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DSO2000 Series Digital Storage Oscilloscope

User Manual

（V1.4）

Copyright Declaration

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General Safety Summary

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

Only qualified personnel should perform maintenance.

Avoid fire or personal injury.

Use suitable power cord. Use only the power cord specified for this product and certified for the country of use.

Connect and disconnect properly. Connect a probe with the oscilloscope before it is connected to measured circuits; disconnect the probe from the oscilloscope after it is disconnected from measured circuits.

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

Connect the probe in a right way. The probe ground lead is at ground potential. Do not connect the ground lead to an elevated voltage.

Check all terminal ratings. To avoid fire or shock hazard, check all ratings and markings on the product. Refer to the product manual for detailed information about ratings before making connections to the product.

Do not operate without covers. Do not operate this product with covers or panels removed.

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

Do not operate with suspected failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Assure good ventilation.

Do not operate in wet/damp environments.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry.

Safety Terms and Symbols

Terms on the product. The following terms may appear on the product:

Danger	It represents that harms may be caused to you at once if you perform the operation.
Warning	It represents that latent harms may be caused to you if you perform the operation.
Notice	It represents the damage possibly caused to the product or other properties if you perform the operation.

Characters on the product. The following characters may appear on the product:

Notice

Protective

Test ground

Shell ground terminal

Product Scrapping

Device Recycling

We need extract and utilize natural resources to produce this device. If you do not reclaim the device in a proper way, some substances it contains may become harmful or poisonous to environments or human bodies. To avoid them being released outside and to minimize the waste of natural resources, we suggest you reasonably call back this device to ensure proper recovery and recycling of most materials within it.

Contents

Copyright Declaration **2**
General Safety Summary **3**
Safety Terms and Symbols **4**
Product Scrapping **4**
DSO2000 series digital storage oscilloscope introduction **7**
1. Introduction **8**
1.1. General Inspection 8
1.2. Prepare Instrument for Use 8
1.3. Brief Introduction of Front Panel 8
1.4. The user interface 10
1.5. Functional Check 11
1.5.1. Connect the oscilloscope 11
1.5.2. Observe the waveform 11
1.6. Probe Introduction 11
1.6.1. Safety 11
1.6.2. Manual Probe Compensation 12
1.6.3. Probe Attenuation Setting 12
2. Function Introduction **13**
2.1. Menu and Control Keys 13
2.2. Connector 15
2.3. Multi-function Knobs and Softkeys 15
2.4. Oscilloscope Setup 16
2.5. Horizontal Controls 16
2.6. Vertical System 17
2.6.1. Vertical Controls 17
2.6.2. Math Operation 18
2.7. Trigger System 21
2.7.1. Edge Trigger 22
2.7.2. Pulse Trigger 23
2.7.3. Video Trigger 24
2.7.4. Slope Trigger 25
2.7.5. Overtime Trigger 26
2.7.6. Window Trigger 27
2.7.7. Pattern Trigger 28
2.7.8. Interval Trigger 29
2.7.9. Under Amp Trigger 30
2.7.10. UART Trigger 31
2.7.11. LIN Trigger 32
2.7.12. CAN Trigger 33
2.7.13. SPI Trigger 34
2.7.14. IIC Trigger 35
2.8. Protocol Decode 36
2.8.1. UART Decode 36

2.8.2. LIN Decode 37
2.8.3. CAN Decode 38
2.8.4. SPI Decode....40
2.8.5. IIC Decode 40
2.9. Save/Recall....41
2.9.1. Internal Save and Recall 42
2.9.2. External save and recall....43
2.9.3. Save picture....43
2.9.4. File Manager....44
2.10. Measure System....45
2.10.1. Scale measurement....45
2.10.2. Cursor measurement....46
2.10.3. Automatic Measurement 47
2.11. DVM 49
2.12. Acquire....50
2.12.1. Run Control 50
2.12.2. XY Mode 51
2.12.3. Roll Mode 52
2.13. Display....52
2.14. Utility System 52
2.14.1. Update Firmware 53
2.14.2. Self Calibration 53
2.14.3. Pass/Fail....53
2.15. Fast Action Buttons....54
2.15.1. AUTO SCALE....54
2.15.2. Default Setup....55
2.15.3. Dual-window Mode....56
3. Waveform Generator 57
3.1. Set Wave Type and Parameters 57
3.2. Waveform modulation setting 58
3.3. Burst setting....59
3.4. Edit Arbitrary Waveform 59
3.5. Output Arbitrary Waveform....60
4. Remote Control 61
5. Troubleshooting 63
6. Services and Support 64
7. General Care and Cleaning 65
General Care 65
Cleaning 65
Appendix A: Technical Specifications 65
Appendix B: Accessories 71
Appendix C Harmful and Poisonous Substances or Elements 72

DSO2000 series digital storage oscilloscope introduction

DSOXXXX Series oscilloscopes cover the bandwidths from 100MHz to 150MHz, and provide the real-time up to 1GSa/s. In addition, they have 7 inchs color TFT LCD as well as WINDOWS-style interfaces and menus for easy operation.

What's more, the plenty menu information and the easy-to-operate buttons allow you to gain information as much as possible in measurement; the Multifunctional Knobs and the powerful shortcut keys help you save a lot of time in operation; the Auto Scale function lets you detect sine and square waves automatically.

Model	Channels	Bandwidth	Storage depth	Sample Rate	AFG
DSO2C10	2	100MHz	8M	1GS/s	—
DSO2C15	2	150MHz	8M	1GS/s	—
DSO2D10	2	100MHz	8M	1GS/s	√
DSO2D15	2	150MHz	8M	1GS/s	√

1. Introduction

1.1. General Inspection

Please check the instrument as following steps after receiving an oscilloscope:

Check the shipping container for damage:

Keep the 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.

Check the accessories:

Accessories supplied with the instrument are listed in "Accessories" in this manual. If the contents are incomplete or damaged, please notify the franchiser.

Check the instrument:

In case there is any mechanical damage or defect, or the instrument does not operate properly or fails performance tests, please notify the franchiser.

1.2. Prepare Instrument for Use

Adjust the Supporting Legs

Adjust the supporting legs properly to use them as stands to tilt the oscilloscope upwards for stable placement of the oscilloscope as well as better operation and observation.

Connect the Power Cord

Connect the power cord as desired.

This oscilloscope can accept 100-240 V, 45-440 Hz AC power supply. Please use the power cord supplied with the accessories to connect the oscilloscope to the power source as shown in the figure below.

Turn the instrument on by pressing the power switch in the lower left corner of front panel. If the instrument does not turn on, verify that the power cord is firmly connected. Also make sure that the instrument is connected to an energized power source.

Power Switch:

To turn off the instrument, please press power switch.

1.3. Brief Introduction of Front Panel

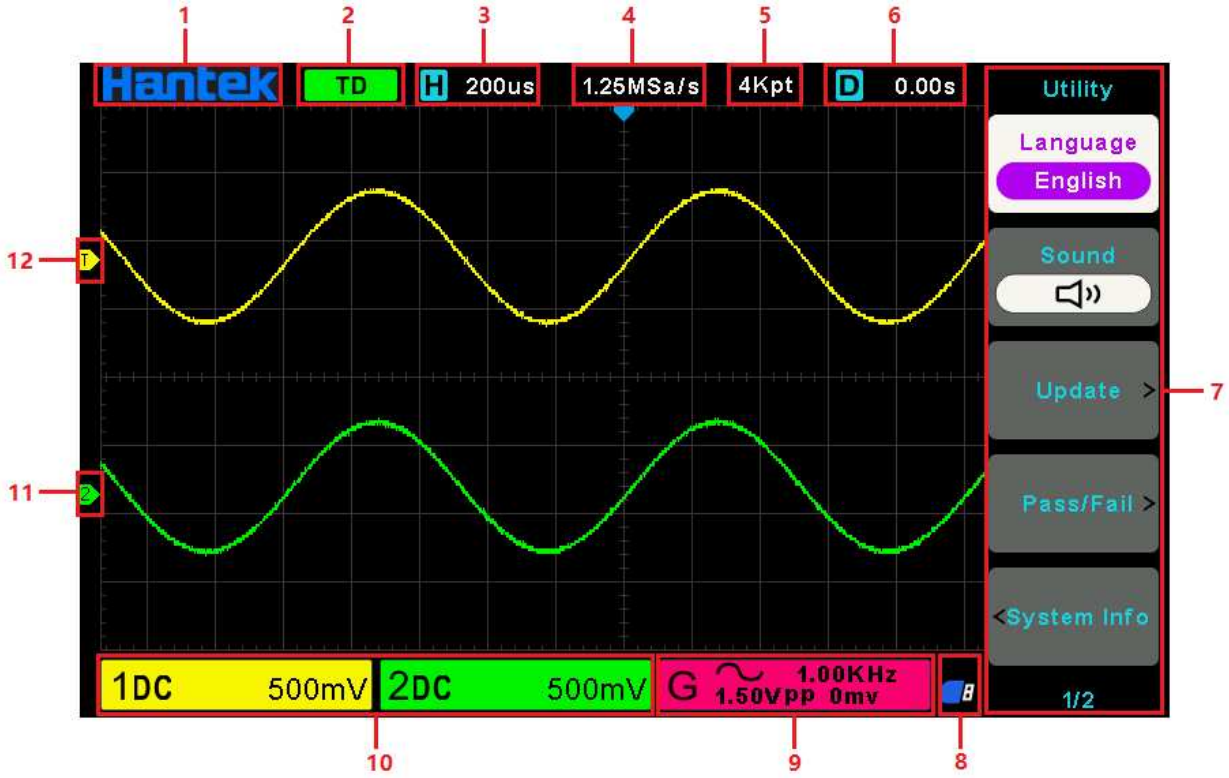
The content below simply describes and introduces the front panel and the back part of this series of

digital oscilloscope so that you can get familiar with this series of digital oscilloscope well within the shortest time.

1. Power button
2. Bracket
3. USB interface
4. Menu selection key
5. Vertical control system
6. CH1、CH2 Input Channel for signal
7. Horizontal control system
8. Signal source output (only valid for model with function generator) /external trigger input channel
9. Probe compensation function zone
10. Signal source (only valid for model with function generator)
11. Trigger control system
12. Operation mode hot key (Run/Stop, Single SEQ, Auto Set)
13. Menu Function Button
14. Multifunctional Knob
15. Function hot key
16. Menu display/hide key

1.4. The user interface

This section will make you understand the front operation panel of this series of digital oscilloscope at first before use.



1. Hantek logo.

2. Trigger Status.

AUTO: The oscilloscope works in auto mode and is acquiring waveform in the absence of triggers.
READY: All pre-triggered data have been acquired and the oscilloscope is ready to accept a trigger.
ROLL: The oscilloscope is acquiring and displaying waveform data continuously in roll mode.
STOP: The oscilloscope has stopped acquiring waveform data.
ARM1/ARM: The FPGA is acquiring pre-trigger data.

3. The main time base of the current window.

4. Sample rate.

5. Storage depth.

6. Horizontal Tigger time.

7. Operating Menu shows different information for respective function keys.

8. If this icon lights up/active, it means the USB disk has been connected.

9. Signal source information (only valid for model with function generator).

10. Channel information: coupling, bandwidth and volt/div of CH1~CH2.

11. Channel Marker

12. Trigger level.

1.5. Functional Check

Follow the steps below to perform a quick functional check to your oscilloscope.

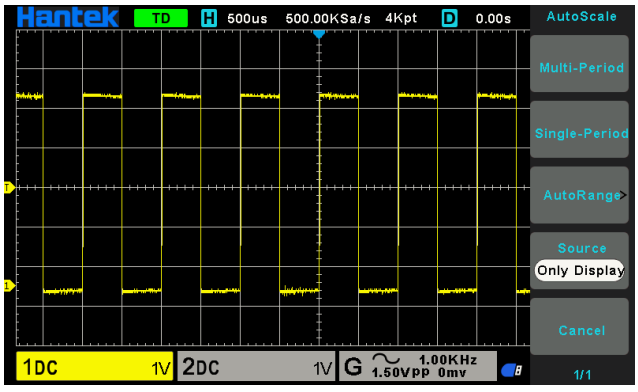
1.5.1. Connect the oscilloscope

Set the switch on the probe to X 10 and connect the probe to Channel 1 on the oscilloscope. First, align the slot in the probe connector with the protuberance on the CH1 BNC and push to connect; then, turn to right to lock the probe in place; after that, connect the probe tip and reference lead to the PROBE COMP connectors. There is a mark on the panel: ~5V@1KHz.

CH1: To connect with probe Probe Comp

1.5.2. Observe the waveform

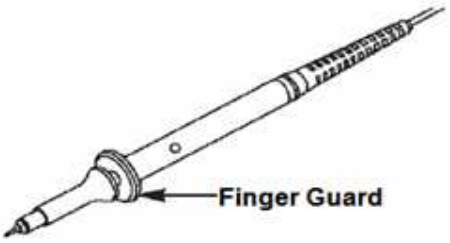
Press the **[Auto Set]** button and you should see within a few seconds a square wave of about 5V peak-to-peak at 1KHz in the display.



1.6. Probe Introduction

1.6.1. Safety

When using the probe, keep your fingers behind the guard on the probe body to avoid electric shock. Do not touch metallic portions of the probe head while it is connected to a voltage source. Connect the probe to the oscilloscope and connect the ground terminal to ground before you start any measurements.

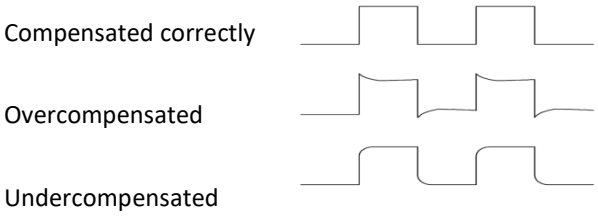


1.6.2. Manual Probe Compensation

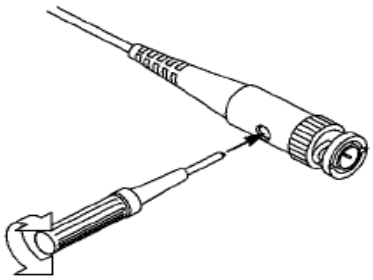
Upon the first connection of a probe and an input channel, you should manually perform this adjustment to match the probe to the input channel. Uncompensated or miscompensated probes may lead to errors or faults in measurement. To adjust the probe compensation, follow the steps below.

1. Set the Probe option attenuation in the channel menu to 10X. Set the switch on the probe to 10X and connect the probe to Channel 1 on the oscilloscope. If you use the probe hook-tip, ensure it is firmly inserted onto the probe. Attach the probe tip to the PROBE COMP ~2V@1KHz connector and the reference lead to the PROBE COMP Ground connector. Display the channel and then press the Auto Scale button.

2. Check the shape of the displayed waveform.



3. If necessary, use a nonmetallic screwdriver to adjust the variable capacity of your probe until the shape of the waveform turns to be the same as the above figure. Repeat this step as necessary. See the figure below for the way of adjustment.



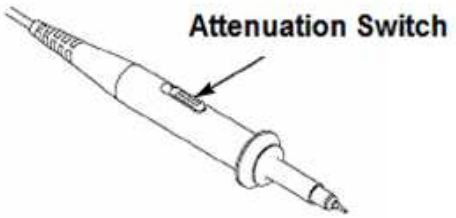
1.6.3. Probe Attenuation Setting

Probes are of various attenuation factors which affect the vertical scale of the signal. The Probe Check function is used to verify if the Probe attenuation option matches the attenuation of the probe.

You can push a vertical menu button (such as the **CH1** MENU button) and select the Probe option that matches the attenuation factor of your probe.

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

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



2. Function Introduction

This chapter provides some general information that you need to learn before using an oscilloscope. It contains:

2.1. Menu and Control Keys

As shown in the figure below:

All the keys are described as follows:

Menu keys

■ **[SAVE/RECALL]**: "Save/Recall" menu, to save and recall files such as waveforms and settings.

■ **[MEASURE]**: “Measure” menu, to measure waveform parameters such as frequency and amplitude.

■ **[ACQUIRE]**: Waveform “Acquisition” menu, to set waveform acquisition parameters such as acquisition mode, storage depth.

■**[UTILITY]**: "Auxiliary function" menu, to view system information, perform system upgrades, self-calibration and other auxiliary functions.

■**[CURSOR]:** "Cursor" measurement menu, when using cursor measurement, you can use the [V0] knob to adjust the cursor position.

■**[DISPLAY]:** "Display Parameters" menu, to set the oscilloscope display parameters such as waveform brightness, grid type, and persist.

Operation mode keys

■**[AUTO SET]:** automatically set the control state of the oscilloscope so as to display suitable waveform.

■**[RUN/STOP]:** continuously acquire waveform or stop acquisition

■**[SINGLE SEQ]:** Acquire a single trigger, finish acquisition and then stop.

Shortcut keys

■**[DEFAULT SETUP]**: Recall the default factory setup.

■**[HELP]**: View the "Help" message and press this key again to exit the help.

■**[SAVE TO USB]**: Press to quickly save the screenshot to the USB disk. Insert the USB disk before use.

■**[DECODE]:** Set protocol decoding parameters and view decoded data.

Vertical control system

■**[CH1 MENU]**, **[CH2 MENU]**: Channel menu, for setting channel parameters such as coupling mode and probe ratio.

■**[MATH MENU]**: "Math operation" function menu, used for function operation between data channel waveforms.

■**[POSITION]**: The vertical offset knob, to set the position of the waveform in the vertical direction.

■**[VOLTS/DIV]**: Volts/div knob, to set the voltage value represented by each grid in the vertical direction.

Horizontal control system

■**[HORIZ MENU]**: "Horizontal Parameters" menu, to set the display mode.

■**[POSITION]**: Horizontal offset knob, to set the position of the waveform in the horizontal direction.

■**[SEC/DIV]**: Horizontal time base knob, to set the time represented by each grid in the horizontal direction.

Trigger control system

■**[TRIG MENU]**: "Trigger parameter" control menu, to set trigger parameters such as trigger type and trigger mode.

■**[FORCE TRIG]**: No matter whether the oscilloscope detects the trigger or not, this button can be used to stabilize the current waveform, which is mainly used for "sampling" and "single time" in the trigger mode.

Signal source

■**[EXT TRIG/WAVE GEN]:** “Signal source” menu, to set signal source parameters such as waveform, frequency, and offset. Can also be used for external trigger.

