Digital Storage Oscilloscope

DSO-1000D Series

USER MANUAL

(GB) Legal notice

These operating instructions are a publication by Voltcraft®, Lindenweg 15, D-92242 Hirschau/Germany,
Phone +49 180/586 582 7 (www.voltcraft.de).

These operating instructions represent the technical status at the time of printing. Changes in technology and equipment reserved.

Table of Contents

SAFETY INSTRUCTIONS

This chapter contains important safety instructions that you must follow during operation and storage. Read the following before any operation to insure your safety and to keep the instrument in the best possible condition.

Safety Symbols

These safety symbols may appear in this manual or on the DSO-1000D.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the DSO-1000D or to other properties.
	DANGER High Voltage
	Attention Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal

Do not dispose electronic equipment as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased.

Safety Guidelines

General Guideline

- Make sure the BNC input voltage does not exceed 300Vrms.

CAUTION

- Never connect a hazardous live voltage to the ground side of the BNC connectors. It might lead to fire and electric shock.
- Do not place any heavy object on the DSO-1000D.
- Avoid severe impact or rough handling that leads to damaging the DSO-1000D.
- Do not discharge static electricity to the DSO-1000D.
- Use only mating connectors, not bare wires, for the terminals.
- Do not block the cooling fan opening.
- Do not perform measurement at a power source or building installation site (Note below).
- Do not disassemble the DSO-1000D unless you are qualified.

(Measurement categories) EN 61010-1:2010 specifies the measurement categories and their requirements as follows. The DSO-1000D falls under category I.

- Measurement category IV is for measurement performed at the source of low-voltage installation.
- Measurement category III is for measurement performed in the building installation.
- Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation.
- Measurement category I is for measurements performed on circuits not directly connected to Mains.

Power Supply ⚠ WARNING	• AC Input voltage: 100 - 240V AC, 50 - 60Hz, auto selection. Power consumption: 30 Watts. • Connect the protective grounding conductor of the AC power cord to an earth ground, to avoid electrical shock.
Cleaning the DSO-1000D	• Disconnect the power cord before cleaning. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid. • Do not use chemicals containing harsh materials such as benzene, toluene, xylene, and acetone.
Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) • Relative Humidity: ≤80%, 40°C or below; ≤45%, 41°C ~ 50°C • Altitude: < 2000m • Temperature: 0°C to 50°C (Pollution Degree) EN 61010-1:2010 specifies the pollution degrees and their requirements as follows. The DSO-1000D falls under degree 2. Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity". • Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. • Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected. • Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

Storage environment	• Location: Indoor • Temperature: -10°C to 60°C • Humidity: Up to 93% RH (non-condensing) / ≤40°C, up to 65% RH (non-condensing) / 41°C ~ 60 °C
Disposal 	Do not dispose this instrument as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

Power cord for the United Kingdom

When using the oscilloscope in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead/appliance must only be wired by competent persons

WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colours of the wires in main leads may not correspond with the coloured marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with either the letter E, the earth symbol ⏚ or coloured Green/Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, a cable of 0.75mm^2 should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any exposed wiring from a cable, plug or connection that is engaged in a live socket is extremely hazardous. If a cable or plug is deemed hazardous, turn off the mains power and remove the cable, any fuses and fuse assemblies. All hazardous wiring must be immediately destroyed and replaced in accordance to the above standard.

GETTING STARTED

This chapter describes the DSO-1000D in a nutshell, including its main features and front / rear panel introduction. After going through the overview, follow the Set Up section to properly set up the oscilloscope for first time use. The Set Up section also includes a starter on how to use this manual effectively.

DSO-1000D Series Overview

Series lineup

The DSO-1000D series consists of 2 models.

Model name	Frequency bandwidth	Input channels	Max. Real-time Sampling Rate
DSO-1074D	70MHz	4	1GSa/s
DSO-1104D	100MHz	4	1GSa/s

Main Features

Features	• 7 inch, 800 x 480, WVGA TFT display. • Available from 70MHz to 100MHz. • Real-time sampling rate of 1GSa/s max. • Deep memory: 10M points record length. • Waveform capture rate of 50,000 waveforms per second. • Vertical sensitivity: 1mV/div~10V/div. • On-screen Help. • 32 MB internal flash disk. • Go-NoGo app. • Remote Disk app
Interface	• USB host port: front panel, for storage devices. • USB device port: rear panel, for remote control or printing (to PictBridge compatible printers). • Probe compensation output with selectable output frequency (1kHz ~ 200kHz). • Ethernet port. • Calibration output.

Accessories

Standard Accessories

Part number	Description
N/A region dependent	Power cord
GTP-070B-4, for DSO-1074D	Passive probe; 70 MHz
GTP-100B-4, for DSO-1104D	Passive probe; 100 MHz

Optional Accessories

Part number	Description
GTC-001	Instrument cart, 470(W)x430(D)mm (U.S. type input socket)
GTC-002	Instrument cart, 330(W)x430(D)mm (U.S. type input socket)
GTL-110	Test lead, BNC to BNC heads
GTL-242	USB cable, USB2.0A-B type cable 4P
GTP-070B-4	Passive probe; 70 MHz
GTP-100B-4	Passive probe; 100 MHz

Standard Apps

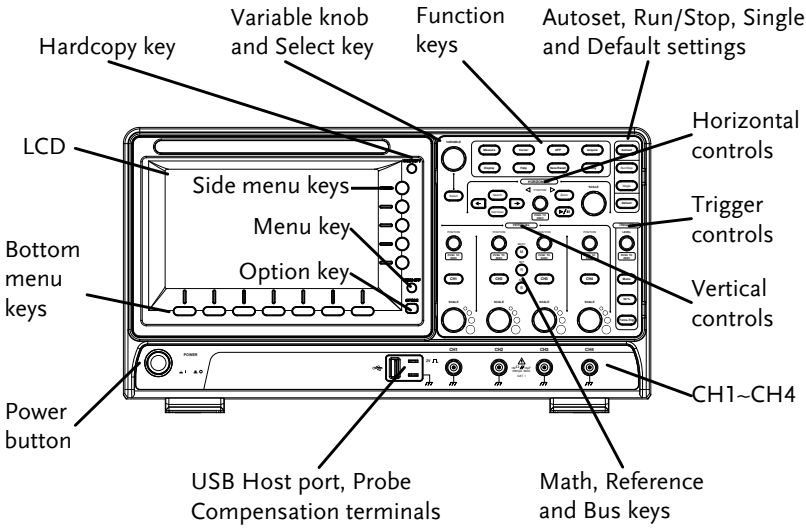
Name	Description
Go-NoGo	Go-NoGo testing app.
Remote Disk	Allows the scope to mount a network share drive.

Drivers

USB driver	LabVIEW driver

Appearance

DSO-1074D/1104D Front Panel



LCD Display — 7″ WVGA TFT color LCD. 800 x 480 resolution, wide angle view display.

Menu Off Key — MENU OFF

Use the Menu Off key to hide the onscreen menu system.

Option Key — OPTION

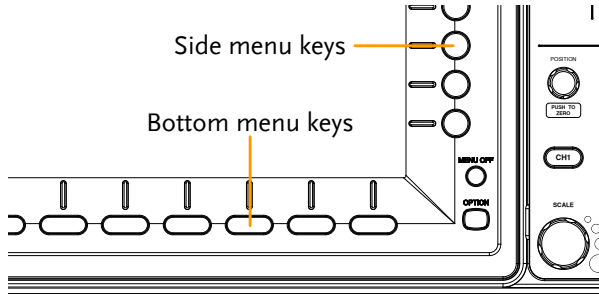
The Option key is used to access future installed options.

Menu Keys

The side menu and bottom menu keys are used to make selections from the soft-menus on the LCD user interface.

To choose menu items, use the 7 Bottom menu keys located on the bottom of the display panel.

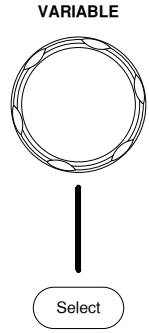
To select a variable or option from a menu, use the side menu keys on the side of the panel. See page 30 for details.



Hardcopy Key

The Hardcopy key is a quick-save or quick-print key, depending on its configuration. For more information see pages 170(save) or 169(print).

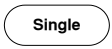
Variable Knob and Select Key

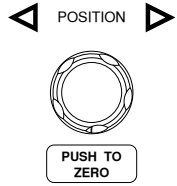
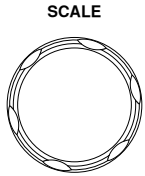
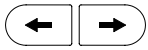


The Variable knob is used to increase/decrease values or to move between parameters.

The Select key is used to make selections.

Function Keys — The Function keys are used to enter and configure different functions on the DSO-1000D.

Measure		Configures and runs automatic measurements.
Cursor		Configures and runs cursor measurements.
APP		Configures and runs applications.
Acquire		Configures the acquisition mode.
Display		Configures the display settings.
Help		Shows the Help menu.
Save/Recall		Used to save and recall waveforms, images, panel settings.
Utility		Configures the Hardcopy key, display time, language, probe compensation and calibration. It also accesses the file utilities menu.
Autoset		Press the Autoset key to automatically set the trigger, horizontal scale and vertical scale.
Run/Stop Key		Press to Freeze (Stop) or continue (Run) signal acquisition (page 40).
Single		Sets the acquisition mode to single triggering mode.

Default Setup		Resets the oscilloscope to the default settings.
Horizontal Controls	The horizontal controls are used to change the position of the cursor, set the time base settings, zoom into the waveforms and search for events.	
Horizontal Position		The Position knob is used to position the waveforms horizontally on the display screen. Pressing the knob will reset the position to zero.
SCALE		The Scale knob is used to change the horizontal scale (TIME/DIV).
Zoom		Press Zoom in combination with the horizontal Position knob.
Play/Pause		The Play/Pause key allows you to play through a waveform in zoom mode.
Search		Not available.
Search Arrows		Not available.
Set/Clear		Not available.

Trigger Controls — The trigger controls are used to control the trigger level and options.

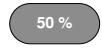
Level Knob

Used to set the trigger level. Pressing the knob will reset the level to zero.

Trigger Menu Key

Used to bring up the trigger menu.

50% Key



Sets the trigger level to the half way point (50%).

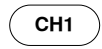
Force - Trig

Press to force an immediate trigger of the waveform.

Vertical POSITION

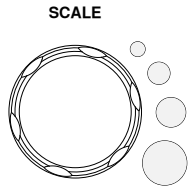
Sets the vertical position of the waveform. Push the knob to reset the vertical position to zero.

Channel Menu Key



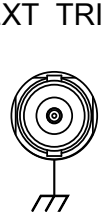
Press the CH1~4 key to set and configure the channel.

(Vertical) SCALE Knob

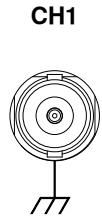
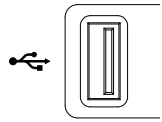
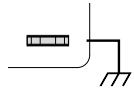
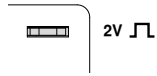


Sets the vertical scale of the channel (TIME/DIV).

External Trigger Input



Input impedance: 1MΩ
Voltage input: ±15V(peak), EXT trigger capacitance:16pF.

Math Key		Use the Math key to set and configure math functions.
Reference Key		Press the Reference key to set or remove reference waveforms.
BUS Key		Not available.
Channel Inputs		Accepts input signals. Input impedance: 1MΩ. Capacitance: 16pF CAT I
USB Host Port		TypeA, 1.1/2.0 compatible. Used for data transfer.
Ground Terminal		Accepts the DUT ground lead for common ground.
Probe Compensation Outputs		The probe compensation output is used for probe compensation. It also has an adjustable output frequency. By default this port outputs a 2Vpp, square wave signal at 1kHz for probe compensation. Please see page 124 for details.

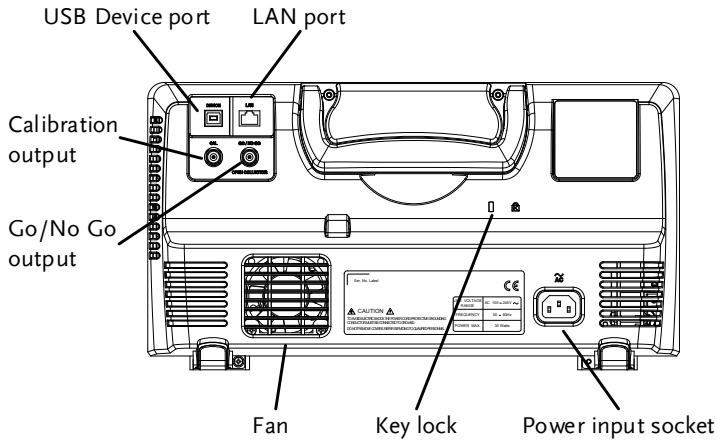
Power Switch 

Used to turn the power on/off.

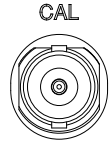
I: ON

O: OFF

Rear Panel

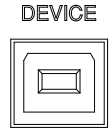


Calibration Output



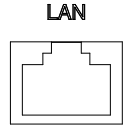
Outputs the signal for vertical scale accuracy calibration (page 184).

USB Device Port



The USB Device port is used for remote control.

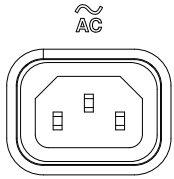
LAN (Ethernet) Port



The LAN port is used for remote control over a network or when combined with the Remote Disk app, allows the scope to be mounted to a share disk.

Note: the LAN port is only available for the 4 channel models

Power Input Socket



Power cord socket accepts AC mains, 100 ~ 240V, 50/60Hz.

For power up sequence, see page 26.

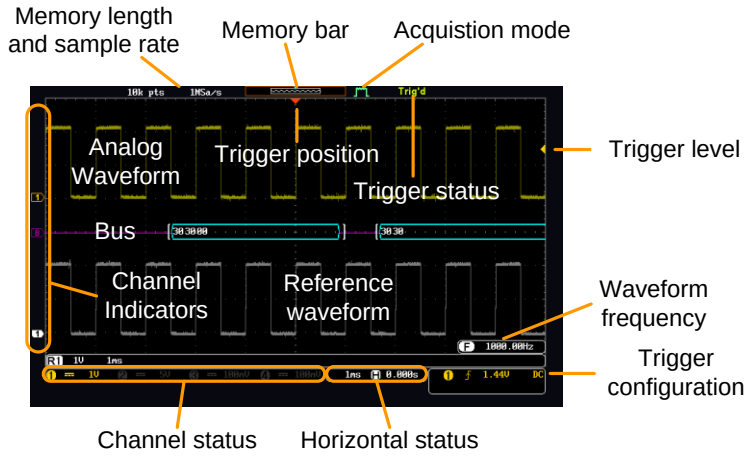
Security Slot

Kensington security slot compatible.

Go-No Go Output

Outputs Go-No Go test results (page 126) as a 500us pulse signal.

Display



Analog Waveforms	Shows the analog input signal waveforms. Channel 1: Yellow Channel 2: Blue Channel 3: Pink Channel 4: Green
Channel Indicators	The channel indicators show the zero volt level of the signal waveform for each activated channel. Any active channel is shown with a solid color. 3 Analog channel indicator 1 Reference waveform indicator M Math indicator
Trigger Position	Shows the position of the trigger.
Horizontal Status	Shows the horizontal scale and position.
Trigger Level	Shows the trigger level on the graticule.
Memory Bar	

The ratio and the position of the displayed waveform compared to the internal memory (page 89). The color of the active channel/bus is also shown as the color of the waveform within the memory bar.

Trigger Status

Trig'd	Triggered.
PrTrig	Pre-trigger.
Trig?	Not triggered, display not updated.
Stop	Trigger stopped. Also appears in Run/Stop (page 40).
Roll	Roll mode.
Auto	Auto trigger mode.

For trigger details, see page 104.

Acquisition Mode

 Normal mode

 Peak detect mode

 Average mode

For acquisition details, see page 78.

Signal Frequency

 Shows the trigger source frequency.

 Indicates the frequency is less than 2Hz (lower frequency limit).

Trigger Configuration

 Trigger source, slope, voltage, coupling.

Horizontal Status

 Horizontal scale, horizontal position.

For trigger details, see page 104.

Channel Status

 Channel 1, DC coupling, 2V/Div.

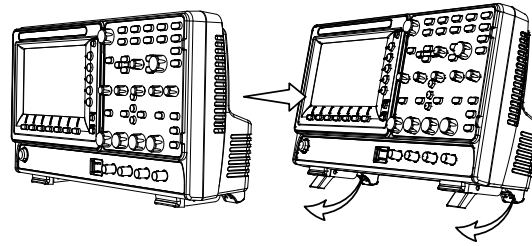
For channel details, see page 96.

Set Up

Tilt Stand

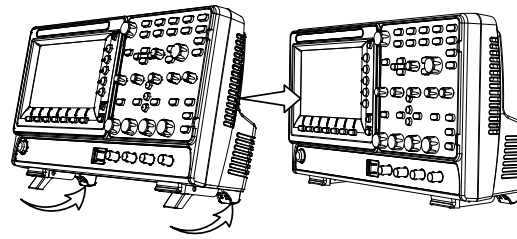
Tilt

To tilt, pull the legs forward, as shown below.



Stand

To stand the scope upright, push the legs back under the casing as shown below.



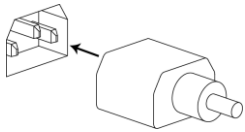
Power Up

Requirements

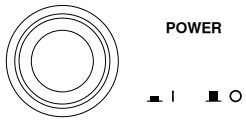
The DSO-1000D accepts line voltages of 100 ~ 240V at 50 or 60Hz.

Step

1. Connect the power cord to the rear panel socket.



2. Press the POWER key. The display becomes active in ~ 30 seconds.



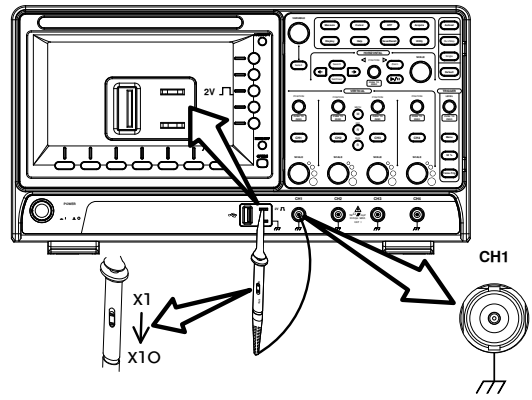
- I: ON
- O: OFF

Note

The DSO-1000D recovers the state right before the power is turned OFF. The default settings can be recovered by pressing the Default key on the front panel. For details, see page 154.

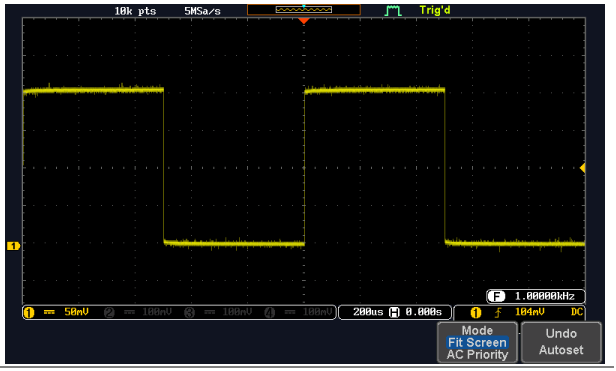
First Time Use

Background	This section describes how to connect a signal, adjust the scale, and compensate the probe. Before operating the DSO-1000D in a new environment, run these steps to make sure the instrument performs at its full potential.	
1. Power On	Follow the procedures on the previous page.	
2. Firmware	Update to the latest firmware.	Page 192
3. Reset System	Reset the system by recalling the factory settings. Press the *Default* key on the front panel. For details, see page 154.	Default
4. Connect Probe	Connect the probe to the Channel 1 input and to the probe compensation output. This output provides a 2Vp-p, 1kHz square wave for signal compensation by default. Set the probe attenuation to x10 if the probe has adjustable attenuation.	



