potential damage hazard close to the marking.
Attention: Indicates there is potential hazard to the product and other properties.
Symbols on the product: Such symbols may appear on the product.

High voltage

Please refer to the manual

Protective ground terminal

Shall ground terminal

Measuring ground terminal

Preface

The Manual introduces information related to the operation of digital storage oscilloscopes 72-2650/72-10510/ 72-8225A   /72-8705A/72-8710A. The manual comprises the following chapters:

Chapter I Introduction

Chapter II Instrument Setting

Chapter III System Message Example and Troubleshooting

Chapter IV Service and Support

Chapter V Technical Indexes

Appendix A: Technical Specification

Appendix B: Accessories of 72-2650/72-10510/72-8225A /72-8705A/72-8710A

Appendix C: Maintenance and Cleaning Maintenance

Appendix D: Chinese and English Panel Comparison Table

This user manual covers the following five models of DSO as shown in the table below:

Model	Bandwidth	Real-time Sampling Rate
72-2650	200MHz	1GS/s
72-8710A	100MHz	1GS/s
72-8705A	50MHz	1GS/s
72-8225A	50MHz	500MS/s
72-10510	25MHz	250MS/s

72-2650/72-10510/72-8225A /72-8705A/72-8710A provide the users with simple operation and clear functions to perform all the basic operations. Scale and position knobs of each channel provide intuitive,controls and use. In order to accelerate adjustment and facilitate measurement, the users can press the AUTO key and the instrument will then display applicable waveform and gear position settings.

Apart from easy to use,72-2650/72-10510/72-8225A/ 72-8705A/72-8710A DSO also has high performance indexes and powerful functions required for faster completion of measurement tasks. Faster signals can be observed on 250MS/s (72-1050) or 500MS/s (72-10510) or 1GS/s (72-8705A/72-8710A/72-2650) equivalent sampling. Powerful trigger and analysis ability make it easier to capture and analyse waveforms. Clear LCD and mathematical operation functions make it easier for users to observe and analyse signal problems in a faster and clearer way.

From the following parameter features, you can understand how this series of DSO can satisfy your measurement requirements.
- Two analog channels.
- High resolution LCD display resolution:
  72-2650: 320×240
  72-1050/72-10510:400×240
  72-8705A/72-8710A:800x400
- Support plug and play USB storage equipment and be capable of communicating with computer via USB storage equipment.
- Automatic waveform and state settings.
- Waveform saving and replay feature.
- Delicate window extension function and precise analysis on waveform details and overview.
- Automatic measurement of 28 waveform parameters.
- Automatic cursor tracking measurement function.
- Unique functions of waveform recording and playback.
- Built-in FFT software function.

- Multi-waveform mathematical operation function (including: addition, subtraction, multiplication and division).
- Edge, video, pulse width, alternating trigger and other functions .
- Multi-language menu selection.
- Simplified Chinese and English help information display.

Accessories of 72-2650/72-10510/72-8225A/72-8705A/ 72-8710A DSO

- Two of probes with 1:1/10:1 X selection.
- One power line.
- One User Manual .
- USB cable.
- Oscilloscope communication control software CD.

Chapter I Introductions

72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO is desk type DSO. It is designed with conventional user interface design for intuitive DSO usage for testing and measurement. This chapter will cover the following as the beginner guide to the 72-2650/72-10510 /72-8225A/72-8705A/ 72-8710A DSO:

△ 1.1 Get to know the User Interface

△ 1.2 General inspection

△ 1.3 Functional inspection

△ 1.4 Probe compensation

△ 1.5 Automatic settings of waveform display

△ 1.6 Introduction to the vertical system

△ 1.7 Introduction to the horizontal system

△ 1.8 Introduction to the trigger system

1.1 Get to know the User Interface

Gaining familiarity with the different parts of the user interface of the 72-2650/72-10510/72-8225A /72-8705A/

72-8710A DSO is important for use and the operation of the DSO. The user interface of 72-2650/72-10510/ 72-8225A /72-8705A/72-8710A DSO consist of:

● Vertical control

● Horizontal control

● Trigger control

● LCD display area

● Function buttons (F1, F2, F3, F4, F5)

● User menu area

● Input terminal (CH1, CH2, EXT TRIG)

● Multi-purpose knob

● USB interface

72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO are shown on the figure 1-1 and figure 1-2.
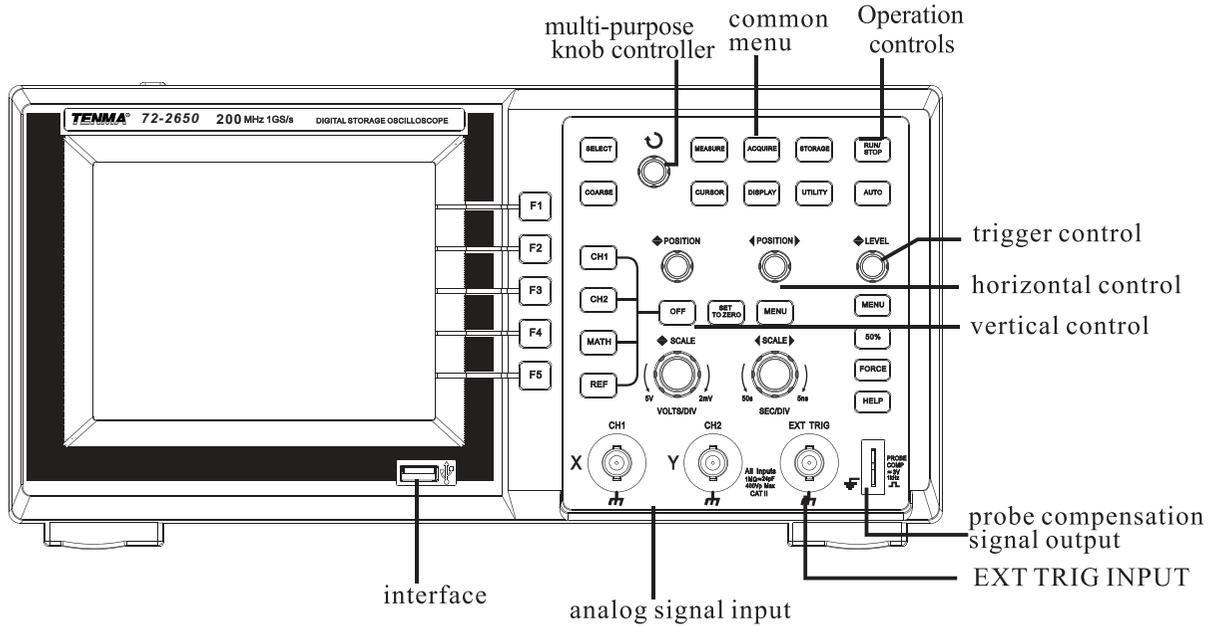
Figure 1-1: 72-2650 DSO Panel Diagram - 5.7-inch TFT color LCD display
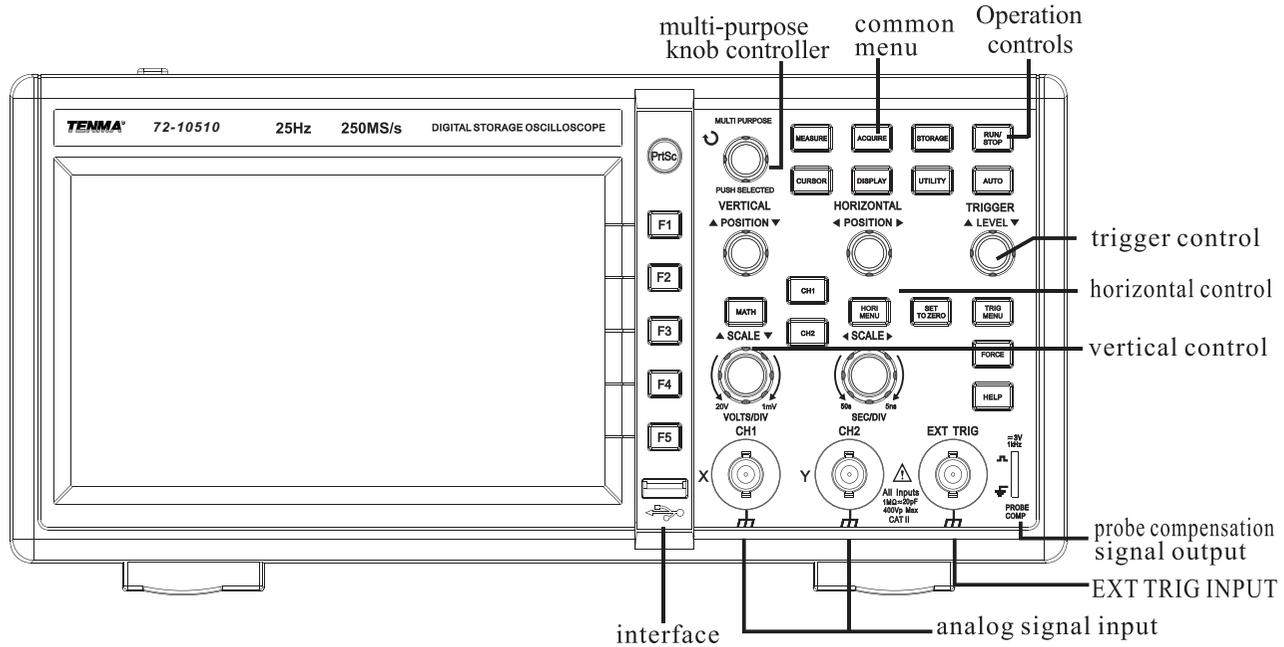
Figure 1-2: 72-10510/72-8225A/72-8705A/72-8710A DSO Panel Diagram -7-inch TFT color LCD display

display of horizontal trigger position

display of trigger status

time display of central scale line

mark of
channel 1

Menu varies with
different function
keys.