■**[BURST/GEN TRIG]**: "Burst" menu, to manually burst the waveform with a specified number of cycles.

2.2. Connector

■**CH1, CH2:** for an input connector of a measured signal.

■**EXT TRIG/GEN OUT:** Function multiplexing connector, can be used for signal source waveform output and external trigger signal input. External trigger can trigger on the third channel while collecting data. Note: GEN OUT function only valid for model with built in function generator.

■**Probe compensation:** The probe compensation signal is output and grounded so that the probe is matched with the channels of the oscilloscope.

2.3. Multi-function Knobs and Softkeys

V0: Multifunctional knob. Under different menu items (specifically see the operation of each menu), support menu item selection, cursor movement, level movement; press the knob to select menu, data reset (trigger holdoff time), And rotate to change the data bit, etc., the operation is extremely convenient.

Wave Gen: To open signal source function (only valid for model with function generator).

Hide/Show softkey. Push it to hide the menu options on the right side of the screen and give a full screen display of waveform. Push it again to show the menu options.

F1-F5: These five softkeys are all multi-functional. They are in charge of selecting corresponding menu options on the screen in different menu modes.

This functional softkey is used to turn pages and confirm a selection, such as “next page”, “previous page”.

2.4. Oscilloscope Setup

While operating the oscilloscope, you may often use four features: Auto Scale, saving a setup, recalling a setup and default setup. Hereinafter they are introduced one by one.

Auto Set: This function can be used to adjust the horizontal and vertical scales of the oscilloscope automatically and set the trigger coupling, type, position, slope, level and mode, etc., to acquire a stable waveform display.

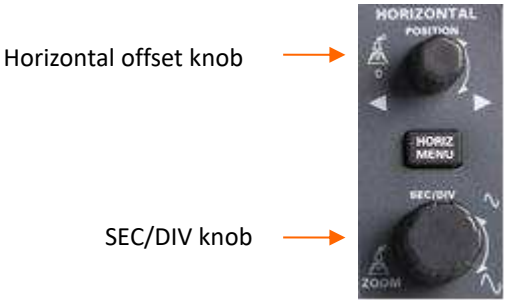
Saving a Setup: By default, the oscilloscope will save the setup each time before being closed, and automatically recall the setup once being turned on. (Note: If you modify the setup, please wait for more than 10 seconds before turning off the oscilloscope to ensure the proper storage of new settings.) You can save 10 settings permanently in the oscilloscope and reset them as necessary.

Recalling a Setup: The oscilloscope can recall any of your saved setups or the default factory setup.

Default Setup: The oscilloscope is preset for normal operations when it is shipped from the factory. This is the default setup. You may recall this setup at any time for your requirements.

2.5. Horizontal Controls

Use the horizontal controls to change the horizontal scale and position of waveform. The horizontal position readout shows the time represented by the center of the screen, using the trigger time as zero. When you change the horizontal scale, the waveform will expand or contract to the screen center. The readout near the upper right of the screen shows the current horizontal position in second. The oscilloscope also has an arrow icon at the top of the graticule to indicate the horizontal position.



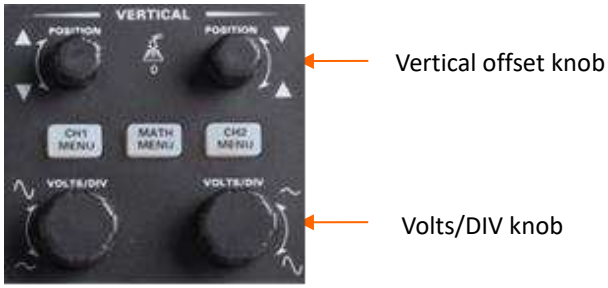
1. Horizontal Offset Knob: Used to control the trigger position against the screen center. Push this button to reset the trigger point back to the screen center.

2.SEC/DIV Knob: Used to change the horizontal time scale so as to magnify or compress the waveform horizontally. If the waveform acquisition is stopped (by using the **[Run/Stop]** or **[Single]** button), the SEC/DIV control will expand or compress the waveform.

2.6. Vertical System

2.6.1. Vertical Controls

Vertical controls can be used to display and remove waveform, adjust vertical scale and position, set input parameters and perform math calculations. Each channel has a separate vertical menu to set. See below for menu description.



1.Vertical Offset Knob: Move the channel waveform up and down on the screen. In dual-window mode, move the waveform in both windows at the same time in a same direction. Push this knob to return waveform to the vertical center position on the screen. Two channels correspond to two knobs.

2.VOLTS/DIV Knob: Control the oscilloscope to magnify or attenuate the source signal of the channel waveform. The vertical size of the display on the screen will change (increase or decrease) to the ground level.

3.Menu (CH1, CH2): Display vertical menu options; turn on or off the display of channel waveform.

Options	Settings	Comments
Coupling	DC	DC passes both DC and AC components of the input signal.
	AC	AC blocks the DC component of the input signal and attenuates signals below 10Hz.
	GND	Ground disconnects the input signal.
BW 20MHz	OFF	Limits the bandwidth to reduce display noise; filters the signal to eliminate noise and other unnecessary HF components.
	ON	

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	Selects a value according to the probe attenuation factor so as to ensure correct vertical readouts. Reduce bandwidth to 6MHz when using a 1X probe.
Invert	OFF ON	The invert function turns the displayed waveform 180 degrees, with respect to the ground level. When the oscilloscope is triggered on the inverted signal, the trigger is also inverted.

2.6.2. Math Operation

The series of scope supports many math operations between analog channels waveform, including addition (+), subtraction (-), multiplication (*), division (/) and FFT. You can use cursors to measure it. The contents of this chapter:

- Units for Math waveform
- Math Operators
- To Adjust the Math Waveform Scale and Offset

Note: If the analog channel or the math function display is truncated (waveform do not display on the screen completely), the resulting math will also be truncated.

Operation	Unit
Addition (+) or subtraction (-)	V
multiplication (*)	V^2
division (/)	None
FFT	dB, VRms

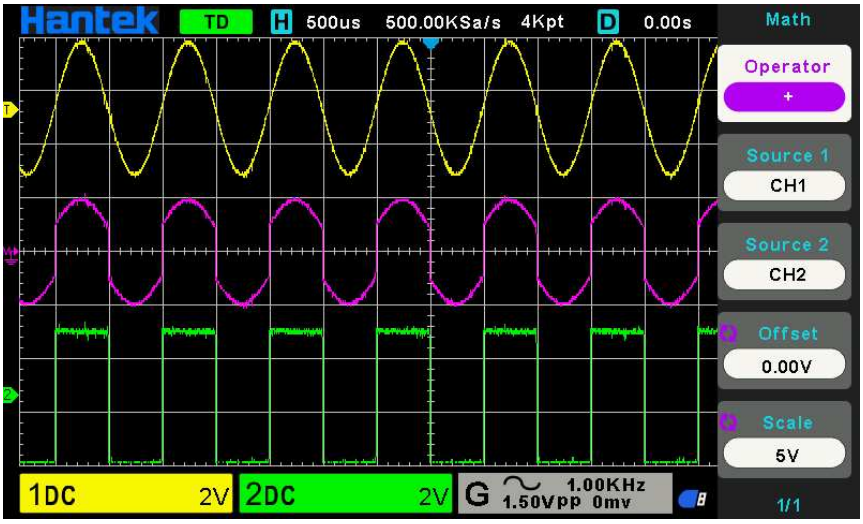
Addition or Subtraction

Math operators perform arithmetic operations - add or subtract operation - on any two analog input channels. When you select addition or subtraction, the Source A and Source B values are added or subtracted point by point, and the result is displayed.

1. Press the **[Math]** button on the front panel to enter the MATH function menu.

2. Press the **Source 1** and **Source 2** softkey respectively, and turn the Multifunctional Knob to select the source to do math operation. Analog channels (CH1~CH2) can all be used as Source 1 or source 2.

3. Press the **Operator** softkey and turn the universal to select + or -to make addition or subtraction operation. The resulting math waveform is displayed on the screen and labeled with “M”.



4. Press the **Scale** softkey, and turn the Multifunctional Knob to select the vertical scale.

5. Press the **Offset** softkey, and turn the Multifunctional Knob to set offset.

Multiplication and Division

Math operators perform arithmetic operations multiplication or division operation on any two analog input channels. When you select multiplication or division, the Source 1 and Source 2 values are multiplied or divided point by point and the result is displayed.

1. Press the **[Math]** button on the front panel to enter the MATH function menu.

2. Press the **Source 1** and **Source 2** softkey respectively, and turn the Multifunctional Knob to select the source to do math operation. Analog channels (CH1 ~CH2) can all be used as Source 1 or source 2.

3. Press the **Operator** softkey and turn the universal to select * or / to make multiplication or division operation. The resulting math waveform is displayed on the screen and labeled with “M”.

4. Press the **Scale** softkey, and turn the Multifunctional Knob to select the vertical scale.

5. Press the **Offset** softkey, and turn the Multifunctional Knob to set offset.

FFT Operation

FFT is used to compute the fast Fourier transform using analog input channels or reference waveform. FFT takes the digitized time record of the specified source and transforms it to the frequency domain. When the FFT function is selected, the FFT spectrum is plotted on the oscilloscope display as magnitude in dBV versus frequency. The readout for the horizontal axis changes from time to frequency (Hertz) and the vertical readout changes from volts to dB. The mathematical calculation function can convert the 2048 center points of the time domain waveform into an FFT spectrum. The final FFT spectrum contains 1024 points from DC (0 Hz) to the Nyquist frequency. Normally, the display screen compresses the FFT spectrum horizontally to 250 points, but you can use "FFT zoom" to expand the FFT spectrum to more clearly see the frequency components of each of the 1024 data points in the FFT spectrum. FFT operation can facilitate the following works:

- Measure harmonic components and distortion in the system
- Measure the characteristics of the noise in DC power

➢ Analyze vibration

To display FFT waveform:

1. Press the **[Math]** button on the front panel to open the MATH function menu.

2. Press the **Operation** softkey and then turn the **Multifunctional Knob** to select **FFT**. The resulting math waveform is displayed on the screen and labeled with “M”.

3. Press the **Source** softkey, and then turn the **Multifunctional Knob** to select the source to do FFT operation. Analog channels (CH1~CH2) can be used as the source.

4. Press **Center** softkey and then turn the **Multifunctional Knob** to adjust the frequency of the frequency domain waveform corresponding to the horizontal center of the screen.

5. Press **Span** softkey and then turn the **Multifunctional Knob** to adjust the the horizontal scale of the frequency domain waveform.

6. Press the **Vertical Units** softkey to select the unit of vertical axis. The units of the vertical axis can be dB or Vrms which use a logarithmic scale or a linear scale to display vertical amplitude respectively.

7. Press the **Scale** softkey to select the vertical scale.

8. Press the **Window** softkey, and then turn the **Multifunctional Knob** to select an appropriate window.

Spectral leakage can be considerably decreased when a window function is used. The series of scope provides six kinds of FFT window functions which have different characteristics and are applicable to measure different waveform. You need to select the window function according to different waveform and their characteristics. Please read the table below carefully to make an appropriate option according to the input signal.

Window	Measurement	Characteristics
Rectangular	Pulse or Transient Waveform	Special-purpose window applicable to discontinuous waveform. This is actually the same as no windows.
Hanning	Periodic Waveform	Better frequency, poorer amplitude accuracy than Flattop
Hamming	Transient or short pulse	A litter bit better frequency resolution than Hanning.
Blackman	Single frequency signal, search for higher order harmonics.	The best amplitude resolution; the poorest frequency resolution
Bartlett	Narrow band signal with stronger	Better frequency resolution.
Flattop	Periodic Waveform	Better amplitude, poorer frequency accuracy than Hanning

9. Press the **Show-Only** softkey to select to display FFT operation results only and not display the source channel.

Note:

1.Signals with DC components or deviation would cause an error or deviation of the FFT waveform components. To reduce the DC components, set the Channel Coupling to AC.

2.To reduce the random noise and aliasing frequency components of repetitive or single pulse, set the Acquisition of the oscilloscope to Average.

Using Cursors to measure FFT waveform

To make cursor measurements, press the Cursors button to turn the cursors, and then press the Mode softkey to select Manual or Track, Use the AX and BX cursors to measure frequency values and the difference between two frequency values (BX-AX). Use the AY and BY cursors to measure amplitude in dB and difference in amplitude (BY-AY).

2.7. Trigger System

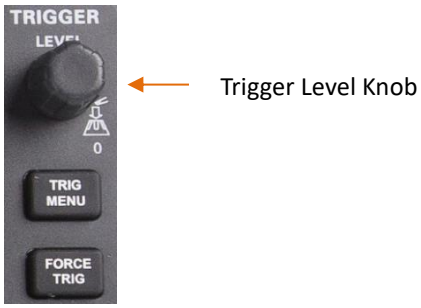
The trigger determines when the oscilloscope begins to acquire data and display a waveform. Once a trigger is properly set up, the oscilloscope can convert unstable displays or blank screens to meaningful waveform. Here introduce some basic concepts about trigger.

Trigger Source: The trigger can be generated with multiple sources. The most common one is the input channel (CH1~CH2). Whether the input signal is displayed or not, it can trigger normal operations. Also the trigger source can be any signal connected to an external trigger channel (only for Edge trigger).

Trigger Mode: You can select the Auto or Normal mode to define how the oscilloscope acquires data when it does not detect a trigger condition. **Auto Mode** performs the acquisition freely in absence of valid trigger. It allows the generation of untriggered waveform with the time base set to 100ms/div or slower. **Normal Mode** updates the displayed waveform only when the oscilloscope detects a valid trigger condition. Before this update, the oscilloscope still displays the old waveform. This mode shall be used when you want to only view the effectively triggered waveform. In this mode, the oscilloscope displays waveform only after the first trigger. To perform a single sequence acquisition, push the **[Single]** button.

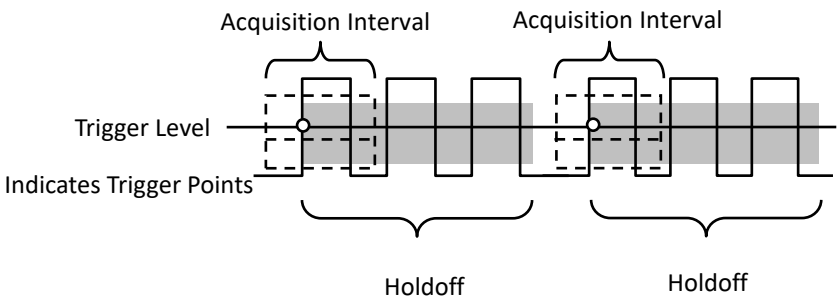
Trigger Position: The horizontal position control establishes the time between the trigger position and the screen center.

Trigger Level: It sets the amplitude level the signal must cross to cause an acquisition when using the Edge or Pulse Width trigger.



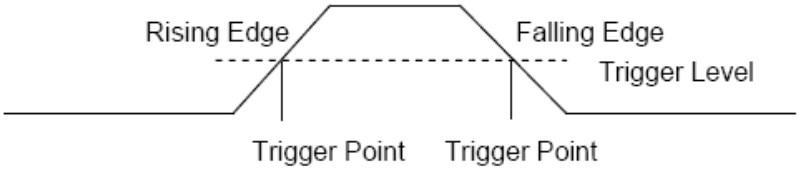
Force Trigger: Used to complete an acquisition regardless of an adequate trigger signal. This button becomes useless if the acquisition is already stopped.

Holdoff: To use Trigger Holdoff, push the **Trig Menu** button and press **Holdoff** softkey. The Trigger Holdoff function can be used to generate a stable display of complex waveform (such as pulse trains). Holdoff is the time between when the oscilloscope detects one trigger and when it is ready to detect another. During the holdoff time, the oscilloscope will not trigger. For a pulse train, the holdoff time can be adjusted to let the oscilloscope trigger only on the first pulse in the train.



2.7.1. Edge Trigger

Edge trigger distinguishes the trigger points by seeking the specified edge (rising, falling, rising & falling) and trigger level.



1. Press the **[Trig Menu]** button on the front panel to enter the Trigger system function menu.

2. Press the **Type** softkey, turn the Multifunctional Knob to set select “Edge” and then press the knob to confirm.

3. Press the **Source** softkey, turn the Multifunctional Knob to select **CH1~CH2** or **External** or **Line** as the trigger source.

CH1~CH2: Analog channel.

External: External trigger input, it is on the front panel of the oscilloscope. The external trigger signal must be a waveform with the minimum value of 0V and the maximum value of 5V.

Line: Trigger on the 50% level of the AC power signal.

4. Press the **Slope** softkey, turn the Multifunctional Knob to select the desired trigger edge (rising, falling or rising & falling), and then press down the knob to confirm.

5. Turn the Trigger Level Knob to adjust the trigger level to obtain stable trigger.

6. Press of **50%** softkey to set the trigger level to the vertical midpoint between the peaks of the trigger signal. The trigger level values are displayed at the upper right corner of the screen.

7. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

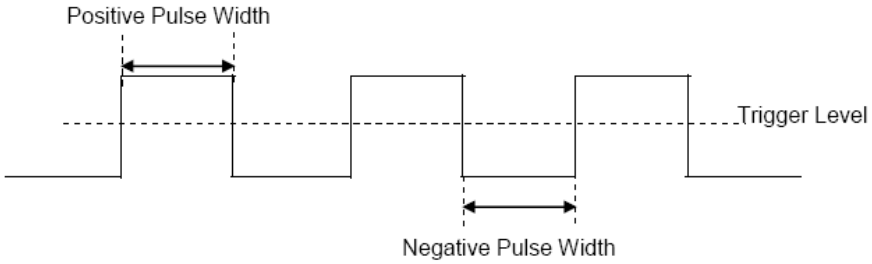
Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

8. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

*Note: Press the **[Auto Set]** button will set the trigger type to Edge and slope to rising.*

2.7.2. Pulse Trigger

Pulse trigger sets the oscilloscope to trigger on a positive or negative pulse of a specified width. You can set the trigger source, polarity (positive pulse width, negative pulse width), limit conditions, and pulse width in this menu.



1. Press the **[Trig Menu]** button on the front panel to enter the TRIGGER function menu.

2. Press the **Type** softkey, turn the **Multifunctional Knob** to select Pulse and then press the knob to confirm.

3. Press the **Source** softkey, turn the **Multifunctional Knob** to select CH1~CH2 as the trigger source.

4. Turn the **Trigger Level Knob** to adjust the trigger level to the desired place.

5. Press the **Polarity** softkey to select Positive or Negative pulse that to trigger on.

6. Press the **When** softkey, turn the **Multifunctional Knob** to select the desired condition,

and push down the knob to confirm.