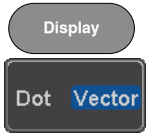
5. Capture Signal (Autoset)

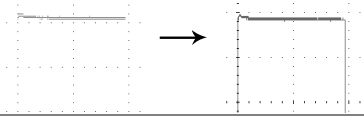
Press the *Autoset* key. A square waveform appears on the center of the screen. For Autoset details, see page 38.



6. Select Vector Waveform

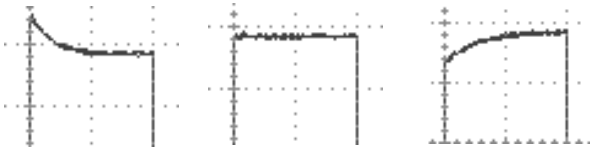
Press the *Display* key, and set the display to *Vector* on the bottom menu.



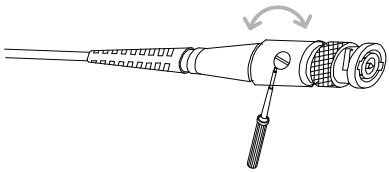


7. Compensate Probe

Turn the adjustment point on the probe to make the square waveform edge flat.



Over Compensation | Normal | Under Compensation



8. Start Operation Continue with the other operations.

Measurement: page 36
Configuration: page 76
Save/Recall: page 136
File Utilities: page 161
Apps: page 125
Hardcopy key: page 168
Remote Control: page 172
Maintenance: page 183

How to Use This Manual

Background

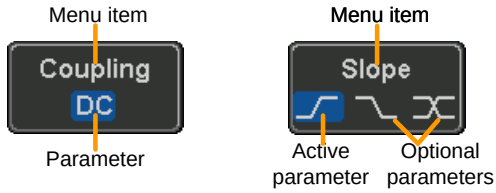
This section describes the conventions used in this manual to operate the DSO-1000D.

Throughout the manual any reference to pressing a menu key refers to the keys directly below or beside any menu icons or parameters.

When the user manual says to "toggle" a value or parameter, press the corresponding menu item. Pressing the item will toggle the value or parameter.

Active parameters are highlighted for each menu item. For example in the example below, Coupling is currently set to DC.

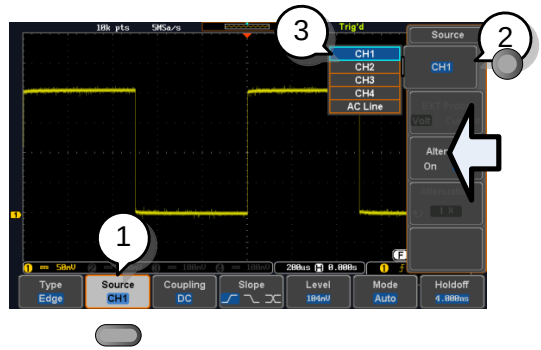
If a menu item can be toggled from one value or parameter to another, the available options will be visible, with the current option highlighted. In the example below the slope can be toggled from a rising slope to a falling slope or either slope.



Selecting a Menu Item, Parameter or Variable

When the user manual says to "select" a value from one of the side menu parameters, first press the corresponding menu key and use the Variable knob to either scroll through a parameter list or to increase or decrease a variable.

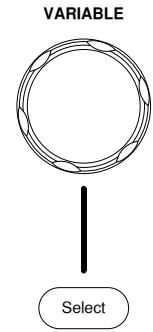
Example 1



1. Press a bottom menu key to access the side menu.

2. Press a side menu key to either set a parameter or to access a sub menu.

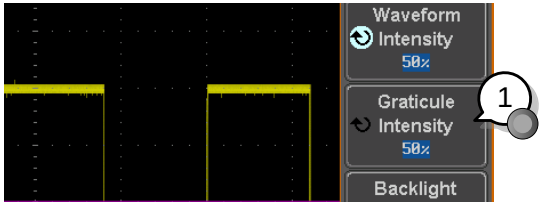
3. If accessing a sub menu or setting a variable parameter, use the Variable knob to scroll through menu items or variables. Use the Select key to confirm and exit.



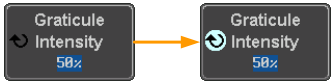
4. Press the same bottom menu key again to reduce the side menu.

Example 2

For some variables, a circular arrow icon indicates that the variable for that menu key can be edited with the Variable knob.

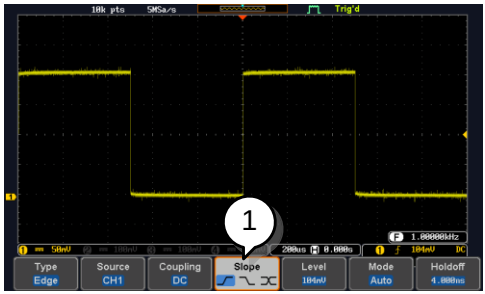


1. Press the desired menu key to select it. The circular arrow will become highlighted.

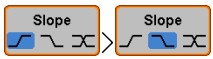


2. Use the Variable knob to edit the value.

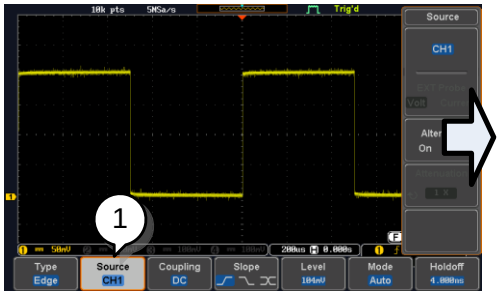
Toggling a Menu Parameter



1. Press the bottom menu key to toggle the parameter.



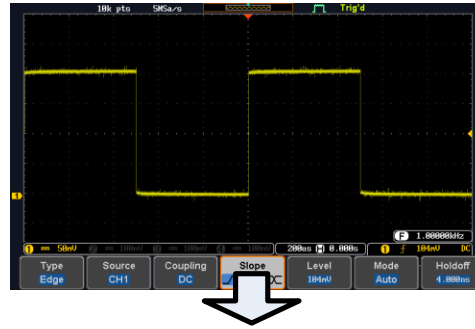
Reduce Side Menu



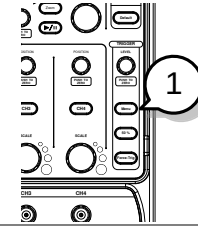
1. To reduce the side menu, press the corresponding bottom menu that brought up the side menu originally.

   For example: Press the *Source* soft-key to reduce the Source menu.

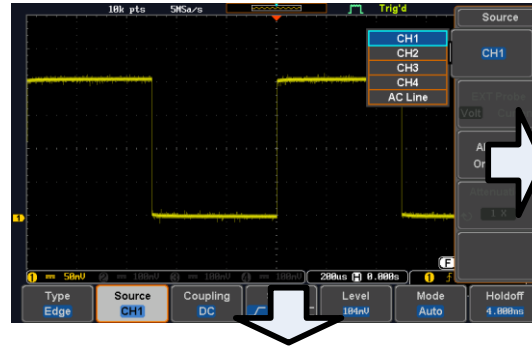
Reduce Lower Menu



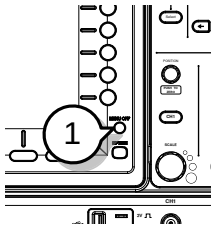
1. Press the relevant function key again to reduce the bottom menu. For example: press the Trigger Menu key to reduce the trigger menu.



Remove All Menus

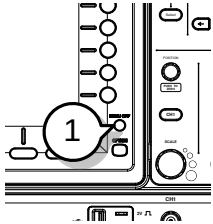


1. Press the *Menu Off* key to reduce the side menu, press again to reduce the bottom menu.



Remove On-Screen Messages

1. The *Menu Off* key can also be used to remove any on screen messages.



Built-in Help

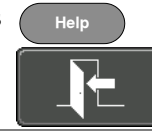
The Help key accesses a context sensitive help menu. The help menu contains information on how to use the front panel keys.

Panel Operation

1. Press the *Help* key. The display changes to Help mode.

2. Use the *Variable* knob to scroll up and down through the Help contents. Press *Select* to view the help on the selected item.

Example: Help on the Display key

Home Key	Press the *Home* key to return to the main help screen.	
Go Back	Press the *Back* key to go to the previous menu page.	
Exit	Press the *Help* key again or press the *Exit* key to exit the Help mode.	

MEASUREMENT

Basic Measurement

This section describes the basic operations required in capturing and viewing the input signal. For more detailed operations, see the following chapters.

- Cursor Measurement → from page 58
- Configuration → from page 76

Before operating the oscilloscope, please see the Getting Started chapter, page 10.

Channel Activation

Activate Channel

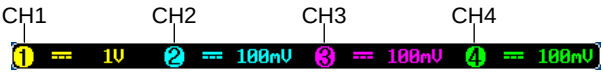
To activate an input channel, press a *channel* key.

CH1 → CH1

When activated, the channel key will light up. The corresponding channel menu will also appear.

Each channel is associated with the color shown beside each channel's vertical SCALE dial: CH1: yellow, CH2: blue, CH3: pink and CH4: green.

When a channel is activated, it is shown above the bottom menu system.



De-activate Channel

To de-activate a channel, press the corresponding *channel* key again. If the channel menu is not open, press the *channel* key twice (the first press shows the Channel menu).

CH1 → CH1

Default Setup

To activate the default state, press *Default*.

Autoset

Background

The Autoset function automatically configures the panel settings to position the input signal(s) to the best viewing condition. The DSO-1000D automatically configures the following parameters:

- Horizontal scale
- Vertical scale
- Trigger source channel

There are two operating modes for the Autoset function: Fit Screen Mode and AC Priority Mode.

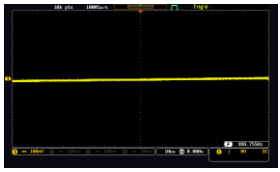
Fit Screen Mode will fit the waveform to the best scale, including any DC components (offset). AC priority mode will scale the waveform to the screen by removing any DC component.

Panel Operation

1. Connect the input signal to the DSO-1000D and press the *Autoset* key.

2. The waveform appears in the center of the display.

Before



After

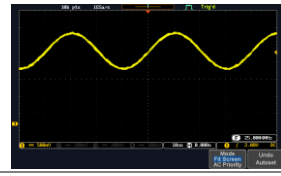
3. To undo Autoset, press *Undo Autoset* from the bottom menu.

Change modes

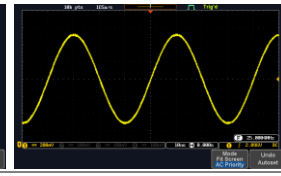
1. Choose between *Fit Screen Mode* and *AC Priority Mode* from the bottom menu.

2. Press the *Autoset* key again to use Autoset in the new mode.

Fit Screen Mode



AC Priority



Limitation

Autoset does not work in the following situations:

- Input signal frequency is less than 20Hz
- Input signal amplitude is less than 10mV

Note

The Autoset key does NOT automatically activate the channels to which input signals are connected.

Run/Stop

Background

By default, the waveform on the display is constantly updated (Run mode). Freezing the waveform by stopping signal acquisition (Stop mode) allows flexible observation and analysis. To enter Stop mode, two methods are available: pressing the Run/Stop key or using the Single Trigger mode.

Stop mode icon 

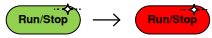
Triggered icon 

When in Stop mode, the Stop icon appears at the top of the display.

Freeze Waveform using the Run/Stop Key

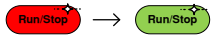
Press the *Run/Stop* key once. The Run/Stop key turns red. The waveform and signal acquisition freezes.

Stop:



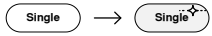
To unfreeze, press the *Run/Stop* key again. The Run/Stop key turns green again.

Run:



Freeze Waveform by Single Trigger Mode

Press the *Single* key to go into the Single Trigger mode. The Single key turns bright white.



In the Single Trigger mode, the scope will be put into the pre-trigger mode until the scope encounters the next trigger point. After the scope has triggered, it will remain in Stop mode, until the *Single* key is pressed again or the *Run/Stop* key is pressed.

Waveform Operation

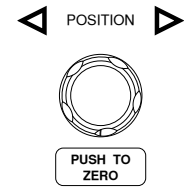
The waveform can be moved or scaled in both Run and Stop mode, but in different manners. For details, see page 89 (Horizontal position/scale) and page 96 (Vertical position/scale).

Horizontal Position/Scale

For more detailed configuration, see page 89.

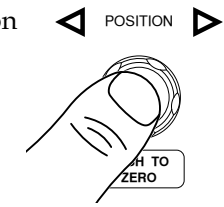
Set Horizontal Position

The horizontal position knob moves the waveform left and right.



Set Horizontal Position to 0

Pressing the horizontal position knob will reset the horizontal position to 0.



Alternatively, pressing the *Acquire* key and then pressing *Reset H Position to 0s* from the bottom menu will also reset the horizontal position.

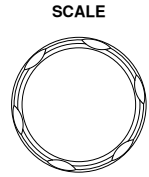
As the waveform moves, the display bar on the top of the display indicates the portion of the waveform currently shown on the display and the position of the horizontal marker on the waveform.

Position Indicator

The horizontal position is shown at the bottom of the display grid to the right of the H icon.

Select Horizontal Scale

To select the timebase, turn the horizontal *SCALE* knob; left (slow) or right (fast).



Range 5ns/div ~ 100s/div, 1-2-5 increments

The scale is displayed to the left of the H icon at the bottom of the screen.

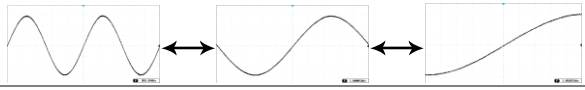
Display bar The display bar indicates how much of the waveform is displayed on the screen at any given time. Changes to timebase will be reflected on the display bar. The display bar is not shown in rolling acquisition mode.

Fast 

Medium 

Slow 

Stop mode In the Stop mode, the waveform size changes according to the scale.



Note

The Sample rate changes according to the timebase and record length. See page 82.

Vertical Position/Scale

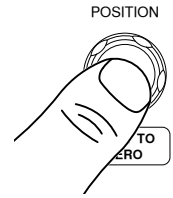
For more detailed configuration, see page 96.

Set Vertical Position

To move the waveform up or down, turn the *vertical position knob* for each channel.

Push the *vertical position knob* to reset the position to 0.

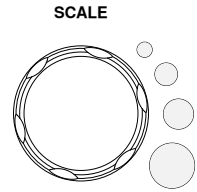
As the waveform moves, the vertical position of the cursor appears on the display.



Run/Stop mode — The waveform can be moved vertically in both Run and Stop mode.

Select Vertical Scale

To change the vertical scale, turn the vertical *SCALE* knob; left (down) or right (up).



Range — 1mV/div ~ 10V/div

1-2-5 increments

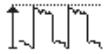
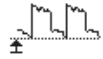
The vertical scale indicator for each channel on the bottom of the display changes accordingly.

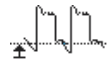
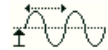
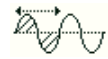
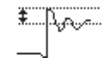
Automatic Measurement

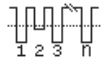
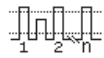
The automatic measurement function measures and updates major items for Voltage/Current, Time, and Delay type measurements.

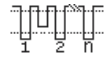
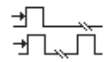
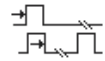
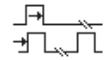
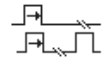
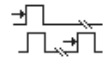
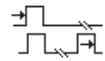
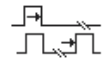
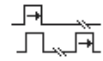
Measurement Items

	V/I Measurements	Time Meas.	Delay Meas.
Overview	Pk-Pk Max Min Amplitude High Low Mean Cycle Mean RMS Cycle RMS Area Cycle Area ROVShoot FOVShoot RPREShoot FPREShoot	Frequency Period RiseTime FallTime +Width -Width Dutycycle +Pulses -Pulses +Edges -Edges	FRR FRF FFR FFF LRR LRF LFR LFF Phase

Voltage/Current Measurement	Pk-Pk (peak to peak)		Difference between positive and negative peak. (=max − min)
	Max		Positive peak.
	Min		Negative peak.

Amplitude		Difference between the global high value and the global low value, measured over the entire waveform or gated region. (=high − low)
High		Global high voltage. See page 53 for details.
Low		Global low voltage. See page 53 for details.
Mean		The arithmetic mean value is calculated for all data samples as specified by the Gating option.
Cycle Mean		The arithmetic mean value is calculated for all data samples within the first cycle found in the gated region.
RMS		The root mean square of all data samples specified by the Gating option.
Cycle RMS		The root mean square value is calculated for all data samples within the first cycle found in the gated region.
Area		Measures the positive area of the waveform and subtracts it from the negative area. The ground level determines the division between positive and negative areas.
Cycle Area		The Summation based on all data samples within the first cycle found in the gated region.
ROVShoot		Rise overshoot

	FOVShoot		Fall overshoot
	RPREShoot		Rise preshoot
	FPREShoot		Fall preshoot
Time Measurement	Frequency		Frequency of the waveform.
	Period		Waveform cycle time. (=1/Freq)
	RiseTime		The time required for the leading edge of the first pulse to rise from the low reference value to the high reference value.
	FallTime		The time required for the falling edge of the first pulse to fall from the high reference value to the low reference value.
	+Width		Positive pulse width.
	–Width		Negative pulse width.
	Duty Cycle		Ratio of signal pulse compared with whole cycle. =100x (Pulse Width/Cycle)
	+Pulses		Measures the number of positive pulses.
	-Pulses		Measures the number of negative pulses.
	+Edges		Measures the number of positive edges.

	-Edges		Measures the number of negative edges.
Delay Measurement	FRR		Time between: Source 1 first rising edge and Source 2 first rising edge.
	FRF		Time between: Source 1 first rising edge and Source 2 first falling edge.
	FFR		Time between: Source 1 first falling edge and Source 2 first rising edge.
	FFF		Time between: Source 1 first falling edge and Source 2 first falling edge.
	LRR		Time between: Source 1 first rising edge and Source 2 last rising edge.
	LFR		Time between: Source 1 first rising edge and Source 2 last falling edge.
	LRF		Time between: Source 1 first falling edge and Source 2 last rising edge.
	LFF		Time between: Source 1 first falling edge and Source 2 last falling edge.
	Phase		The phase difference of two signals, calculated in degrees. $\frac{t1}{t2} \times 360°$

Note

The in-built help system can be used to see detailed automatic measurement definitions.

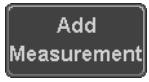
Add Measurement

The *Add Measurement* function allows you to add up to eight automatic measurement items on the bottom of the screen from any channel source.

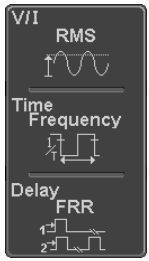
Add Measurement Item

1. Press the *Measure* key.

2. Press *Add Measurement* from the bottom menu.



3. Choose either a *V/I*, *Time* or *Delay* measurement from the side menu and choose the type of measurement you wish to add.