mark of
channel 2

waveform
display window

vertical scale
coefficient of
display channel

display setup of
main time base
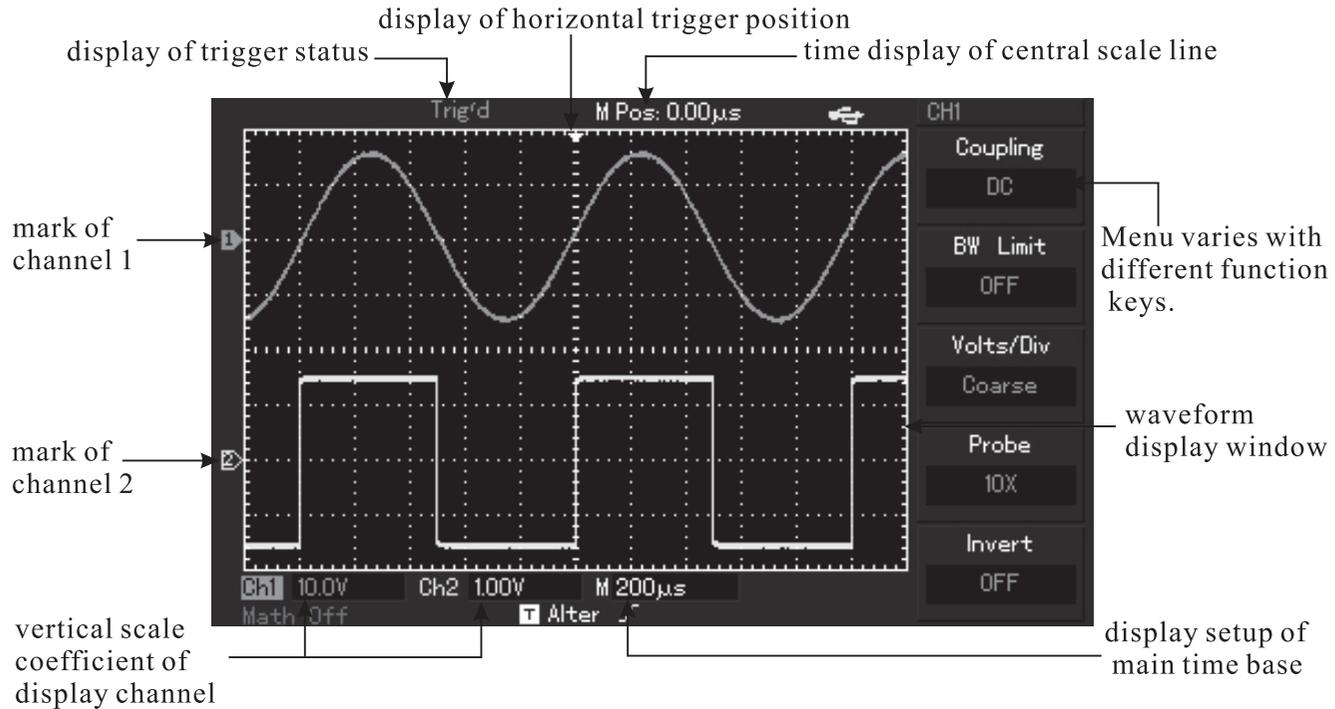
DSO User Interface Menu Display (72-10510 pictured)

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1.2 General Inspection

After purchasing a new 72-2650/72-10510/72-8225A / 72-8705A/72-8710A DSO, we recommend you to inspect the instrument according to the following steps.

1. Inspect whether there is any damage caused by transit.

In case of damage to the packing box or foamed plastic packaging materials, contact your point of purchase.

2. Accessories inspection.

For provided accessories details, description has been made in aforesaid "accessories of 72-2650/72-10510/ 72-8225A /72-8705A/72-8710A DSO" item of this user manual. Please check whether there are any accessories missing. If any of the items are missing or damaged please contact your point of purchase.

3. Check the complete instrument.

In case of damages to the appearance of the instrument, abnormal operation or failure to pass the performance tests, please contact the Tenma product distributors or local Tenma offices.

If the instrument is damaged due to transportation, please pay attention to keeping the package, notify transportation department and Tenma product distributors and Tenma will make arrangement for repair or replacement.

Warning: Please ensure that the DSO has been safely grounded to avoid hazard.

1.3 Function Inspection

Conduct a fast function inspection to verify whether the instrument is in normal operation. Please take the following steps:

Power on the instrument

Power on the instrument with a voltage supply of AC 100 to 240VAC and frequency of 45 to 440Hz. After powering on, press UTILITY menu and wait for 30min, and then press F1 auto calibration. At the next menu level, press the F1 button again at the "factory settings" as shown in Figure 1-4.

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Figure 1-4

Warning: please confirm that the DSO has been safely grounded to avoid hazard.

DSO accessing to signal

①. 72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO has two input channels with an additional external trigger input channel. Please check the signal according to the following steps. Connect DSO probe to CH1 input terminal and set the attenuation rate switch on the probe as 10× (Figure 1-5)

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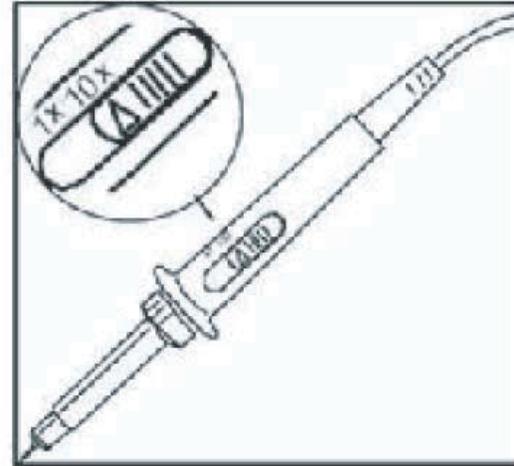
Figure 1-5 Setting of Probe Attenuation Rate Switch

②. It is necessary to set probe attenuation coefficient on DSO. Attenuation coefficient changes the vertical gear position rate of the instrument, thus making the measurement result correctly reflect the amplitude of measured signals. Probe attenuation coefficients are set in the following ways:

Press F4 to make the menu display 10×

Probe ratio
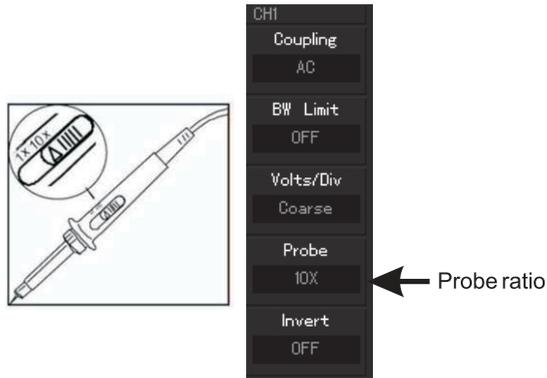
Figure 1-6 Setting of attenuation coefficient on DSO

③. Connect the probe pin and ground clamp to the corresponding terminal of the probe compensation signal. Press AUTO key. Within several seconds, square wave display (1kHz, about 3V, peak-to-peak value) is as shown in Figure 1-7. Check CH2 in the same way; press OFF

function key to close CH1; press CH2 function key to turn on CH2; repeat step 2 and step 3.
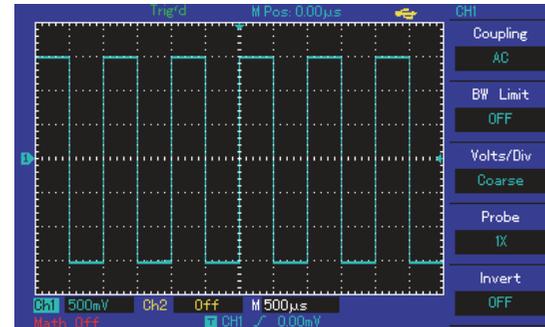
Figure 1-7 Probe Compensation Signal

1.4 Probe Compensation

When connecting the probe with any input channel for the first time, it is required to make the adjustment each, matching the probe with input channel. Probe use without compensation will lead to measurement error. In case of probe compensation, follow the following

steps:

1. Set the probe menu attenuation coefficient as 10×, place the switch on the probe at 10× and connect the DSO probe with CH1. Connect the probe end and signal output connector to the probe compensator, the ground clamp and ground lead connector of the probe compensator, turn on CH1 and press AUTO .

2. Observe displayed waveform

Over-compensation   Correct compensation   Under-compensation
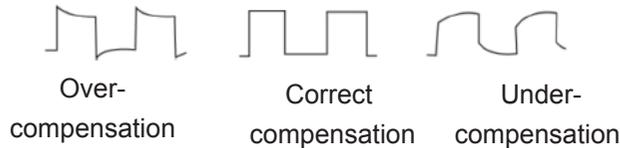
Figure 1-8a Probe Compensation and Correction

If the screen displays "under-compensation" or "over-compensation" for waveform as shown in the above figures, use a screwdriver with a nonmetal handle to adjust the variable capacitance on the probe until the screen displays "correct compensation" for the waveform as shown in the below figure.

Figure1-8b:Correct compensation

Warning: In order to avoid electric shock when measuring high voltage with the probe, please ensure that the insulation lead of the probe is in good condition and do not touch the metal part of the probe when connected to a high voltage power supply.

1.5 Automatic Settings of Waveform Display

72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO has automatic setting function. According to input signals, the DSO automatically adjusts the vertical deflection factor, scanning time base and trigger mode until the most appropriate waveform is displayed. To apply the automatic setting, the frequency of the measured signal is required to be ≥ 50Hz and the duty ratio is > 1%.

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Apply automatic setting

1. Connect the measured signal to the signal input channel.

2. Press AUTO key. DSO will automatically set its vertical deflection factor, scanning time base and trigger mode. If further careful observation is required, adjustment can be conducted again after automatic settings until the waveform display reaches the required optimum effect.

1.6 Introduction to The Vertical System

As shown in the figure below, there are a series of keys and knobs in the vertical control area. The instructions below will guide you with controlling the vertical system.

72-2650 vertical control panel (Left)
72-10510/72-8225A /72-8705A/72-8710A vertical control panel (Right)
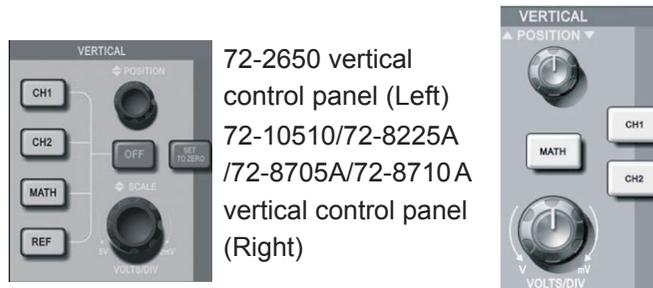
Figure 1-9 Vertical Control Area on the Panel

1. Use the vertical position knob to move the vertical position of the waveform display on the LCD screen. By default, the waveform should be displayed at the centre of the screen.

2. The user should see the waveform move vertically upward and downward when the knob is rotated.

3. The user can also change the waveform scale by rotating the Scale Knob on the vertical system. Please notice that the "V/div" will be changed to indicate the corresponding vertical scale level.

4. The user can enable/disable the input channel by pressing the [CH1] and [CH2] button on the vertical system (For 72-10510/72-8225A/72-8705A/72-8710A DSO).

Attention:

To disable the input channel for the 72-2650 DSO, please press the [OFF] button on the vertical system.

All of the other vertical system settings will be explained in greater detail in chapter II of this user manual.

1.7 Introduction to The Horizontal System

As shown in the figure below, there is one key and two knobs within the horizontal control area. The instructions below will guide you with setting the horizontal time base.

72-2650 horizontal control panel (Left)
72-10510/72-8225A/72-8705A/72-8710A horizontal control panel (Right)

Figure 1-10 Horizontal Control Area on the Panel

1. Use the horizontal SCALE knob to change the gear position settings of the horizontal time base and observe the changes of state information. Turn the horizontal SCALE knob to change the "s/div" time base gear position, and you can findthat corresponding changes have taken place in the time base gear position display of the corresponding channel in the status bar.