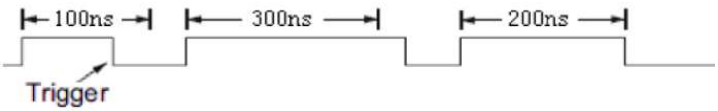
< (less than a time value): trigger when the positive or negative slope time of the input signal is lower than the specified time value.

For example, for a positive pulse, if you set t (pulse real width) < 100ns, the waveform will trigger.

> (greater than a time value): trigger when the positive or negative slope time of the input signal is greater than the specified time value.

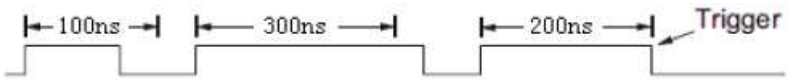
For example, for a positive pulse, if you set t (pulse real width) >100ns, the waveform will trigger.

!= (not equal to time value): trigger when the positive or negative slope time of the input signal is not equal to the specified time value.



= (equal to time value): trigger when the positive or negative slope time of the input signal is equal to the specified time value.

For example, for a positive pulse, if you set t (pulse real width) = 200ns, the waveform will trigger.



7. Press of **50%** softkey to set the trigger level to the vertical midpoint between the peaks of the trigger signal. The trigger level values are displayed at the upper right corner of the screen.

8. Press the **Width** soft key and select V0 to set the reference width of the pulse signal.

The pulse width of the data source must be ≥ 5ns so that the oscilloscope can detect the pulse.

=, ≠: Within a ±5% tolerance, triggers the oscilloscope when the signal pulse width is equal to or not equal to the specified pulse width.

<, >: Triggers the oscilloscope when the source signal pulse width is less than or greater than the specified pulse width.

9. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

10. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.3. Video Trigger

Video triggering can be used to capture the complicated waveform of most standard analog video signals. The trigger circuitry detects the vertical and horizontal interval of the waveform and produces triggers based on the video trigger settings you have selected. The series of scope support standard video signal field or line of NTSC (National Television Standards Committee), PAL (Phase Alternating Line).

1. Press the **[Trig Menu]** button on the front panel to enter the Trigger function menu.

2. Press the **Type** softkey, then turn the **Multifunctional Knob** to select Video and push down the knob to confirm.

3. Press the **Source** softkey turn the Multifunctional Knob to select CH1~CH2 as the trigger source.

4. Press **Polarity** to select the trigger polarity (positive and negative).

5. Press the **Standard** softkey to select the desired video standard. The series of scope support the following video standards: PAL and NTSC.

6. Press the **Sync** softkey, then turn the Multifunctional Knob to select field or line.

7. Press the **Line Num** softkey and turn V0 to set the line number in the field to be triggered.

8. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

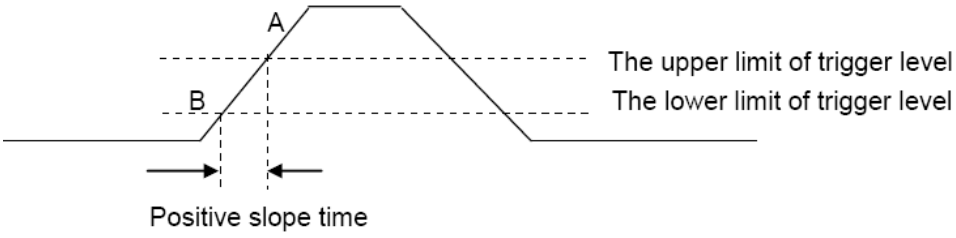
Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

9. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.4. Slope Trigger

The slope trigger looks for a rising or falling transition from one level to another level in the specified time range. In the series of scope, positive slope time is defined as the time difference between the two crossing points of trigger level line A and B with the positive edge as shown in the figure below.



1. Press the **[Trig Menu]** button on the front panel to enter the Trigger function menu.

2. Press the **Type** softkey, turn the **Multifunctional Knob** to set select Slop and then press the knob to confirm.

3. Press the **Source** softkey, turn the Multifunctional Knob to select CH1~CH2 as the trigger source.

4. Press the **Slop** softkey, turn the **Multifunctional Knob** to set select the desired trigger edge (rising or falling), and then push down the knob to confirm.

5. Press the **Level** softkey and press of Lower Upper softkey to select Lower(V2) or Upper(V1) the trigger level; then turn the **Trigger Level** Knob to adjust the position. The trigger different level value between Upper and Lower is displayed at the upper right corner of the screen.

The Lower trigger level cannot be upper than the upper trigger level. V1 means the upper trigger level while V2 means the lower trigger level.

6. Press the **When** softkey, then turn the **Multifunctional Knob** to select the desired slope condition, and push down the knob to confirm.

< (**less than a time value**): trigger when the positive or negative slope time of the input signal is lower

than the specified time value.

> (**greater than a time value**): trigger when the positive or negative slope time of the input signal is greater than the specified time value.

!=(**not equal to a time value**): trigger when the positive or negative slope time of the input signal is not equal to the specified time value..

=(**equal to a time value**): trigger when the positive or negative slope time of the input signal is equal to the specified time value.

7. Press the **Time** softkey and turn V0 to set the reference value of the slope time.

8. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

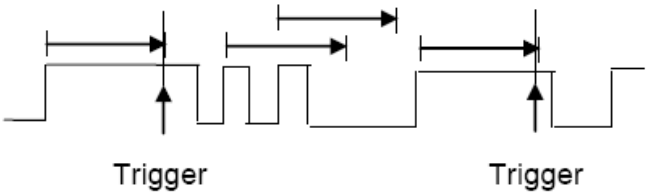
Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

9. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.5. Overtime Trigger

Trigger when the time interval (△T) from when the rising edge (or falling edge) of the input signal passes through the trigger level to when the neighboring falling edge (or rising edge) passes through the trigger level is greater than the timeout time set, as shown in the figure below.



1. Press the **[Trig Menu]** button on the front panel to enter the Trigger system function menu.

2. Press the **Type** softkey, then use the **Multifunctional Knob** to select Overtime and push down the knob to confirm.

3. Press the **Source** softkey, turn the **Multifunctional Knob** to select CH1~CH2 as the trigger source. Select channel with signal input as trigger source to obtain stable trigger.

4. Press the **Polarity** softkey to select Positive or Negative edge.

5. Press the **Time** softkey, turn the **Multifunctional Knob** to select the desired value.

6. Press of **50%** softkey to set the trigger level to the vertical midpoint between the peaks of the trigger signal.

7. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

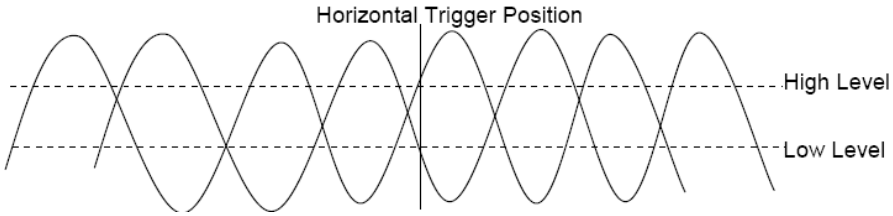
Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

8. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.6. Window Trigger

Windows trigger provides a high trigger level and a low trigger level. The instrument triggers when the input signal passes through the high trigger level or the low trigger level.



- If the lower and the upper trigger levels are both within the waveform amplitude range, the oscilloscope will trigger on both rising and falling edge.
- If the upper trigger level is within the waveform amplitude range while the lower trigger level is out of the waveform amplitude range, the oscilloscope will trigger on rising edge only.
- If the lower trigger level is within the waveform amplitude range while the upper trigger level is out of the waveform amplitude range, the oscilloscope will trigger on falling edge only.

1. Press the **[Trig Menu]** button on the front panel to enter the Trigger function menu.

2. Press the **Type** softkey, then use the **Multifunctional Knob** to select Window and push down the knob to confirm.

3. Press the **Source** softkey, turn the Multifunctional Knob to select CH1~CH2 as the trigger source.

4. Press **Level** softkey to select Lower or Upper trigger level or both levels, then turn the **Trigger Level** Knob to adjust the position. The trigger level values are displayed at the upper right corner of the screen. The trigger different level value between Upper and Lower is displayed at the upper right corner of the screen.

The Lower trigger level cannot be upper than the upper trigger level. V1 means the upper trigger level while V2 means the lower trigger level.

5. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

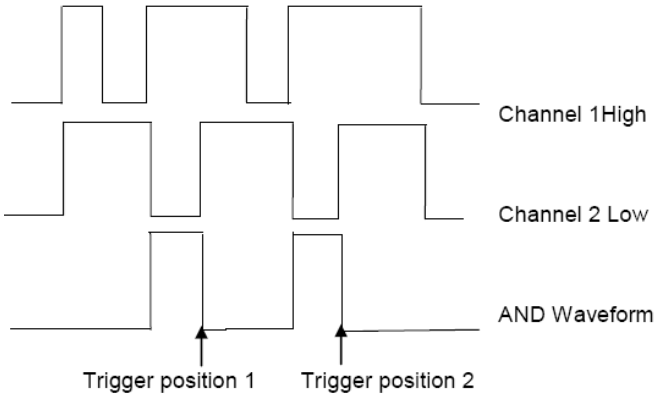
Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

6. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.7. Pattern Trigger

Identify a trigger condition by looking for a specified pattern. This pattern is a logical "AND" or “Or” combination of channels. Each channel can have a value of high (1), low (0) or don't care (X). A rising, falling edge, rising or falling can be specified for one channel included in the pattern. When an edge is specified, the oscilloscope will trigger at the edge specified if the pattern set for the other channels are true (namely the actual pattern of the channel is the same with the preset pattern). If no edge is specified, the oscilloscope will trigger on the last edge that makes the pattern true. If all the channels in the pattern are set to "Don’t Care", the oscilloscope will not trigger.



To set interval trigger:

1. Press the **[Trig Menu]** button on the front panel to enter the Trigger system function menu.

2. Press the **Type** softkey, then use the **Multifunctional Knob** to select Pattern and push down the knob to confirm.

3. Press the **Logic** softkey, turn the **Multifunctional Knob** to select a logical "AND" or “Or” combination of channels and push down the knob to confirm.

4. Press **Pattern** to set the pattern of the current signal source, turn the **Multifunctional Knob** to select a pattern. At this point, the corresponding pattern is displayed on the menu. The patterns of channels CH1-CH2 are presented from left to right. You can set the pattern of a signal source when the souce is open. Press **Pattern** softkey to set pattern for other sources.

1: Set the pattern of the channel selected to "H", namely the voltage level is higher than the trigger level of the channel.

0: Set the pattern of the channel selected to "L", namely the voltage level is lower than the trigger level of the channel.

X: Set the pattern of the channel selected to "Don’t Care", namely this channel is not used as a part of the pattern. When all channels in the pattern are set to "Don’t Care", the oscilloscope will not trigger.

: Set the pattern to the rising edge of the channel selected.

: Set the pattern to the falling edge of the channel selected.

: Set the pattern to the rising or falling edge of the channel selected.

5. Press the **Level** softkey to set the trigger level. For the analog channels, the trigger level of each channel needs to be set independently. For example, set the trigger level of CH1. Press **Level** softkey to select CH1, and then use **Trigger level** knob to modify the level. Press **Pattern** softkey again to set the trigger level for other source.

6. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

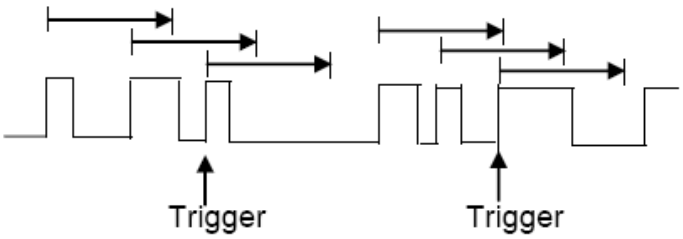
Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

7. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.8. Interval Trigger

Trigger when the time difference between the neighboring rising or falling edges meets the time limit condition (<, >, !=, =).



To set interval trigger:

1. Press the **[Trig Menu]** button on the front panel to enter the Trigger system function menu.

2. Press the **Type** softkey, then use the Multifunctional Knob to select Interval and push down the knob to confirm.

3. Press the **Source** softkey, turn the Multifunctional Knob to select CH1~CH2 as the trigger source.

4. Press the **Slope** softkey to select rising or falling edge.

5. Press the **When** softkey, turn the Multifunctional Knob to select desired condition.

< (less than a time value): trigger when the positive or negative pulse time of the input signal is less than the specified time value.

> (greater than a time value): trigger when the positive or negative pulse time of the input signal is greater than the specified time value.

!= (not equal to a time value): trigger when the positive or negative pulse time of the input signal is not equal to the specified limit of time.

= (equal to a time value): trigger when the positive or negative pulse time of the input signal is equal to the specified limit of time.

6. Press the **Time** softkey and turn V0 to set the reference value of the time.

7. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

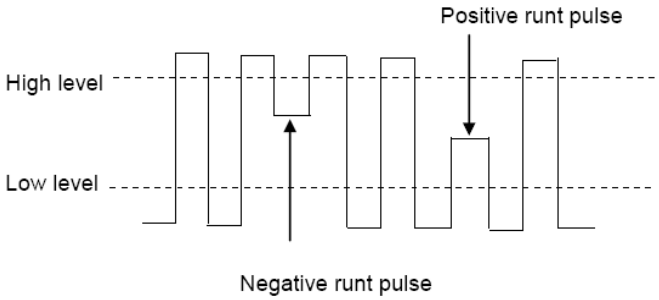
Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

8. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.9. Under Amp Trigger

The Under Amp trigger looks for pulses that cross one threshold but not another as shown in the picture below.



- A positive under Amp pulse across through a lower threshold but not an upper threshold.
- A negative under Amp pulse across through an upper threshold but not a lower threshold.

To trigger on under Amp pulse:

1. Press the **[Trig Menu]** button on the front panel to enter the Trigger system function menu.

2. Press the **Type** softkey, then turn the **Multifunctional Knob** to select Under Amp and push down the knob to confirm.

3. Press the **Source** softkey, turn the **Multifunctional Knob** to select CH1~CH2 as the trigger source.

4. Press the **Polarity** softkey to select Positive or Negative pulse to trigger.

5. Press the **When** softkey, turn the **Multifunctional Knob** to select the desired condition (<, >, != or =).

6. Press the **Width** softkey, and then turn the **Multifunctional Knob** to select the desired value.

7. Press the **Level** softkey to select Upper(V1) or Lower(V2) trigger level, and turn the **Multifunctional Knob** to set the position, make the Under Amp pulse to be captured between the two levels.

8. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

9. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.10. UART Trigger

Set UART trigger:

1. Press the **[Trig Menu]** button on the front panel to enter the Trigger system function menu.

2. Press the **Type** softkey, then turn the **Multifunctional Knob** to select UART and push down the knob to confirm.

3. Press the **Source** softkey, turn the **Multifunctional Knob** to select CH1~CH2 as the trigger source.

4. Set the following parameters:

- **Idle Level**: Set the idle level High or Low to match your device under test.
- **Baud**: Press the **Baud Rate** softkey, then press the **Multifunctional Knob** and select a baud rate to match the signal in your device under test. If the desired baud rate is not listed, select Custom on the Baud softkey, and then press the Custom softkey and turn the **Multifunctional Knob** to set the desired baud rate.
- **Parity**: Parity Check. Choose odd, even, or none, based on your device under test.
- **Data Bits**: Data Length, Set the number of bits to match your device under test. (selectable from 5-8 bits).

5. Press the **When** softkey and set up the desired trigger condition:

- **Start** - The oscilloscope triggers when a start bit occurs.
- **Stop** - Triggers when a stop bit occurs on measured signal. The trigger occurs on the first stop bit regardless of using 1, 1.5 or 2 stop bit.
- **Spec Data** - Triggers on a data byte that you specify. For use when the device under test data words are from 5 to 8 bits in length

  a. Press the **When** softkey, and choose an equality qualifier. You can choose equal to(=), not equal to(!=), less than(<), or greater than(>) a specific data value.

  b. Press the **Data** softkey, and turn V0 to set the data value for your trigger comparison. The range of the data value is 0x00 to 0xff. This works in conjunction with the **When** softkey.

- **Parity error**: The oscilloscope triggers when the parity check is error when there is parity check.
- **Com error**: The oscilloscope triggers when the received data is error.

Note: *Use V0 to set the data. When the arrow shows vertical on the top left of Data menu, turn V0 to set the value of the current data bit; then press V0, the arrow shows horizontal, and turn V0 to select the data bits that you want to set.*

: Horizontal arrow, turn the **Multifunctional Knob** to select a digit.

: arrow, turn the **Multifunctional Knob** to set the value of the selected digit.

6. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

7. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.11. LIN Trigger

LIN triggering can trigger on the rising edge at the Sync Break exit of the LIN single-wire bus signal (that marks the beginning of the message frame), the Frame ID, or the Frame ID and Data.

Set LIN trigger:

1. Press the **[Trig Menu]** button on the front panel to enter the Trigger system function menu.

2. Press the **Type** softkey, then turn the **Multifunctional Knob** to select LIN and push down the knob to confirm.

3. Press the **Source** softkey, turn the **Multifunctional Knob** to select CH1~CH2 as the trigger source.

4. Press the **Buad Tate** softkey, and turn the **Multifunctional Knob** to set the Baud Rate.

5. Press the **Idle Level** softkey, and turn the **Multifunctional Knob** to set the Idle Level.

6. Press the **Identifier** softkey, and turn the **Multifunctional Knob** to set the Identifier. The range is from 0x00 to 0x3f.

7. Press **When** softkey to set trigger condition.

- **Interval Field** - The oscilloscope triggers when the interval field end.
- **Sync Field** –The oscilloscope triggers when the synchronous field end.
- **Id Field** –The oscilloscope triggers when the Id field end.
- **Sync Id Error** - The oscilloscope triggers when the Synchronization ID ERROR end.

➢**Identifier (Frame ID)** - The oscilloscope triggers when a frame with an ID equal to the selected value is detected. Use the Multifunctional Knob to select the value for the Frame ID.