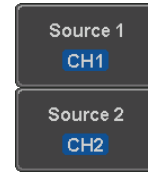
V/I (Voltage/ Current)	Pk-Pk, Max, Min, Amplitude, High, Low, Mean, Cycle Mean, RMS, Cycle RMS, Area, Cycle Area, ROVShoot, FOVShoot, RPREShoot, FPREShoot
Time	Frequency, Period, RiseTime, FallTime, +Width, –Width, Duty Cycle, +Pulses, -Pulses, +Edges, -Edges
Delay	FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF, Phase

4. All of the chosen automatic measurements will be displayed in a window on the bottom of the screen. The channel number and channel color indicate the measurement source.
   For the analog inputs: yellow = CH1, blue = CH2, pink = CH3, green = CH4.

Choose a Source

The channel source for measurement items can be set either before or when selecting a measurement item.

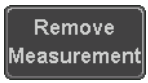
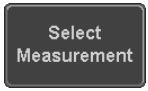
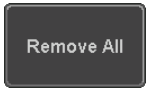
1. To set the source, press either the *Source1* or *Source2* key from the side menu and choose the source. Source 2 is only applicable for delay measurements.



Range CH1~ CH4, Math

Remove Measurement

Individual measurements can be removed at any time using the Remove Measurement function.

Remove Measurement Item	1. Press the *Measure* key.	
	2. Press *Remove Measurement* from the bottom menu.	
	3. Press *Select Measurement* and select the item that you want to remove from the measurement list.	
Remove All Items	Press *Remove All* to remove all the measurement items.	

Gated mode

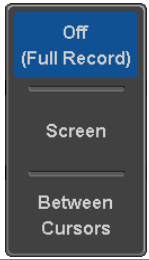
Some automatic measurements can be limited to a "gated" area between cursors. Gating is useful for measuring a magnified waveform or when using a fast time base. The gated mode has three possible configurations: Off (Full Record), Screen and Between Cursors.

Set Gating Mode

1. Press the *Measure* key.

2. Press *Gating* from the bottom menu.

3. Choose one of the gating modes from the side menu: *Off (full record)*, *Screen*, *Between Cursors.*



Cursors On Screen

If *Between Cursors* is selected, the cursor positions can be edited by using the cursor menu.

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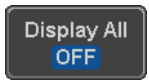
Display All mode

Display All mode shows and updates all items from Voltage and Time type measurements.

View Measurement Results

1. Press the *Measure* key.

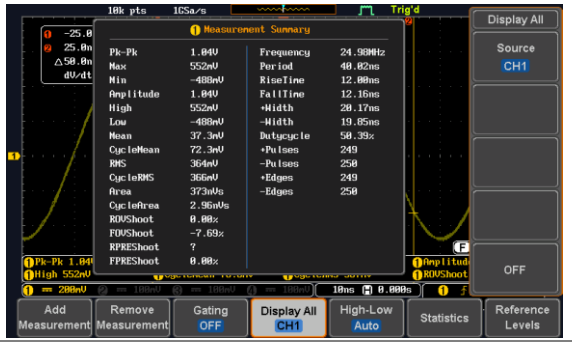
2. Press *Display All* from the bottom menu.



3. Press Source from the side menu and choose a measurement source.

Range CH1~CH4, Math

4. The results of Voltage and Time type measurements appear on the display.



Remove Measurements

To remove the measurement results, press *OFF*.

Delay Measurements

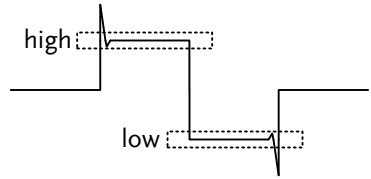
Delay type measurements are not available in this mode as only one channel is used as the source. Use the individual measurement mode (page 48) instead.

High Low Function

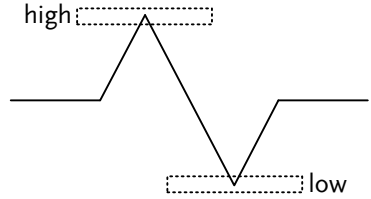
Background

The High-Low function is used to select the method for determining the value of the High-Low measurement values.

Auto	Automatically chooses the best high-low setting for each waveform when measuring.
Histogram	Uses histograms to determine the high-low values. This mode ignores any preshoot and overshoot values. This mode is particularly useful for pulse-type waveforms



Min-max	Sets the high-low values as the minimum or maximum measured values.



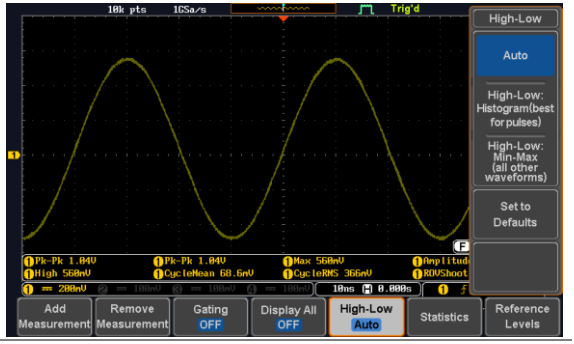
Set High-Low

1. Press the *Measure* key.

2. Press *High-Low* from the bottom menu.

3. Select the type of High-Low settings from the side menu.

   High-Low Settings: Histogram, Min-Max, Auto



Restore Default High-Low Settings

To return to the default High-Low settings, press *Set to Defaults*.

Statistics

Background

The Statistics function can be used to view a number of statistics for the selected automatic measurements. The following information is displayed with the Statistics function:

Value	Currently measured value
Mean	The mean value is calculated from a number of automatic measurement results. The number of samples used to determine the mean can be user-defined.
Min	The minimum value observed from a series of measured results for the selected automatic measurement items.

Max	The maximum value observed from a series of measured results for the selected automatic measurement items.
Standard Deviation	The variance of the currently measured value from the mean. The standard deviation equals the squared root of the variance value. Measuring the standard deviation can, for example, determine the severity of jitter in a signal. The number of samples used to determine the standard deviation can be user-defined.

Panel Operation

1. Press the *Measure* key.

2. Select at least one automatic measurement.

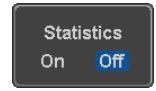
Page 48

3. Press *Statistics* from the bottom menu.

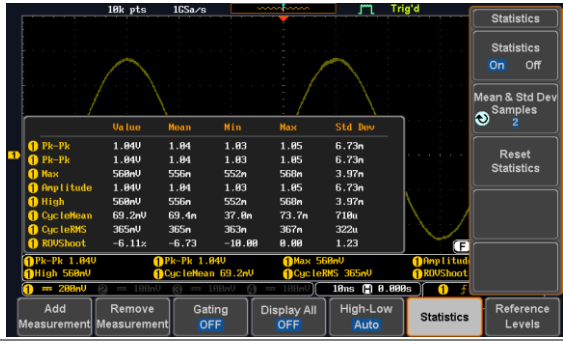
4. Set the number of samples to be used in the mean and standard deviation calculations.

   Samples: 2~1000

5. Press *Statistics* and turn Statistics on.



6. The statistics for each automatic measurement will appear at the bottom of the display in a table.



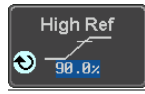
Reset Statistics

To reset the standard deviation calculations, press *Reset Statistics*.

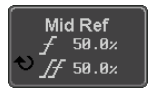
Reference Levels

Background

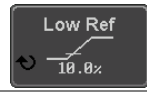
The reference level settings determine the measurement threshold levels for some measurements like the Rise Time measurement.



High Ref: Sets the high reference level.



Mid Ref: Sets the middle reference for the first and second waveforms.



Low Ref: Sets the low reference level.

Panel Operation

1. Press the *Measure* key.

2. Press *Reference Levels* from the bottom menu.

3. Set the reference levels from the side menu.

   Ensure the reference levels do not cross over.

High Ref	0.0% ~ 100%
Mid Ref	0.0% ~ 100%
	0.0% ~ 100%
Low Ref	0.0% ~ 100%

Default Settings

4. Press *Set to Defaults* to set the reference levels back to the default settings.

Cursor Measurement

Horizontal or vertical cursors are used to show the position and values of waveform measurements and math operation results. These results cover voltage, time, frequency and other math operations. When the cursors (horizontal, vertical or both) are activated, they will be shown on the main display unless turned off.

Use Horizontal Cursors

Panel Operation

1. Press the *Cursor* key once.

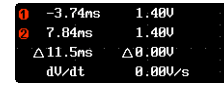
2. Press *H Cursor* from the bottom menu if it is not already selected.

3. When the H Cursor is selected, repeatedly pressing the *H Cursor* key or the *Select* key will toggle which cursors are selected.

OR

Range	Description
	Left cursor (1) movable, right cursor position fixed
	Right cursor (2) movable, left cursor position fixed
	Left and right cursor (1+2) movable together

4. The cursor position information appears on the top left hand side of the screen



Cursor 1 Hor. position, Voltage/Current

Cursor 2 Hor. position, Voltage/Current

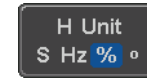
Δ Delta (difference between cursors)

dV/dt or dI/dt

5. Use the *Variable* knob to move the movable cursor(s) left or right.

Select Units

6. To change the units of the horizontal position, press *H Unit.*

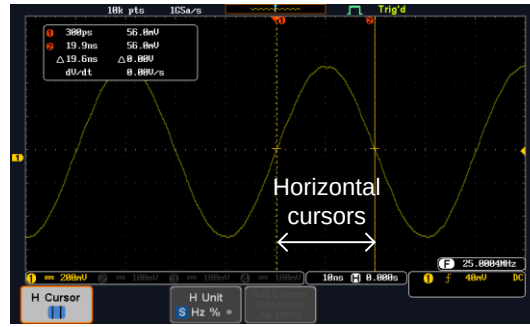


Units S, Hz, %(ratio), ˚(phase)

Phase or Ratio Reference

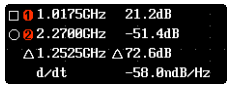
7. To set the 0% and 100% ratio or the 0˚ and 360˚ phase references for the current cursor positions, press *Set Cursor Positions As 100%*.

Example



FFT

FFT cursors can use different units. For FFT details, see page 68.



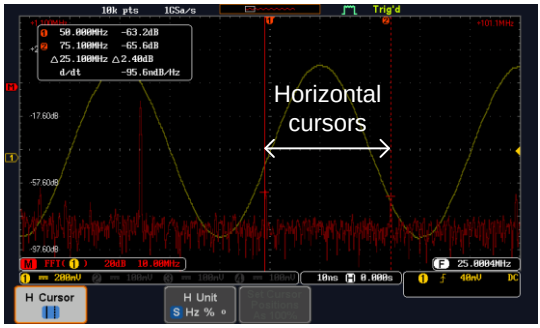
Cursor 1 Hor. position, dB/Voltage

Cursor 2 Hor. position, dB/Voltage

△ Delta (difference between cursors)

dV/dt or d/dt

Example



XY Mode

XY mode cursors measure a number of X by Y measurements.

1 (X) Versus 2 (Y)		1	2	△
	t:	-625us	625us	1.25ms
Rectangular	x:	16.0V	17.6V	1.60V
	y:	1.76V	-1.44V	-3.20V
Polar	r:	16.0V	17.6V	3.57V
	θ:	6.27°	-4.67°	-63.4°
Product	x×y:	28.1VV	-25.3VV	-5.12VV
Ratio	y÷x:	110mV/V	-81.8mV/V	-2.00V/V

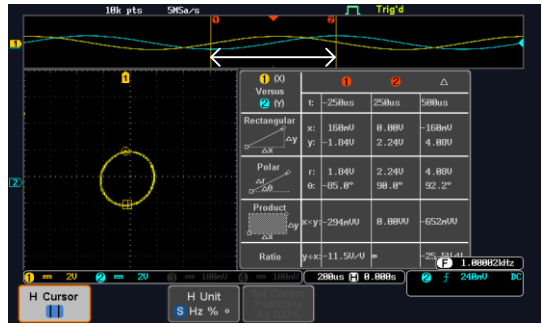
Cursor 1 Time, rectangular, polar co-ordinates, product, ratio.

Cursor 2 Time, rectangular, polar co-ordinates, product, ratio.

△ Delta (difference between cursors)

Example

Horizontal cursors



Use Vertical Cursors

Panel Operation/ Range

1. Press the *Cursor* key twice.

x2

2. Press *V Cursor* from the bottom menu if it is not already selected.

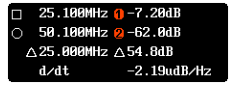
3. When the V Cursor is selected, repeatedly pressing the *V Cursor* key or the *Select* key will toggle which vertical cursor is selected.

OR


Range

——— ----------	Upper cursor movable, lower cursor position fixed
---------- ———	Lower cursor movable, upper cursor position fixed
——— ———	Upper and lower cursor movable together

4. The cursor position information appears on the top left hand side of the screen.



□,○	Time: cursor 1, cursor 2
❶, ❷	Voltage/Current: cursor1, cursor2
△	Delta (difference between cursors)

dV/dt or dI/dt

5. Use the *Variable* knob to move the cursor(s) up or down.

Select Units

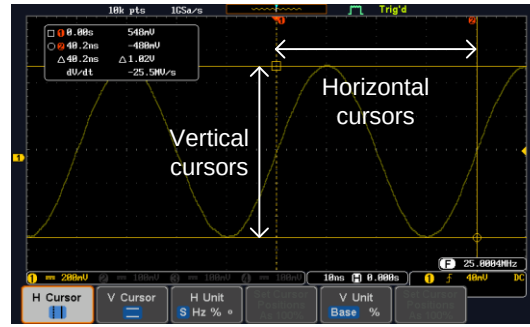
6. To change the units of the vertical position, press *V Unit*.

Units Base (source wave units), % (ratio)

Base or Ratio Reference

7. To set the 0% and 100% ratio references for the current vertical cursor position, press *Set Cursor Positions As 100%*.

Example



FFT

FFT has different content. For FFT details, see page 68.

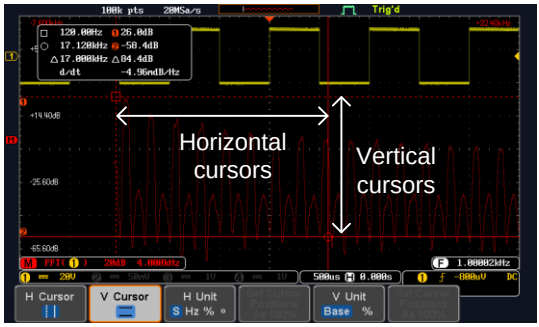
□,○ Frequency/Time: cursor1, cursor2

❶, ❷ dB/V: cursor1, cursor2

△ Delta (difference between cursors)

d/dt

Example



XY Mode

XY mode cursors measure a number of X by Y measurements.

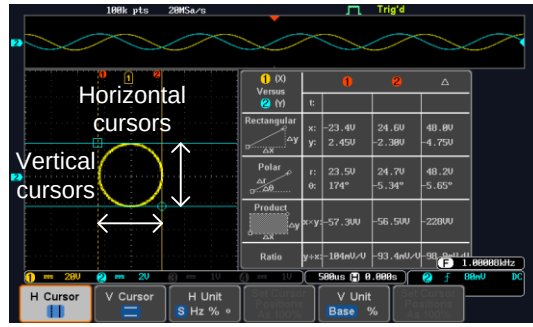
❶ (X) Versus ❷ (Y)		❶	❷	△
	t:	-625us	625us	1.25ms
Rectangular	x:	18.4V	-14.4V	-32.8V
	y:	-1.44V	-1.68V	-240mV
Polar	r:	18.4V	14.4V	32.8V
	θ:	-4.47°	-173°	-179°
Product	x×y:	-26.4VV	24.1VV	7.87VV
Ratio	y÷x:	-78.2mV/V	116mV/V	7.31mV/V

Cursor ❶ Rectangular, polar co-ordinates, product, ratio.

Cursor ❷ Rectangular, polar co-ordinates, product, ratio.

△ Delta (difference between cursors)

Example


Horizontal cursors
Vertical cursors
H Cursor
V Cursor
H Unit
V Unit

Math Operation

Basic Math Overview & Operators

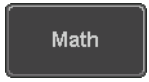
Background	The Math function performs basic math functions (addition, subtraction, multiplication, division) on the input signals or the reference waveforms. The resultant waveform will be shown on the screen in real-time.
Addition (+)	Adds the amplitude of two signals. Source CH1~4, Ref1~4
Subtraction (–)	Extracts the amplitude difference between two signals. Source CH1~4, Ref1~4
Multiplication (×)	Multiplies the amplitude of two signals. Source CH1~4, Ref1~4
Division (÷)	Divides the amplitude of two signals. Source CH1~4, Ref1~4

Addition/Subtraction/Multiplication/Division

Panel Operation

1. Press the *Math* key.

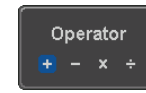
2. Press the *Math* key on the lower bezel.



3. Select *Source 1* from the side menu

Range CH1~4, Ref1~4

4. Press *Operator* to choose the math operation.



Range +, -, ×, ÷

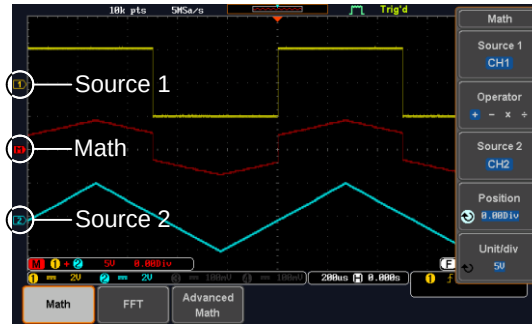
5. Select *Source 2* from the side menu.

Range CH1~4, Ref1~4

6. The math measurement result appears on the display. The vertical scale of the math waveform appears at the bottom of the screen.

From left: Math function, source1, operator, source2, Unit/div

Example



Position and Unit

To move the math waveform vertically, press the *Position* key from the side menu and use the *Variable* knob to set the position.

Range –12.00 Div ~ +12.00 Div

To change the unit/div settings, press *Unit/div*, then use the *Variable* knob to change the unit/div.

The units that are displayed depend on which operator has been selected, and whether the probe for the selected channel has been set to voltage or current.

Operator:	Unit/div:
Multiplication	VV, AA or W
Division	V/V, A/A
Addition/Subtraction	V or A

Turn Off Math

To turn off the Math result from the display, press the *Math* key again.

FFT Overview & Window Functions

Background

The FFT Math function performs a Fast Fourier Transform on one of the input signals or the reference waveforms. The resultant spectrum will be shown on the screen in real-time. Four types of FFT windows are available: Hanning, Hamming, Rectangular, and Blackman, as described below.

Hanning FFT Window		
	Frequency resolution	Good
	Amplitude resolution	Not good
	Suitable for....	Frequency measurement on periodic waveforms

Hamming FFT Window	Frequency resolution	Good
	Amplitude resolution	Not good
	Suitable for....	Frequency measurement on periodic waveforms
Rectangular FFT Window	Frequency resolution	Very good
	Amplitude resolution	Bad
	Suitable for....	Single-shot phenomenon (this mode is the same as having no window at all)
Blackman FFT Window	Frequency resolution	Bad
	Amplitude resolution	Very good
	Suitable for....	Amplitude measurement on periodic waveforms

FFT Operation

Panel Operation

1. Press the *Math* key.

2. Press *FFT* from the bottom menu.

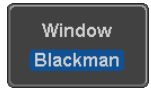
3. Select the *Source* from the side menu.