Horizontal scanning rate steps up in multiples of 1,2 and then 5, e.g. 1ms/div->2ms/div->5ms/div->10ms/div…. etc.

*Note: the horizontal time base range of different 72-2650/72-10510/72-8225A /72-8705A/72-8710A varies between 2ns/div to 50s/div. Details are listed in technical specification.

2. Use the horizontal POSITION knob to adjust the horizontal position of the signal in the waveform window. The horizontal POSITION knob controls the trigger position of the input signal. When applying to trigger position and turning the horizontal POSITION knob, it is possible to observe the horizontal movement of the waveform along with POSITION knob turning.

All of the other horizontal system settings are explained in greater detail in chapter II of this user manual.

1.8 Introduction to The Trigger System

As shown in Figure 1-11, there is one knob and three (or two) keys in the trigger menu control area. The instructions below will guide you with the setting of the trigger system.

All of the other trigger system settings are explained in more detail in chapter II of this user manual.

72-2650 trigger control panel

72-10510/72-8225A/72-8705A/72-8710A trigger control panel

Trigger Menu Display

Figure 1-11 Trigger Menu on the Panel

Chapter II Instrument Settings

Until now, a basic explanation has been given for controlling 72-2650/72-10510/72-8225A/72-8705A/72-8710A DSO at the vertical, horizontal, and trigger systems. We recommend you to repeat Chapter I if you are still not familiar with the basic control of the operations.

In this chapter, you will be learning about different settings related to the 72-2650/72-10510/72-8225A/72-8705A/72-8710A DSO:

2.1 Set The Vertical System
(CH1 , CH2 , MATH , REF , OFF)

2.2 Set The Horizontal System
(MENU or HORI MENU)

2.3 Set The Trigger System
(MENU , TRIG MENU , 50% and FORCE)

2.4 Set The Acquire System (ACQUIRE)

2.5 Set The Display System (DISPLAY)

2.6 Set The Storage and Load System (STORAGE)

2.7 Set The Utility System (UTILITY)

2.8 Set The Measurement Parameters (MEASURE)

2.9 Set The Cursor Measurement (CURSOR)

It is advised that you to read this chapter carefully to understand multiple measuring functions and system operation methods of 72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO.

2.1 Set The Vertical System

Each channel for 72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO can be set independently through the vertical system menu. After pressing CH1 or CH2 function key, the system shall display the function menu of CH1 or CH2 channel. See Table 2-1 below for description.

Function Menu	Setting	Description
Coupling	AC	Block the DC component of input signal.

Coupling	DC	Pass through DC and AC components of input signal.
	Grounding	Disconnect input signal.
Bandwidth Limited	On	Limit bandwidth to 20MHz to reduce displayed noise. Full bandwidth.
	Off	Turn off bandwidth limited.
V/div	Rough adjustment	Set vertical deflection factor by coarse adjustment based on 1-2-5 scale. Rough adjustment setting range is further subdivided for fine adjustments to improve vertical resolution.
	Fine adjustment	
Probe	1× 10× 100× 1000×	Please set the probe compensation system ratio to match the probe attenuation coefficient of the probe to be used.
Inverting	On	Activate reverse function of waveform. Waveform will be displayed reversely.
	Off	Waveform is displayed normally.

Setting coupling channel

The following example shows how to change the coupling of the input channel. If the measured signal connected to the CH1 channel is a sinusoidal signal containing DC component, press F1 to select AC coupling, to set the CH1 into AC coupling mode. The DC component of the measured signal is blocked.

The Waveform display is shown in the figure below.
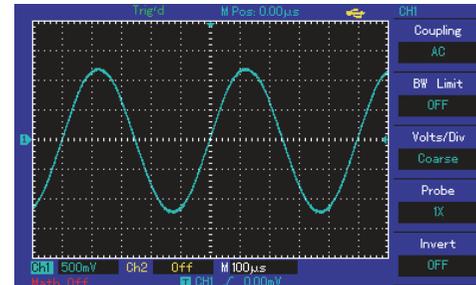
Figure 2-1 Blocked DC Component of Signal

If you press F1 to select DC coupling, setting both the DC and AC components of measured signals at

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the CH1 channel as shown in the figure below.
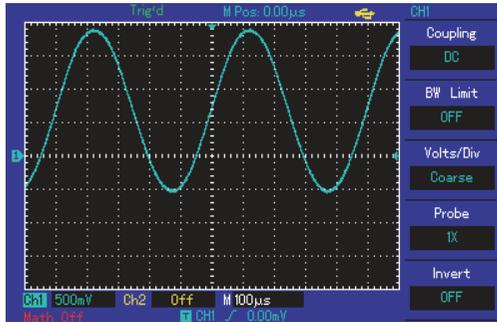
Figure 2-2 Simultaneous Display of Signal DC and AC Components

If you press F1 to select as grounding , to set CH1 to connect to the internal ground of the instrument, both DC and AC components of the input signal are blocked. The waveform display is shown in the figure below. (Note: although no waveform is displayed on the screen in this mode, the input signal is still connected with the

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channel circuit.)
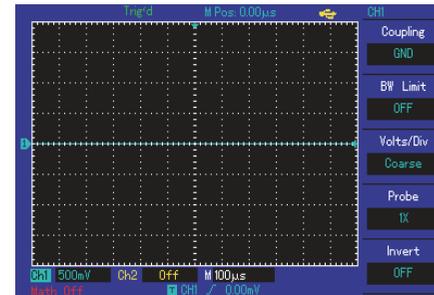
Figure 2-3 Simultaneous Blocking of Signal DC and AC Components

Setting channel bandwidth Limited

The following example shows how to change the bandwidth limited of the input channel. Assuming that the input signal is a 40MHz sinusoidal signal, connect to CH1. If you press F2 to set bandwidth limited as OFF, there will not be any bandwidth limited to CH1. You can see all the high-frequency components in measured signal as the waveform display is shown in

the figure below.
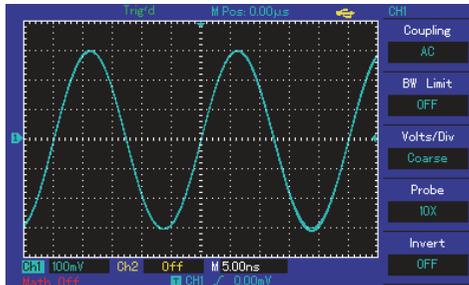
Figure 2-4 Waveform Display When Setting
Bandwidth Throttling in OFF Position

If you press F2 again to set the bandwidth limited
as ON, the noises or high-frequency component over
20MHz in measured signal shall be attenuated,
as the waveform display shows in the figure below.
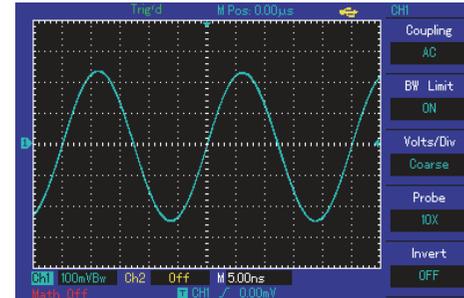
Figure 2-5 Waveform Display When Setting
Bandwidth Throttling as ON

Setting probe Rate

In order to function with the attenuation coefficient
setting of probe, it is required to set the probe attenuation
coefficient in the channel function menu. If the probe
attenuation coefficient is 10:1, the probe coefficient in the
channel function menu shall be set to 10× and
vice-versa.

You can press the F4 function key to select a different

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probe coefficient for the input channel as shown in the figure below.
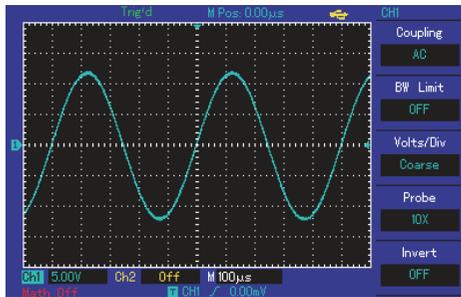
Figure 2-6 Probe Attenuation Coefficient
Setting in Channel Menu

Vertical V/div adjustment setting

Adjustments of vertical deflection factor V/div gear position can be set to coarse adjustment and fine adjustment by pressing the F3 function key.

Coarse adjustment, V/div can be adjusted in steps of 1,2 and 5,

e.g. 10mV/div->20mV/div ->50mV/div…. etc.

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Fine adjustments refer to changing the deflection factor with smaller stepping within the current vertical gear position range.
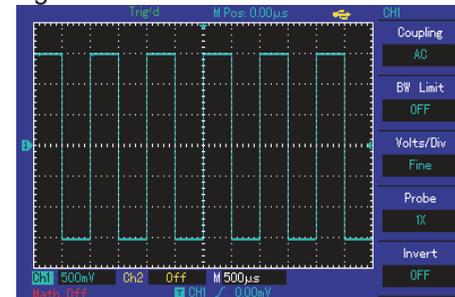
Figure 2-7 Coarse and Fine Adjustment of
Vertical Deflection Factors

Settings of waveform inverting

Waveform inverting can be set by the F5 function button. The measured input signal will display with 180 degrees difference (vertically inverted) if the waveform inverting is ON. Please see Figure 2-8 for a non-inverted

waveform and Figure 2-9 for an inverted waveform.
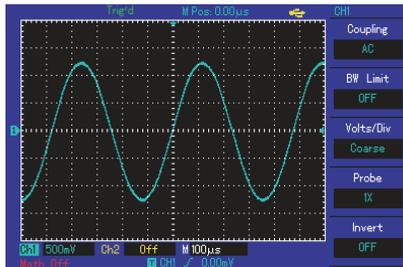
Figure 2-8 Vertical Channel Inverted
Settings (Invert: OFF)
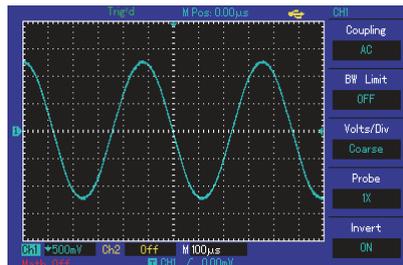
Figure 2-9 Vertical Channel Inverted
Settings (Invert: ON)

Mathematical operation function

72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO support mathematical operation function for the input signals. Figure below show the match result for CH1 + CH2 as an example.
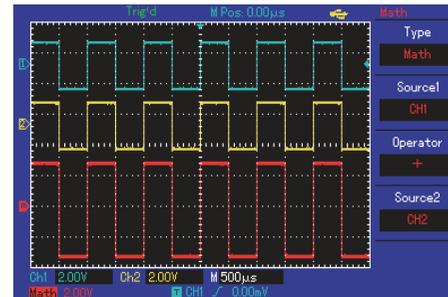
Figure 2-10 Mathematical Operation

After pressing the MATH button at the menu area the mathematic operations will be enabled.