➢**ID and Data (Frame ID and Data)** - The oscilloscope triggers when a frame with an ID and data equal to the selected values is detected. Use the Multifunctional Knob to select the value for the ID and Data.

a. Press **Data** software, use V0 to set the data, refer to 2.7.10;

b. **Data Mask:** When set to "ON", the data is ignored when it is triggered; the setting is "OFF", and the data on the data line must be consistent with the data of the index so that it can trigger;

c. **Data Index**: The range is 0 to 3. It can set four hexadecimal data.

8. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

9. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.12. CAN Trigger

Set CAN trigger:

1. Press the **[Trig Menu]** button on the front panel to enter the Trigger system function menu.

2. Press the **Type** softkey, then turn the **Multifunctional Knob** to select CAN and push down the knob to confirm.

3. Press the **Source** softkey, turn the **Multifunctional Knob** to select CH1~CH2 as the trigger source.

4. Press the **Buad Tate** softkey, and turn the **Multifunctional Knob** to set the Baud Rate.

5. Press the **Idle Level** softkey, and turn the **Multifunctional Knob** to set the Idle Level.

6. Press the **Identifier** softkey, and turn the **Multifunctional Knob** to set the Identifier.

Note: The Identifier means Remote ID and Data ID.

7. Press **When** softkey to set trigger condition.

➢**Start**: The oscilloscope triggers at the start of a frame.

➢**Remote ID**: The oscilloscope triggers on remote frames with the specified ID.

➢**Data ID**: The oscilloscope will trigger on data frames matching the specified ID

➢**Frame ID**: The oscilloscope will trigger on data frames od remote frames matching the specified frame data.

➢**Data Frame and data**: The oscilloscope will trigger on data frames matching the specified data frame

ID and data.

a. Press **Data** software, use V0 to set the data, refer to 2.7.10;

b. **Data Mask:** When set to "ON", the data is ignored when it is triggered; the setting is "OFF", and the data on the data line must be consistent with the data of the index so that it can trigger;

c. **Data Index**: The range is 0 to 3. It can set four hexadecimal data.

- Error: The oscilloscope will trigger on error frames matching the specified data.
- All Error: The oscilloscope will trigger when any form error or active error is encountered. Not include judgment of CRC errors.
- Ack Error: The oscilloscope will trigger when the comfirm is high.
- Overload Frame: The oscilloscope will trigger on overload frames.

8. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

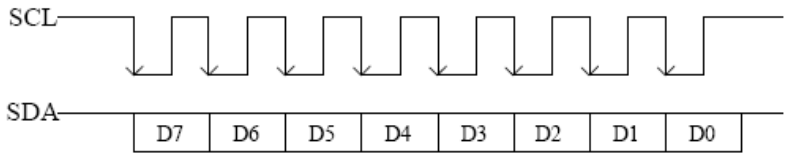
Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

9. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.13. SPI Trigger

In SPI trigger, when timeout condition is satisfied, the oscilloscope triggers when the specified data is found. When using SPI trigger, you need to specify the SCL clock sources and SDA data sources. Below is the sequential chart of SPI bus.



1. Press the **[Trig Menu]** button on the front panel to enter the Trigger system function menu.

2. Press the **Type** softkey, then turn the **Multifunctional Knob** to select SPI and push down the knob to confirm.

3. **Source**: Press **SCL** and **SDA** softkey to specify the data sources of SCL and SDA respectively. They can be set to CH1-CH2.

4. Data Line Setting:

Press **Data Width** to set the number of bits of the serial data character string. The serial data string can be specified to be from 4, 8, 16, 24, 32 bits long.

Press **Data** softkey, use V0 to set the data, refer to 2.7.10.

Data Mask: it is hexadecimal, 0-Mask, f-No Mask, 1~e mask some data.

5. Trigger Condition: Press **Overtime** softkey to set the timeout, the range is from 8 ns to 10 s.

Timeout: the clock (SCL) signal need to maintain a certain idle time before the oscilloscope searches for a trigger. The oscilloscope will trigger on when the data (SDA) satisfying the trigger conditions is found.

6. Slope: Press **Slope** softkey to select the desired clock edge.

Rising: sample the SDA data on the rising edge of the clock.

Falling: sample the SDA data on the falling edge of the clock.

7. When select SCL channel, press SCL and use **Trigger Level** knob to modify the trigger level of the SCL channel. When select SDA channel, use **Trigger Level** knob to modify the trigger level of the SDA channel.

8. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

9. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

2.7.14. IIC Trigger

IIC (Inter-IC bus) signals setup consists of connecting the oscilloscope to the serial data (SDA) line and the serial clock (SCL) line and then specifying the input signal threshold voltage levels.

To set up the oscilloscope to capture IIC signals, please refer to the following:

1. Press the **[Trig Menu]** button on the front panel to enter the Trigger system function menu.

2. Press the **Type** softkey, then turn the **Multifunctional Knob** to select **IIC** and push down the knob to confirm.

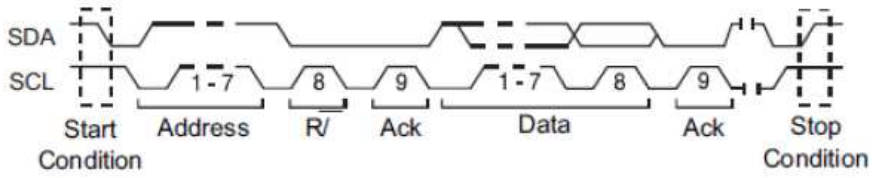
3. Source Selection: Press **SCL** and **SDA** softkey, turn the **Multifunctional Knob** to to specify the data sources of SCL and SDA respectively. They can be set to CH1-CH2.

4. Press **When** softkey to set trigger condition. Select trigger condition “Start Bit”, connect the SCL signal to CH1 and connect the SDA signal to CH2.

Press the corresponding **Level** softkey; then, turn the **Trigger Level** knob to set the signal threshold voltage level.

Data must be stable during the entire high clock cycle or it will be interpreted as a start or stop condition (data transitioning while the clock is high).

Trigger Condition: Press When softkey to select the desired trigger condition.



- **Start**: trigger when SDA data transitions from high level to low level while SCL is high level.
- **Stop**: trigger when SDA data transitions from low level to high level while SCL is high level.
- **No Ack**: trigger when the SDA data is high level during any acknowledgement of SCL clock position.
- **Address**: the trigger searches for the specified address value. When this event occurs, the oscilloscope will trigger on the read/write bit.

  The AddrBits is "7 bits"; so the range can be from 0 to 0x7F.
- **Restart**: trigger when another start condition occurs before a stop condition.
- **Address and Data**: the trigger searches for the specified address and data value on the data line (SDA). When this event occurs, the oscilloscope will trigger on the clock line (SCL) transition edge of the last bit of data. After this trigger condition is selected:

  a. Press **Data** software, use V0 to set the data, refer to 2.7.10;

  b. **Data Mask:** When set to "ON", the data is ignored when it is triggered; the setting is "OFF", and the data on the data line must be consistent with the data of the index so that it can trigger;

  c. **Data Index**: The range is 0 to 3. It can set four hexadecimal data.

5. **Trigger Level:** When select SCL channel, press SCL and use **Trigger Level** knob to modify the trigger level of the SCL channel. When select SDA channel, use **Trigger Level** knob to modify the trigger level of the SDA channel.

6. Press the **Mode** softkey, turn V0 to select the trigger mode (auto, normal), and press V0 to confirm.

Auto: When the oscilloscope meets the trigger condition, it completes a trigger acquisition once; when the trigger condition is not met, it can run the acquisition waveform freely.

Normal: When the oscilloscope meets the trigger condition, the input waveform is displayed; when the trigger condition is not met, the original waveform is displayed.

7. Press the **Holdoff** softkey and turn V0 to set the time that the oscilloscope waits before a trigger to the next trigger, so that complex waveforms are displayed stably.

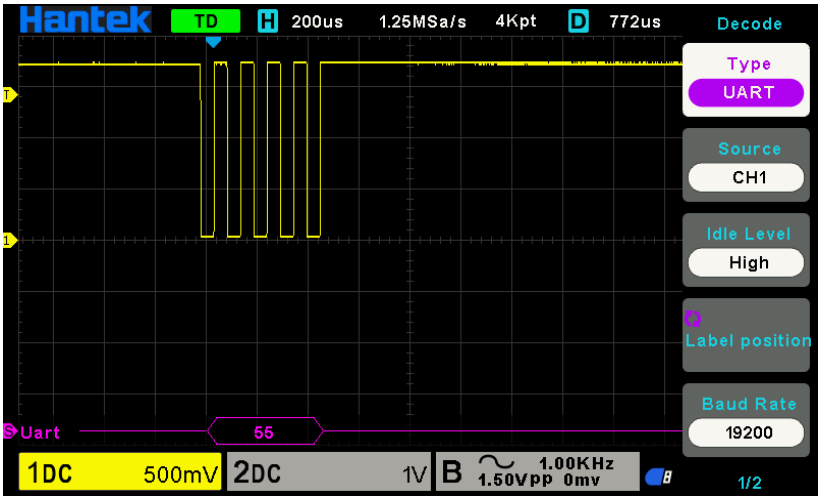
2.8. Protocol Decode

For the menu settings under protocol decoding, please refer to the five protocol trigger settings in 2.7 Trigger System. Protocol decoding can be implemented under any trigger type. Examples of protocol decoding are shown below for reference.

2.8.1. UART Decode

UART decode settings: Source: CH1; Baud: 19200; Idle: High; Parity: No; Data Bit: 8; When: “Start”.

The trigger result is shown below:



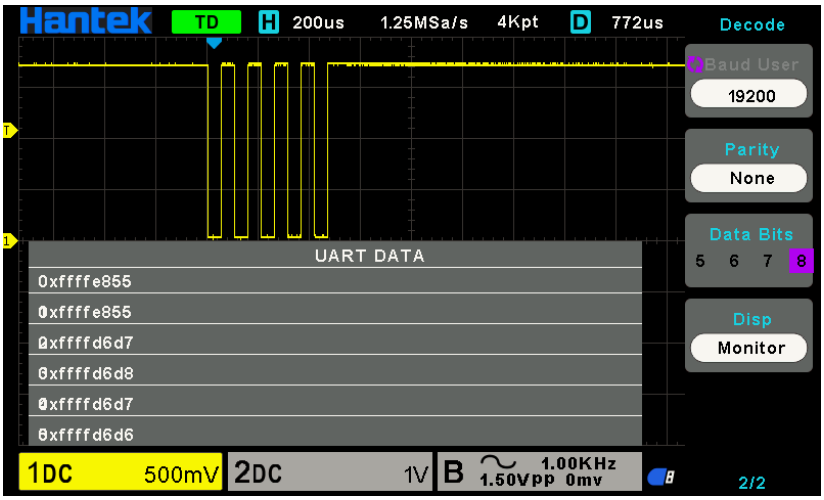
UART Decode interpretation:

1. The decode data is displayed in hexadecimal;

2. The decoded data is at the bottom of the waveform interface by default, and displayed in purple;

3. When there are "?" or "adjust the time base", you need to adjust the time base to see the decoding results.

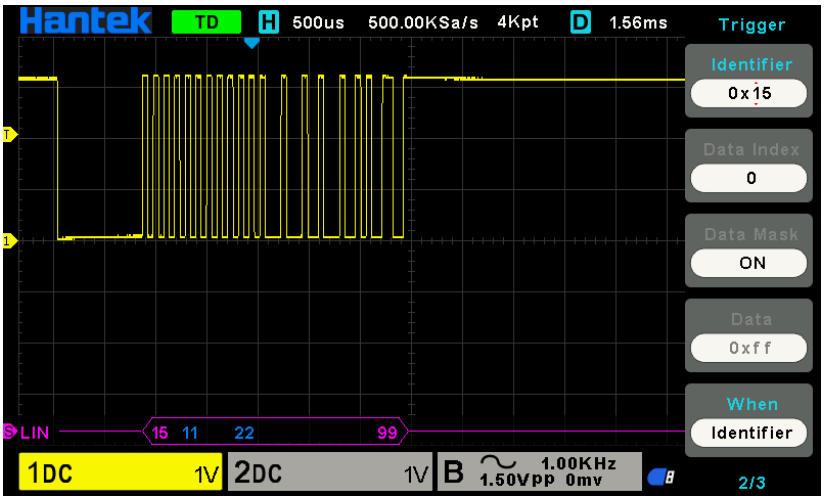
UART text interface is shown as below:



2.8.2. LIN Decode

LIN decode settings: Source: CH1; Baud: 19200; Idle: High; When: Identifier; Identifier: 0X15; And set the trigger level.

The trigger result is shown below:



LIN Decode interpretation:

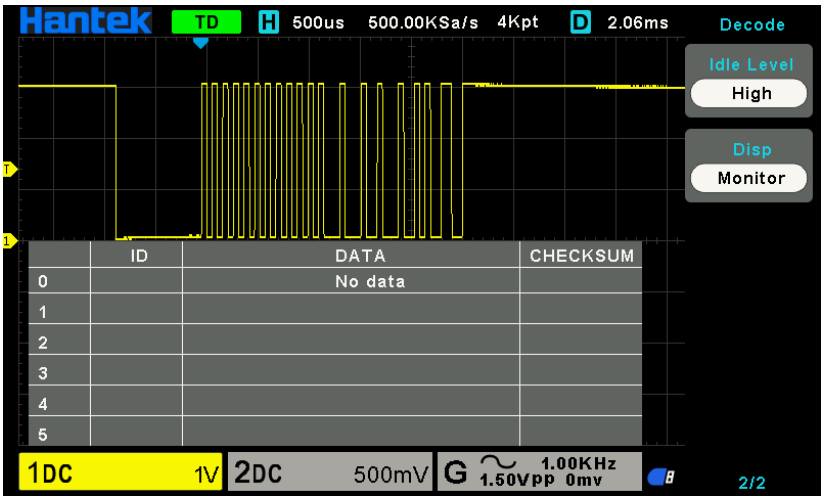
1. The decode data is displayed in hexadecimal;

2. The decoded data is at the bottom of the waveform interface by default. The color of "Frame ID" and "Checksum" is purple, and the color of "Data" is blue;

3. When there are "?" or "adjust the time base", you need to adjust the time base to see the decoding results.

4. In the LIN decode result, the synchronous field "55" is not decoded and displayed.

LIN text interface is shown as below:



ID: The ID value of the current frame;

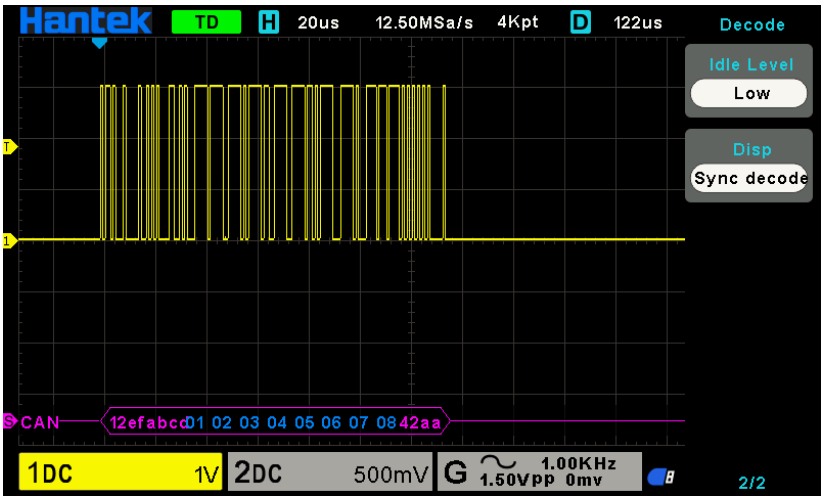
Data: The data of the current frame;

Checksum.

2.8.3. CAN Decode

CAN decode settings: Source: CH1; Baund Rate: 1000000; Idle Level: Low; When: Start Bit.

The trigger result is shown below:



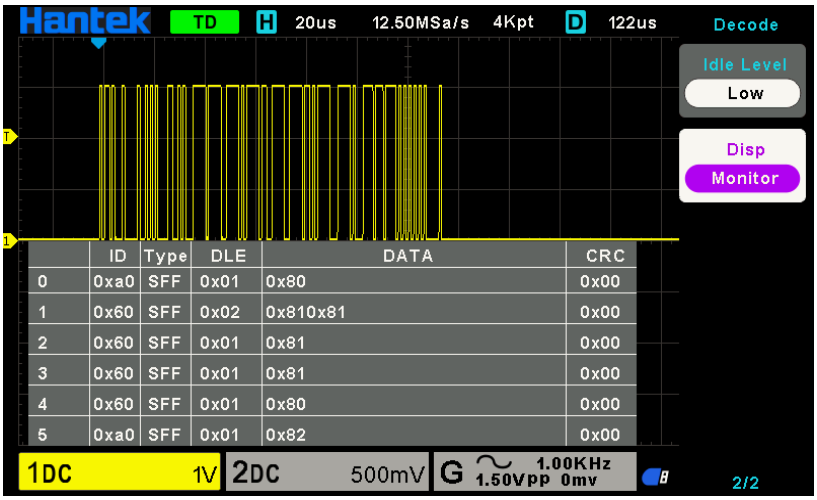
CAN Decode interpretation:

1. The decode data is displayed in hexadecimal;

2. The decoded data is at the bottom of the waveform interface. The color of “frame ID” is displayed purple, the “Data” is blue, the “CRC” is purple;

3. When there are "?" or "adjust the time base", you need to adjust the time base to see the decoding results.

CAN text interface is shown as below:



ID: The ID value of the current frame, displayed as hexadecimal;

Type: Frame type. “SFF”- Standard data frame, “SRF”- Standard remote frame, “EFF”- Extended data frame, “ERF”- Extended remote frame;

DLE: Data bytes of current frame;

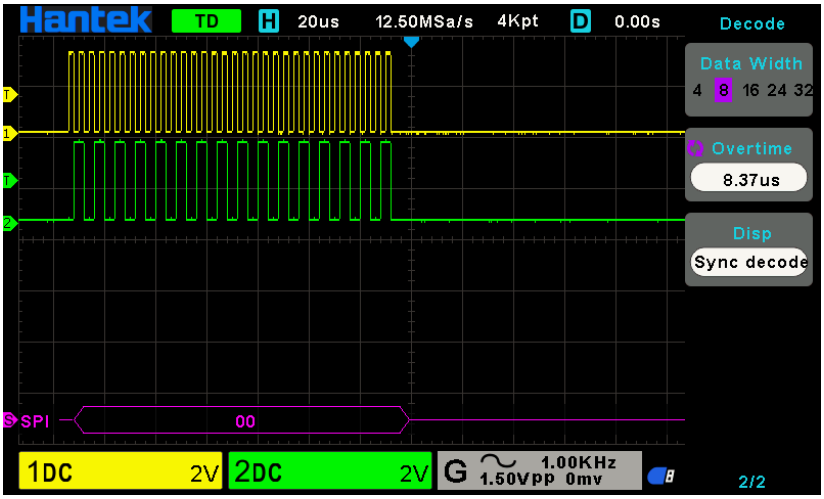
Data: The data of current frame;

CRC： The CRC check code of current frame.