Range CH1~4, Ref~4

4. Press the *Vertical Units* key from the side menu to select the vertical units used.

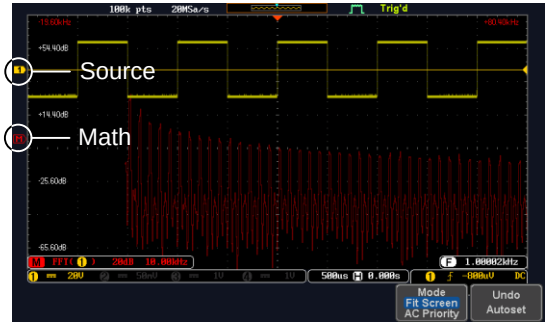
Range Linear RMS, dBV RMS

5. Press the *Window* key from the side menu and select the window type.



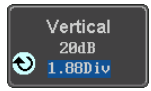
Range Hanning, Hamming, Rectangular, and Blackman.

6. The FFT result appears. For FFT, the horizontal scale changes from time to frequency, and the vertical scale from voltage/current to dB/RMS.



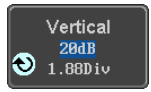
Position and Scale

To move the FFT waveform vertically, press *Vertical* until the *Div* parameter is highlighted and then use the Variable knob.



Range –12.00 Div ~ +12.00 Div

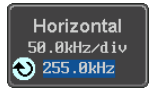
To select the vertical scale of the FFT waveform, press *Vertical* until the *dB* or *voltage* parameters are highlighted and then use the Variable knob.



Range 2mV~1kV RMS, 1~20 dB

Horizontal Position and Scale

To move the FFT waveform horizontally, press *Horizontal* until the *Frequency* parameter is highlighted and then use the Variable knob.



Range 0Hz ~ 2.5MHz

To select the horizontal scale of the FFT waveform, press *Horizontal* repeatedly until the *Hz/div* parameter is highlighted and then use the Variable knob.

Range	10kHz/Div ~ 250kHz/Div

Advanced Math Overview

Background	The advanced math function allows complex math expressions to be created based on the input sources, reference waveforms or even the automatic measurements available from the *Measure* menu (see page 44). An overview of each of the major parameters that can be used in the advanced math function are shown below:
Expression	Displays the function expression as it is created.
Source	Selects the source signal. Source: CH1~4, Ref1~4
Function	Adds a mathematical function to the expression. Function: Intg, Diff, log, Ln, Exp, Sqrt, Abs, Rad, Deg, Sin, Cos, Tan, Asin, Acos, Atan
Variable	Adds a user-specified variable to the expression. The variable is a floating point number consisting of a mantissa and an exponent. Variable: VAR1, VAR2
Operator	Adds an operator or parenthesis to the function expression.

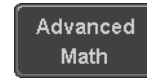
	Operator	+, -, *, /, (,), !(, <, >, <=, >=, ==, !=, ||, &&
Figure	Adds a value to the expression.	
	Figure	Integers, floating point, or floating point with exponent values.
Measurement	Adds automatic measurements to the expression. Not all automatic measurements are supported.	
	Measurement	Pk-Pk, Max, Min, Amp, High, Low, Mean, CycleMean, RMS, CycleRMS, Area, CycleArea, ROVShoot, FOVShoot, Freq, Period, Rise, Fall, PosWidth, NegWidth, Dutycycle, FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF, Phase

Advanced Math Operation

Panel Operation

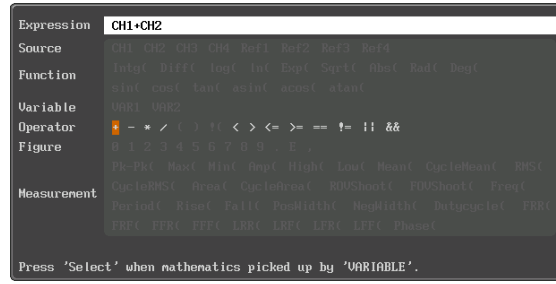
1. Press the *Math* key.

2. Press *Advanced Math* from the bottom menu.



3. Press *Edit Expression*.

4. The Edit f(x) screen appears. CH1 + CH2 is shown in the expression box as an example at startup.



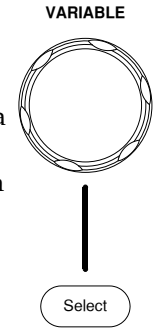
5. Press *Clear* to clear the expression entry area.

6. Use the *Variable* knob and *Select* key to create an expression.

   Use the *Variable* knob to highlight a source, function, variable, operator, figure or measurement in orange.

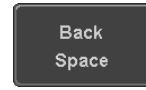
   Press the *Select* key to make the selection.

   If a particular parameter is grayed out, it indicates that that particular parameter is not available at that time.

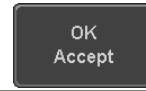


Back Space

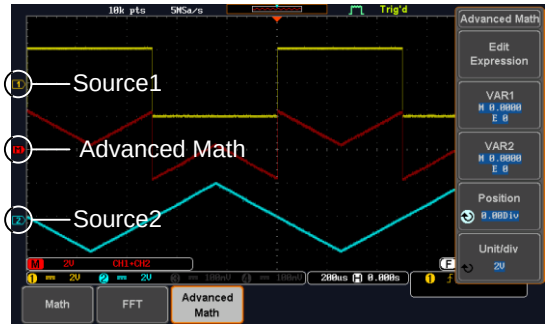
7. To delete the last parameter press *Back Space*.



8. When the expression is complete, press *OK Accept*.



Example:
CH1 + CH2



Set the VAR1 & VAR2

9. Press *VAR1* or *VAR2* to set VAR1/VAR2 if they were used in the expression created previously.

10. Press *Mantissa*.

    Use the *Left* and *Right* arrow keys to select a digit and use the variable knob to set the value of the selected digit.

11. Press *Exponent*.

    Use the Variable knob to set the exponent of the variable.

12. Press *Go Back* to finish editing VAR1 or VAR2.

Vertical Position and Scale

13. Press *Unit/div* and use the Variable knob to set the vertical scale of the math waveform.

14. Press *Position* and use the Variable knob to set the vertical position of the math waveform on the display.

Clear Advanced Math

To clear the advanced math result from the display, press the *Math* key again.

CONFIGURATION

Acquisition

The Acquisition process samples the analog input signals and converts them into digital format for internal processing.

Select Acquisition Mode

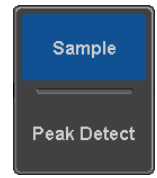
Background	The acquisition mode determines how the samples are used to reconstruct a waveform.	
	Sample	This is the default acquisition mode. Every sample from each acquisition is used.
	Peak detect	Only the minimum and maximum value pairs for each acquisition interval (bucket) are used. This mode is useful for catching abnormal glitches in the signal.
	Average	Multiple acquired data is averaged. This mode is useful for drawing a noise-free waveform. To select the average number, use the Variable knob. Average number: 2, 4, 8, 16, 32, 64, 128, 256

Panel Operation

1. Press the *Acquire* key.

2. To set the Acquisition mode, press *Mode* on the bottom menu.

3. Select an acquisition mode from the side menu.

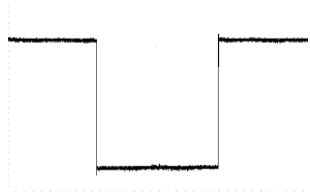


4. If *Average* was chosen, set the number of samples to be used for the average function.

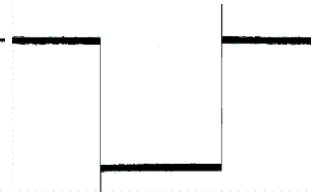
Mode	Sample, Peak Detect, Average
Average sample	2, 4, 8, 16, 32, 64, 128, 256

Example

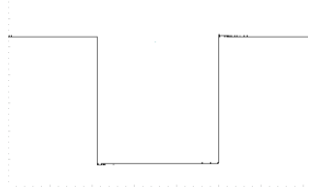
Sample



Peak Detect



Average (256 times)



Show Waveform in XY Mode

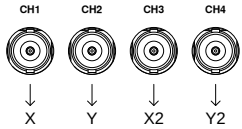
Background

The XY mode maps the input of channel 1 to the input of channel 2. In 4 channel models, the input of channel 3 can be mapped to the input of channel 4. This mode is useful for observing the phase relationship between waveforms.

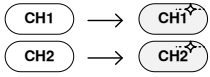
Reference waveforms can also be used in XY mode. Ref1 is mapped to Ref2 and Ref3 is mapped to Ref4. Using the reference waveforms is the same as using the channel input waveforms.

Connection

1. Connect the signals to Channel 1 (X-axis) and Channel 2 (Y-axis) or Channel 3 (X2-axis) and Channel 4 (Y2-axis).



2. Make sure a channel pair is active (CH1&CH2 or CH3&CH4). Press the Channel key if necessary. A channel is active if the channel key is lit.



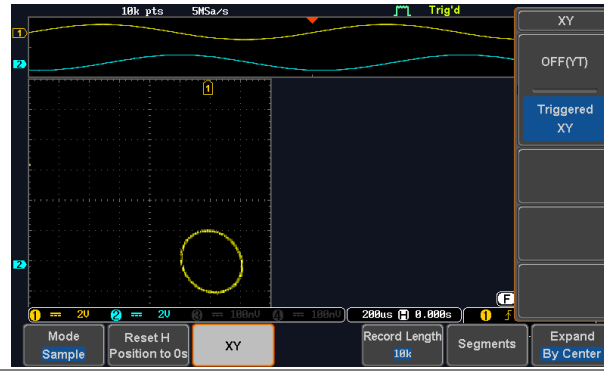
Panel Operation

1. Press the *Acquire* menu key.

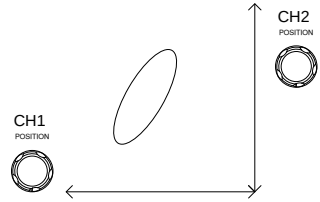
2. Press *XY* from the bottom menu.

3. Choose *Triggered XY* from the side menu.

XY mode is split into two windows. The top window shows the signals over the full time range. The bottom window shows XY mode.



To move the X Y waveform position, use the vertical position knob: Channel 1 knob moves the X Y waveform horizontally, Channel 2 knob moves the X Y waveform vertically. Similarly, the X2 and Y2 axis can be positioned using the channel 3 and channel 4 vertical position knobs.



The horizontal position knob and horizontal scale knob can still be used under the XY mode.

Turn Off XY Mode

To turn off XY mode, choose *OFF (YT)* mode.

Cursors and XY Mode

Cursors can be used with XY mode. See the Cursor chapter for details.

Page 57

Set the Record Length

Background

The number of samples that can be stored is set by the record length. Record length is important in an oscilloscope as it allows longer waveforms to be recorded.

The maximum record length for the DSO-1000D depends on the operating mode. The table below describes the record lengths that are available for each mode.

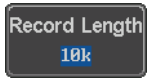
Limitations

Record Length	Normal	Zoom	FFT	FFT in Zoom Window
1k	✓	✗	✓	✓
10k	✓	✓	✓	✓
100k	✓	✓	✓	✓
1M	✓	✓	✓	✗
10M	✓	✓	✗	✗

Panel Operation

1. Press the *Acquire* key.

2. Press the *Record Length* key on the bottom menu and choose the record length.



Record length 1000, 10k, 100k, 1M, 10M points

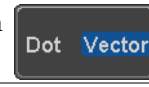
Note

The sampling rate may also be changed when the record length is changed.

Display

The Display menu defines how the waveforms and parameters appear on the main LCD display.

Display Waveform as Dots or Vectors

Background	When the waveform is displayed on the screen, it can be displayed as dots or vectors.
Panel Operation	1. Press the *Display* menu key. 
	2. Press *Dot / Vector* to toggle between Dot and Vector mode. 
Range	Dot: Only the sampled dots are displayed. Vectors: Both the sampled dots and the connecting line are displayed.
Example:	Vectors  Dots 

Set the Level of Persistence

Background	The persistence function allows the DSO-1000D to mimic the trace of a traditional analog oscilloscope. A waveform trace can be configured to "persist" for a designated amount of time.
Panel Operation	1. Press the *Display* menu key. 
	2. To set the persistence time, press the *Persistence* menu button on the bottom bezel. 
	3. Use the Variable knob to select a persistence time. 
	Time 16ms, 30ms, 60ms, 120ms, 240ms, 0.5s, 1s, 2s,~4s, Infinite, Off
Clear	To clear persistence, press *Clear Persistence*. 

Set the Intensity Level

Background	The intensity level of a signal can also be set to mimic the intensity of an analog oscilloscope by setting the digital intensity level.
Panel Operation	1. Press the *Display* menu key. 
	2. Press *Intensity* from the bottom menu. 

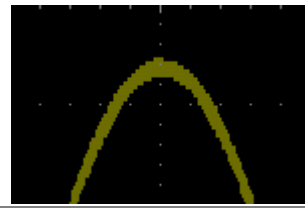
Waveform Intensity

3. To set the waveform intensity, press *Waveform Intensity* and edit the intensity.

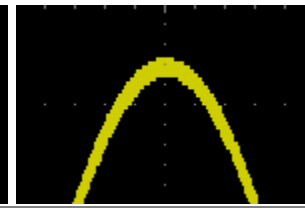
   Range 0~100%

Example

Waveform Intensity 50%



Waveform Intensity 100%



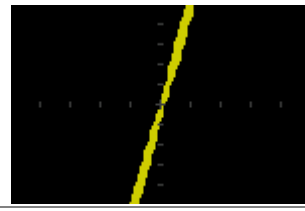
Graticule Intensity

4. To set the graticule intensity, press *Graticule Intensity* from the side menu and edit the intensity value.

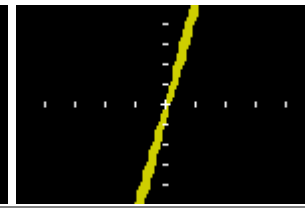
   Range 10~100%

Example

Graticule Intensity 100%



Graticule Intensity 10%



Backlight Intensity

5. To set the LCD backlight intensity, press *Backlight Intensity* from the side menu and edit the intensity value.

   Range 2~100%

Backlight Auto-Dim

6. To automatically dim the backlight after a set duration, set *Backlight Auto-Dim* to On and then set the *Time* parameter to the appropriate time.

   After a set amount of time with no panel activity, the screen will dim until a panel key is pressed again. This function will prolong the life of the LCD display.

   Range 1~180 min

Select Display Graticule

Panel Operation

1. Press the *Display* menu key.

2. Press *Graticule* from the bottom menu.

3. From the side menu choose the graticule display type.

Full: Shows the full grid; X and Y axis for each division.

Grid: Show the full grid without the X and Y axis.

Cross Hair: Shows only the center X and Y frame.

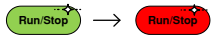
Frame: Shows only the outer frame.

Freeze the Waveform (Run/Stop)

For more details about Run/Stop mode, see page 40.

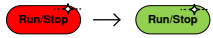
Panel Operation

1. Press the *Run/Stop* key. The *Run/Stop* key turns red and waveform acquisition is paused.



2. The waveform and the trigger freezes. The trigger indicator on the top right of the display shows Stop.

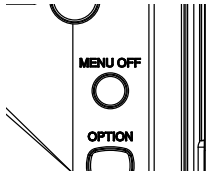
3. To unfreeze the waveform, press the *Run/Stop* key again. The Run/Stop key turns green again and acquisition resumes.



Turn Off Menu

Panel Operation

4. Press the *Menu Off* key below the side menu keys to reduce a menu. The menu key needs to be pressed each time to reduce one menu.



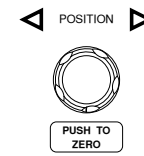
See page 30 for more information.

Horizontal View

This section describes how to set the horizontal scale, position, and waveform display mode.

Move Waveform Position Horizontally

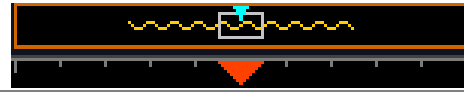
Panel Operation



The horizontal position knob moves the waveform left/right.

Note: the horizontal position is not applicable in the Roll mode.

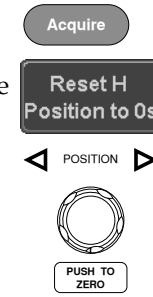
As the waveform moves, a position indicator on the on the top of the display indicates the horizontal position of the waveform in memory.



Reset Horizontal Position

1. To reset the horizontal position, press the Acquire key and then press *Reset H Position to 0s* from the bottom menu.

   Alternatively, pushing the horizontal position knob will also reset the position to zero.



Run Mode

In Run mode, the memory bar keeps its relative position in the memory since the entire memory is continuously captured and updated.

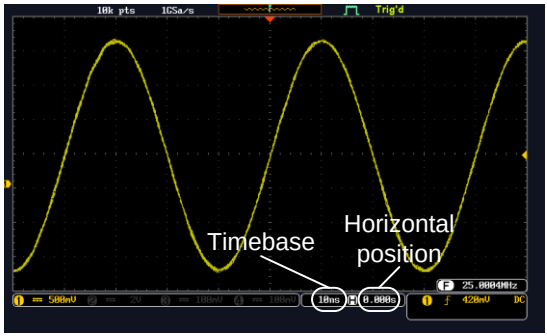
Select Horizontal Scale

Select Horizontal Scale

To select the timebase (time/div), turn the horizontal Scale knob; left (slow) or right (fast).

Range 5ns/div ~ 100s/div, 1-2-5 increment

The timebase indicator updates as the horizontal scale is adjusted.

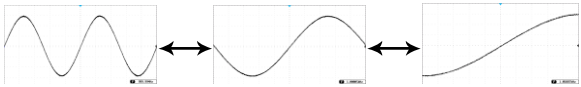


Run Mode

In Run mode, the memory bar and waveform size keep their proportion. When the timebase becomes slower, roll mode is activated (if the trigger is set to Auto).

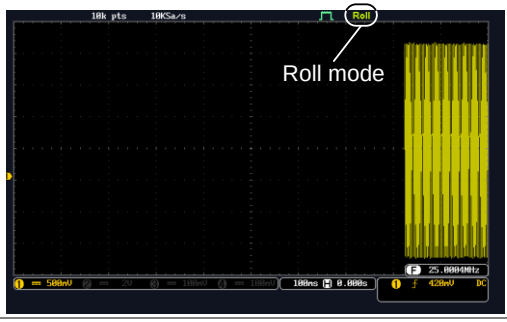
Stop Mode

In Stop mode, the waveform size changes according to the scale.



Select Waveform Update Mode

Background	The display update mode is switched automatically or manually according to the timebase and trigger.	
Normal	Updates the whole displayed waveform at once. Automatically selected when the timebase (sampling rate) is fast.	
	Timebase	≤50ms/div
	Trigger	all modes
Roll Mode	Roll	Updates and moves the waveform gradually from the right side of the display to the left. Automatically selected when the timebase (sampling rate) is slow.
	Timebase	≥100ms/div
	Trigger	all modes



Select Roll Mode Manually

1. Press the Trigger *Menu* key.

2. Press *Mode* from the bottom menu and select *Auto (Untriggered Roll)* from the side menu.

Zoom Waveform Horizontally

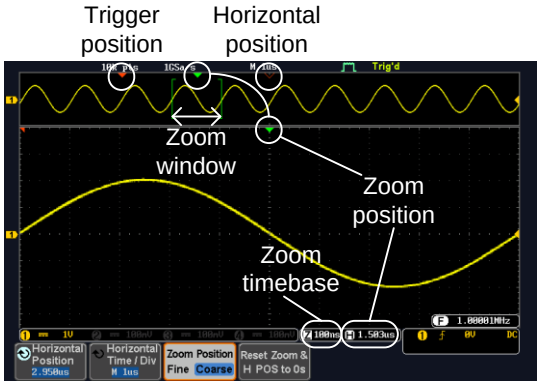
Background

When in Zoom mode, the screen is split into 2 sections. The top of the display shows the full record length, while the bottom of the screen shows the normal view.