By pressing F1 on the math menu, you can select mathematic operation or FFT operation.

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Table 2-2: Math Menu

Function Menu	Settings	Description
Type	Math	Mathematic operation
Signal source 1(F2)	CH1 CH2	You can select signal source 1 as CH1 or CH2
Operator (F3)	+ − × ÷	Signal source 1 + signal source 2 Signal source 1 - signal source 2 Signal source 1 × signal source 2 Signal source 1 ÷ signal source 2
Signal source 2 (F4)	CH1 CH2	You can select signal source 1 as CH1 or CH2

FFT spectral analysis

By pressing the F1 button again in mathematical operation mode to enter FFT (fast fourier transform) operation, the time domain (YT) signal can be converted into frequency domain signal.

At FFT operation, it is convenient to observe signals of the following types:

● Measure harmonic content and distortion in the system.

● Display noise characteristic in DC power supply.

● Analyse vibration.

Table 2-3: FFT Menu Description

Function Menu	Settings	Description
Type	FFT	FFT mathematical operation
Signal source (F2)	CH1 CH2	Set to select CH1 or CH2 as waveform to be transform
Window (F3)	Hanning Hamming Blackman Rectangle	Set to select Hanning, Hamming, Blackman, or Rectangle window function
Vertical unit (F4)	Vrms dBVrms	Set vertical units as Vrms or dBVrms

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FFT operation skills

Signal with DC component or deflection will lead to error or deviation of FFT waveform component. AC coupling mode can be selected to reduce DC component. In order to reduce random noise of repeated or single pulse events and aliasing frequency components, the acquiring mode of DSO is set to be average acquiring.

Select FFT window

Assuming that YT waveform is continuously repeated, DSO shall conduct FFT conversion for time record with finite length. In this case, when the cycle is an integer, YT waveforms are of the same amplitude at the starting and ending positions, without interrupting. However, if the cycle of YT waveform is not an integer, the waveform amplitudes shall be different at starting and ending positions. Therefore, high-frequency transient interruption shall occur at the joints. In frequency domain, this effect is called leakage. Therefore, in order to avoid the generation of leakage, by multiplying original waveform by a window function, the value at forced starting and ending positions is 0. See the table below for window function application:

Table 2-4 FFT window function

FFT Window	Features	The most suitable measurement content
Rectangle	The best frequency resolution and the worst amplitude resolution. It is basically similar to the condition without window.	Signal levels, before and after transient state or short pulse, are basically equal. Constant amplitude sinusoid with very similar frequency possesses bandwidth random noise with slow spectrum change.
Hanning	Compared with rectangular window, it has better frequency resolution and worse amplitude resolution.	Random noise of sine, cycle and narrow-band.

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Hamming	The frequency resolution of Hamming window is slightly superior to Hanning window.	Signal levels, before and after transient state or short pulse, are of large difference.
Blackman	The best amplitude resolution and the worst frequency resolution.	Mainly used for single frequency signal seeking for higher subharmonic.

Explanation of nouns

FFT resolution: defined as the quotient of sampling and operation point. When the number of operation points are fixed, the lower the sampling rate is, the better the FFT resolution will be.

Nyquist frequency: for waveform with maximum frequency of f, at least 2f sampling rate is required to reconstruct original waveform. It is also called Nyquist rule, where f refers to Nyquist frequency, while 2f refers to Nyquist sampling rate.

Load a Reference Waveform

Any of the pre-saved waveforms can be loaded by pressing the $\boxed{\text{REF}}$ button on the 72-2650 DSO. For 72-10510/72-8225A/72-8705A/72-8710A, pressing the $\boxed{\text{STORAGE}}$ button will load the pre-saved waveform. Please see the "Storage and Load" section for how to save a waveform.

After pressing the $\boxed{\text{REF}}$ button, the user should be able to select two of the RefA $\boxed{\text{F1}}$ and RefB $\boxed{\text{F2}}$ on the function menu to load the pre-saved waveform.

Assume that you select RefA, you will be able to see the load function menu as below.

Table 2-5 Load function menu

Function Menu	Settings	Description
Source (@)	1~20	Destination (Position of the internal memory) where the waveform will be loaded. There are 20 sets of internal memory available to storewaveforms navigated by the multipurpose knob.

Disk (F2)	DSO	Select to load a pre-saved waveform from the internal memory of the DSO
	USB	Select to load a pre-saved waveform from the external USB device (selection can only be available after inserting USB)
OFF (F3)	———	Turn off reference waveform
Load (F4)	———	Press to load a pre-saved waveform

Assuming that the user has already stored a waveform into DSO internal memory location 3. To load this waveform back to RefA, the user should do the following at the Load function menu.

Select the memory location 3 by using the multi-purpose knob.

Press F4

A loading progress bar will be shown on the screen.

If loading successfully, a white waveform should be displayed on the screen label with RefA.

If there is no waveform stored at the selected memory location, you will see a system message showing "no data in the position".

The user can turn off the RefA reference waveform by pressing the OFF F3 button on the load function menu.

Attention:

Loading the pre-saved waveform into RefB follows the same procedure as above.

If waveform is stored to the USB device, there should be 200 available memory locations to be selected. Please see the "Storage and Load" section for how to save a waveform to the USB device.

2.2 Set The Horizontal System

Horizontal control knob

Using the horizontal control knob can change the horizontal scale (time base) and trigger horizontal position (trigger position) in internal storage. The vertical midpoint in screen horizontal direction is the time reference point of waveform. Changing of the horizontal scale can lead

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to expansion or contraction of the waveforms relative to the screen centre. When the horizontal position changes, the position relative to waveform trigger point will be changed.

The horizontal system can be controlled by the following panel of buttons/knobs.
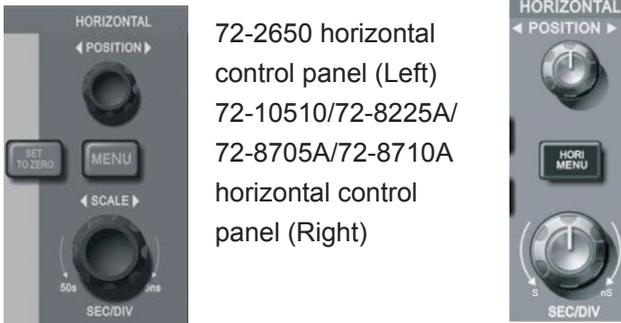
72-2650 horizontal control panel (Left) 72-10510/72-8225A/ 72-8705A/72-8710A horizontal control panel (Right)

Figure 2-11 Horizontal System Interface

The horizontal position control knob is used to adjust the horizontal position of channel waveform (including mathematical operation). The resolution of the horizontal position control knob varies at different time bases.

The horizontal scale control knob is used to change the time base of the channel waveform, by shown as s/div. If the extension time base is turned on, the window width will be changed due to the delay in the scanning time base through turning the horizontal scale knob.

Horizontal menu button: the user can press to enter the horizontal menu function. (See table below)

Table 2-6 HORI MENU / MENU

Function Menu	Settings	Description
Main time base (F1)	———	Press to turn on the main time base
———		
Window extension (F3)	———	Press to turn on the extension time base
———		
Trigger hold-off (@)	———	To adjust the trigger hold-off time by multi-purpose knob

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The Window extension time base function is used to observe the waveform detail for a given window of the waveform. The user can enable this function by pressing the ⌐F3⌐ button at the horizontal function menu.

Horizontal extension of the waveform

Extension time base

Horizontally extended part of the waveform
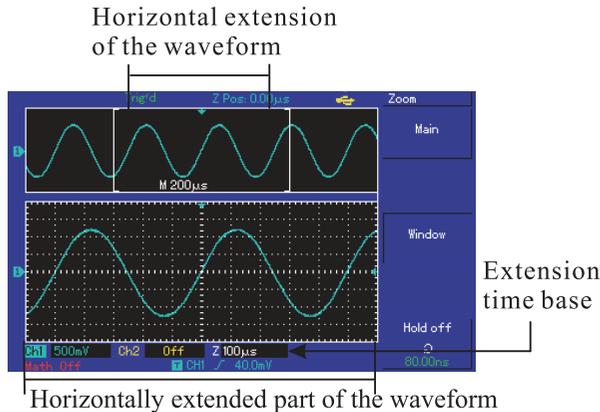
Figure 2-12 Screen Display under Window Extension

Under Window extension time base, there are two display areas, as shown in the figure above. The original waveform is displayed in the upper part, this area can be moved left and right by turning the horizontal POSITION knob or can be enlarged and reduced by turning the horizontal SCALE knob.

The waveform generated through horizontal extension time base of the selected original waveform area shall be displayed in the lower part. As the waveform displayed in the whole lower part corresponds to the selected area in the upper part, the extension time base can be enhanced by turning the horizontal SCALE knob to reduce the selected area of the waveform.

Trigger hold-off time adjustment

Trigger hold-off time is the time interval between two trigger events (100ns by default).

Trigger hold-off time can be adjusted by using the multi-purpose knob at the horizontal function menu.

During trigger hold-off, DSO will not be triggered by any new events until the hold-off time is over. For example, if a set of pulse train shall be triggered from the first pulse upon request, then the hold-off time can be set as the

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pulse train width. As shown in Figure 2-13.
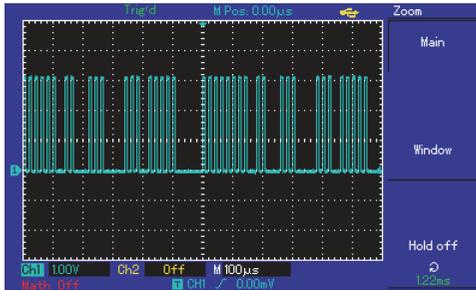
Figure 2-13 Trigger Hold-off for Synchronization
of Complex Waveform

The trigger setting of a DSO decides when the data of the waveform starts to be collected and displays on the screen. Once the trigger is correctly set, it can convert unstable display into meaningful waveform display.   Data acquisition of a DSO starting trigger conditions satisfied. After a signal trigger is detected, DSO will continuously collect data and display the waveform on the right of the trigger point. The trigger control area of the DSO operation panel includes: trigger level adjustment knob; trigger menu key: TRIG MENU for 72-10510/72-8225A/ 72-8705A/72-8710A and [MENU] for 72-2650. For the 72-10510/72-8225A/72-8705A/72-8710A DSO, it can set the trigger level to be at 50% of signal vertical midpoint by the 50% button. For the 72-10510/72-8225A DSO, it is achieved by pressing SET TO ZERO key. Forcing trigger shall be achieved by pressing FORCE button. FORCE trigger is a trigger signal generated by force and is mainly applied in trigger mode and "normal" and "single" mode.

2.3 Set The Trigger System

Trigger level knob: trigger knob is used to adjust the trigger level (to set the voltage level corresponding to trigger point).

Trigger Type

72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO support: edge, pulse width, video trigger and alternative trigger;
Edge Trigger: Edge trigger mode refers to the triggering

of the trigger threshold on the input signal edge.