2.8.4. SPI Decode

SPI decode settings： SCL: CH2; SDA: CH1; Slope: Rising; Data Width: 8; Overtime: 8.37us.

The trigger result is shown below:



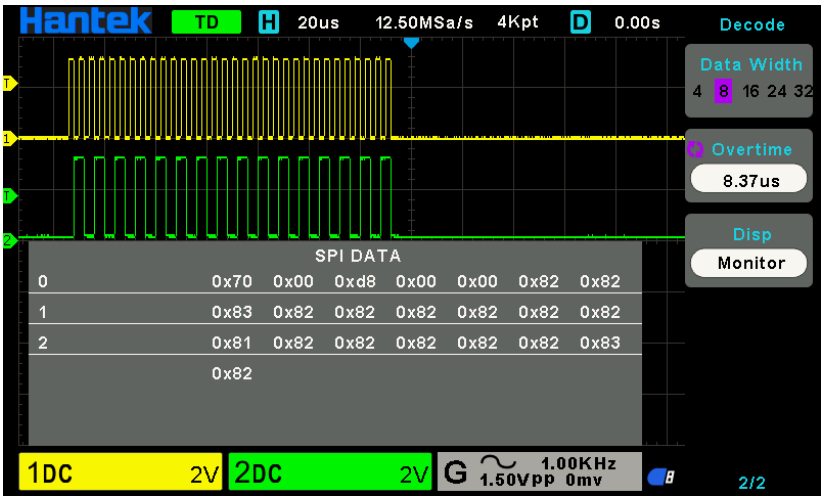
SPI Decode interpretation:

1. The decode data is displayed in hexadecimal;

2. The decoded data is at the bottom of the waveform interface. The color of “Data” is displayed purple;

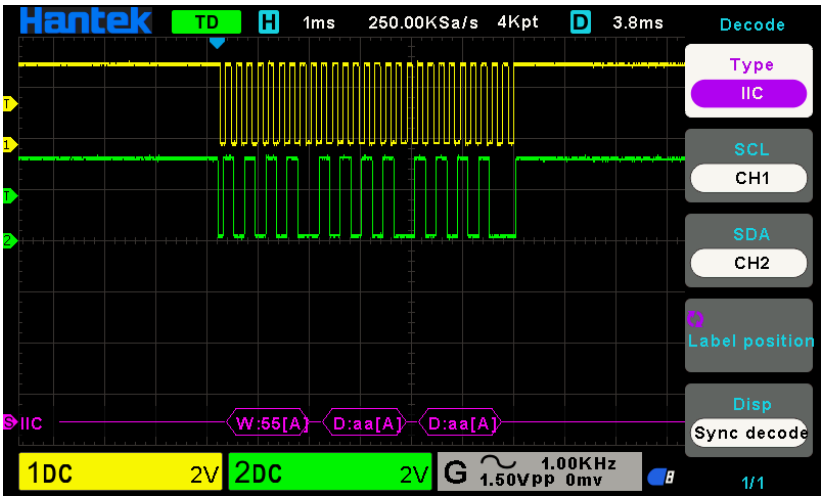
3. When there are "?" or "adjust the time base", you need to adjust the time base to see the decoding results.

SPI text interface is shown as below:



2.8.5. IIC Decode

IIC decode settings: SCL: CH1; SDA: CH2; When: Start Bit. The trigger result is shown below:



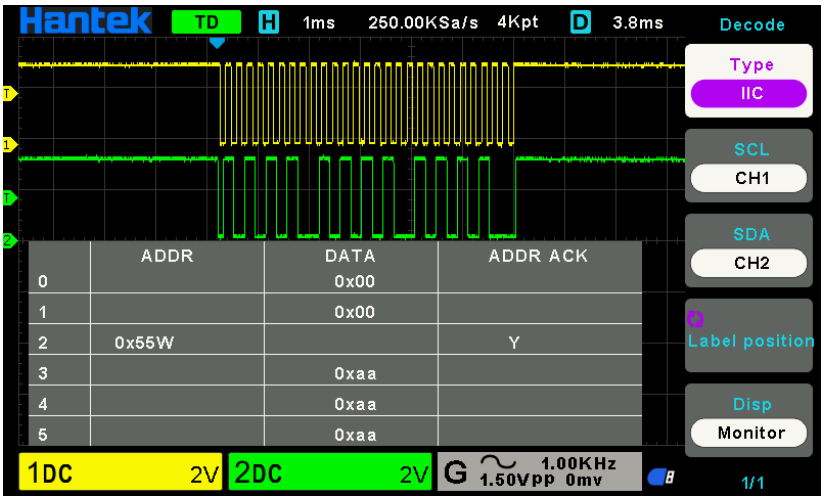
IIC Decode interpretation:

1. The decode data is displayed in hexadecimal;

2. The decoded data is at the bottom of the waveform interface. The color of “Address” and “Data” are displayed purple; "W" indicates the write operation, "R" indicates the read operation, "D" indicates the decoded data, "~A" indicates the unacknowledged bit;

3. When there are "?" or "adjust the time base", you need to adjust the time base to see the decoding results.

IIC text interface is shown as below:



ADDR: In the address bar, "R" represents the read operation, and "W" represents the write operation;

DATA: It is the data sent by a read or write operation;

ADDR ACK: "Y" means response, and "N" means no response.

2.9. Save/Recall

Oscilloscope setups, waveform, and reference waveform files can be saved to internal oscilloscope memory or to a USB storage device, the CSV and picture can be saved to USB storage device, the

default save type is setups. The saved setups, waveform and Ref can be recalled from an USB Host interface on the front panel to connect an USB device for external storage.

1. Setup

It's the default storage type of the scope. It saves the settings of the oscilloscope in internal or external memory in ".set" format. Up to 9 setting files (No.1～No.9) can be stored in the internal memory. The stored settings can be recalled.

2. Wave (Binary)

The scope saves the waveform data in memory in ".lwf" format. Up to 9 wave files (No.1～No.9) can be stored in the internal memory. The stored wave can be recalled.

3. Reference

The scope saves the waveform data in memory in ".ref" format. Up to 9 Ref files (No.1～No.9) can be stored in the internal memory. The stored Ref can be recalled, a total of 2 Refs can be recalled. At recall, the Refs will be displayed on the screen directly, at the same time, the time base, volt/div and level position when saving the Refs file are displayed. When the Refs is not needed, you can select "Close".

4. CSV

It saves the waveform data in external memory in ".csv" format. The stored files contain the waveform data of the displayed channels and the main setting information of the oscilloscope. The recall of CSV file is not supported.

5. Picture

Save the oscilloscope display interface to external storage in ".bmp" format. The recall of picture file is not supported.

2.9.1. Internal Save and Recall

Taking the "Setup" file as an example, the following describes the methods and steps for saving and recalling.

2.9.1.1.Save the oscilloscope setup file to internal memory.

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

2. Press **[Save/Recall]** button on the front panel to enter the SAVE/RECALL function menu.

3. Press the **Save** softkey and then turn the **Multifunctional Knob** to select **Setup** and then press the knob to confirm.

4. Press the **Save To** softkey to select Internal to save the current setup of the oscilloscope to the internal memory.

5. Press the **SetUp** softkey button, then turn the **Multifunctional Knob** to select the location to save. The internal memory can save as many as 9 setup files, from No.1～No.9.

6. Press the **Save** softkey to save the current setup to the appointed location. After a few seconds, it will

pop-out the message “Save successfully”.

2.9.1.2.Recall the oscilloscope setup file of internal memory

If want to recall the setup after having finished the steps above, please do the following steps: Press the **Recall** softkey, and then turn the **Multifunctional Knob** to select the location that you want to recall, press the **Recall** softkey to recall the setup, and it will pop-out the message “Recall Successfully”.

Note: if need to delete a setup file in the memory, please save a new setup to the same location to overwrite it.

2.9.2. External save and recall

Before using external storage and recall, make sure that the USB storage device is connected correctly. External storage supports all the types of files in save, but in recall, CSV is not supported.

2.9.2.1.Save the setup file to external USB storage device.

1. Press the **[Save/Recall]** button on the front panel to enter the SAVE/RECALL function menu.

2. Insert the USB storage device into the front panel USB Host interface, if the device is recognized successful, the pop-uptip “Storage device is connected”.

3. Press the **Save** softkey to select **Setup**.

4. Use the **SaveTo** softkey to external location. Press **Save** softkey and into USB storage interface. File can be stored under the root directory or in a certain folder under the root directory of the USB storage device.

5. After the save position is selected, press the **New** softkey to turn on the editing interface. Refer to the descriptions in “2.9.4. File Manager” to create a new file name.

6. Press the **Save** softkey to save the current waveform to the external USB storage device.

2.9.2.2.Recall the suptup file of external USB storage device.

1. Insert the USB storage device into the front panel USB Host interface, if thedevice is recognized successful, the pop-uptip “Storage device is connected”.

2. Press the **[Save/Recall]** button on the front panel to enter the SAVE/RECALL function menu.

3. Press the **Type** softkey to select **Setup**.

4. Press the **Recall** softkey to enter the SAVE/RECALL file system.

5. Turn the **Multifunctional Knob** to select the file to be recalled, press the **Recall** softkey to recall the waveform or setup.

2.9.3. Save picture

Ensure that the USB storage device is connected, and save the picture to external USB storage device.

1. Press the **[Save/Recall]** button on the front panel to enter the SAVE/RECALL function menu.

2. Insert the USB storage device into the front panel USB Host interface, if thedevice is recognized successful, the pop-uptip “Storage device is connected”.

3. Press the **Save** softkey to enter save menu.

4. Press the **Type** softkey to select Save Type to **Picture**.

5. Press the **Screen Inverted** softkey, select **OFF** or **ON.**

OFF: The color of the saved picture is the color of the screen.

ON: The color of the saved picture is the opposite color of the screen.

6. Press the **Save** softkey to save the picture to the external USB storage device.

Screenshot

Press **SAVE TO USB** on the front panel to automatically take a screenshot to save the picture to an external storage device.

2.9.4. File Manager

2.9.4.1.Create a New File

This operation is only valid in external storage. DSOXXXX supports English input method. The file name or folder name can contain letters, numbers and underscores. Let’s use an example to introduce how to create a file or folder.

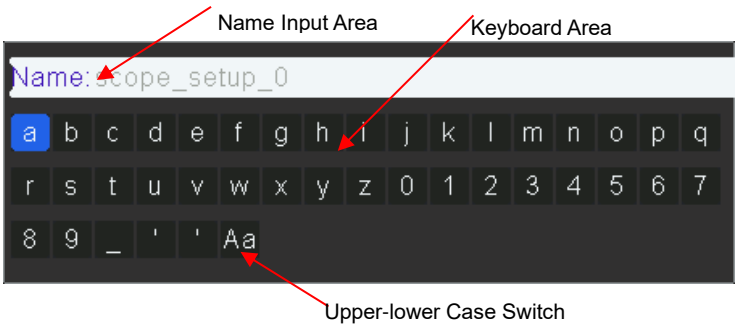
Create a file named “DSOXXXX01”

1.Insert the USB storage device, press the **Save** softkey in “Save/Recall” menu to enter the Save function menu.

2.Press the **Type** softkey, and then turn the **Multifunctional Knob** to select one type.

3.Use the **SaveTo** softkey to external location. Press Save softkey and into File Manager interface.

4.Press the **New** softkey to open the interface shown as the picture below. It divides into two parts: name input area and keyboard area. The default is keyboard area. As the picture shows below, “Aa" is used to switch upper-lower case.



5.Turn V0 to select “Aa” and press V0 to confirm to set the input method to upper case.Turn V0 to select “DSOXXXX01” and then press V0 to input the characters successively.

6.To delete the name in the name input area, press Switch Focus To softkey to switch to Name Input Area. Press the Delete softkey continuously to delete the character on the left of the cursor one by one. Turn V0 to move the cursor position.

7.Press the Save softkey to enter the file name. You will see a file or folder named “DSOXXXX01”.

2.9.4.2.Delete a file or folder

This operation is only valid in external storage.

1. Insert the USB storage device, press the **Save** softkey in “Save/Recall” menu to enter the Save function menu.

2. Press the **Type** softkey, and then turn the **Multifunctional Knob** to select one type.

3. Use the **SaveTo** softkey to external location. Press **Save** softkey and into File Manager interface.

4. Turn the **Multifunctional Knob** V0 to select the file or folder to be deleted, and then press the Delete softkey. Then the file or folder will be deleted.

2.9.4.3.Rename a file or a folder

This operation is only valid in external storage.

1. Insert the USB storage device, press the **Save** softkey in “Save/Recall” menu to enter the Save function menu.

2. Press the **Type** softkey, and then turn the **Multifunctional Knob** to select one type.

3. Use the **SaveTo** softkey to external location. Press **Save** softkey and into File Manager interface.

4. Turn the Multifunctional Knob V0 to select the file or folder, press the **Rename** softkey, and then refer to the descriptions in “Create a new file” to create a new file name.

2.10. Measure System

The oscilloscope displays graphs of voltage - time and can help to measure the displayed waveform. There are several ways to take measurements, using the graticule, the cursors or performing an automatic measurement.

2.10.1. Scale measurement

Graticule: This method allows you to make a quick, visual estimate and take a simple measurement through the graticule divisions and the scale factor.

For example, you can take simple measurements by counting the major and minor graticule divisions involved and multiplying by the scale factor. If you counted 6 major vertical graticule divisions between the minimum and maximum values of a waveform and knew you had a scale factor of 50mV/division, you could easily calculate your peak-to-peak voltage as follows:

6 divisions x 50mV/division = 300mV.

2.10.2. Cursor measurement

Cursor: This method allows you to take measurements by moving the cursors. Cursors always appear in pairs and the displayed readouts are just their measured values. There are two kinds of cursors: Amplitude Cursor and Time Cursor.

The amplitude cursor appears as a horizontal dotted line, measuring the vertical parameters.

The time cursor appears as a vertical dotted line, measuring the horizontal parameters.

The cursor measurement includes two modes: Manual mode and Tracking mode.

1. Manual mode:

Horizontal cursors or vertical cursors appear in pair to measure time or voltage, and the distance between the cursors can be manually regulated. The signal source should be set as a waveform to be measured before the cursors are used.

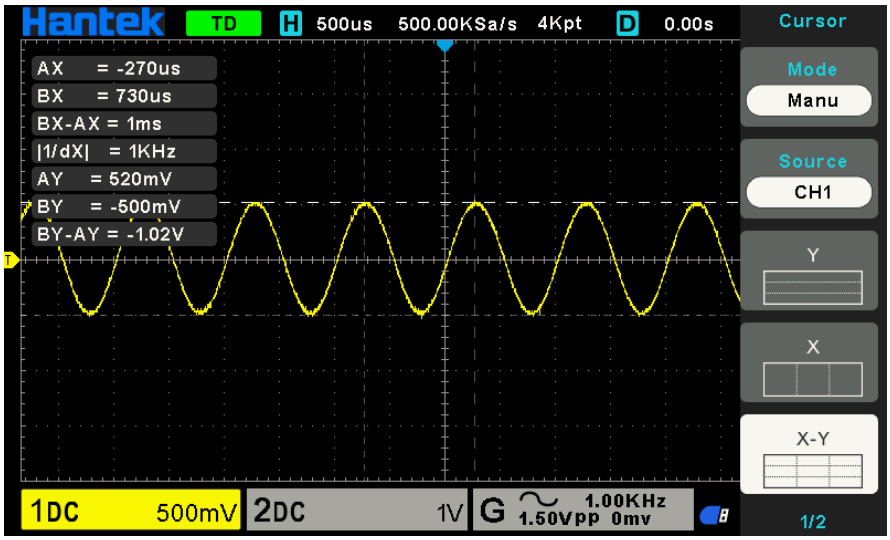
2. Tracking mode:

A horizontal cursor is intersected with a vertical cursor to form a cross cursor. The cross cursor is automatically located on the waveform, and the horizontal position of the cross cursor on the waveform is regulated by selecting “Cur A” or “Cur B” and rotating the [UNIVERSAL] knob. The coordinates of the cursor point will be displayed on the screen of the oscilloscope.

Push the **CURSOR** button to display the Cursor Menu.

Options	Settings	Comments
Mode	Manual Track	Select a measurement cursor and display it.
Source	CH1~CH2 MATH	Select a waveform to take the cursor measurement. Use the readouts to show the measurement.
Select Cursor	AX(BX) AXBX AY(BY) AYBY	A selected cursor is highlighted, which can be moved freely. Both cursors can be selected and moved at the same time. The box behind the cursor displays the location of the cursor.

Moving Cursors: Press the key near Select Cursor to select a cursor and turn **Multifunctional Knob** to move it. Cursors can be moved only when the Cursor Menu is displayed.



2.10.3. Automatic Measurement

Automatic Measurement: The oscilloscope performs all the calculations automatically in this mode. As this measurement uses the waveform record points, it is more precise than the graticule and cursor measurements. Automatic measurements show the measurement results by readouts which are periodically updated with the new data acquired by the oscilloscope.

Push the **Meas** button to perform auto measurements. There are 32 types of measurements and up to 4 can be displayed at a time.

Perform the steps below and select voltage or time parameters to make automatic measurements.

1. Press the **[Meas]** button on the front panel to enter the Measure function menu.

2. Press the **Source** softkey, and then use the **Multifunctional Knob** to select the desired channel.

3. Press the **Type** softkey, and then turn the **Multifunctional Knob** to select the desired measurement parameter.

4. Press the **Multifunctional Knob** to add the measurement parameter, the parameters and value will be shown above the menu, and the statistics status will update.