Panel Operation

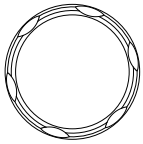
1. Press the *Zoom* key.

2. The Zoom mode screen appears.



Horizontal Navigation

To scroll the waveform left or right, press *Horizontal Position* and use the *Variable Position* knob.



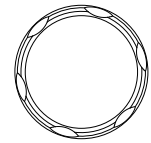
The horizontal position will be shown on the *Horizontal Position* icon.

Horizontal Scale

To change the horizontal scale, press *Horizontal Time/Div* and use the *Variable Position* knob.

The scale will be shown on the *Horizontal Time/Div* icon.

VARIABLE

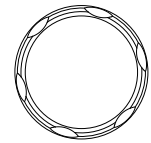


Zoom

To increase the zoom range, use the *Horizontal Scale* knob.

The zoom time base (Z) at the bottom of the screen will change accordingly.

SCALE

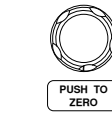


Move the Zoom Window

Use the *Horizontal Position* knob to pan the zoom window horizontally.

To reset the zoom position, press the *Horizontal Position* knob.

POSITION



The position of the zoom window, relative to the horizontal position is shown at the bottom of the screen next to the Zoom time base.

Scroll Sensitivity

To alter the scrolling sensitivity of the zoom window, press the *Zoom Position* key to toggle the scrolling sensitivity.

Sensitivity Fine, Coarse

Reset the Zoom & Horizontal Position

To reset both the zoom and horizontal position, press *Reset Zoom & H POS to 0s*.

Exit

To go back to the original view, press the *Zoom* key again.

Play/Pause

Background

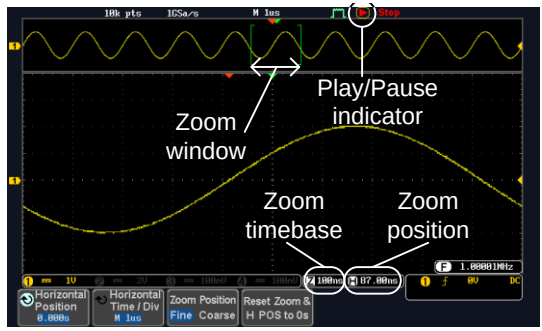
The Play/Pause key can be used to play through signals in the Zoom mode.

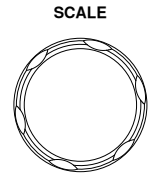
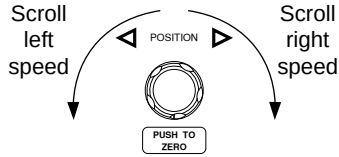
Panel Operation

1. Press the *Play/Pause* menu key.

2. The scope will go into the Zoom Play mode and begin to scroll through the acquisition (from left to right).

   The full-record length waveform will be shown at the top and the zoomed section will be shown at the bottom. The Play/Pause indicator shows the play status.



Zoom	To increase the zoom range, use the horizontal *Scale* knob. The zoom time base (Z) at the bottom of the screen will change accordingly. 	
Scroll Speed	To alter the scrolling speed of the zoom window, press the *Zoom Position* key to toggle the scrolling speed. Sensitivity Fine, Coarse Alternatively, use the horizontal position knob to control the scroll speed. • Turning the *Horizontal Position* knob determines the speed and direction of the scrolling. 	
Reset the Zoom Position	To reset both the zoom position and horizontal position, press *Reset Zoom & H POS to 0s*.	
Pause	Press the *Play/Pause* key to pause or resume playing the waveform.	
Reverse Direction	Press the *Play/Pause* key when at the end of the record length to play back through the waveform in reverse.	
Exit	To exit, press the Zoom key.	

Vertical View (Channel)

This section describes how to set the vertical scale, position, and coupling mode.

Move Waveform Position Vertically

Panel Operation

1. To move the waveform up or down, turn the *Vertical Position* knob for each channel.

2. As the waveform moves, the vertical position of the cursor appears at the bottom half of the display.

View or Set the Vertical Position

1. Press a channel key. The vertical position is shown in the ↻*Position* / ⬇*Set to 0* soft key.

2. To change the position, press ↻*Position* / ⬇*Set to 0* to reset the vertical position or turn the *vertical position* knob to the desired level.

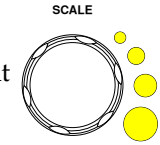
Run/Stop Mode

The waveform can be moved vertically in both Run and Stop mode.

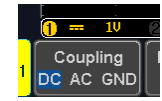
Select Vertical Scale

Panel Operation

To change the vertical scale, turn the *Vertical Scale* knob; left (down) or right (up).



The vertical scale indicator on the bottom left of the display changes accordingly for the specific channel.



Range 1mV/div ~ 10V/div. 1-2-5 increments

Stop Mode

In Stop mode, the vertical scale setting can be changed.

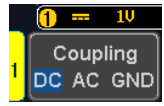
Select Coupling Mode

Panel Operation

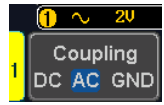
1. Press a *channel* key.

2. Press *Coupling* repeatedly to toggle the coupling mode for the chosen channel.

Range



DC coupling mode. The whole portion (AC and DC) of the signal appears on the display.



AC coupling mode. Only the AC portion of the signal appears on the display. This mode is useful for observing AC waveforms mixed with DC signals.

Ground coupling mode. The display shows only the zero voltage level as a horizontal line.

Example

Observing the AC portion of the waveform using AC coupling

DC coupling

AC coupling

Input Impedance

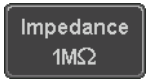
Background

The input impedance of the DSO-1000D is fixed at 1MΩ. The impedance is displayed in the channel menu.

View Impedance

1. Press the *Channel* key.

2. The impedance is displayed in the bottom menu.



Invert Waveform Vertically

Panel Operation

1. Press the *Channel* key.

2. Press *Invert* to toggle Invert On or Off.

Limit Bandwidth

Background

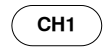
Bandwidth limitation puts the input signal into a selected bandwidth filter.

This function is useful for cutting out high frequency noise to see a clear waveform shape.

The bandwidth filters available are dependent on the bandwidth of the oscilloscope model.

Panel Operation

1. Press the *Channel* key.



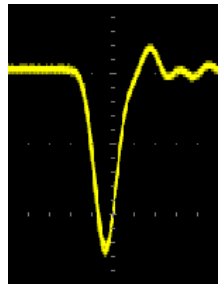
2. Press *Bandwidth* from the bottom menu.

3. Choose a bandwidth* from the side menu.

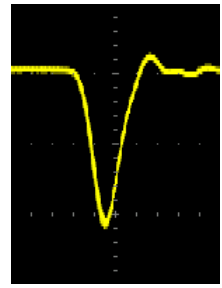
   Range Full, 20MHz

Example

BW Full



BW Limit 20MHz



Expand by Ground/Center

Background

When the voltage scale is changed, the Expand function designates whether the signal expands from the center of the screen or from the signal ground level. Expand by center can be used to easily see if a signal has a voltage bias. Expand by ground is the default setting.

Panel Operation

1. Press a *channel* key.

2. Press *Expand* repeatedly to toggle between expand *By Ground* and *Center*.

Range By Ground, By Center

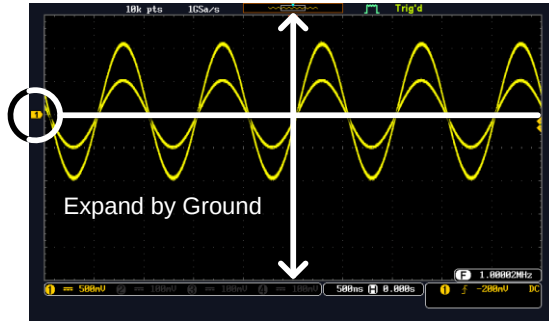
Example

If the vertical scale is changed when the Expand function is set to ground, the signal will expand from the ground level*. The ground level does not change when the vertical scale is changed.

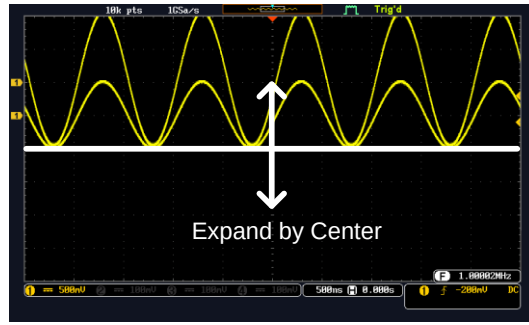
If the vertical scale is changed when the Expand function is set to center, the signal will expand from the center of the screen. The ground level will suit to match the signal position.

*Or from the upper or lower edge of the screen if the ground level is off-screen.

Expand by Ground



Expand by Center



Select Probe Type

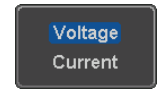
Background — A signal probe can be set to voltage or current.

Panel Operation

1. Press the *Channel* key.

2. Press *Probe* from the bottom menu.

3. Press the *Voltage/Current* soft-key to toggle between voltage and current.



Select Probe Attenuation Level

Background

An oscilloscope probe has an attenuation switch to lower the original DUT signal level to the oscilloscope input range, if necessary. The probe attenuation selection adjusts the vertical scale so that the voltage level on the display reflects the real value on a DUT.

Panel Operation

1. Press the *Channel* key.

2. Press *Probe* from the bottom menu.

3. Press *Attenuation* on the side menu and use the Variable knob to set the attenuation.

Alternatively, press *Set to 10X*.

Range 1mX ~1kX (1-2-5 step)

Note

The attenuation factor adds no influence on the real signal. It just changes the voltage/current scale on the display.

Set the Deskew

Background

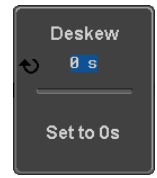
The deskew function is used to compensate for the propagation delay between the oscilloscope and the probe.

Panel Operation

1. Press one of the *Channel* keys.

2. Press *Probe* from the bottom menu.

3. Press *Deskew* on the side menu and use the Variable knob to set the deskew time.



   Alternatively, press *Set to 0s* to reset the deskew time.

   Range -50ns~50ns, 10ps increments

4. Repeat the procedure for another channel if necessary.

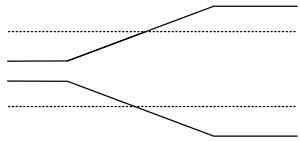
Trigger

The trigger configures the conditions for when the DSO-1000D captures a waveform.

Trigger Type Overview

Edge

The edge trigger is the simplest trigger type. An edge trigger triggers when the signal crosses an amplitude threshold with either a positive or negative slope.



Rising edge trigger

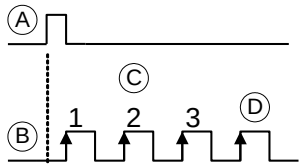
Falling edge trigger

Delay

The Delay trigger works in tandem with the edge trigger, by waiting for a specified time (duration) or number of events before the delay trigger starts. This method allows pinpointing a location in a long series of trigger events.

Note: when using the delay trigger, the edge trigger source can be any one of the channel inputs, the EXT* input or the AC line. *EXT only available on 2 channel models.

Delay trigger example (by event)



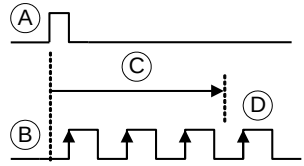
A Edge trigger

B Delay Source

C Delay event count (3)

D First triggering point

Delay trigger example (by time)



A Edge trigger
B Delay Source
C Delay time length
D First triggering point

Pulse Width

Triggers when the pulse width of the signal is less than, equal, not equal or greater than a specified pulse width.

Pulse width

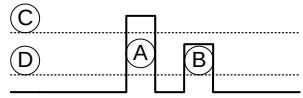
Video

Extracts a sync pulse from a video format signal, and triggers on a specific line or field.

Pulse and Runt

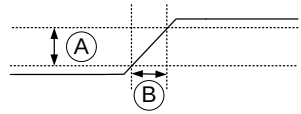
Triggers on a "runt". A runt is a pulse that passes a specified threshold but fails to pass a second threshold. Both positive and negative runts can be detected.

A Pulse
B Runt
C High threshold
D Low threshold



Rise and Fall (Slope)

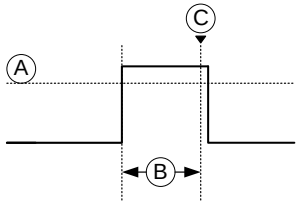
Trigger on rising and or falling edges, below or over a specified rate. The threshold can also be specified.



A Thresholds
B Rate (time)

Timeout

Triggers when the signal stays high, low or either for a designated amount of time. The trigger level determines when a signal is high or low.

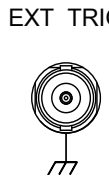


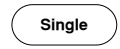
A Trigger level threshold
B Timer
C Triggering point

Trigger Parameter Overview

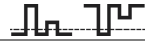
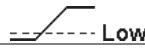
All the following parameters are common for all the trigger types unless stated otherwise.

Trigger Source	CH1 ~ 4	Channel 1 ~ 4 input signals.
	EXT	External trigger input signal. Only available on 2 channel models.
	AC Line	AC mains signal.
	Alternate	Alternate between channel sources for the trigger source.
	EXT Probe	Probe trigger source. Set the probe as either current or voltage.
Trigger Mode	Auto (un-triggered roll)	The DSO-1000D generates an internal trigger if there is no trigger event, to make sure waveforms are constantly updated regardless of trigger events. Select this mode especially when viewing rolling waveforms at slower timebases.



	Normal	The DSO-1000D acquires a waveform only when a trigger event occurs.
	Single	The DSO-1000D acquires a waveform once when a trigger event occurs, then stops acquiring. Press the Single key to acquire a waveform again. 
Coupling (Edge, Delay, Timeout)	DC	DC coupling.
	AC	AC coupling. Blocks DC components from the trigger circuits.
	HF reject	High frequency filter above 70kHz.
	LF reject	Low frequency filter below 70kHz.
	Reject noise	DC coupling with low sensitivity to reject noise.
Slope (Edge, Delay, Rise & Fall)		Trigger on a rising edge.
		Trigger on a falling edge.
		Either. (either rising or falling edge)
		(Edge, Delay, Rise & Fall trigger type only)
Trigger Level (Edge, Delay)	Level	Adjusts the trigger manually using the Trigger LEVEL knob. 
	Set to TTL 1.4V	Sets the trigger level to 1.4V, suitable for triggering on TTL signals.
	Set to ECL -1.3V	Sets the trigger to -1.3V. This is suitable for ECL circuits.

	Set to 50%	Sets the trigger level to 50% of the waveform amplitude. 
Holdoff	Holdoff	Sets the holdoff time.
	Set to Minimum	Set the holdoff time to the minimum.
Delay (Delay)	Time	Sets the delay time (4ns ~ 10s) between the trigger event and the real trigger timing.
	Event	Sets the number of events (1 ~ 65535) passed after the trigger event, until the real trigger timing.
	Set to Minimum	Sets the source trigger to the minimum time.
When (Pulse Width)	Sets the pulse width (4ns ~ 10s) and the triggering condition.	
	> Longer than	= Equal to
	< Shorter than	≠ Not equal to
Threshold (Pulse Width)	Sets the amplitude threshold level for the pulse widths.	
	Threshold	–XXV ~ +XXV, user-set level
	Set to TTL	1.4V
	Set to ECL	-1.3V
	Set to 50%	Sets the threshold to 50%
Standard (Video)	NTSC	National Television System Committee
	PAL	Phase Alternate by Line
	SECAM	SEquential Couleur A Memoire

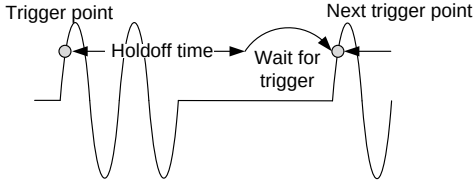
Polarity (Pulse Width, Video)		Positive polarity (triggered on the high to low transition)
		Negative polarity (triggered on the low to high transition)
Polarity (Pulse Runt)		Positive polarity (positive runt)
		Negative polarity (negative runt)
		Either (either negative or positive runt)
Trigger On (Video)	Selects the trigger point in the video signal.	
	Odd Field	NTSC: 1 ~ 263 PAL/SECAM: 1 ~ 313 EDTV: 1~525(480P), 1~625(576P) HDTV: 1~750(720P), 1~563(1080i), 1~1125(1080P)
	Even Field	NTSC: 1 ~ 262, PAL/SECAM: 1 ~ 312 HDTV: 1~562(1080i)
	All Fields	Triggers on all fields.
	All Lines	Triggers on all lines.
Threshold (Pulse Runt)		Sets the upper threshold limit.
		Sets the lower threshold limit.
Threshold (Rise & Fall)		Sets the High threshold.
		Sets the Low threshold.
Trigger When (Timeout)	Stays High	Triggers when the input signal stays high for a designated amount of time.
	Stays Low	Triggers when the input signal stays low for a designated amount of time.
	Either	Triggers when the input signal stays high or low for a designated amount of time.

Timer (Timeout)	4nS~10.0S	Sets the amount of time that a signal must stay high or low for the timeout trigger.

Setup Holdoff Level

Background

The holdoff function defines the waiting period before the DSO-1000D starts triggering again after a trigger point. The holdoff function ensures a stable display if there are a number of points in a periodic waveform that can be triggered. Holdoff applies to all the triggering types.



Panel Operation

1. Press the trigger *Menu* key.

2. To set the Holdoff time, press the *Holdoff* (or *Mode/Holdoff*) menu button on the bottom bezel.

3. Use the side menu to set the Holdoff time.

Range 4ns~10s

Pressing *Set to Minimum* sets the Holdoff time to the minimum, 4ns.

Note

Note: The holdoff function is automatically disabled when the waveform update mode is in roll mode (page91).

Setup Trigger Mode

Background

The trigger mode can be set to Normal or Auto (untriggered roll). The triggering mode applies to all the trigger types. See page 91.

Panel Operation

1. Press the Trigger menu key.

2. Press *Mode* from the bottom menu to change the triggering mode.

3. Use the side panel to select *Auto* or *Normal* triggering modes.

   Range Auto, Normal

Using the Edge Trigger

Panel Operation

1. Press the trigger *Menu* key.

2. Press *Type* from the lower bezel menu.

3. Select *Edge* from the side menu. The edge trigger indicator appears at the bottom of the display.

From left: trigger source, slope, trigger level, coupling

4. Press *Source* to change the trigger source.

5. Use the side menu to select the trigger source type.

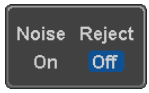
   Range Channel 1 ~ 4 (Alternate On/Off), EXT (Ext Probe: Volt/Current, Attenuation: 1mX~1kX, CH2 models only), AC Line

6. Press *Coupling* from the bottom bezel menu to select the trigger coupling or frequency filter settings.

   Choose the coupling from the side menu.