Pulse Width trigger: trigger produces when the pulse width of the trigger signal satisfies some set trigger >, < or = condition.

Video Trigger: conduct field or line trigger for standard video signal. The triggering can be enabled by pressing the [F1] button at the [TRIG MENU] for the 72-10510/ 72-8225A/72-8705A/72-8710A DSO, by pressing [F1] button at the [MENU] for the 72-2650 DSO;

Alternating trigger: applicable to trigger signals without frequency correlation.

All kinds of trigger menus shall be respectively described as follows.

The user can enable the alternating trigger by pressing [F2] button at the [TRIG MENU] for the 72-10510 / 72-8225A/ 72-8705A/72-8710A DSO, or by pressing [F2] button at the [MENU] for the 72-2650 DSO.

Edge trigger

Edge trigger mode refers to the triggering of trigger threshold on the input signal edge. When selecting "edge trigger", trigger on the rising edge or falling edge of input signal shall be completed.

Table 2-7

Function Menu	Settings	Description
Type	Edge	
Source (F2)	CH1	Set CH1 as the triggering signal source
	CH2	Set CH2 as the triggering signal source
	EXT	Set external trigger input channel as the triggering signal source
	EXT/5	Set external trigger source (divided by 5) as trigger level range (Only for 72-2650)
	AC Line	Set AC power line as trigger source
	Alter	Set to Alternative trigger between CH1 and CH2 as signal source

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Slope (F3)	Rising	Set trigger on the signal rising edge
	Falling	Set trigger on the signal falling edge
	Rise/fall	Set trigger on the signal both rising and falling edge
Mode (F4)	Automation	Set to automatic trigger. The DSO will continuously perform data acquisition without triggering signal.
	Normal	Set to normal trigger. The DSO will only perform data acquisition when there is a triggering signal.
	Single	Set to single trigger. The DSO will only perform 1 cycle of the data acquisition when there is a triggering signal.
Trigger coupling (F5)	AC	Block the DC component of the triggering signal
	DC	Pass through DC and AC components of the triggering signal

Trigger coupling (F5)	High-frequency rejection	Reject high-frequency components of the triggering signal (over 80kHz signals)
	Low-frequency rejection	Reject low-frequency components of the triggering signal (below 80kHz signals)

Pulse width trigger

For pulse width trigger, the trigger time shall be subject to the pulse width of the triggering signal. You can capture abnormal pulse by setting pulse width conditions.

Table 2-8

Function Menu	Settings	Description
Type	Pulse width	
Source (F2)	CH1	Set CH1 as the triggering signal source
	CH2	Set CH2 as the triggering signal source
	EXT	Set external trigger input channel as the triggering signal source

Source (F2)	EXT/5	Set external trigger source (divided by 5) as trigger level range (Only for 72-2650)
	AC Line	Set AC power line as trigger source
	Alter	Set to Alternative trigger between CH1 and CH2 as signal source
Pulse width conditions (F3)	>	Trigger when pulse width is greater than pulse width setting values
	>	Trigger when pulse width is less than pulse width setting values
	=	Trigger when pulse width is equal to pulse width setting values
Pulse width setting (@)		Set the pulse width to between 20ns~10s by using the multi-purpose knob on the front panel
Next page 1/2	———	Go to next page

Type	Pulse width	Set the positive pulse width as trigger signal. Set the negative pulse width as trigger signal.
Trigger polarity (F2)	Positive	Set the positive pulse width as trigger signal
	Negative	Set the negative pulse width as trigger signal
Mode（F3）	Automation	Set to automatic trigger. The DSO will continuously perform data acquisition without a triggering signal.
	Normal	Set to normal trigger. The DSO will only perform data acquisition when there is a triggering signal.
	Single	Set to single trigger. The DSO will only perform 1 cycle of the data acquisition when there is a triggering signal.

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Trigger coupling (F4)	AC	Block the DC component of the triggering signal
	DC	Pass through DC and AC components of triggering signal
	High-frequency rejection	Reject high-frequency component of the triggering signal (over 80kHz signals)
	Low-frequency rejection	Reject low-frequency component of the triggering signal (below 80kHz signals)
Previous page 2/2	_____	Go to previous page

Video trigger

72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO support video trigger compactable to NTSC or PAL standard video signals. Trigger coupling will automatically preset to DC coupling if the video trigger is active. Video trigger menus are shown in the table below:

Table 2-9 Video Trigger Setting

Function Menu	Settings	Description
Type	Video	
Source (F2)	CH1	Set CH1 as the triggering signal source
	CH2	Set CH2 as the triggering signal source
	EXT	Set external trigger input channel as the triggering signal source
	EXT/5	Set external trigger source (divided by 5) as trigger level range (Only for 72-2650)
	AC Line	Set AC power line as trigger source
Standards (F3)	PAL	Select to PAL video standard
	NTSC	Select to NTSC video standard
Synchronization (F4)	All lines	Set trigger synchronize to video line
	Designated line	Set trigger to synchronize in designated video line number. Adjust video line number by using the multipurpose knob in the upper part of front panel.

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Figure 2-14 is an example screen display when PAL video trigger model is selected as standard and synchronization mode is All Line Synchronization.
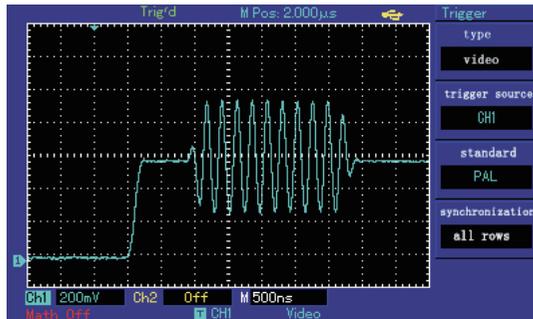
Figure 2-14 Video Trigger: Line Synchronization

Figure 2-15 is an example screen display when PAL video trigger model is selected as standard and synchronization mode is set to field synchronization.
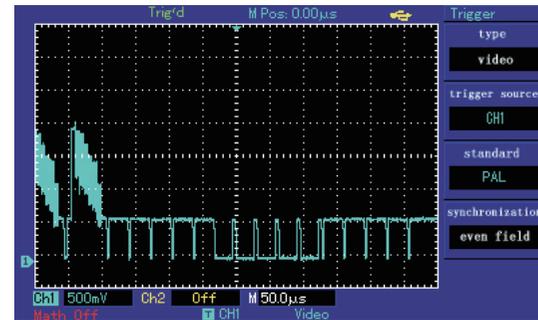
Figure 2-15 Video Trigger: Field Synchronization

Alternating trigger

During alternating trigger, the trigger signal comes from two input channels, CH1 and CH2 alternatingly. Alternating trigger is useful for observing two signals with different frequency. See the figure below for display of triggered alternating waveform example and Table 2-10 for triggered alternating menu setting:

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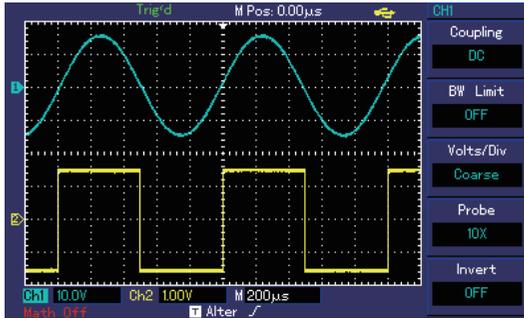
Figure 2-16 Observing Signals with Two
Different Frequencies by Alternating
Trigger Mode

Table 2-10 Alternating Trigger Mode Setting

Function Menu	Settings	Description
Type	Edge	Edge-triggered mode is set
Trigger source	Alternating	CH1 and CH2 alternating trigger
Slope	Ascending	Rising edge is set for trigger slope
Trigger mode	Automation	Auto-triggered mode is set
Trigger coupling	AC	AC trigger coupling mode is set

Force trigger

Force trigger can be understood as forcing the DSO to refresh the data acquisition process, so the user can observe the waveform being captured. To enable the force trigger, press the FORCE button. One of the very useful applications for force trigger is at the "normal" and "single" triggering mode. When the triggering signal does not present, DSO will stop data acquisition. You can press the force trigger to re-enable the data acquisition of the DSO to see the current input signal.

Explanation of nouns

1. Trigger source: trigger can be achieved from several signal sources: input channels (CH1 and CH2), external triggers (EXT and EXT/5) and AC line.

■**External trigger (EXT TRIG):** meaning to set the triggering source base on given external connection to the "EXT TRIG" input channel. This can be a significant application for 72-2650/72-10510/72-8225A /72-8705A/72-8710A to perform data acquisition using CH1 and CH2 based on an external clock signal connects to the

 "EXT TRIG" input channel. External trigger signal connects to "EXT TRIG" input terminal is used for EXT and EXT/5 trigger source selection. When selecting EXT as trigger source, the external trigger levels voltage range is limited to -3V and +3V. Whereas, if EXT/5 is selected as trigger source, external trigger level voltage range can be expanded to -15V-+15V. (EXT/5 is only available for 72-2650)

■**AC line trigger:** use AC line power as trigger source. This can be significant application to observe the signals correlated to AC line power for applications in lighting equipment and power supply equipment R&D development.

2. Trigger mode: deciding the behavioural pattern of DSO under no trigger event conditions. Three trigger modes are provided for DSO: auto, normal and single.

■**Auto trigger:** Set to automatic trigger mode. The DSO will continuously perform data acquisition without triggering signal. When there is trigger signal, DSO will automatically synchronise with the trigger signal.

Attention: when scanning, the waveform is set as 50ms/div or slower time base, no trigger signal is allowed under "auto trigger" mode.

■**Normal trigger:** Set to normal trigger mode. The DSO will only perform data acquisition when trigger conditions are satisfied. When the trigger condition is not satisfied, DSO stops data collection.

■**Single trigger:** Set to single trigger mode. The DSO will only perform one cycle of data acquisition when trigger conditions are satisfied. When the trigger condition is not satisfied, DSO stops data collection.

2.4 Set the Acquire System

   The user can change the data acquisition setting of the DSO by pressing the ACQUIRE button as shown in the figure below 72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO.

72-2650 DSO

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72-10510/72-8225A/72-8705A/72-8710A

Figure 2-17 Function Key of Sampling System

While ACQUIRE button is pressed, the function menu
will change to set the data acquisition setting for the DSO.

Table 2-11 Acquire Menu

Function Menu	Settings	Description
Acquisition Mode (F1)	Sampling	Set to sampling acquisition mode.
	Peak value	Set to peak value acquisition mode.
	Average	Set to average acquisition mode.
Averages (@)	2~256	At the average sampling mode, set average number by using the multipurpose knob (Average number can be set to 2,4,8,16,32,64,128,256)

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Sampling (F3)	Real-time	Set to Real-time sampling.
	Equivalence	Set to Equivalent sampling.
Fast Acq (F4)	ON	Turn on fast acquiring. Waveform capturing rage up to at 2k waveform/second.
	OFF	Turn off fast acquiring.