5. To turn off the statistic function, press the **Statistics** softkey to select “OFF”.

The measurement display area can display 4 measurement parameters at most, and the measurements will arrange according to the selecting order. If add a sixth measurement parameter, it will delete the first measurement.

Note: If the parameter does not match the measured condition, it will display as “*****”.

To Clear Measurement Parameters

Press the **Clear All** softkey to clear all the measurement parameters that are displaying on the screen.

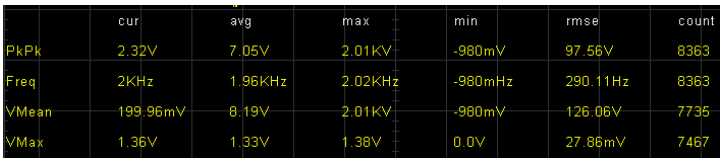
Statistic Function

Make statistic and display the current, average, minimum, maximum, root mean square error and count

values of at most 4 measurement items that are turned on last.

1. Press the **[Meas]** button on the front panel to enter the Measure function menu.

2. Press the **Statistics** softkey to select ON.



	cur	avg	max	min	rmse	count
PkPk	2.32V	7.05V	2.01KV	-980mV	97.56V	8363
Freq	2KHz	1.96KHz	2.02KHz	-980mHz	290.11Hz	8363
VMean	199.96mV	8.19V	2.01KV	-980mV	126.06V	7735
VMax	1.36V	1.33V	1.38V	0.0V	27.86mV	7467

To Make All Measurement

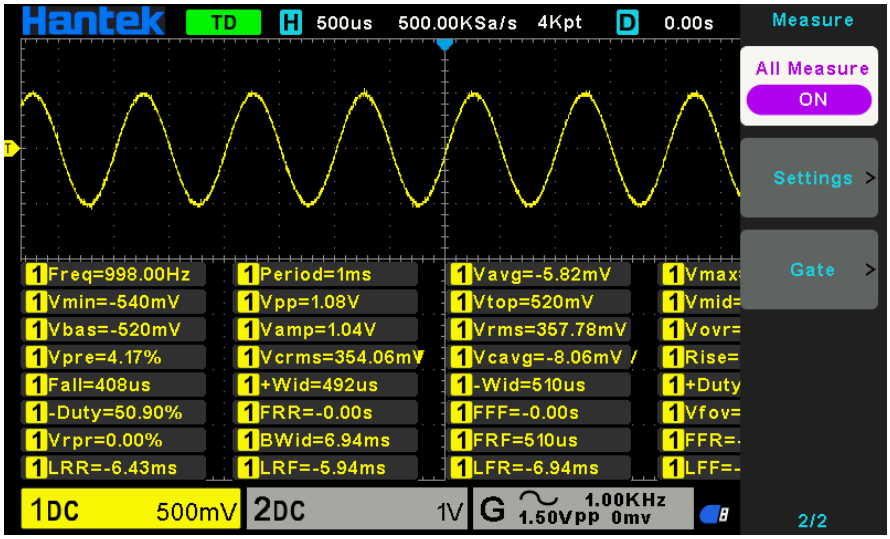
All measurement could measure all parameters of the current measurement source and display the results on the screen.

Do the following steps to make all parameters measurement.

1. Press the **[Meas]** button on the front panel to enter the MEASURE function menu.

2. Press the **All Measure** softkey to select ON.

3. Press the **Source** softkey to select the measure source (CH1~CH2).



No.	Type	Comments
1	Frequency	The reciprocal of the period.
2	Period	The time between two consecutive threshold points of the same polarity edge.
3	Average	The arithmetic mean of the entire waveform or selected area.
4	Pk-Pk	The voltage value from the peak to the lowest point of the waveform.
5	RMS	That is a valid value. According to the energy converted by the AC signal in one cycle, the DC voltage corresponding to the equivalent energy is the root mean square value.
6	Period Rms	The root mean square value of the signal within 1 cycle.
7	Min	The most negative peak voltage measured over the entire waveform.
8	Max	The most positive peak voltage measured over the entire waveform.
9	RiseTime	Measure the time between 10% and 90% of the first rising edge of the waveform.
10	FallTime	Measure the time between 90% and 10% of the first falling edge of the waveform.

11	+ Width	Measure the time between the first rising edge and the next falling edge at the waveform 50% level.
12	- Width	Measure the time between the first falling edge and the next rising edge at the waveform 50% level.
13	+ Duty	Measure the first cycle waveform. Positive Duty Cycle is the ratio between positive pulse width and period.
14	- Duty	Measure the first cycle waveform. Negative Duty Cycle is the ratio between positive pulse width and period.
15	Vbase	Measure the highest voltage over the entire waveform.
16	Vtop	Measure the lowest voltage over the entire waveform.
17	Vmid	Measure the voltage of the 50% level from base to top.
18	Vamp	Voltage between Vtop and Vbase of a waveform.
19	Overshoot	Defined as (Base - Min)/Amp x 100 %, Measured over the entire waveform.
20	Preshoot	Defined as (Max - Top)/Amp x 100 %, Measured over the entire waveform.
21	PeriodAvg	Calculate the arithmetic mean voltage over the first cycle in the waveform.
22	FOVShoot	Defined as (Vmin-Vlow)/Vamp after the waveform falling.
23	RPREShoot	Defined as (Vmin-Vlow)/Vamp before the waveform falling.
24	BWidth	The duration of a burst measured over the entire waveform.
25	FRR	The time between the first rising edge of source 1 and the first rising edge of source 2 of 50 voltage level.
26	FFF	The time between the first falling edge of source 1 and the first falling edge of source 2 of 50 voltage level.
27	FRF	The time between the first rising edge of source 1 and the first falling edge of source 2.
28	FFR	The time between the first falling edge of source 1 and the first rising edge of source 2.
29	LRR	The time between the first rising edge of source 1 and the last rising edge of source 2.
30	LRF	The time between the first rising edge of source 1 and the last falling edge of source 2.
31	LFR	The time between the first falling edge of source 1 and the last rising edge of source 2.
32	LFF	The time between the first falling edge of source 1 and the last falling edge of source 2.

Delay settings

When the 8 delay measurements of FRR, FFF, FRF, FFR, LRR, LRF, LFR, and LFF are selected, the source that is selected in the main menu of measure is the source 1 of delay measurement. In the second page of measurement main menu, select **Settings** softkey to enter delay menu, users can set the opened channel to the source 2 of delay measurement.

Gate measurement

In the second page of measurement main menu, select **Gate** softkey to enter gate menu. Only when the type of measurement is opened, the gate measurement can be opened.

After opening the gate measurement, the measurement results only measure the waveform between the cursor A and the cursor B.

2.11. DVM

DVM supports 3-bit voltage and 6-bit frequency measurement of any analog channel waveform. The

measurement is always performed when the oscilloscope is running or stopped.

Press [**MEASURE**] on the front panel to enter the measurement interface, and press **F3** to select the **DVM** to enter DVM setting interface.

Press **CH1 Enable, CH2 Enable** to enable any channel or all channels of DVM.

Press **CH1 Type, CH2 Type** to select the data type displayed by DVM.

DC RMS: displays the root-mean-squre value of the acquired data.

AC RMS: displays the root-mean-squre value of the acquired data with the DC component removed.

DC: Display the DC value of the acquired data.

The display in the middle of the DVM box is the corresponding ratio of the current measured voltage value to the range corresponding to the eight vertical grids on the screen with the selected volt/div (turn the volt/div knob).

2.12. Acquire

2.12.1. Run Control

Press the **[Run/Stop]** or **[Single]** button on the front panel to run or stop the sampling system of the scope.

When the **[Run/Stop]** is green, the oscilloscope is running, that is, acquiring data when trigger conditions are met. To stop acquiring data, press the **[Run/Stop]** button. When stopped, the last acquired waveform is displayed.

When the **[Run/Stop]** button is red, data acquisition is stopped. Red "Stop" is displayed next to the trademark logo in the status line at the top of the display. To start acquiring data, press **[Run/Stop]**.

To capture and display a single acquisition (whether the oscilloscope is running or stopped), press **[Single]** button. The Single run control lets you view single-shot events without subsequent waveform data overwriting the d isplay.

When **[Single]** is pressed, the display is cleared, the trigger mode is temporarily set to Normal (to keep the oscilloscope from auto-triggering immediately), the trigger circuitry is armed, the Single key is illuminated, and the oscilloscope waits until a user defined trigger condition occurs before it displays a waveform.

When the oscilloscope triggers, the single acquisition is displayed and the oscilloscope is stopped (the **[Run/Stop]** button is illuminated in red). Press **[Single]** button again to acquire another waveform.

When you acquire an analog signal, the oscilloscope will convert it into a digital one. The real-time acquisition has four modes: Normal, Peak Detect, Average and High Resolution. The acquisition rate is affected by the setting of time base.

Normal: In this acquisition mode, the oscilloscope samples the signal in evenly spaced intervals to establish the waveform. This mode accurately represents signals in most time. However, it does not acquire rapid variations in the analog signal that may occur between two samples, which can result in aliasing and may cause narrow pulses to be missed. In such cases, you should use the Peak Detect mode to acquire data.

Peak Detect: In this acquisition mode, the oscilloscope gets the maximum and minimum values of the input signal over each sample interval and uses these values to display the waveform. In this way, the oscilloscope can acquire and display those narrow pulses that may have otherwise been missed in Normal mode. However, noise will appear to be higher in this mode.

Average: In this acquisition mode, the oscilloscope acquires several waveform, averages them, and displays the resulting waveform. You can use this mode to reduce random noise.

High Resolution (HR): This mode uses a kind of ultra-sample technique to average the neighboring points of the sample waveform to reduce the random noise on the input signal and generate much smoother waveform on the screen. This is generally used when the sample rate of the digital converter is higher than the storage rate of the acquisition memory.

Note: "Average" and "HR" modes use different averaging methods. The former uses "Multi-sample Average" and the latter uses "Single Sample Average".

Time Base: The oscilloscope digitizes waveform by acquiring the value of an input signal at discrete points. The time base helps to control how often the values are digitized. Use the SEC/DIV knob to adjust the time base to a horizontal scale that suits your purpose.

Push the **UTILITY** button and press **Acquire** softkey to set the acquisition parameter.

Options	Settings	Comments
Mode (Real Time)	Normal	Acquire and accurately display most waveform.
	Peak Detect	Detect glitches and eliminate the possibility of aliasing.
	Average	Reduce random or uncorrelated noise in signal display. The number of averages is selectable.
	HR	
Disp Mode	YT	YT format shows the vertical voltage in relation to time (horizontal scale); XY format displays a dot between CH1 and CH2 each time when a sample is acquired, where the voltage or current of CH1 determines the X coordinate of the dot (horizontal) and the voltage or current of CH2 determines the Y coordinate (vertical). For detailed information, refer to descriptions on XY format in the following text.
	XY	
	Roll	
Averages	4, 8, 16, 32, 64, 128	Select the number of averages by pressing F3 or F4.
Memory Depth	4K, 8K, 16K, 4M, 8M	The maximum single-channel display is 8M.

2.12.2. XY Mode

The XY mode is used to analyze phase differences, such as those represented by Lissajous patterns. The

format plots the voltage on CH1 against the voltage on CH2, where CH1 is the horizontal axis and CH2 is the vertical axis. The oscilloscope uses the untriggered Normal acquisition mode and displays data as dots.

The oscilloscope can acquire waveform in YT mode at any sampling rate. You may view the same waveform in XY mode. To perform this operation, stop the acquisition and change the display mode to XY.

2.12.3. Roll Mode

In Roll mode, the waveform display rolls from right to left. No trigger or horizontal offset control of waveform is available during Roll Mode, and it's only available when set to 100ms/div or slower.

2.13. Display

The waveform display is affected by settings of the oscilloscope. A waveform can be measured once it is captured. The different styles to display a waveform on the screen give significant information about it.

Push the **[Display]** button and the following menu appears.

Options	Settings	Comments
Type	Vectors Dots	Vectors fill up the space between adjacent sample points in the display; Dots only displays the sample points.
Waveform Intensity		Adjustable, Turn the multi-functional knob to adjust.
Grid	Dotted line Real line OFF	Off only displays the horizontal and vertical coordinates at the center graticule on the screen.
Grid Intensity		Adjustable, Turn the multi-functional knob to adjust.
Screen Brightness		Adjustable, Turn the multi-functional knob to adjust.
Persist	OFF Infinite 1s, 5s, 10s,30s	Sets the time length to display each displayed sample point.

2.14. Utility System

Push the **UTILITY** button to display the Utility Menu as follows.

Options	Comments
Language	Set the language
Sound	Set the buzzer.
Update	Insert a USB disk with upgrade program. Press the Update Program button and the Software Upgrade window pops up. Refer to tips to upgrade or cancel.
Pass/Fail	Pass/Fail function.
System Info	Display the software and hardware versions, serial number and some other information about the oscilloscope.

Calibrate	Press this option and the Self Calibration dialog pops up. Refer to tips to perform the self calibration or cancel.
Front Panel Self Test	Test the function of all keys and knobs on the front panel.
Legal Information	Display source code license.

2.14.1. Update Firmware

This series of oscilloscope can upgrade the software by the USB flash disc, which needs about 5 minutes.

The firmware is upgraded by the following steps:

1. Plug the USB flash disc in which a firmware program is saved in USB Host interface on the front panel of the oscilloscope.

2. Press **[Utility]** button to skip to the Utility menu.

3. Press **Update -> Update Firmware** softkey.

4. Select the file and press **Multifunctional Knob** to confirm. Then press **Start updating** softkey to update the firmware.

5. Reboot the machine after finishing upgrading, and the software version is upgraded. The oscilloscope should be self-corrected once after upgrading.

2.14.2. Self Calibration

The self calibration routine helps optimize the oscilloscope signal path for maximum measurement accuracy. You can run the routine at any time but should always run it if the ambient temperature changes by 5℃ or more. For a more accurate calibration, please power on the oscilloscope and wait for 20 minutes until it has adequately warmed up.

To compensate the signal path, disconnect any probes or cables from the front-panel input connectors. Then, push the [Utility] button, select Calibrate option and follow the directions on the screen.

2.14.3. Pass/Fail

“Pass/Fail” is used for judging whether the input signal is in a built rule range and outputting the past or failed waveform so as to detect the change condition of the signal.

Option	Setup	Description
Pass/Fail	ON/OFF	Run/Stop the pass/fail function.
Source	CH1~CH2	Select the signal input channel.
Regular	Vertical	Use the **Multifunctional Knob** to set a horizontal tolerance range: 0.020div-4.00div.
	Horizontal	Use the **Multifunctional Knob** to set a vertical tolerance range: 0.025div-8.00div.
	Create	Create a rule template according to the two setups above.
	Save	Select a save position for the rule.

	SavaTo	1-10 locations for internal flash memory.
	Save	Save the rule setups.
	Recall	Recall the waved rule setups.
Message	On/Off	Turn on or off the display of the number of failed passes.
Run/Stop	-	Run or stop the pass/fail test.
Output Stop	On/Off	Enter STOP state if output exist or continue to run if output exists.
Mode	Pass/Fail	Output a negative pulse train when the test is passed; Output a negative pulse train when the test is failed.
	Pass Ring/Fail Ring	Same as pass failure mode, accompanied by ringing.

2.15. Fast Action Buttons

Auto Set: Automatically set the oscilloscope controls to generate a usable display of the input signals. Refer to the following table for relative content.

Single: Acquire a single waveform and then stop the acquisition.

Run/Stop: Continuously acquire waveform or stop the acquisition.

Default Setup: automatically recall the default settings.

Help: Press to enter the built-in help system, press any other key to view the corresponding help information, and press this key again to exit the help system.

Save To USB: Save the current screen image to a USB external storage device.

Decode: Display protocol decoding, set the main parameters of decoding. For details, see 2.8 Protocol Decoding.

Time/Div: Press the time base knob to enter the dual window display mode. Press the knob again to exit the dual window display.

2.15.1. AUTO SCALE

Auto Scale is one of the advantages digital oscilloscopes have. When you push the Auto Scale button, the oscilloscope will identify the type of waveform (sine or square wave) and adjust controls according to input signals so that it can accurately display the waveform of the input signal.

Functions	Settings
Acquire Mode	Adjusted to Normal or Peak Detect
Cursor	Off
Display Format	Set to YT
Display Type	Set to Vectors for an FFT spectrum; otherwise, unchanged
Horizontal Position	Adjusted

SEC/DIV	Adjusted
Trigger Coupling	Adjusted to DC, Noise Reject or HF Reject
Trigger Holdoff	Minimum
Trigger Level	Set to 50%
Trigger Mode	Auto
Trigger Source	Adjusted; Auto Scale can not be used for the EXT TRIG signal
Trigger Slope	Adjusted
Trigger Type	Edge
Trigger Video Sync	Adjusted
Trigger Video Standard	Adjusted
Vertical Bandwidth	Full
Vertical Coupling	DC (if GND was chosen before); AC for the video signal; otherwise, unchanged
VOLTS/DIV	Adjusted

The Auto Scale function examines all channels for signals and displays corresponding waveform. Auto Scale determines the trigger source according to the following conditions.

➢If multiply channels get signals, the oscilloscope will use the channel with the lowest frequency signal as the trigger source.

➢If no signals are found, the oscilloscope will use the lowest-numbered channel displayed in Auto Scale as the trigger source.

➢If no signals are found and no channels are displayed, the oscilloscope will display and use Channel 1 as the trigger source.

When you use the Auto Scale function and the oscilloscope determines that the signal is similar to a sine wave, the oscilloscope displays the following options.

Wave Options	Details
Multi-Period	Display multiple periods that have appropriate vertical and horizontal scales.
Single-Period	Set the horizontal scale to display about one period of the waveform.
Autoscale	Autoscale setting.
Source	Select the source: only display the current source or all sources.
Cancel	Let the oscilloscope recall the previous setup.

2.15.2. Default Setup

When you push the DEFAULT SETUP button, the oscilloscope will display the CH1 waveform and remove all the others. When you are at the default setup, press F5 to **Undo Preset**. Then the oscilloscope returns to the status before default setup. The table below gives the options, buttons and controls that change settings at default setup.