   Range DC, AC, HF Reject, LF Reject

7. Toggle *Noise Rejection* On or Off from the side menu.



   Range On, Off

8. From the bottom menu press *Slope* to toggle the slope type.

   Range Rising edge, falling edge, either

9. To set the external trigger level, select *Level* from the bottom bezel menu (Not applicable for AC line source).

10. Set the external trigger level using the side menu.

    Range 00.0V~ 5 screen divisions

    Set to TTL 1.4V

    Set to ECL -1.3V

    Set to 50%

Using Advanced Delay Trigger

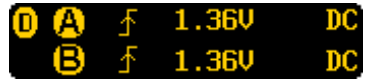
Panel Operation

1. Set the edge trigger source. This will set the initializing trigger for the delay source. Page 111

2. Press the trigger *Menu* key.

3. Press *Type* from the lower bezel menu.

4. Select *Delay* from the side menu. The delay trigger indicator appears at the bottom of the display.



From left: Delay trigger indicator (D), edge trigger (A), edge slope, edge level, edge coupling, delay trigger (B), delay slope, delay trigger level, delay coupling.

5. To set the delay source, press *Source* and select a source from the side menu.

Source	CH1 ~ CH4, AC Line, EXT* *2 channel models only.

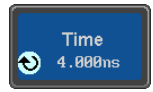
6. Press *Coupling* from the bottom bezel menu to select the trigger coupling or frequency filter settings.

Choose the coupling from the side menu.

Range	DC, AC, HF Reject, LF Reject

7. To set the delay press *Delay* from the bottom bezel.

8. To Delay by Time (Duration), press *Time* from the side menu and set the delay time.



Range 4ns ~ 10s (by time)

Set to minimum

9. To Delay by Event, press *Event* from the side menu and set the number of events.

Range 1 ~ 65535 events

Set to Minimum

Using Pulse Width Trigger

Panel Operation

1. Press the trigger *Menu* key.

2. Press the *Type* key from the lower bezel menu.

3. Select *Pulse Width* from the side menu. The pulse width trigger indicator appears at the bottom of the display.

From left: source, polarity, when, coupling

4. Press *Source* from the lower bezel.

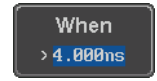
5. Use the side menu to select the pulse width trigger source.

   Range Channel 1 ~ 4 (Alternate On/Off), EXT (Ext Probe: Volt/Current, Attenuation: 1mX~1kX), AC Line

6. Press *Polarity* to toggle the polarity type.

   Range Positive (high to low transition)
   Negative (low to high transition)

7. Press *When* from the lower bezel.



   Then use the side menu to select the pulse width condition and width.

   Condition > , < , = , ≠

   Width 4ns ~ 10s

8. Press *Threshold* from the lower bezel to edit the pulse width threshold.

   Use the side menu to set the threshold.

   Range -XXV~XXV
   Set to TTL 1.4V
   Set to ECL -1.3V
   Set to 50%

Using Video Trigger

Panel Operation

1. Press the trigger *Menu* key.

2. Press the *Type* key from the lower bezel menu.

3. Select *Video* from the side menu. The video trigger indicator appears at the bottom of the display.

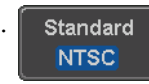
From left: source, video standard, field, line, coupling

4. Press *Source* from the lower bezel.

5. Use the side menu to select the video trigger source.

Range	Channel 1 ~ 4

6. Press *Standard* on the bottom bezel.



Use the side menu to select the video standard.

Range	NTSC, PAL, SECAM, EDTV(480P, 576P), HDTV(720P, 1080i, 1080P)

7. Press *Trigger On* to edit the video field and line.

Use the side menu to select the field and line.

Odd Field	NTSC: 1 ~ 263 PAL/SECAM: 1 ~ 313 EDTV: 1~525(480P), 1~625(576P) HDTV: 1~750(720P), 1~563(1080i), 1~1125(1080P)
Even Field	NTSC: 1 ~ 262 PAL/SECAM: 1 ~ 312 HDTV: 1~562(1080i)
All Fields	Triggers on all fields.
All Lines	Triggers on all lines.

8. Press *Polarity* to toggle the polarity type.

Range	positive, negative

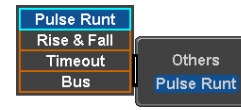
Pulse Runt trigger

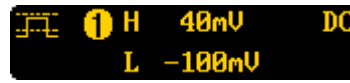
Panel Operation

1. Press the trigger *Menu* key.

2. Press the *Type* key from the lower bezel menu.

3. Select *Others* → *Pulse Runt* from the side menu. The Pulse and Runt indicator appears at the bottom of the display.





From left: polarity, source, high/low threshold, threshold level, coupling

4. Press *Source* from the lower menu.

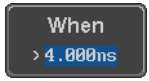
Use the side menu to select a source.

Range	Channel 1 ~ 4(Alternate On/Off)

5. Press *Polarity* to toggle the polarity.

Range	Rising edge, falling edge, either.

6. Press *When* from the lower menu.



Then use the side menu to select the condition and width.

Condition	> , < , = , ≠
Width	4ns ~ 10s

7. Press *Threshold* from the lower bezel to edit the threshold for the upper and lower threshold.

8. Use the side menu to set the upper threshold.

Range	-XXV~XXV

9. Use the side menu to set the lower threshold.

Range	-XXV~XXV

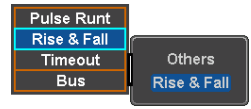
Using Rise and Fall Trigger

Panel Operation

1. Press the trigger *Menu* key.

2. Press the *Type* key from the lower bezel menu.

3. Select *Others* → *Rise and Fall* from the side menu. The Rise and Fall indicator appears at the bottom of the display.



From left: slope, source, high/low threshold, threshold level, coupling

4. Press *Source* from the lower menu.

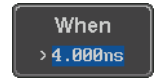
Use the side menu to select a source.

Range Channel 1 ~ 4(Alternate On/Off)

5. Press *Slope* from the bottom menu to toggle the slope.

Range Rising edge, falling edge, either

6. Press *When* from the lower menu.



Then use the side menu to select the logic conditions and true or false status.

Condition > , < , = , ≠

Width 4ns ~ 10s

7. Press *Threshold* from the lower bezel to edit the High and Low threshold.

Range High: -XXV~XXV

Low: -XXV~XXV

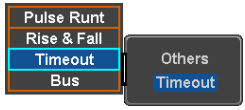
Using the Timeout Trigger

Panel Operation

1. Press the trigger *Menu* key.

2. Press the *Type* key from the lower bezel menu.

3. Select *Others* → *Timeout* from the side menu. The Timeout indicator appears at the bottom of the display.



From left: Source, Trigger type, threshold level, coupling

4. Press *Source* from the lower menu.

Use the side menu to select a source.

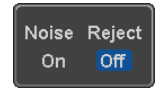
Range Channel 1 ~ 4, EXT (Ext Probe: Volt/Current, Attenuation: 1mX~1kX), AC Line

5. Press *Coupling* from the bottom bezel menu to select the trigger coupling or frequency filter settings.

   Choose the coupling from the side menu.

   Range DC, AC, HF Reject, LF Reject

6. Toggle *Noise Rejection* On or Off from the Coupling side menu.



   Range On, Off

7. Press *Trigger When* from the lower menu.

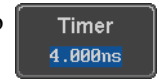
   Then use the side menu to select trigger conditions.

   Condition Stays High, Stays Low, Either

8. Press *Level* from the lower bezel to set the trigger level.

   Range -XXV~XXV
   Set to TTL 1.4V
   Set to ECL -1.3V
   Set to 50%

9. Press *Timer* from the lower bezel to set the timer time.



   Range 4ns~10.0S

System Settings and Miscellaneous Settings

This section describes how to set the interface, language, time/date, probe compensation signal and erase the internal memory.

Select Menu Language

Description: The DSO-1000D has a number of different languages to choose from.

Panel Operation

1. Press the *Utility* key.

2. Press *Language* on the lower menu.

3. Select the language* from the side menu.

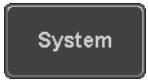
   *Language selections may differ based on region, and as such are not listed here.

View System Information

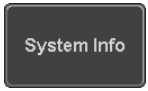
Panel Operation

1. Press the *Utility* key.

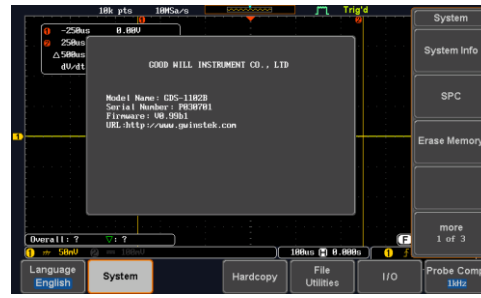
2. Press *System* from the lower menu.



3. Press *System Info* from the side menu. A display panel will appear showing:



- Manufacturer name
- Model name
- Serial number
- Firmware version
- Manufacturer URL



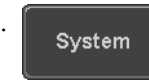
Erase Memory

Background	The Erase Memory function will erase all internal waveforms, setup files and labels from internal memory.
Erased Items	Waveform 1~20, Setting memory 1~20, Reference 1~4, Labels

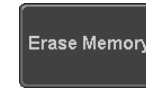
Panel Operation

1. Press the *Utility* key.

2. Press *System* from the lower menu.

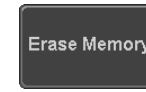


3. Press *Erase Memory* from the side menu.



A message will prompt you to press Erase Memory again to confirm the process. Pressing any other key will cancel erasing the memory.

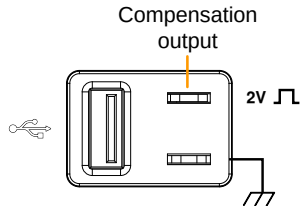
4. Press *Erase Memory* again.



Probe Compensation Frequency

Background

The probe compensation output can be set from 1kHz (default) to 200kHz, in steps of 1kHz.



Panel Operation/ Parameter

1. Press the *Utility* key.

2. Press *Probe Comp.* on the lower menu.

3. Press *Frequency* and change the frequency of the probe compensation signal.

Default Frequency

4. Press *Set to Defaults* to set the frequency of the probe compensation signal to 1kHz default.

APPS

Applications

Overview

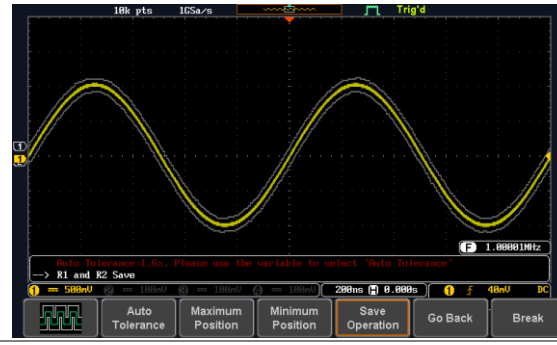
Background	The APP function allows different software applications to be run. The DSO-1000D comes pre-installed with the Go-NoGo app and the Mount Remote Disk app. Other optional applications can be downloaded from the Conrad website free of charge. For details on how to install or uninstall apps, please see page 194 for details.	
Included Applications	Go/No-Go	The Go/No-Go application can be used to set threshold boundaries for input signals. Go/No-Go tests to see if a waveform will fit inside a user-specified maximum and minimum amplitude boundary (template).
	Mount Remote Disk	This app allows the scope to mount a network share drive.
Optional Applications	Digital Filter	Adds a digital low or high pass filter to any of the input channels. Each filter can have a user-defined cutoff frequency set.
	DVM	The DVM application displays a digital voltage meter readout that floats on the top left-hand side of the screen.

Data Log	The Data Log app will log waveform data and/or screenshots at set intervals for set duration of time.

Using Go-NoGo

Background

The Go-NoGo test checks if a waveform fits inside a user-specified maximum and minimum boundary. Boundary templates are automatically created from a source channel. Boundary tolerances and violation conditions can be set.

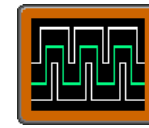


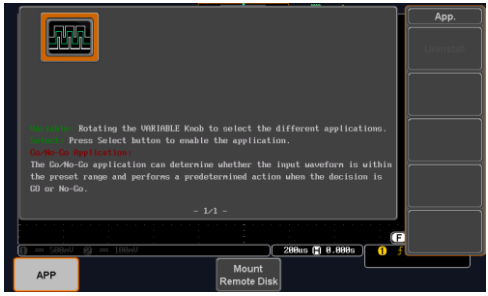
Panel Operation

1. Press the *APP* key.

2. Press *APP* from the bottom menu.

3. Choose the Go_NoGo application from the APP menu. Please visit this model in Conrad website.





4. Select Go/No-Go by pressing the *Select* key *twice*.

Select ×2

Set Go-NoGo Conditions

Select the Go-NoGo conditions (NG When) and actions when a Go-NoGo condition has been met (Violating).

1. Press *NG When* from the bottom menu and select the NoGo conditions:

NG When

Enter

Enter: Sets the NoGo condition to when the input signal stays within the limit boundary.

Exit

Exit: Sets the NoGo condition to when the input signal exceeds the limit boundary.

2. Press *Go Back* to return to the previous menu.

Go Back

Set Go-NoGo Actions

1. Press *Violating* to set what action to perform when a signal violates the Go-NoGo conditions.

Violating

Stop

The waveform stops when the conditions are violated.

Continue — Ignore violations and continue to monitor the signal. Each violation is counted.

2. Press *Go Back* to return to the previous menu. — Go Back

Set Go-NoGo Source

1. Press *Compare Source* from the bottom menu to set the Go-NoGo boundary source. — Compare Source

CH1 — Sets CH1 as the source.

CH2 — Sets CH2 as the source.

CH3 — Sets CH3 as the source.

CH4 — Sets CH4 as the source.

2. Press *Go Back* to return to the previous menu. — Go Back

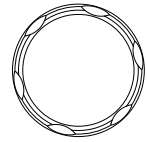
Set Boundary Tolerance

1. To set the Go-NoGo boundary tolerance, press *Reference Mode*. — Reference Mode

Auto Tolerance

2. To set the boundary tolerance as a percentage offset from the source waveform, press *Auto Tolerance* and use the Variable knob. — Auto Tolerance

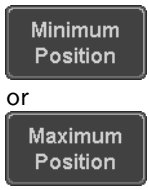
VARIABLE



Offset	0.4% ~ 40% (.4% steps)

Maximum and Minimum Position

3. To manually set the template tolerance, press *Minimum Position* or *Maximum Position* and use the Variable knob to set the absolute minimum or maximum position.



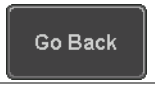
Range Voltage division range

Save Boundary Template

4. Press *Save Operation* to save the tolerance boundaries.

5. The Maximum Position tolerance will be saved to reference waveform R1, and the Minimum Position tolerance to R2.

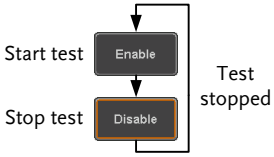
6. Press *Go Back* to return to the previous menu.



Start Go-NoGo

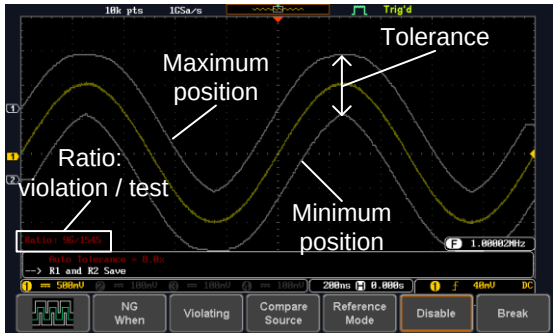
Press *Enable* to start the Go-NoGo test. The Enable button will change to Disable. Pressing *Disable* will stop the Go-NoGo test and toggle the button back to Enable.

If the Violating setting was set to Stop, press *Enable* to restart the test after it has stopped.



Results

When Go-NoGo is running, the violation/test ratio is displayed in the bottom left-hand corner. The first digit represents the number of violations, and the right hand digit represents the number of tests.



Exit the Application

To exit the application, press *Break*.

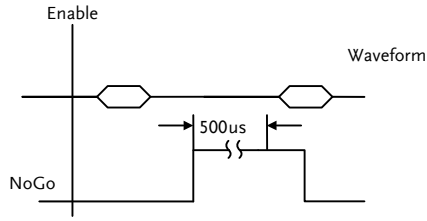
Note

After you exit the Go/NoGo app, the boundary templates that were saved to R1 & R2 reference waveforms will still be turned on. See page 159 to turn the reference waveforms off.

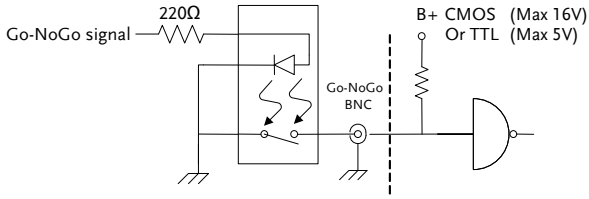
Using the Go-NoGo Output

To output the Go-NoGo results to an external device, the Go-NoGo rear panel terminal (open collector) can be used. The Go-NoGo terminal will output a positive pulse each time a NoGo violation has occurred for a minimum of 500us. The voltage of the pulse depends on the external pull-up voltage.

Timing Diagram



Circuit Diagram



Remote Disk

Background

The Remote Disk app allows the scope to mount a network share drive.

Basic Features:

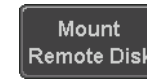
- Save and load files from the network share drive.
- Ability to automatically mount the network share drive at startup.

Example

Panel Operation

1. Press the *APP* key.

2. Press *Mount Remote Disk* from the bottom menu.



3. A form will appear (above) prompting you to enter the IP Address, Path Name, User Name and Password.
   - IP Address refers to the IP address of the network share drive.
   - Path Name refers to name of the shared directory of the network drive. This path must be in the root directory of the boot drive of the network disk. No sub-directories are allowed in the path name. For example a path name of "DSO" would be equivalent to C:/DSO.
   - User Name refers to a username with permission to access the share drive.
   - Password refers to the password for the username above.
   - Use the Up and Down soft-keys to navigate to each item in the form.
   - Use the Variable knob and Back Space soft-key to enter characters for each item in the form.

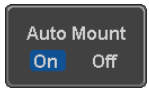
Mount/Unmount

4. To mount the network share driver, press *Mount* from the side menu. Press again to unmount.

   When the drive is successfully mounted, "Complete!" will be shown on the display.

Auto Mount

5. Press *Auto Mount* to automatically mount the network share drive at startup.



Set File Path

6. When accessing the file utilities, the network share drive is shown as "Z" drive. Files can be saved to or recalled from the network share drive in the same manner as the internal memory or a USB flash disk. See the File Utilities chapter for usage details.

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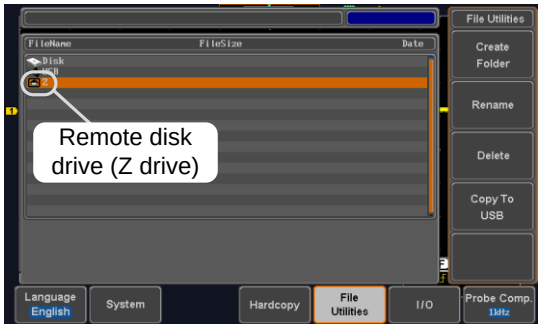
Example



SAVE/RECALL

File Format/Utility

Image File Format

Format	*.bmp or *.png
Default Filename	DSxxxx.bmp/png
Contents	The display image is 800 by 480 pixels. The background color can be inverted (Ink saver function). Each image file is saved to the current file path as a bitmap or PNG file.