By changing the acquisition setting of the DSO, the user
can observe the input signal in a different manner. The
example below is a noise waveform acquired by different
acquisition setting of the 72-2650/72-10510/72-8225A /
72-8705A/72-8710A DSO.

Figure 2-18 shows the original signal using sampling
acquisition, the user can see that the waveform display is
very noisy.

Figure 2-19 shows the same signal with average
acquisition of a 32 number, please observe that the
waveform display becomes much smoother.
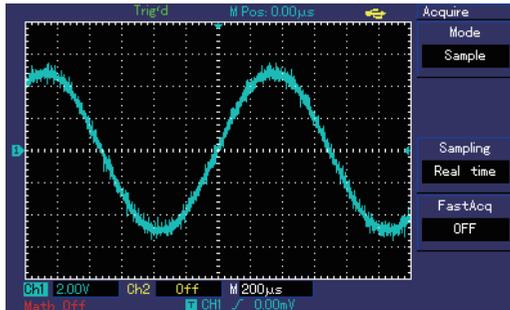
Figure 2-18 Waveform using sampling method
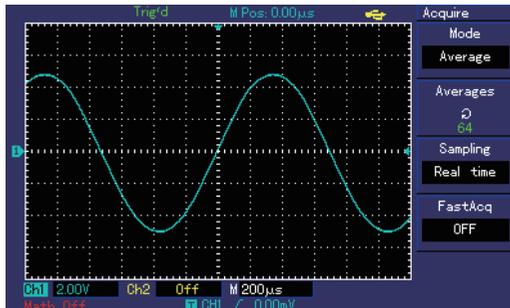
Figure 2-19 Waveform using average
acquisition of 32 number

Notice:

1. Select real-time sampling mode when observing single signal.

2. Select equivalent sampling mode when observing high frequency periodic signal.

3. Select peak detection mode when hoping to observe the signal envelope for any modulation signal.

4. Select average sampling mode when hoping to reduce the random noise in displayed signals.

Explanation of nouns

Real-time sampling mode:

Data sampling at the real-time sampling rate of the system. This is used to observe any waveform within the sampling rate of the system.

Equivalent sampling mode:

Data sampling at higher than maximum sampling rate of the system. This is used to observe any periodical waveform at beyond the maximum sampling rate.

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2.5 Set The Display System

The user can change the display setting of the DSO by pressing the DISPLAY button of the 72-2650/72-10510/ 72-8225A /72-8705A/72-8710A DSO as the figure shows below.

72-2650 DSO

72-10510/72-8225A/72-8705A/72-8710A DSO

Figure 2-20 Function Keys of Display System

After pressing the DISPLAY button, the function menu will change to the display setting for the DSO.

Table 2-12 Display Menu

Function Menu	Settings	Description
Types (F1)	Vector	Display as vector of sampled data points
	Dots	Display any of the sampled data points
Format (F2)	YT	Display Y-axis as voltage level of input signal and X-axis as time
	XY	Display Y-axis as CH2 voltage level of input signal and X-axis as CH1 voltage level of input signal
Persist (F3)	Off	Real-time updating (Display) of the acquired signal
	1s	Display the acquired signal every 1s
	2s	Display the acquired signal every 2s
	5s	Display the acquired signal every 5s
	Infinite	Accumulate display all the acquired
Waveform Brightness (@)	1 % - 100%	Set the brightness of the waveform by multi-purpose node between 1%-100% brightness

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XY Mode

The user can enter the X-Y mode by pressing the Display button and select F2. In this mode, CH1 and CH2 are required to be applied simultaneously. The figure below shows an example for the XY mode display
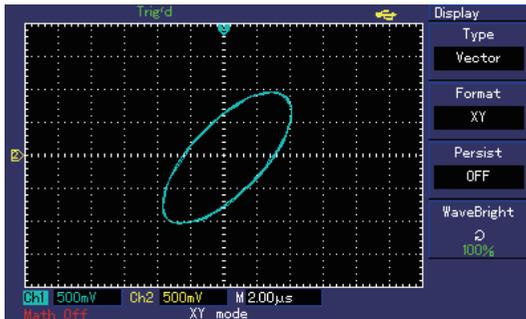
Figure 2-21 Waveform Display in XY Mode

Attention:

The following functions will be disabled in XY display mode:

● Automatic measurement

● Cursor measurement

2.6 Set The Storage and Load System

The user can enter the storage and load menu by pressing the STORAGE button.

72-2650 DSO (Top)

72-10510/72-8225A/72-8705A/72-8710A DSO (Down)

Figure 2-22 Function Key of

Sampling System (STORAGE)

The below steps will guide you to store a waveform in the internal memory of the DSO:

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Press the Storage button and you will see the following menu:

Table 2-13 Waveform Storage Menu

Function Menu	Settings	Description
Type (F1)	Wave	Select to store an acquired waveform
Source(F2)	CH1	Select waveforms from CH1 channel to be saved
	CH2	Select waveforms from CH2 channel to be saved
Dest (@)	1～20	Destination (Position of the internal memory) where the waveform will be saved. There are 20 sets of internal memory available to storage waveform navigated by the multipurpose knob.
Save	———	Store waveform
Next page 1/2	———	Go to the next page

Press F2 to select the waveform source to be saved.

Use the multi-purpose knob to select the storage memory destination.

Press F4 to store the waveform.

Attention:

Any storage of the waveform will overwrite previous memory space in the same memory location.

To load a waveform from the internal memory of the DSO, please refer to Chapter 2 of this user manual.

The below steps will guide you to store a waveform to a USB device:

Insert a USB disk into the "USB Host" interface. If the USB is connected successfully, you should see the system message "USB device install successful" shown on the screen.

Press the Storage button and you will see the following menu:

Table 2-14 Waveform Storage Menu (Page 1)

Function Menu	Settings	Description
Type (F1)	Wave	Select to store an acquired waveform
Source(F2)	CH1	Select waveforms from CH1 channel to be saved
	CH2	Select waveforms from CH2 channel to be saved
Dest (@)	1~20	Destination (position of the internal memory) where the waveform will be saved. There are 20 sets of internal memory available to storage waveform navigated by the multipurpose knob.
Save	———	Store waveform
Next 1/2 [F5]	———	Go to the next page

Press F5 to go to next function menu.
User should see below function menu.

Table 2-14 Waveform Storage Menu (Page 2)

Function Menu	Settings	Description
Desk (F1)	DSO	Select to store an acquired waveform into the internal memory of the DSO
	USB	Select to store an acquired waveform onto the USB device
Length (F2)	Normal	Select normal data length (Same data number as display)
	Long	Select long data length (Same as data number as data buffered in the DSO FIFO)
———	———	———
———	———	———
Previous 2/2 [F5]	———	Go to the previous page

Press F1 to select USB as storage destination.

Press F2 to select normal storage.

Press F5 to go to the first page of the function menu.

   Use the multi-purpose knob to select the storage memory destination (please note that there will be 200) .

Press F4 to store the waveform

Remove the USB stick.

Attention:

  Any storage of the waveform will overwrite previous memory space at the same memory location. If "Long" length data is selected, the data cannot be loaded back to the DSO display and is only able to load through Software Application. To load a waveform from the USB desk, please refer to Chapter 2 of this user manual.

The below steps will guide you on how to store DSO setting to the internal memory of the DSO:

Press the Storage button and you will see the following menu.

Table 2-15 Waveform Storage Menu (Page 1)

Function Menu	Settings	Description
Types (F1)	Wave	Select to store an acquired waveform
	Setup	Select to store a DSO setting
Source(F2)	CH1	Select waveforms from CH1 channel to be saved
	CH2	Select waveforms from CH2 channel to be saved
Dest (@)	1~20	Destination (position of the internal memory) where the waveform will be saved. There are 20 sets of internal memory available to store waveform navigated by the multipurpose knob.
Save [F4]	——	Store waveform
Next page 1/2	——	Go to the next page

Press F1 to select Setup.

Use the multi-purpose knob to select the storage

memory location.

Press F4 to store the DSO setting

Attention:

Any storage of the DSO setting will overwrite previous memory space at the same memory location.

Table 2-15 DSO Setting Storage Menu (Page 2)

Function Menu	Settings	Description
Types (F1)	Setup	Select to store a DSO setting
Setup(@)	1~20	Destination (position of the internal memory) where the Setup will be saved. There are 20 sets of internal memory available to storage Setup navigated by the multipurpose knob.
Save[F3]	——	Press to store a Setup into the selected storage memory destination
Load[F4]	——	Press to load a Setup from the selected storage memory destination

From the DSO setting storage menu (Page 1)

Use the multi-purpose knob to select the storage memory location.

Press F4 to load the pre-stored DSO setting.

If there is not a pre-stored DSO setting at the memory location, there will be a warning "no data in the position"

Below step will guide you to store a bitmap to USB device:

Insert a USB disk into the "USB Host" interface. If the USB is connected successfully,you should see the "USB device install successful" notification on the screen.

Press the Storage button and you will see the following menu:

Table 2-16 Bit Map File Storage Menu (Page 1)

Function Menu	Settings	Description
Types (F1)	Wave	Select to store an acquired waveform
	Setup	Select to store a DSO setting

Types (F1)	Bit Map	Select to store a Bit Map file into the USB disk only
Source(F2)	CH1	Select waveforms from CH1 channel to be saved
	CH2	Select waveforms from CH2 channel to be saved
Dest (@)	1~20	Destination (position of the internal memory) where the waveform will be saved. There are 20 sets of internal memory available to store a waveform navigated by the multipurpose knob.
Save	——	Store waveform
Next 1/2 [F5]	——	Go to the next page

Press F1 to go to Bit Map selection.

The user should see the below function menu.

Table 2-16 Bit Map File Storage Menu (Page 2)

Function Menu	Settings	Description
Types (F1)	Bit Map	Select to store a Bit Map file into the USB disk only
——	——	——
Dest (@)	1~200	Destination (position of the USB desk memory) where the bit map file will be saved. There are 200 sets of USB disk memory available to store a bitmap file navigated by the multipurpose knob.
Save[F4]		Press to store bitmap file
	——	

Use the multi-purpose knob to select the storage memory destination (please note that there will be 200 memory locations available).

Press F4 to store the bitmap file into a USB disk;

Remove the USB stick.

2.7 Set The Utility System

By pressing the UTILITY function button on the menu area, the user can set a different utility setting, where the button locations are shown in the figure below.

72-2650 DSO (Top)
72-10510/72-8225A/72-8705A/
72-8710A DSO (Down)
Figure 2-23 Function Key of
Sampling System (Function)

There are three function menu pages at the Utility menu, all of which are shown in Tables 2-17, 2-18 and 2-19.