Menu or System	Option, Button or Knob	Default Setting
Acquire	Mode	Normal
Operating status	Run/Stop	Run
Cursor	State	Off
Display	Type	Vectors

	Persist	Off
	Display Mode	YT
Horizontal	Window Mode	Single-window
	Trigger Knob	Level
	Position	0.00s
	SEC/DIV	200μs
Math	Status	Off
Measure	Status	Off
Trigger (Edge)	Type	Edge
	Source	CH1
	Slope	Rising
	Mode	Auto
	Level	0.00v
Vertical System, All Channels	Bandwidth Limit	Unlimited
	VOLTS/DIV	Coarse
	Probe Attenuation	1X
	Invert	Off
	Position	0.00div (0.00V)
	VOLTS/DIV	1V

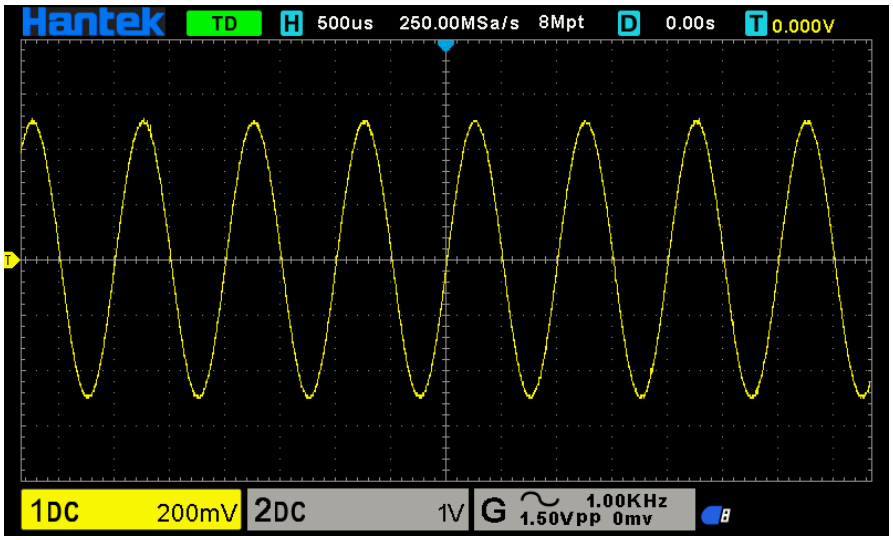
The following settings do not change when you push the **[Default]** button.

- Language Option
- Saved Settings
- Saved Reference waveform
- Display Contrast
- Calibration Data

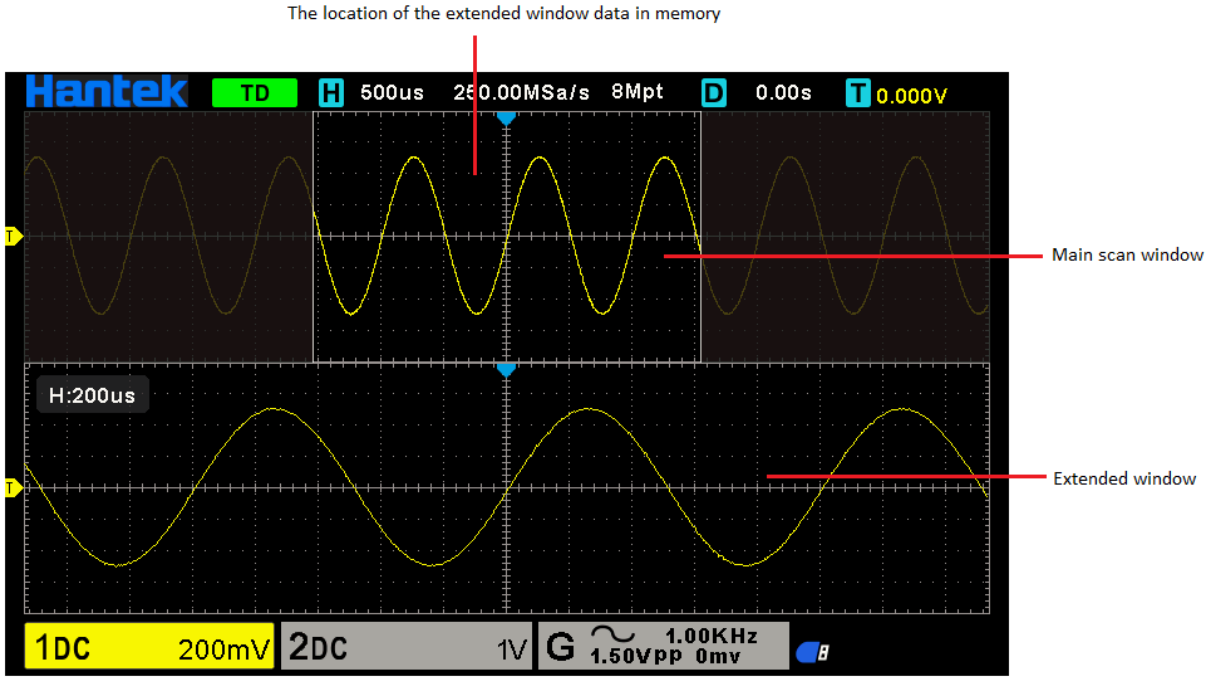
2.15.3. Dual-window Mode

Press the Sec/DIV knob to enter the dual-window mode, and press the button again to exit the dual-window mode.

Single-window Mode



Dual-window Mode



3. Waveform Generator

The series oscilloscope is equipped with waveform generator function, with one channel of arbitrary waveform output. User can edit the arbitrary waveform or choose the regular waveform such as Sine, Ramp, Square, Exponent, Noise, DC and Arb waveform.

3.1. Set Wave Type and Parameters

1. Press the **[Wave Gen]** button on the front panel to open the arbitrary waveform generator function.

2. Press the **Wave** softkey; then turn the **Multifunctional Knob** to select the desired waveform and push down the knob to confirm. Press the Wave Type softkey continually can also select the waveform

type.

3. Press the **Frequency** softkey to set frequency, press this key repeatedly to set the **Period** or **Frequency/Period fine**, and turn the Multifunctional Knob to set the value.

4. Press the **Amplitude** softkey to set amplitude, press this key repeatedly to set the **High Level** (Offset automatically switches to low level) or **Amplitude /High Level fine**, and turn the Multifunctional Knob to set the value.

5. Press the **Offset** softkey to set offset, press this key repeatedly to set the **Low Level** (Amplitude automatically switches to high level) or **Offset /Low Level fine**, and turn the Multifunctional Knob to set the value.

6. Press the **Duty** softkey to set the duty of Square waveform.

7. Press the Symmetry softkey to set the symmetry of Ramp waveform.

8. Press the Impedance to set the output impedance of the waveform generator, the default is 50Ω.

The waveform will output from GEN OUT BNC port.

3.2. Waveform modulation setting

Press the **Modulation** softkey to enter the modulation menu.

There are two types of modulation, amplitude modulation and frequency modulation.

Amplitude modulation (AM): Modify the amplitude of the original carrier signal according to the amplitude of the modulated signal.

Frequency modulation (FM): Modify the frequency of the original carrier signal according to the frequency of the modulation signal.

Waveform: Select the waveform of the modulating wave. Sine wave, square wave and ramp wave can be selected.

Modulation frequency: Set the frequency of the modulation wave. The range is 1Hz~50KHz.

Modulation depth: Set the modulation depth of AM. The setting range is 0-120.

Modulation deviation: Set the modulation deviation of FM, that is, the deviation between the waveform frequency after modulation and the original carrier frequency. The range is 0.1Hz~carrier frequency. (The carrier is the modulated wave, and the carrier frequency refers to the frequency of the selected waveform excluding noise and DC output by the signal generator.) The sum of the modulation deviation and the carrier frequency must be less than or equal to the sum of the upper limit of the carrier frequency and 1KHz.

Set the modulation frequency, deviation, depth:

: Horizontal arrow, turn the **Multifunctional Knob** to select a digit to change, press the **Multifunctional Knob** to confirm, after turning into a vertical arrow, turn the **Multifunctional Knob** to set a value.

: Vertical arrow, turn the **Multifunctional Knob** to set a value.

3.3. Burst setting

Press the front panel **Burst** button to enter the burst menu.

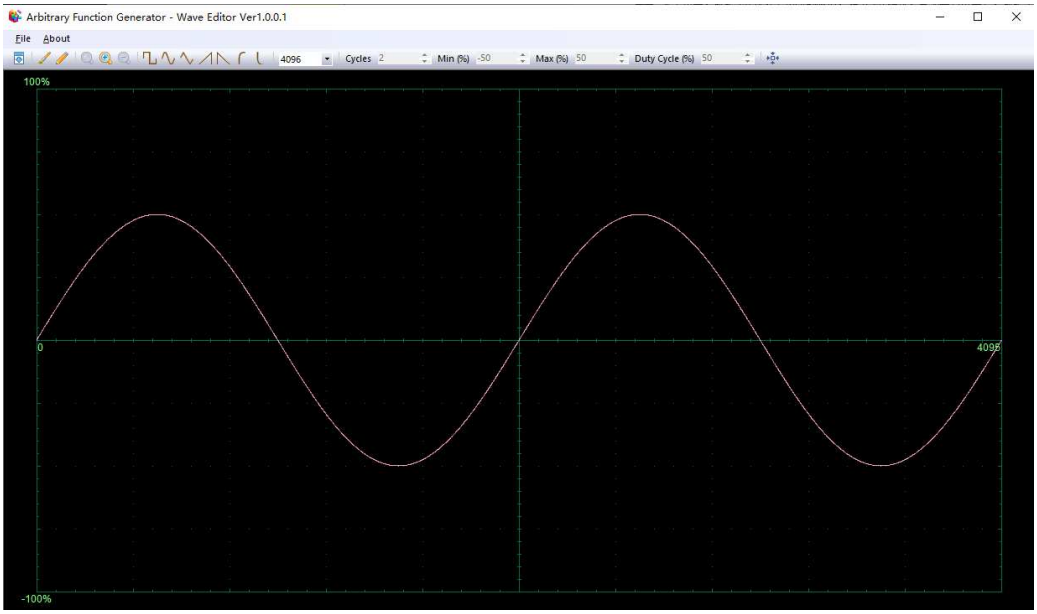
Press the **Count** soft key to set the number of pulses. The range is 1~1024.

The **data source** is specified as manual.

Press **Burst** to output a burst with a specified number of cycles.

3.4. Edit Arbitrary Waveform

Double click “WaveEditor.exe” in WaveEditor folder in CD disk to enter arbitrary waveform generator window.



Menu:

Import from CSV: Import the CSV format file to the arbitrary waveform generator window.

Export as CSV: Save as CSV format file.

Import from ARB: Import the ARB format file to the arbitrary waveform generator window.

Export as ARB: Save as ARB format file.

Note: The device can recall ARB format file in USB disk, but CSV format file can’t be recalled by the device.

Toolbar buttons

: Download waveform data to the device.

: Smooth Drawing Mode. You can draw any waveform shape using the left-mouse.

: Line Drawing Mode. You can click on the waveform to draw a straight line from the previous point.

: Zoom tools. To zoom the time axis in or out, click the + or - zoom button and then click on the waveform area. Click the 100% button to restore the time axis to its original scale.

: Standard waveform shapes. Draw a standard waveform with the settings specified in the numerical controls below the toolbar. The current waveform will be erased.

Cycles 2 : Cycles. The number of cycles to draw. This control is used in conjunction with the Standard waveform shapes buttons. Select one of the standard waveform shapes and then enter the number of cycles, and it will draw the requested number of cycles of the waveform.

Min (%) -50 : Minimum. When one of the Standard waveform shapes buttons is pressed, this control sets the minimum signal level.

Max (%) 50 : Maximum. When one of the Standard waveform shapes buttons is pressed, this control sets the maximum signal level.

Duty Cycle (%) 50 : Duty cycle. When a square, triangular or ramp waveform is selected using one of the Standard waveform shapes buttons, this control sets the duty cycle of the signal. Duty cycle is defined as the time that the signal spends above zero volts divided by the total cycle time. Thus, a symmetrical square or triangular wave has a duty cycle of 50%. Reducing the duty cycle shortens the positive part of the cycle and lengthens the negative part, and increasing the duty cycle does the opposite.

Note:

The Frequency, Amplitude, Offset parameter of the ARB waveform can not be regulated in this WaveEditor software, but it can be done by tuning on the device directly (refer to above Chapter 3.1) after the waveform data is downloaded to device (refer to below Chapter 3.3).

Do not use the WaveEditor and the DSO software at the same time, it will cause errors.

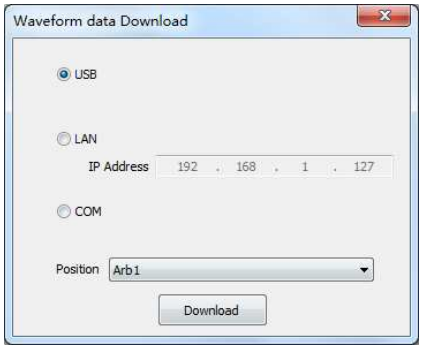
3.5. Output Arbitrary Waveform

1. Press the Wave Gen button on the front panel to enable the AWG function and enter the Wave Gen function menu.

2. Connect the device with PC which has installed the WaveEditor software using a USB cable.

3. Double click the WaveEditor icon to open the program.

4. Select a waveform file or draw an arbitrary waveform; then click the in toolbar and select waveform data download position to download waveform data to the device.



The waveform will output from GEN OUT BNC port.

Also, you can recall ARB format file in USB disk to output a waveform.

Press the Wave Gen button on the front panel to enter Wave Gen function menu.

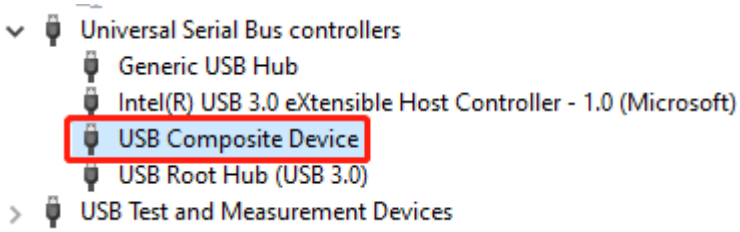
Press the Wave softkey, turn the Multifunctional Knob to select Arb1~Arb4 and then press the knob to confirm.

Press Recall softkey and select desired recalled ARB format file in USB disk.

The waveform will output from GEN OUT BNC port.

4. Remote Control

Connect the Type-A end of the USB cable to the computer, and connect the Type-B end to the USB port on the back of the oscilloscope. A new device will be displayed in the computer device manager.

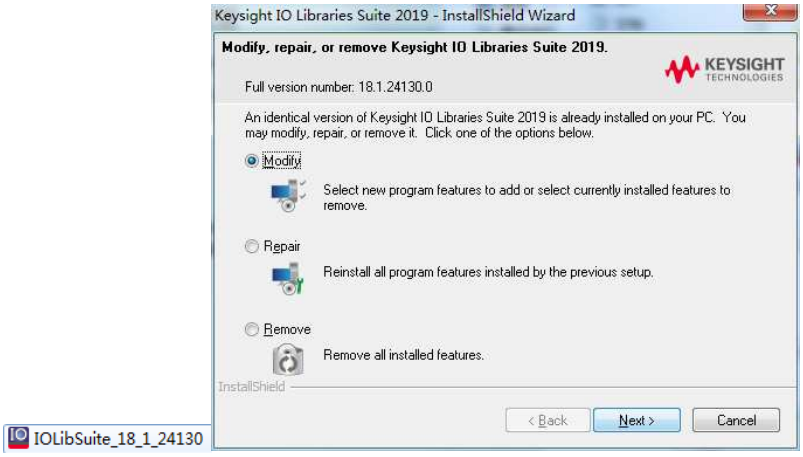


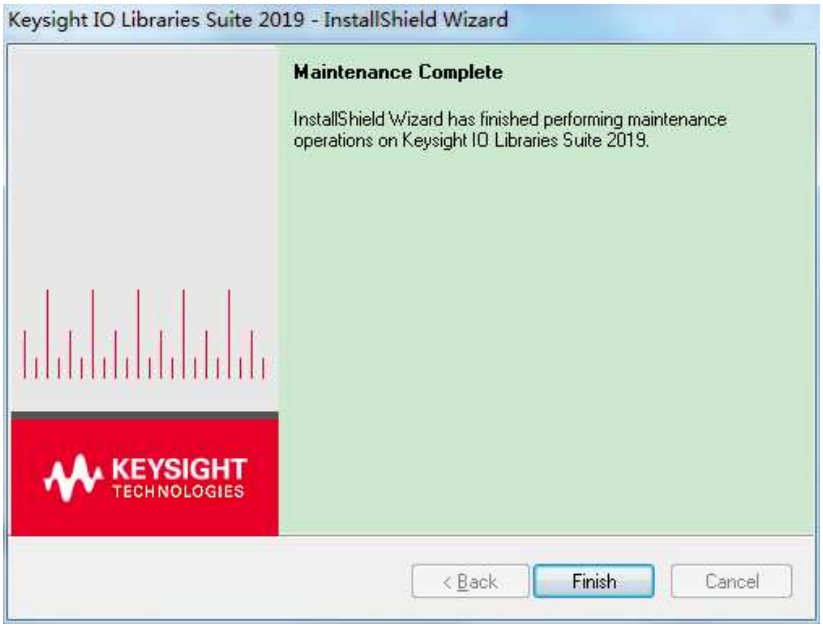
Install the IO driver:

Click the following URL to download the latest IO software:

https//www.keysight.com/main/software.jspx?ckey=2175637&lc=chi&cc=CN&nid=-11143.0.00&id=2175637

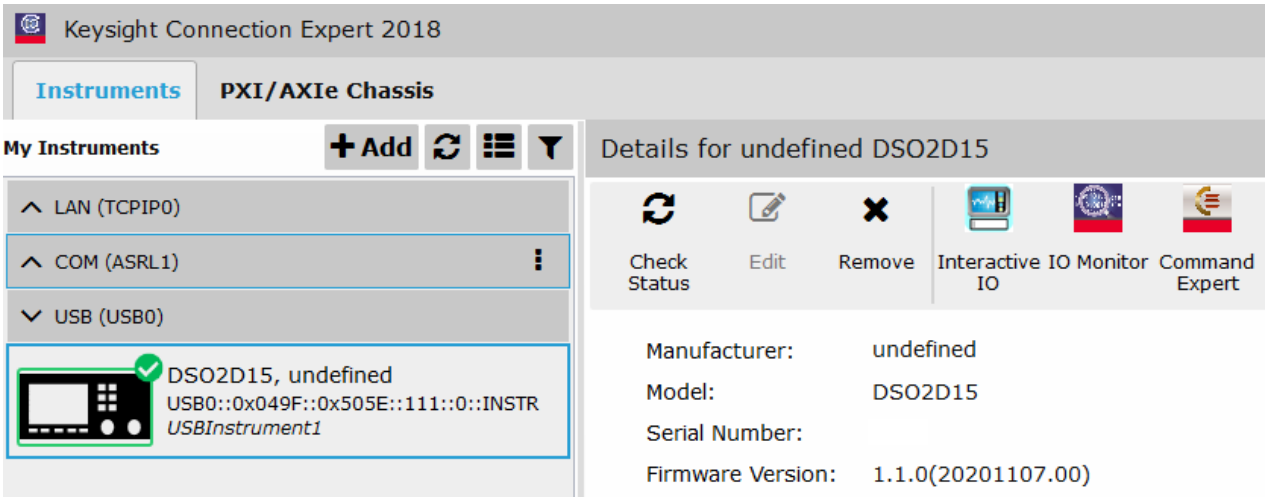
Double-click the application to start the installation. According to the installation prompts, install step by step, the installation process may take several minutes.