Waveform File Format

Format	DSxxxx.lsf, CH1~CH4.lsf The LSF file format efficiently stores waveforms. This is the file format used for storing and recalling all waveforms that are used with the DSO-1000D series.	
Filename	DSxxxx.lsf, CH1 ~ CH4.lsf	
Waveform Type	CH1 ~ 4	Input channel signal
	REF	Reference waveform
	Math	Math operation result (page 66)
	All Displayed	Saves all the activated input channels or onscreen reference waveforms.
Storage Location	Wave1 ~ Wave20	Waveform files stored to the internal memory. Stored waveforms can be transferred to Ref. 1 ~ 4 to be viewed on the display. (W1 ~ W20 waveforms cannot be directly recalled on the display).

	Ref 1~4	Reference waveforms stored in the internal memory, separate from W1 ~ W20. Reference waveforms (Ref 1 ~ 4) can be displayed directly onto the display with amplitude and frequency information. Ref 1~4 are useful for reference purposes. Other waveforms (LSF and W1~20) must be recalled to R1~4 before being displayed.
Contents: Waveform Data	The waveform data can be used for detailed analysis. It consists of the horizontal and vertical data used by the waveform.	

Spreadsheet File Format

Format	*.csv (Comma-separated values format, can be opened in spreadsheet applications such as Microsoft Excel). CSV-formatted files can be stored in either a short-memory format or a long-memory format: Detail CSV, Fast CSV. The number of points that are saved depends on the record length settings. Detail CSV will record both the horizontal and vertical sample points of the waveform. All the points are recorded in scientific notation for analog data. Fast CSV will only record the vertical amplitude of the sample points. Fast CSV also contains data that enables the horizontal data points to be reconstructed, such as trigger position, etc. Data is recorded as integers. Note, however, that only fast CSV can be recalled to the internal memory. Detailed CSV cannot be recalled.
Filename	DSxxxx.csv

Waveform Type	CH1 ~ 4	Input channel signal
	Ref1 ~ 4	Reference waveform
	Math	Math operation result (page 66)

Contents: Detail CSV

Detail CSV waveform data contains channel information such as vertical and horizontal position of a signal for all the recorded points.

The following information is included in Detail CSV, where applicable:

- Format (scope type)
- Memory length
- Trigger Level
- Source
- Label
- Probe ratio
- Vertical units
- Vertical scale
- Vertical position
- Horizontal units
- Horizontal scale
- Horizontal position
- Horizontal mode
- Sampling period
- Firmware
- Time
- Mode
- Vertical data
- Horizontal data

Contents: Fast CSV

The following information is included in the Fast CSV waveform files, where applicable:

- Format (scope type)
- Memory length
- IntpDistance (input trigger distance)
- Trigger address
- Trigger level
- Source
- Vertical units
- Vertical units div
- Vertical units extend div
- Label
- Probe type
- Probe ratio

- Vertical scale
- Horizontal units
- Horizontal position
- SincET mode (sampling mode)
- Horizontal old scale
- Firmware
- Mode
- Vertical position
- Horizontal scale
- Horizontal mode
- Sampling period
- Horizontal old position
- Time
- Raw vertical waveform data

Setup File Format

Format	DSxxxx.set (proprietary format) The setup file saves or recalls the following settings.		
Contents	Acquire	• Mode • Sample rate • XY	• Sample mode • Record Length
	Display	• Mode • Persistence • Waveform intensity • Graticule intensity	• Backlight intensity • Graticule • Backlight • Auto-dim
	Channel	• Scale • Channel • Coupling • Impedance • Invert • Bandwidth	• Expand • Position • Probe • Probe attenuation • Deskew

Cursor	• Horizontal cursor • H Unit	• Vertical cursor • V Unit
Measure	• Source • Gating • Statistics	• Display • High-Low • Reference levels
Horizontal	• Scale	
Math	• Source1 • Operator • Source2	• Position • Unit/Div • Math Off
FFT Math	• Source • Vertical Units • Window	• Vertical position • Horizontal position
Advanced Math	• Expression • VAR1 • VAR2	• Position • Unit/Div
Trigger	• Type • Source • Coupling • Alternate • Rejection • Noise Rejection	• Slope • Level • Mode • Trigger When • Timer • Holdoff
Utility	• Language • Hardcopy key • File Format	• Ink Saver • Assign Save • Probe Comp.
Save/ recall	• Image file format	• Data file format

Create/Edit Labels

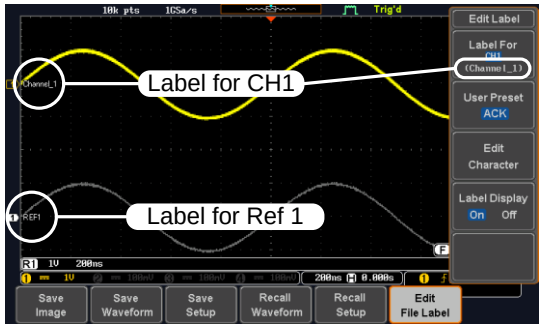
Overview

Reference files, Setup files and the analog input channels can have individual file labels set.

For the analog channels and reference waveforms, the file label can be displayed next to the channel/reference indicator.

The file labels are also used to easily identify reference files, setup files or channels when saving or recalling waveforms and setups.

Example



In the example above, the file label for channel 1 is displayed next to the channel indicator and is also displayed in the *Edit Label* menu. The Ref_1 file label is shown next to the reference indicator.

Panel Operation

1. Press the *Save/Recall* key from the front panel.

2. Press *Edit File Label* from the bottom menu.

3. Press *Label For* and select the item that you want to create the label for.

Label For	CH1~CH4, Ref1~4, Set1~20, Math

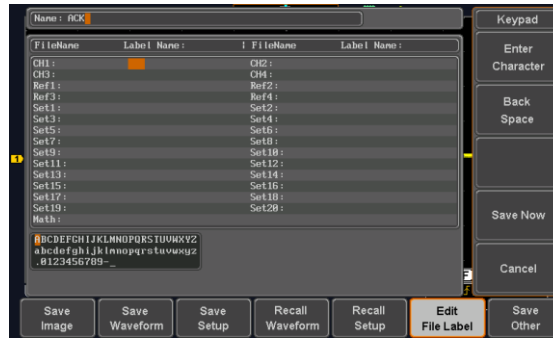
4. To choose a preset label, Press *User Preset* from the side menu and choose a label.

Labels	ACK, AD0, ANALOG, BIT, CAS, CLK, CLOCK, CLR, COUNT, DATA, DTACK, ENABLE, HALT, INT, IN, IRQ, LATCH, LOAD, NMI

Edit Label

1. Press *Edit Character* to edit the current label.

2. The Edit Label window appears.



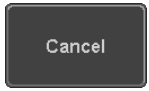
3. Use the Variable knob to highlight a character.

Press *Enter Character* to select a number or letter.

Press *Back Space* to delete a character.

Press *Save Now* to save the label and return to the previous menu.

To cancel the editing the label and return to the previous menu, press *Cancel*.



Display Label

To display the currently selected file label on the screen next to its respective indicator, toggle *Label Display* to On.

Conversely, if you want to remove the currently selected file label from the display, toggle *Label Display* to Off.

Save

File Type/Source/Destination

Item	Source	Destination
Panel Setup (DSxxxx.set)	• Front panel settings	• Internal memory: Set1 ~ Set20 • File system: Disk, USB
Waveform Data (DSxxxx.csv) (DSxxxx.lsf) (CH1~CH4.lsf, Ref1~Ref4.lsf, Math.lsf)* ALLxxxx.csv	• Channel 1 ~ 4 • Math operation result • Reference waveform Ref1~4 • All displayed waveforms	• Internal memory: Reference waveform Ref1~4, Wave1 ~ Wave20 • File system: Disk, USB
Display Image (DSxxxx.bmp/png) (Axxx1.bmp/png)**	• Display image	• File system: Disk, USB

*Stored in ALLXXXX directories when All Displayed waveforms are saved.
**Stored in ALLXXXX directories when the Hardcopy key is assigned to save Waveform, Setup or All.

Note: By default all filenames/directories are named DSxxxx/ALLxxxx where xxxx is a number starting from 0001 and is incremented by one after each save.

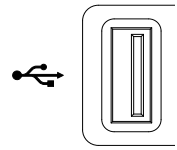
Save Image

Images can be saved either using the Save/Recall key or by using the Hardcopy key. To save images using the Hardcopy key, see the hardcopy section on page 168.

Panel Operation

1. To save to USB, connect a USB drive to the front panel USB port. If a USB drive is not connected, images can still be saved to the internal memory.

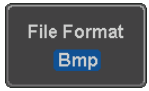
Front Panel



2. Press the *Save/Recall* key from the front panel.

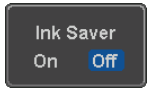
3. Press *Save Image* from the bottom menu.

4. Press *File Format* to choose PNG or BMP file types.

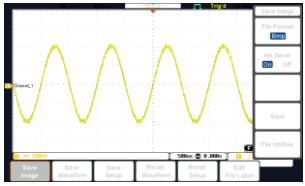


Range DSxxxx.bmp, DSxxxx.png

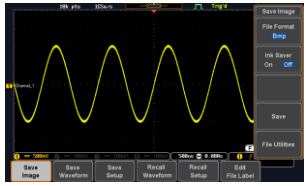
5. Press *Ink Saver* to toggle Ink Saver On or Off.



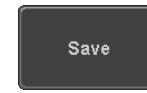
Ink Saver On



Ink Saver Off



6. Press *Save* from the side menu to save the display as an image file.



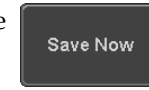
7. You will automatically be taken to a file utility where you will be able to edit the name of the file.

8. To edit the file name, use the *Variable* knob to highlight a character.

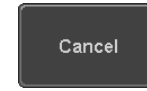
Press *Enter Character* or the *Select* key to select a number or letter.

Press *Back Space* to delete a character.

9. Press *Save Now* to save the file. The file name need not have been edited to save the file.



Note: Pressing *Cancel* will cancel the save operation and return you to the Save/Recall menu.



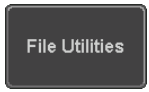
After *Save Now* has been pressed the file will be saved.

Note

The file will not be saved if the power is turned off or the USB drive is taken out before the message ends.

File Utility

To edit the internal memory or the USB flash drive contents (create/ delete/rename files and folders) or to edit the default file path, press *File Utilities* from the side menu. See page 161 for details.

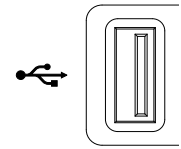


Save Waveform

Panel Operation

1. To save to an external USB flash drive, connect the drive to the front panel USB port. If a USB drive is not connected, files can still be saved to the internal memory.

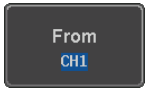
Front Panel



2. Press the *Save/Recall* key from the front panel.

3. Press *Save Waveform* from the bottom menu.

4. Choose the *From* waveform on the side menu.

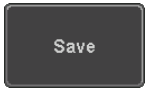


Source	CH1~4, Math, Ref1~4, All Displayed

5. Press *To* (internal memory) or *To File* and choose a destination to save.

To	Ref1~4, Wave1~20
To File	Format: LSF, Detail CSV, Fast CSV

6. Press *Save* to save the file.



7. If you are saving to a file, a file utility appears where you will be able to edit the name of the file from the default "DSXXX" filename.

8. To edit the filename, use the *Variable* knob to highlight a character.

Press *Enter Character* or the *Select* key to select a number or letter.

Enter Character

Press *Back Space* to delete a character.

Back Space

9. Press *Save Now* to save the file. The filename need not have been edited to save the file.

Save Now

Note: Pressing *Cancel* will cancel the save operation and return you to the Save/Recall menu.

Cancel

After *Save Now* has been pressed the file will be saved.

Note

The file will not be saved if the power is turned off or the USB drive is taken out before the message ends.

File Utility

To edit the internal memory or the USB flash drive contents (create/delete/rename files and folders), press *File Utilities*. For details, see page 161.

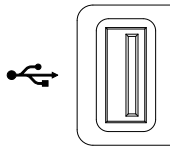
File Utilities

Save Setup

Panel Operation

1. To saving to an external USB flash drive connect the drive to the front or rear panel USB port. If a USB drive is not connected, files can be saved to the internal memory.

Front Panel



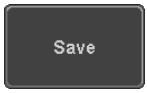
2. Press the *Save/Recall* key from the front panel.

3. Press *Save Setup* from the bottom menu.

4. Press *To* (internal memory) or *To File* and choose a destination to save to.

To	Set1~Set20
To File	DSxxxx.set

5. Press *Save* to confirm saving. When completed, a message appears at the bottom of the display.



6. If you are saving to a file, a file utility appears where you will be able to edit the name of the file from the default "DSxxxx" filename.

7. To edit the filename, use the *Variable* knob to highlight a character.

Press *Enter Character* or the *Select* key to select a number or letter.

Enter Character

Press *Back Space* to delete a character.

Back Space

8. Press *Save Now* to save the file. The filename need not have been edited to save the file.

Save Now

Note: Pressing *Cancel* will cancel the save operation and return you to the Save/Recall menu.

Cancel

After *Save Now* has been pressed the file will be saved.

Setup saved to USB:/DS0001.SET.

Note The file will not be saved if the power is turned off or the USB drive is taken out before the message ends.

File Utility

To edit the internal memory or the USB flash drive contents (create/ delete/ rename files and folders) or to set the file path, press *File Utilities*. For details, see 161.

File Utilities

Edit Label

To edit labels for Setup files, press *Edit Label*. For more details on editing labels, see page 142.

Edit Label

Recall

File Type/Source/Destination

Item	Source	Destination
Default Panel Setup	• Factory installed setting	• Current front panel
Reference Waveform	• Internal memory: Ref1~4	• Current front panel
Panel Setup (DSxxxx.set)	• Internal memory: S1 ~ S20 • File system: Disk, USB	• Current front panel
Waveform Data (DSxxxx.lsf, DSxxxx.csv**) (CH1~CH4.lsf, Ref1~Ref4.lsf, Math.lsf)*	• Internal memory: Wave 1 ~ Wave20 • File system: Disk, USB	• Reference waveform 1 ~ 4

*Recalled from ALLXXX directories. Note that Allxxxx.csv cannot be recalled to the oscilloscope.

**Detail CSV files cannot be recalled to the oscilloscope.

Recall Default Panel Setting

Panel Operation	1. Press the *Default* key. 	
	2. The screen will update with the default panel settings.	
Setting Contents	The following is the default (factory) setting contents.	
Acquire	Mode: Sample	XY: OFF
	Record Length: 10k	Expand: By Center
Display	Mode: Vector	Persistence: 240ms
	Waveform intensity: 50%	Graticule intensity: 50%
	Backlight Intensity: 80%	Backlight Auto-dim: On
	Time: 10min	Graticule: full 
Channel	Scale: 100mV/Div	CH1: On
	Coupling: DC	Impedance: 1MΩ
	Invert: Off	Bandwidth: full
	Expand: By Ground	Position: 0.00V
	Probe: Voltage	Probe attenuation: 1x
	Deskew: 0s	
Cursor	Horizontal cursor: Off	Vertical Cursor: Off
Measure	Source: CH1	Gating: Screen
	Display All: Off	High-Low: Auto
	Statistics: Off	Mean & Std Dev Samples: 2
	High Ref: 90.0%	Mid Ref: 50.0%
	Low Ref: 10.0%	

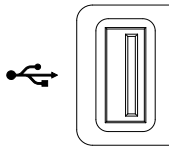
Horizontal	Scale: 10us/Div	Position: 0.000s
Math	Source1: CH1	Operator: +
	Source2: CH2	Position: 0.00 Div
	Unit/Div: 200mV	Math Off
FFT	Source: CH1	Vertical Units: dBV RMS
	Window: Hanning	Vertical: 20dB
	Horizontal:5MHz/div	
Advanced Math	Expression: CH1+CH2	VAR1: 0
	VAR2: 1	Position: 0.00Div
	Unit/div: 500mV	
APP	App: Go-NoGo, Mount Remote Disk, Demo	
Trigger	Type: Edge	Source: CH1
	Coupling: DC	Alternate: Off
	Noise Rejection: Off	Slope: Positive
	Level: 0.00V	Mode: Auto
	Holdoff: 10.0ns	
Utility	Hardcopy: Save	Ink Saver: Off
	Assign Save To: Image	File Format: Bmp
	Probe Comp.: 1kHz	

Recall Waveform

Panel Operation

1. For recalling from an external USB flash drive, connect the drive to the front or rear panel USB port.

Front Panel



2. The waveform must be stored in advance. See page 149 for waveform store details.

3. Press the *Save/Recall* key.

4. Press *Recall Waveform* from the bottom menu. The Recall menu appears.

5. Press *From* (internal memory) or *From File* and choose a source to recall from.

From	Wave1~20
From File*	File format: Lsf, Fast Csv

*Only files in the current file path will be available, this includes files saved in the ALLxxxx directories.

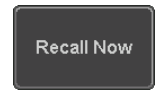
Allxxxx.csv files cannot be recalled to the oscilloscope.

Only the "Fast CSV", "LSF" files can be recalled to the oscilloscope.

6. Press *To* and select the reference waveform to recall to.

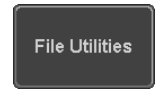
   To Ref1~4

7. Press *Recall Now* to recall the waveform. The reference waveform will appear on the screen when successful.



File Utility

To edit USB flash drive contents (create/ delete/ rename files and folders) or to set the file path, press *File Utilities*. For details, see page 161.

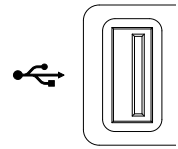


Recall Setup

Panel Operation

1. (For recalling from an external USB flash drive) Connect the drive to the front or rear panel USB port.

Front Panel



2. Press the *Save/Recall* key.

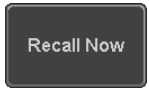
3. Press *Recall Setup* from the bottom menu.

4. Press *From* (internal memory) or *From File* and choose a source to recall from.

From	Set1~20
From File	DSxxxx.set (USB, Disk)*

* Only files in the current file path will be available.

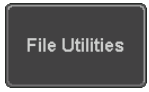
5. Press *Recall Now* to confirm recalling. When completed, a message appears at the bottom of the display.



Note: The file will not be recalled if the power is turned off or the USB drive is taken out before the message appears.

File Utility

To edit the internal memory or the USB flash drive contents (create/ delete/ rename files and folders) or to set the file path, press *File Utilities*. For details, see page 161.



Edit Label

To edit labels for Setup files, press *Edit label*. For more details on editing labels, see page 142.

Reference Waveforms

Recall and Display Reference Waveforms

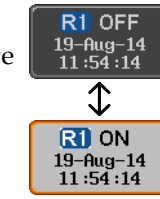
Panel Operation

A reference waveform must be stored in advance. See page 149 to store waveforms as reference waveforms.

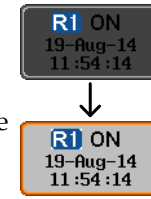
1. Press the *REF* key on the front panel.

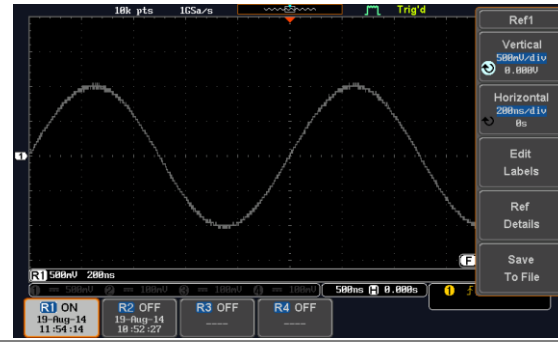
2. Pressing *R1~R4* repeatedly will toggle the corresponding reference waveform OFF/ON.