Table 2-17 Utility menu page 1

Function Menu	Settings	Description
Self-Adj (F1)	Execute	Press to execute self- calibration function
	Close	Leave self-calibration
Pass/Fail (F2)	See Table 2-22.	Set waveform pass/fail operation
Recorder (F3)	See Table 2-20.	Set waveform recording operation
Language (F4)	Language	Press to change to different system language
Next(1/3) (F5)		Press to go to next utility function menu page

Table 2-18 Utility menu page 2

Function Menu	Settings	Description
Reset (F1)		Reset to factory default setting
Skin (F3)		Change the skin for the function menu
Grid Bright(@)	1%-100%	Adjust the grid brightness by using the multi-purpose knob
Next 2/3	——	Go to the next page

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Table 2-19 Utility menu page 3

Function Menu	Settings	Description
Version (F1)		Press to view the system version.
LAN (F2)		Press to enter the LAN address setting. Notice that LAN is an option for 72-2650 DSO.
⎯⎯	⎯⎯	⎯⎯
Frequency Counter * (F4)	ON	To turn ON frequency counter
	OFF	To turn OFF frequency counter
First 3/3(F5)	⎯⎯	Back to page 1

The waveform recorder function at the 72-2650/72-10510/ 72-8225A /72-8705A/72-8710A DSO is
generally easy to operate.
The user should set up Source and Operation as shown in the below table.

Table 2-20 Waveform Recorder Menu

Function Menu	Settings	Description
Source (F1)	CH1	Select CH1 as recording signal source
	CH2	Select CH2 as recording signal source
	CH1+CH2	Select CH1and CH2 as recording signal sources
Operation (F2)	See Table 2-21 for detail	Sub-menu for operation
Save (@) (F3)		Save waveform recording into USB memory. Select from 1-200 memory location. Press F3 to save.
Load (@) (F4)		Load the waveform recording into USB memory. Select from 1-200 memory location. Press F3 to load.
Return (F5)		Press to return to Utility function menu

After pressing the F2 button on the waveform recorder menu, you should see the waveform recorder operation

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menu below.

Table 2-21 Waveform Recorder Operation Menu

Function Menu	Settings	Description
Record (F1)		Press to start waveform recording; the number waveform being recorded is show on the screen.
RePlay (F2)		Press to start waveform replay.
Stop(F3)		Press to stop waveform recording.
Return (F4)	———	Go back to previous menu

One of the very useful functions for the 72-2650/ 72-10510/72-8225A /72-8705A/72-8710A DSO is the pass/fail detection function.You can create a template of pixels area to compare with the input signal. The user can also select the output condition for the logical result between the templates of area and the input source.

You can enable the PASS/FAIL function by pressing F1 on the PASS/FAIL function menu. After turning on this function, you can see the total number of waveforms being processed, the number of waveforms that pass and the number of waveforms that fail on the LCD screen.

Table 2-22 Pass/Fail function menu

Function Menu	Settings	Description
Status (F1)	ON	Press to turn on the PASS/FAIL function
	OFF	Press to turn off the PASS/FAIL function
Source (F2)	CH1	Select CH1 as the detection signal source
	CH2	Select CH2 as the detection signal source
	MATH	Select MATH result as the detection signal source
	RefA	Select RefA as the detection signal source
	RefB	Select RefB as the detection signal source
Output (F3)	Pass	Select the logical result as input signal within the template of pixels area
	Fail	Select the logical result as input signal outside of the template of pixels area
	Pass/Halt	Same as Pass output condition; stop once detected
	Fail/Halt	Same as Fail output condition; stop once detected

Template (F4)	See Table 2-23.	Press to create template of pixel area.
Back (F5)		Return to Utility Function Menu

After pressing the F4 on the Pass/Fail function menu, you will be able to create a template of pixels to be compared.

Table 2-23 Template Setting

Function Menu	Settings	Description
Create (F1)	/	According to adjustment, build horizontal and vertical Pass/Fail tolerance range.
Horizontal (F2 and @)	1-200 Pixel	Press [F2] to select horizontal length and use the multi-purpose knob to set the pixel length for the horizontal length.
Vertical (F3 and @)	1-100 Pixel	Press [F3] to select vertical length and use the multi-purpose knob to set the pixel length for the vertical length.
Return (F4)	/	Return to pass detection menu.

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You will need to press F1 to confirm creating the pixel template after setting the horizontal and vertical length of the pixels.

2.8 Set The Measurement Parameters

72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO support up to 28 of the automatic waveform measurement parameters. You can view at most five of the measurement parameters at the same time on F1-F5 function menu. To see measurement parameters, please press MEASURE on the control panel.

72-2650 DSO(Top) ,
72-10510/72-8225A/72-8705A/72-8710A DSO (Down)
Figure 2-24 Function Key of (Auto measurement parameter)

For each of the measurement parameters located on the F1-F5 function menu, you can press F1-F5 to set the view of the parameter (Measurement sub menu)

Table 2-24 Measurement Sub Menu

Function Menu	Settings	Description
Back (F1)		Return to measurement parameter function menu
Source (F2)	CH1	Select the CH1as source
	CH2	Select the CH2 as source
Volt (F3)		Select different Voltage parameters
Source (F2)		Select different Time parameters
Parameters (F5)		Press to display all of the measurement parameter of the input source. Or, press to turn off the parameter display.

Voltage Parameter

Below are the automatically measured voltage parameters for the 72-2650/72-10510/72-8225A / 72-8705A/72-8710A and its definitions:

Vpp: Peak-to-peak voltage.

Vmax Maximum voltage level.

Vmin: Minimum voltage level.

Vmid: Medium voltage level.

Vamp: The voltage amplitude from waveform top to bottom.

Vtop: The voltage value from waveform top level to GND (Ground).

Vbase: The voltage value from waveform base level to GND (Ground).

Over-shoot: The ratio between (Vmax – Vtop) and voltage amplitude (Vamp) in percentage.

Pre-shoot: The ratio between (Vmin – Vbase) and voltage amplitude (Vamp) in percentage.

Average: The average amplitude of signal within 1 cycle.

Vrms: Root-mean-square value (effective value).

Time parameter

RiseTime: The time of waveform amplitude rising from 10% to 90%.

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FallTime: The time of waveform amplitude falling from 90% to 10%.

+Width: The width of positive pulse at amplitude of 50%.

-Width: The width of negative pulse at amplitude of 50%.

Delay (rising edge): The delay time between rising edges. Delay (falling edge): the delay time between falling edges.

+Duty: The specific value of positive pulse width and cycle.

-Duty: The specific value of negative pulse width and cycle.

2.9 Set The Cursor Measurement

The user can press the $\boxed{\text{CURSOR}}$ button to enable the cursor measurement function for 72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO, where the location of the $\boxed{\text{CURSOR}}$ button can be found on the figure below.

72-2650DSO (Top),
72-10510/72-8225A/72-8705A/
72-8710A DSO (Down)
Figure 2-25 Function Key of
Sampling System (CURSOR)

72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO supports 3 different types of cursor measurements.

Volt: Voltage (Vertical System)

Time: Time (Horizontal System)

Track: Volt and Time working at the same time.

At the **Volt** cursor measurement, the user should be able

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to see the **ΔV**, Va, and Vb parameters on the display screen, where **ΔV is the difference between Va and Vb.** The user can move the Va cursor by rotating the multi-purpose knob by default. Once the location of the Va cursor is moved to the ideal location, the user can press the multi-purpose knob (the SELECT button on the 72-2650 DSO) to switch to Vb; the user can move the Vb cursor by rotating the multi-purpose knob in the same way as moving the Va cursor.

 At the **Time** cursor measurement, the user can repeat the similar operation as Volt cursor measurement by using the multi-purpose knob and the SELECT button on the 72-2650 series DSO.

The **Track** cursor measurement mode is similar to the Time cursor measurement except, it will automatically track any of the voltage level where the time cursor is pointing at the screen.

After activating the COARSE button, there will be a quicker response for the cursor movement.

Chapter III System Message Example and Troubleshooting

System Message Examples
"Operation at limit":
    System will show "Operation at limit" when the user attempts to operate any activity beyond the system limit; for example, setting the horizontal scale to more than 50.00s.
"Saving" Progress Bar
    When the user is performing saving bitmap file, waveform and setup file, the system will show the "Saving" progress bar. Please be patient until the end of the saving progress complete.
"Loading" Progress Bar
    When the user is loading a waveform file or setup file, system will show the "Load" progress bar. Please be patient until the end of the loading progress is complete.

Troubleshooting :

1. After pressing the power button of the DSO, the screen is dark and will not display:

①. Check if the power connector is properly connected to power socket

②. Check if the power button is pressed to the ON position.

③. Restart the instrument after completing the above checks.

④. If the product still does not work normally, please contact Tenma.

2. Cannot acquire signal waveform

①.Check if the BNC connector of the probe is properly connected to DSO

②.Check if the probe is working properly by connecting the probe to "Probe compensation signal output" and check for any signal waveform;

③. Check if the probe is properly connected to the device under test.

④. Try to acquire signal again.

3. The voltage amplitude measured is 10 times higher or lower than the actual value:- Check if the attenuation coefficient of the channel matches with the attenuation rate of the probe used.

4. The signal waveform is not stable:

①. Check if the trigger source setting in the trigger menu is matched with the actual channel input of the signal.

②. Check the trigger type: Most of the signal can be triggered by edge trigger mode; while video signal can be triggered by video trigger mode. Only in the correct trigger mode can the waveform be stably displayed.

③. Change the coupling to "high frequency rejection" or "low frequency rejection" display to filter out the high frequency or low frequency noise that maybe interfering with the trigger.

5. No waveform display after pressing RUN/STOP key

①. Check if the trigger level exceeds the waveform range and the trigger mode is "Normal" or "Single", if yes,

manually set the trigger level to the centre; or change the trigger mode to AUTO

②. Or press AUTO button next to the RUN/STOP button, the above setting will be completed automatically.

6. The waveform is refreshing slowly:

①. Check if the Acquire mode is in "Average" mode

②. In "Average" mode, waveform is refreshing slowly because it displays the average value of the waveform to reduce the random noise in displayed signal.

③. Change to "Sample" mode or "Peak" mode for the desired display.

7. The waveform display does not smooth out.

①. The horizontal time division value may be too small, increase the horizontal time base division to improve the waveform smoothness.

②. If the display type is "Vector", the signal waveform may not smooth between the dots. This can be improved by setting the display type to "Dot" mode.

Chapter IV Technical Information

Appendix A: Technical Specification

Unless otherwise specified, all technical specifications are applicable to the probes with the attenuation switch set as 10× as well as 72-2650/72-10510/72-8225A /72-8705A/72-8710A DSO. DSO must first meet the following two conditions to meet those specification standards:

The instrument must continuously operate for over half an hour within the operating temperature.

Technical Specification

Sampling System Specification			
Sampling rate		Real-time	Equivalence
Sampling rate	72-2650	1GS/s	50GS/s
	72-8710A	1GS/s	50GS/s
	72-8705A	1GS/s	50GS/s
	72-8225A	500MS/s	25GS/s
	72-10510	250MS/s	———
Average	N can be chosen among 2, 4, 8, 16, 32, 64, 128 and 256; N is the number of average samples.		