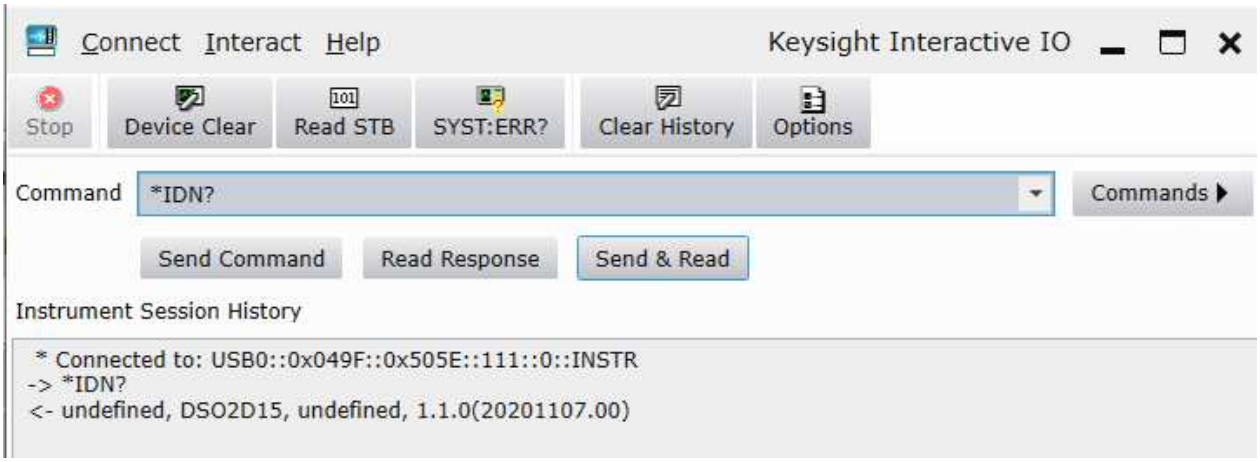


After installation, you can see the running IO software in the lower right corner of the screen.

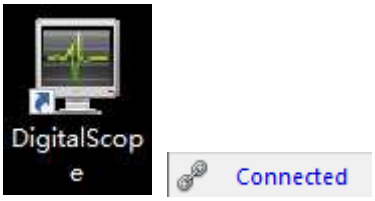
Double-click to open the IO software, you can see the connected device information displayed under My Instrument-USB.



Click "Interactive IO", send an instruction arbitrarily, and the computer and the oscilloscope will communicate.



Double-click to open the host computer software, and "Connected" is displayed in the lower left corner of the interface. At this point, the host computer has been connected.



5. Troubleshooting

1.If the oscilloscope does not start up at power on, follow these steps:

1)Check the power cord to verify it has been connected properly;

2)Check the power on/off button to ensure it has been pushed;

3)Then restart the oscilloscope.

Contact your local HANTEK distributor or directly keep touch with HANTEK Technical Support department if the oscilloscope still can not be turned on normally.

2.If there is no display of waveform on the screen when the oscilloscope is turned on, follow these steps:

1)Check the probe to assure its proper connection to the input BNC;

2)Check the channel switch (CH1~CH2 menu buttons) to make sure it has been turned on;

3)Check the input signal to verify it has been connected to the probe correctly;

4)Affirm that all measured circuits have signals to output;

5)Turn up the magnitude for DC signals with large magnitude;

6)In addition, you may press the Auto Measure button to perform an automatic detection of signals at first.

Contact HANTEK Technical Support department in time if there is still no display of waveform.

3.If the waveform of the input signal is distorted seriously, follow these steps:

1)Check the probe to assure its proper connection to the channel BNC;

2)Check the probe to assure its good connection to the measured object;

3)Check the probe to verify it has been well calibrated. Otherwise, refer to the content about calibration described in this manual.

4.If the waveform is rolling continuously on the screen but can not be triggered, follow these steps:

1)Check the trigger source to make sure it consistent with the input channel;

2)Check the trigger level to assure its correct adjustment. You may push the TRIGGER LEVEL knob to reset the trigger level back to the center of the signal;

3)Check the trigger mode to confirm it is a right choice for the input signal. The default trigger mode is edge trigger. However, it is not suitable for all kinds of input signals.

6. Services and Support

Thank you for choosing HANTEK. Please contact us through the following ways should you have any inquiry regarding our products. We shall do our best to help you.

1. Contact your local HANTEK distributor;
2. Contact your local HANTEK field office;
3. Contact HANTEK headquarters in China.

Headquarters

Qingdao Hantek Electronic Co., Ltd

http://www.hantek.com

Address: 2/F., Zone D2, No. 112 Keyuan Longitude 7th Road, Qingdao City,

Shandong Province, China 266101

Tel: +86-532-88703687 / 88703697

Fax: +86-532-88705691

Email: service@hantek.com

Technical Support

Tel: +86-532-88703687

Email: support@hantek.com

7. General Care and Cleaning

General Care

Do not put or leave the device in a place where the LCD display will be exposed to direct sunlight for long periods of time.

Note: To avoid damage to the oscilloscope or probes, do not expose them to sprays, liquids, or solvents.

Cleaning

Examine the oscilloscope and probes as often as operating conditions require. To clean the exterior surface, perform the following steps:

1)Use a lint-free cloth to remove floating dust on the outside of the oscilloscope and probes. Take care to avoid scratching the glabrous display filter.

2)Use a soft cloth dampened with water to clean the oscilloscope. For more efficient cleaning, you may use an aqueous solution of 75% isopropyl alcohol.

Note: To avoid damage to the surface of the oscilloscope or probes, do not use any corrosive or chemical cleaning agents.

Appendix A: Technical Specifications

All technical specifications are applicable to DSO2000 series digital storage oscilloscopes, see the last part of this chapter for details. To verify whether the oscilloscope meets the technical specifications, the oscilloscope must first meet the following conditions:

➢The oscilloscope must have been operating continuously for twenty minutes under the specified operating temperature.

➢The Do Self Cal operation must be performed through the Utility menu if the operating temperature changes by more than 5℃.

➢The oscilloscope must be within the factory calibration interval.

All specifications are guaranteed unless noted 'typical'.

Oscilloscope Specifications

Horizontal

SEC/DIV Range	2ns/div to 100s/div, in a 1, 2, 5 sequence
Delta Time Measurement Accuracy (Full Bandwidth)	Single, sampling mode ± (1 sample interval +100ppm × reading + 0.6ns)
	＞16 times above average ± (1 sample interval + 100ppm × reading + 0.4ns)
	Sample interval = s/div ÷ 200

Vertical

A/D Converter	8-bit resolution, each channel sampled simultaneously			
VOLTS/DIV Range	2mV/div to 10V/div at input BNC			
Offset Range	2mV~200mV/div, ±1V 500mV/div~10V/div, ±50V			
Selectable Analog Bandwidth Limit, typical	20MHz			
Low Frequency Response (-3db)	≤10Hz at BNC			
Rise Time at BNC, typical	DSO2C10	DSO2C15	DSO2D10	DSO2D15
	≤3.5ns	≤2.4ns	≤3.5ns	≤2.4ns
DC Gain Accuracy	±3% for Normal or Average acquisition mode, 10V/div to 10mV/div ±4% for Normal or Average acquisition mode, 5mV/div to 2mV/div			
Vertical offset accuracy	±0.1div±2mV±1% Offset			

Note: Bandwidth reduced to 6MHz when using a 1X probe.

Acquisition

Sample Rate Range	1GS/s (Single-channel); 500MSa/s (Dual-channel);	
Acquisition Modes	Normal, Peak, Average and High Resolution	
Waveform Interpolation	(sin x)/x	
Acquisition Rate, typical	Up to 2000 waveform per second per channel (Normal acquisition mode, no measurement)	
Minimum detection pulse width	2ns	
Single Sequence	Acquisition Mode	Acquisition Stop Time
	Normal, Peak Detect	Upon single acquisition on all channels simultaneously
	Average	After N acquisitions on all channels simultaneously, N can be set to 4, 8, 16, 32, 64 or 128
Memory depth	Maximum 8M for single channel (4K, 40K, 400K, 4M, 8M optional) Maximum 4M for dual channels (4K, 40K, 400K, 4M optional)	

Trigger

Mode	Auto, Normal, single	
Level	CH1~CH2	±5 divisions from center of screen
	EXT	3.3V [CMOS]
Holdoff Range	20ns ~ 10s	
Trigger Level Accuracy	CH1~CH2	0.2div × volts/div within ±4 divisions from center of screen
Trigger sensitivity	±0.2div	

Edge Trigger

Slope	Rising, Falling, Rising&Falling
Source	CH1~CH2, Line, External

Pulse Trigger

Polarity	Positive, Negative
Condition	<, >, !=, =
Source	CH1~CH2
Width Range	8ns ~ 10s

Video Trigger

Signal Standard	NTSC, PAL
Source	CH1~CH2
Sync	ScanLine, LinrNum, OddField, EvenField and AllField

Slope Trigger

Slope	Rising, Falling
Condition	<, >, !=, =
Source	CH1 ~ CH2
Time Range	8ns ~ 10s

Overtime Trigger

Source	CH1~CH2
Polarity	Positive, Negative
Time Range	8ns ~ 10s

Window Trigger

Source	CH1~CH2

Pattern Trigger

Pattern	0: Lower level; 1: High level; X: Ignore; ⌋: Rise; ⌊: Fall; ⊥: Rise or fall.
Level	CH1~CH2

Interval Trigger

Slope	Rising, Falling
Condition	<, >, !=, =
Source	CH1~CH2

Time Range	8ns ~ 10s

Under Amp Trigger

Polarity	Positive, Negative
Condition	<, >, !=, =
Source	CH1~CH2
Time Range	8ns ~ 10s

UART Trigger

Condition	Start, Stop, Data, Parity Error, COM Error
Source	CH1~CH2
Data format	Hex
Condition	<, >, !=, =
Data Length	1 byte
Data Bits Width	5 bit, 6 bit, 7 bit, 8 bit
Parity Check	None, Odd, Even
Idle Level	High, Low
Baud Rate (Selectable)	110/300/600/1200/2400/4800/9600/14400/19200/38400/57600/115200/230400/380400 /460400 bit/s
Baud Rate (Custom)	300bit/s~334000bit/s

LIN Trigger

Condition	Interval Field, Sync Field, Id field, Sync Id Error, Identifier, Id and Data
Source	CH1~CH2
Data format	Hex
Baud Rate (Selectable)	110/300/600/1200/2400/4800/9600/14400/19200/38400/57600/115200/230400/380400 /460400 bit/s
Baud Rate (Custom)	300bit/s~334000bit/s

CAN Trigger

Condition	Start Bit, Remote Frame, Data Frame Id, Frame Id, DataFrame Id A, Error Frame, All Error, Ack Error, Overload Fram
Source	CH1~CH2
Data format	Hex
Baud Rate (Selectable)	10000, 20000, 33300, 500000, 62500, 83300, 100000, 125000, 250000, 500000, 800000, 1000000
Baud Rate (Custom)	5kbit/s~1Mbit/s

SPI Trigger

Source (SDA/SCL)	CH1~CH2
Data format	Hex
Data Length	4, 8, 16, 24, 32

IIC Trigger

Source (SDA/SCL)	CH1~CH2
Data format	Hex
Data Index	0~3
Condition	Start Bit, Stop Bit, No Ack, Address, Restart, Addresss and Data

Inputs

Number of channels	2 analog channels
Input Coupling	DC, AC or GND
Input Impedance, DC coupled	20pF±3pF, 1MΩ±2%
Probe Attenuation	1X, 10X
Supported Probe Attenuation Factors	1X, 10X, 100X, 1000X
Overvoltage Category	300V CAT II
Maximum Input Voltage	$300V_{RMS}$ (10X)
Isolation between channels	>40dB
Delay deviation between channels	<500ps

Measurements

Cursors	Voltage difference between cursors: △V Time difference between cursors: △T Reciprocal of △T in Hertz (1/ΔT)	
Automatic Measurements	PkPk, Frequency, Average, Max, Min, Period, Vtop, Vmid, Vbase, Vamp, RMS, R-Overshoot, PeriodRms, F-Preshoot, PeriodRms, PeriodAvg, RiseTime, FallTime, + Width, - Width, + Duty, - Duty, FRR, FFF, F-Overshoot, R-preshoot, BWidth, FRF, FFR, LRR, LRF, LFR and LFF	
DVM	Data Source	CH1~CH2
	Measurement Type	DC RMS, AC RMS, DC
	Frequency Meter	Hardware 6 bits

Math operation

Source	CH1~CH2	
Operator	+, -, x, /, FFT	
FFT	Point	1024
	Window	Rectangle, Hanning, Hamming, Blackman, Bartlett, Flattop
	Display	Show only or show all
	Vertical scale	dB, VRms

Storage

Save/recall (non-volatile)	9 types of files can be saved and recalled internally, including settings, waveforms, and references
Save to external memory	CSV file, BMP picture (24 bit)

Arbitrary Wave Generator

Number of channels	1
Standard waveforms	Sine, square, ramp, exponential, noise, DC

Sine	Frequency Range	0.1Hz~25MHz	
Square	Frequency Range	0.1Hz~10MHz	
	Duty	1%~99%	
Ramp	Frequency Range	0.1Hz~1MHz	
	Symmetry	0%~100%	
Exponential	Frequency Range	0.1Hz~5MHz	
Noise	Bandwidth	＞25MHz	
DC	Offset	1.75V(50Ω), 3.5V(High resistance)	
Arbitrary wave	Frequency Range	1uHz~25MHz	
	Wave length	4096	
	Support PC download and external memory recall		
Output impedance	50 Ω+1%, high impedance		
Amplitude	5mV~3.5Vpp(50Ω) 10mV~7Vpp (High impedance)		
Amplitude accuracy	±3dB		
Frequency Resolution	1uHz		
Waveform Depth	4KSa		
Frequency accuracy	<10KHz,100ppm >10KHz,50ppm		
Modulation	FM	Modulation waveform	Sine, square, ramp
		Modulation frequency	1Hz~50KHz
		Modulation deviation	0.1Hz~ Carrier frequency
	AM	Modulation waveform	Sine, square, ramp
		Modulation frequency	1Hz~50KHz
		Modulation depth	0%-120%
Burst	Types of	N Cycle, Infinite	
	Number of cycles	1~1024	
	Trigger source	Manual	
Trigger input signal source			
Level	CMOS		
Probe compensator output			
Output Voltage, typical	5V		
Frequency, typical	1kHz±1%		

General Specifications

Display	
Display Type	7 inchs TFT (diagonal liquid crystal)
Display Resolution	800 (horizontal) * 480 (vertical) pixels
Display type	Point, vector
Waveform brightness	Adjustable
Grid type	Optional
Grid brightness	Adjustable
Screen brightness	Adjustable

Persist	1s, 5s, 10s, 30s, infinite	
Interface		
Standard interface	USB Host, USB Device	
Power Supply		
Supply Voltage	100-120VAC_{RMS}(±10%), 45Hz to 440Hz, CAT Ⅱ 120-240VAC_{RMS}(±10%), 45Hz to 66Hz, CAT Ⅱ	
Power Consumption	<15W	
Fuse	T2A 250VAC 4*8	
Environmental		
Operating Temperature	0 to 50 °C (32 to 122 °F)	
Storage Temperature	-40 to +71 °C (-40 to 159.8 °F)	
Humidity	≤+104℉(≤+40℃): ≤90% relative humidity	
	106℉~122℉ (+41℃ ~50℃): ≤60% relative humidity	
Cooling Method	Convection	
Altitude	Operating and Nonoperating	3,000m (10,000 feet)
	Random Vibration	0.31g_{RMS} from 50Hz to 500Hz, 10 minutes on each axis
	Nonoperating	2.46g_{RMS} from 5Hz to 500Hz, 10 minutes on each axis
Mechanical Shock	Operating	50g, 11ms, half sine
Mechanical		
Dimension	318 x 110 x 150mm (L x W x H)	
Weight	1900g	

Appendix B: Accessories

All the following accessories are available by contacting your local HANTEK distributor.

Standard Accessories

- A Passive Probe (1.5m, 10:1)
- A Test Lead with two clips
- A Power Line
- A USB Line
- A BNC to BNC (Only for the scopes with waveform generator function)
- A PC Software CD of the oscilloscope
- Warranty Card
- Manufacturer Certificate
- Certificate Of Calibration

Appendix C Harmful and Poisonous Substances or Elements

	Harmful and poisonous substances or elements [1]					
Component[2]	Pb	Hg	Cd	Cr (Vi)	PBB	PBDE
Shell and Chassis	X	0	0	X	0	0
Display Module	X	X	0	0	0	0
Circuit Board	X	0	0	X	0	0
Power Supply	X	0	0	X	0	0
Electric Wire and Cable Assembly	X	0	0	0	0	0
Connector	X	0	0	X	0	0
Fastener and Installed Hardware	X	0	X	X	0	0
Other Accessories (including probes)	X	0	0	X	0	0
Others	0	0	0	0	0	0

'X' means that at least the content of this poisonous and harmful substance in a homogeneous material of this component exceeds the limit specified in the SJ/T 11363-2006 standard.

'0' indicates that the content of this poisonous and harmful substance in all homogeneous materials of this component is refrained under the limit stated in the SJ/T 11363-2006 standard.

This component list contains components approved in the file *'Management Measures'*.