Input Channel Specifications		
Input coupling	DC, AC and GND	
Input impedance	72-2650	1±2% MΩ with 21±3pF
	72-10510/U72-8225A/ 72-8705A/72-8710A	1±2% MΩwith24±3pF
Probe attenuation coefficient	1×，10×，100×，1000×	
Maximum input voltage	400V (DC+AC peak value, 1MΩ input impedance)	
Time Delay between Channels (Typical)	150ps	
Horizontal System Specification		
Waveform interpolation	Sin（x）/x	
Horizontal resolution	25p/div	
Record length	2×512k sampling point	
Storage depth	25k	
Scanning scope	72-8705A/72-8710A	2ns/div-50s/div
	72-8225A	5ns/div-50s/div
	72-10510	10ns/div-50s/div

Sampling rate and delay time accuracy	±50ppm (any time interval≥1m)
Measurement accuracy of time interval (△T) (full bandwidth)	Single time: ± (1 sampling time interval+50ppm×reading+0.6ns)
	>16 average values: ± (sampling time interval+50ppm×reading+0.4ns)

Vertical System Specifications		
Analog-to-digital converter (A/D)	8-bit resolution, sampling at two channels at the same time	
Deflection coefficient (V/div) range (at input BNC)	72-2650	2mV/div-5V/div
	72-10510/72-8225A/ 72-8705A/72-8710A	1mV/div-20V/div
Vertical range	±10div (wherein 72-2650 is ±5div)	
Selectable bandwidth limitation (Typical)	20MHz	
Low frequency response (AC coupling, -3dB)	≤10Hz (at BNC)	
DC gain accuracy (sampling or average sampling mode)	72-2650： ±4%（When vertical sensitivity is 2mV/div or 5mV /div） ±3%（When vertical sensitivity is 10mV/div- 5V /div）	

DC gain accuracy (sampling or average sampling mode)	72-10510/72-8225A72-8705A/72-8710A： ±5%　(When vertical sensitivity is 1mV/div or 2mV /div) ±4%　(When vertical sensitivity is 5mV/div) ±3%　(When vertical sensitivity is 10mV/div -20mV /div)
DC measurement accuracy (average sampling mode)	72-2650： When vertical position is 0 and N≥16: ± (4%×reading + 0.1div + 1mV) at 2mV /div and 5mV /div; ± (3%×reading + 0.1div + 1mV) from 10mV /div to 5V /div; When vertical position is not at 0 and N≥16: ±[3%×(reading + vertical position reading) + (1%×vertical position reading)]+0.2div) from 2mV/div to 200mV/div + 2mV The setting value from 200mV/div to 5V/div plus 50mV
	72-10510/72-8225A/72-8705A/72-8710A： When vertical position is 0 and N≥16: ± (5%×reading+0.1div+1mV) and selects 1mV /div or 2mV /div; ± (4%×reading+0.1div+1mV) and selects 5mV /div; ± (3%×reading+0.1div+1mV) and selects 10mV /div or 20mV /div; When vertical position is 0 and N≥16: ±(3%×(reading + vertical position reading) + (1%×vertical position reading)]+0.2div) The setting from 5mV/div to 200mV/div plus 2mV; the setting value from 200mV/div to 20V/div plus 50mV

Measurement accuracy of voltage difference (△V) (average sampling mode)	Under the same setting and environmental conditions and after averaging the captured waveforms with a quantity of ≥16, the voltage difference (ΔV) between any two points on the waveform: ± (3%×reading+0.05div)

Note: the range of deflection factor for UTD 2025C is 2mV/div-10V/div (in the place of input BNC)

Bandwidth For Each Model			
Model	**Analog Bandwidth**	**Real-Time Bandwidth**	**Rise Time**
72-2650	200MHz	100MHz	1.8ns
72-8710A	100MHz	100MHz	3.5ns
72-8705A	50MHz	50MHz	7ns
72-8225A	50MHz	50MHz	7ns
72-10510	25MHz	25MHz	14ns

Trigger System Specifications		
Trigger sensitivity	≤1div	
Range of trigger level	Interior	From the screen centre ±5div
	EXT)	±3V
	EXT/5*	±15V

Trigger level accuracy (Typical) applicable for the signal with rising and falling time ≥20ns	Interior	±(0.3div×V/div) (within±4 div from the screen centre)
	EXT	±(6% setting value+40mV)
	EXT/5*	±(6% setting value +200mV)
Pre-trigger capacity	Normal mode/scan mode, pre-trigger/delay trigger, the pre-trigger depth adjustable	
Hold-off range	72-2650	100ns - 1.5s
	72-10510/72-8225A/ 72-8705A/72-8710A	80ns - 1.5s
Set the level to 50% (Typical).	Operate under the condition of input signal frequency of ≥50Hz	
Edge trigger		
Edge type	Rise, fall, rise and fall	
Pulse width trigger		
Trigger mode	(>, <, and =) positive pulse width and (>, <, and =) negative pulse width range	
Pulse width range	20ns - 10s	

Video trigger*		
Trigger sensitivity (video trigger, Typical)	Interior	2div Vpp
	EXT)	400mV
	EXT/5*	2V
Signal model and line/field frequency (video trigger type)	Support standard NTSC and PAL, and the line number scope is respectively 1-525 (NTSC) and 1-625 (PAL).	
Alternating trigger		
CH1 trigger	Edge, pulse width, and video	
CH2 trigger	Edge, pulse width, and video	

Note*: EXT/5 function only for 72-2650, and video trigger function only for 72-2650/72-10510.

Measurements		
Cursor	Cursor Parameters	Voltage difference between cursors ($\triangle$V), Time difference between cursors ($\triangle$T), Reciprocal of $\triangle$T (Hz) (1/$\triangle$T))
	Track	Voltage value and time value of point of waveform

Automatic measurement	Vpp, Vamp, Vmax, Vmin, Vtop, Vbase, Vmid, Average, Vrms, Overshoot, Preshoot, Frequency, Period, RiseTime, FallTime, +Width, -Width, +Duty, -Duty, Delay	
Math operation	+, -, ×, ÷	
Store (waveform and setting)	20 groups of waveforms, and 20 kinds of settings	
FFT	Window	Hanning, Hamming, Blackman, Rectangle
	Sampling size	1024 points
Lissajous figure	Phase difference	±3degrees
Trigger frequency meter		
Reading resolution	6 bits	
Trigger sensitivity	≤30Vrms	
Accuracy (Typical)	±51ppm (+1 character)	

General Technical Specification

Display			
	72-2650	72-10510/72-8225A	72-8705A/72-8710A
Displays types	LCD with diagonal of 145mm (5.7-inch)	LCD with diagonal of 178mm (7-inch)	LCD with diagonal of 178mm(7-inch)
Display resolution	320 horizontal×RGB×240 vertical pixels	400 horizontal×RGB×240 vertical pixels	800 horizontal×RGB×480 vertical pixels
Display colour	Colour		
Waveform luminance	Adjustable (colour)		
Backlight intensity (Typical)	300nit		

Probe compensator output	
Output voltage (Typical)	About 3Vpp, when the load≥1MΩ
Frequency (Typical)	1kHz

Interface function:		
Standard configuration	72-2650	1 USB Device; 1 USB Host
	72-10510/72-8225A/72-8705A/72-8710A	1USB OTG
Optional components	72-2650 has optional LAN communication port	

Power Source	
Power voltage	100-240VAC RMS，45-440Hz CAT II
Power consumption	Less than 30 VA
Fuse	F1.6AL 250V（Fuse is located inside the instrument housing）
Environment Specifications	
Temperature Range	Operating Temperature Range:0℃～+40℃
	Storage Temperature Range: -20℃-+60℃
Cooling	Built-in cooling fan
Operating Humidity Range:	<35℃：≤90%RH , 35℃-40℃：≤60%RH

Operating Altitude	Below 3,000m

Mechanical specifications

		72-2650	72-10510/72-8225A 72-8705A/72-8710A
Size	W	320mm	306mm
	H	150mm	147mm
	D	130mm	122mm
Weight	Excluding package	2.5kg	2.2kg
	Including package	4.0kg	3.3kg

IP protection

IP 2x

Recommended calibration Interval: The recommended calibration interval is every one year

Appendix B: Accessories of
72-2650/72-10510/72-8225A
72-8705A/72-8710A DSO

Standard accessories:

● Two probes (selectable for 1:1 and 10:1).
Please refer to instructions on probe accessories for details.
ll probe conforming to EN61010-031 standards.
   -When the switch is at 1× position, it belongs to
   150V CAT II.
  -When the switch is located in 10× position, it
   belongs to 300V CAT II.

● One power cable
● One User Manual
● Oscilloscope communication
  control software CD
● One USB Cable

Appendix C: Maintenance
and Cleaning Maintenance

General Maintenance

  Please do not store or place the instrument in any places where the LCD of the instrument is exposed to sunlight directly.

  Caution: Please do not stain the instrument or probe with spray, liquid or solvent, so as to avoid damaging the instrument or probe.

Clearing

  Check the instrument and probe frequently. Clean the surface of the instrument according to the following steps:

1. Please wipe the surface of the instrument and probe with a soft cloth. Do not to scratch the LCD screen.
2. Wipe the instrument with a wet cloth after disconnecting

the power supply. Use detergent or clear water to clean. Do not use any abrasive chemical cleaning agent to avoid damaging the instrument or probe.

Warning: Please make sure that the instrument is completely dry before powering on again, to avoid electrical short circuit or injury.

INFORMATION ON WASTE DISPOSAL FOR CONSUMERS OF ELECTRICAL & ELECTRONIC EQUIPMENT.

When this product has reached the end of its life it must be treated as Waste Electrical & Electronics Equipment (WEEE). Any WEEE marked products must not be mixed with general household waste, but kept separate for the treatment, recovery and recycling of the materials used. Contact your local authority for details of recycling schemes in your area

72-2650/72-10510/72-8225A /72-8705A/72-8710A user manual

Tenma Test Equipment
405 S. Pioneer Blvd
Springboro, OH
www.tenma.com

说明书菲林做货要求：

序号	项目	内容
1	尺寸	尺寸：210X148mm
2	材质	封面用230克铜版纸,内页用80g书纸
3	颜色	单黑印刷
4	外观要求	印字完整清晰、版面整洁，无斑墨、残缺破损、毛边、装钉不齐等缺陷。
5	装订方式	两枚大钉钉装
6	表面处理	无
7	修改	
8	REV.	0

DWH 设计	韦英锁2016-03-15	MODEL UTD2000CL/ 机型：CEX/CE系列	Part NO. 物料编号：110401105556X
CHK 审核			
APPRO. 批准			

UNI-T®　优利德科技（中国）有限公司
UNI-TREND TECHNOLOGY (CHINA) LIMITED