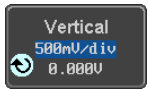
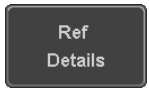
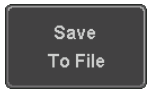
   Turning R1~R4 ON will open the corresponding reference menu.



3. If a reference waveform is ON but not active, its reference menu can be opened by pressing the corresponding *R1~R4* key from the bottom menu.





Vertical Navigation	Press *Vertical* repeatedly from the side menu to choose to edit the vertical position or Unit/Div. Use the Variable knob to edit the values.	
Horizontal Navigation	Press *Horizontal* repeatedly from the side menu to choose to edit the Time/Div or the horizontal position. Use the Variable knob to edit the value.	
View Reference Waveform Details	Pressing *Ref Details* will display the reference waveform details. Details: Sample Rate, Record Length, Date	
Edit Labels	To edit labels for Setup files, press *Edit Labels*. For more details on editing labels, see page 142.	
Save Reference Waveforms	To save reference waveforms, press *Save to File*. For more details on saving waveforms, see page 149.	

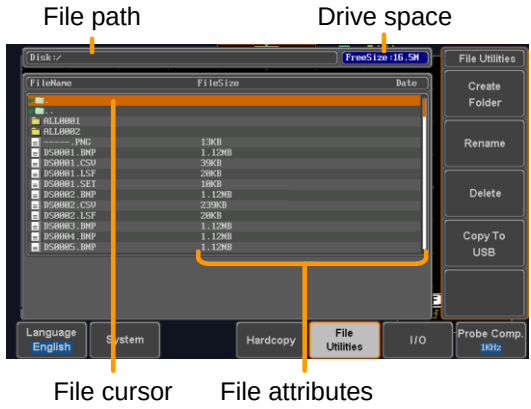
FILE UTILITIES

The file utilities are used each time files need to be saved to internal or external memory. The file utilities can create directories, delete directories, rename files as well as copy files from internal memory to USB. The File Utilities menu also sets the file path for saving and recalling files from the Save/Recall menu.

File Navigation

The File Utilities menu can be used to choose files or to set the file path for saving/recalling files.

File System



Panel Operation

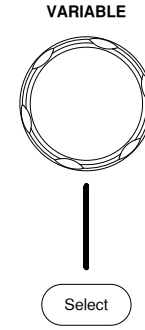
1. Press the *Utility* key.

2. Press *File Utilities* from the bottom menu.

3. The file system appears.

4. Use the *Variable* knob to move the file cursor up and down.

   Use the *Select* key to choose a file or directory or to set the file path.



Note

- When a USB flash drive is used, the file path is remembered each time the USB flash drive is used. This saves you the hassle of setting the USB file path each time the USB flash drive is inserted into the scope.

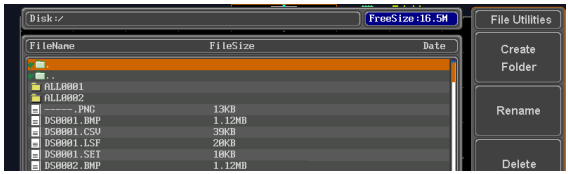
Create Folder

Panel Operation

1. Press the *Utility* key.

2. Press *File Utilities* from the bottom menu.

3. Use the *Variable* knob and *Select* key to navigate the file system.

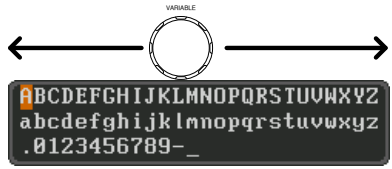


Create Folder

4. Press *Create Folder* to make a new directory at the selected location.

Create Folder

5. Use the *Variable* knob to highlight a character.



Press *Enter Character* or the *Select* key to select a number or letter.

Enter Character

Press *Back Space* to delete a character.

Back Space

6. Press *Save Now* to create the folder.

Save Now

Cancel

Press *Cancel* to cancel the operation.

Cancel

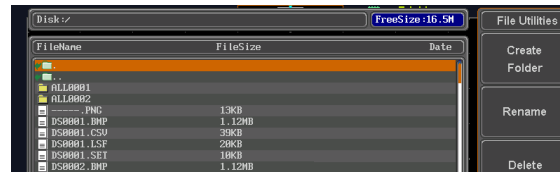
Rename File

Panel Operation

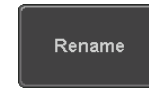
1. Press the Utility key.

2. Press *File Utilities* from the bottom menu.

3. Use the Variable knob and select key to choose a file to rename.



4. Press *Rename* when a file is chosen.

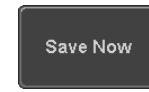


5. Use the *Variable* knob to highlight a character.

Press *Enter Character* or the *Select* key to select a number or letter.

Press *Back Space* to delete a character.

6. Press *Save Now* to rename the folder or file.



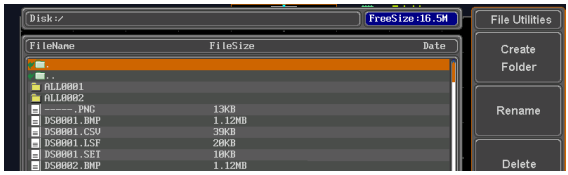
Delete File or Folder

Panel Operation

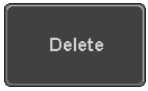
1. Press the *Utility* key.

2. Press *File Utilities* from the bottom menu.

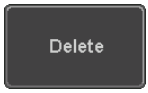
3. Use the Variable knob and select key to navigate the file system to choose a file.



4. Press *Delete* to delete the selected file.



5. Press *Delete* again to confirm the deletion.

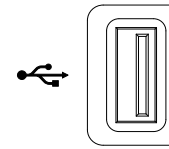


Copy File to USB

Panel Operation

1. Connect a USB drive to the front panel USB port.

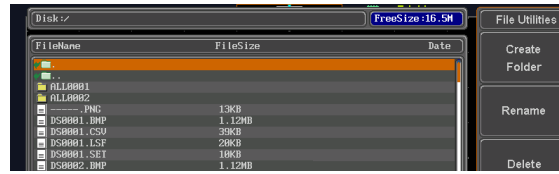
Front Panel



2. Press the *Utility* key.

3. Press *File Utilities* from the bottom menu.

4. Use the *Variable* knob and *Select* key to navigate the file system to choose a file from internal memory.



5. Press *Copy To USB* to copy the selected file to the USB drive.

Note

If the same file name already exists on the USB drive, it will be copied over.

HARDCOPY KEY

The Hardcopy key is used as quick-save or quick-print key. The Hardcopy key can be assigned either to printout screenshots or to save files.

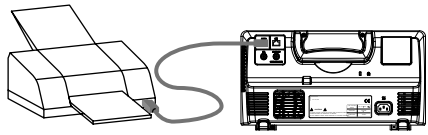
When assigned to "Print" the screen image can be printed to a PictBridge compatible printer using the USB device port. To reduce the amount of printer ink used for each print, images can be printed using the Ink Saver function.

When assigned to "Save", pressing the Hardcopy key can be used to save a screen shot, a waveform, or the current setup, depending on the configuration.

Printer I/O Configuration

Panel Operation

1. Connect a PictBridge printer to the USB device port on the rear panel.



2. Press the *Utility* key.

3. Press *I/O* from the bottom menu.

4. Press USB *Device Port* from the side menu and select *Printer*.

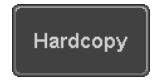
Print Output

Ensure the USB port has been configured for the printer and the printer is connected to the scope before trying to print, see page 168.

Panel Operation

1. Press the *Utility* key.

2. Press *Hardcopy* from the bottom menu.

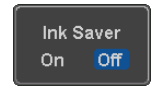


3. On the side menu, press *Function* and select *Print*.

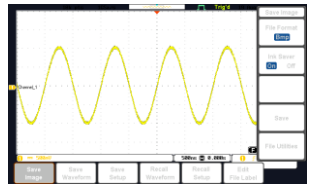
4. Press the *Hardcopy* key to print. The display image is printed out.

Ink Saver

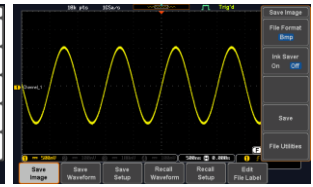
To have a white background on the printed display image, set *Ink Saver* to On.



Ink Saver On



Ink Saver Off



Save - Hardcopy Key

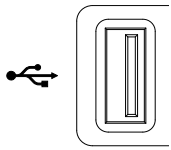
Background

When the Hardcopy key is assigned to "Save", pressing the Hardcopy key can be used to save a screen shot, a waveform, or the current setup, depending on the configuration.

Panel Operation

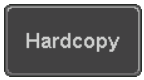
1. If you wish to save to USB, connect a USB drive to the front panel USB port, otherwise the file will save to internal memory.

Front



2. Press the *Utility* key.

3. Press *Hardcopy* from the bottom menu.

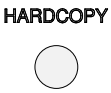


4. On the side menu, press *Function* to select Save.

5. Press *Assign Save To* and select which type of file will be saved when the Hardcopy key is pressed.

File Type: Image, Waveform, Setup, All

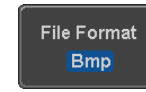
6. Press the *Hardcopy* key to save the file*.



A message will appear when the save is successful.

Image File Format

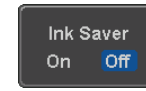
1. For image files the file format can be selected with the *File Format* key.



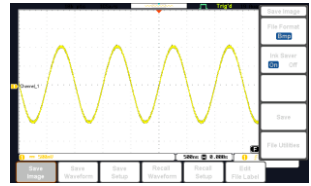
Format: BMP, PNG

Ink Saver

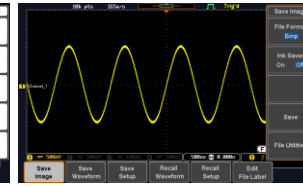
2. To have a white background for image files, set *Ink Saver* to On.



Ink Saver On



Ink Saver Off



Note

*Each time the Hardcopy key is used to save waveforms or setup files, the files are saved into a new directory each time. The save directory is labeled ALLXXXX, where XXXX is a number that is incremented with each save. This directory is created in either the internal memory or to a USB flash drive.

REMOTE CONTROL

CONFIG

This chapter describes basic configuration for remote control. For a command list, refer to the programming manual downloadable from Conrad company website, http://www.conrad.de/

Interface Configuration 173
Configure USB Interface 173
USB Functionality Check 174
Configure the Ethernet Interface 175
Configure Socket Server 177
Socket Server Functionality Check 178

Interface Configuration

Configure USB Interface

USB Configuration	PC side connector	Type A, host
	DSO-1000D side connector	Type B, device
	Speed	1.1/2.0
	USB Class	CDC (communications device class)

Panel Operation

1. Press the Utility key.

2. Press *I/O* from the bottom menu.

3. Press *USB Device Port* from the side menu and select *Computer*.

4. Connect the USB cable to the rear panel device port.

5. When the PC asks for the USB driver, select the USB driver included on the accompanying User Manual CD or download the driver from the Conrad company website, www.conrad.de, in the DSO-1000D Download section. The driver automatically sets the DSO-1000D as a serial COM port (Shown as VPO in the PORTS node of the Windows Device Manager).

USB Functionality Check

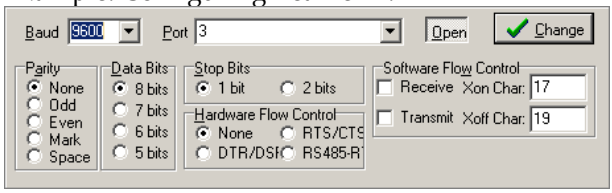
Terminal Application

Invoke a terminal application such as RealTerm.

Set the COM port, baud rate, stop bit, data bit, and parity accordingly.

To check the COM port number and associated port settings, see the Device Manager in the PC. For Windows 7:
Control panel → Hardware and Sound→ Device Manager

Example: Configuring RealTerm:



Functionality Check

Key in this query command via the terminal application.

*idn?

This should return the Manufacturer, Model number, Serial number, and Firmware version in the following format.

CONRAD,DSO-1074D,PXXXXXX,V1.00

Note

For further details about remote control and remote commands, please see the DSO-1000D programming manual, available on the Conrad company website.

Configure the Ethernet Interface

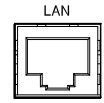
Ethernet Configuration	MAC Address	Domain Name
	Instrument Name	DNS IP Address
	User Password	Gateway IP Address
	Instrument IP Address	Subnet Mask
		HTTP Port 80 (fixed)

Background

The Ethernet interface is used for remote control using a socket server connection. For details, please see the Socket Server section on page 177.

Panel Operation

1. Connect the Ethernet cable to the LAN port on the rear panel.

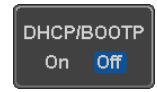


2. Press the *Utility* key.

3. Press *I/O* from the bottom menu.

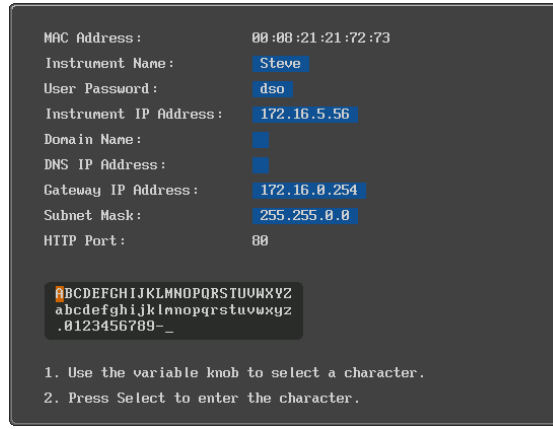
4. Press *Ethernet* from the side menu.

5. Set *DHCP/BOOTP* to *On* or *Off* from the side menu.

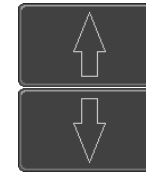


Note

IP addresses will automatically be assigned with DHCP/BOOTP set to on. For Static IP Addresses, DHCP/BOOTP should be set to off.



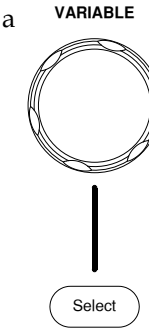
6. Use the *Up* and *Down* arrows on the side menu to navigate to each Ethernet configuration item.



Items MAC Address, Instrument Name, User Password, Instrument IP Address, Domain Name, DNS IP Address, Gateway IP Address, Subnet Mask

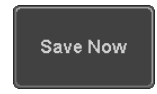
Note: HTTP Port is fixed at 80.

7. Use the *Variable* knob to highlight a character and use the *Select* key to choose a character.



Press *Backspace* to delete a character.

Press *Save Now* to save the configuration. Complete will be displayed when successful.



Configure Socket Server

The DSO-1000D supports socket server functionality for direct two-way communication with a client PC or device over LAN. By default, the Socket Server is off.

Configure Socket Server

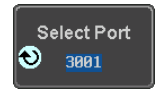
1. Configure the IP address for the DSO-1000D. Page 175
2. Press the *Utility* key.

3. Press *I/O* from the bottom menu.

4. Press *Socket Server* from the side menu.

5. Press *Select Port* and choose the port number with the Variable knob.

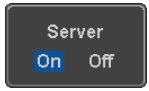
   Range 1024~65535



6. Press *Set Port* to confirm the port number.

7. The Current Port icon will update to the new port number.

8. Press *Server* and turn the socket server On.



Socket Server Functionality Check

NI Measurement and Automation Explorer

To test the socket server functionality, National Instruments Measurement and Automation Explorer can be used. This program is available on the NI website, www.ni.com.

Operation

1. Configure the IP address for the DSO-1000D. Page 175

2. Configure the socket port. Page 177

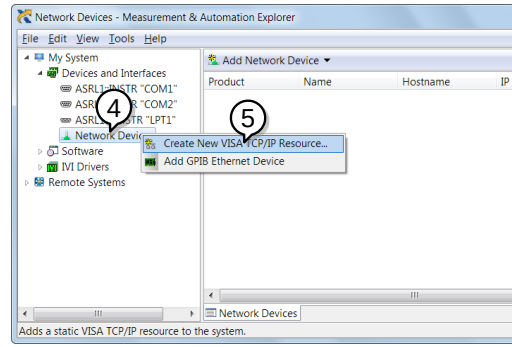
3. Start the NI Measurement and Automation Explorer (MAX) program. Using Windows, press:

Start>*All Programs*>*National Instruments*>*Measurement & Automation*

4. From the Configuration panel access;

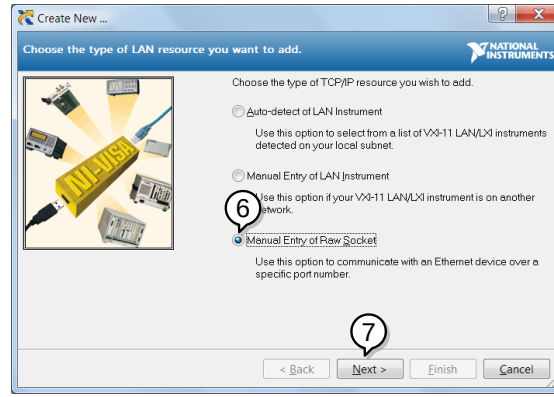
My System>*Devices and Interfaces*>*Network Devices*

5. Right click *Network Devices* and select *Create New Visa TCP/IP Resource…*



6. Select *Manual Entry of Raw Socket* from the popup window.

7. Click *Next*.

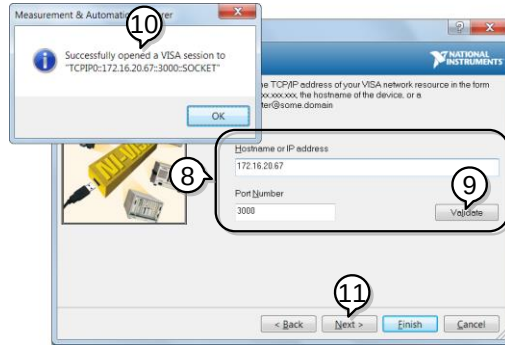


8. Enter the DSO-1000D's IP address and socket port number.

9. Click *Validate*.

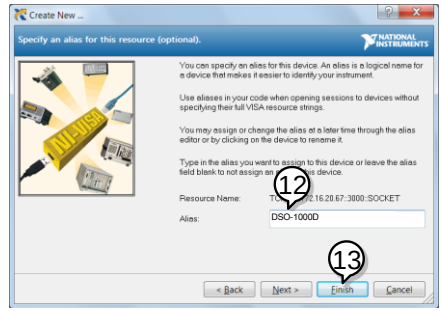
10. A popup will appear to tell you if a VISA socket session was successfully created.

11. Click *Next*.



12. Choose an alias for the socket connection if you like.

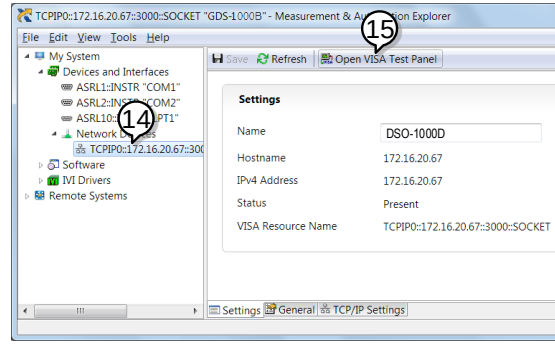
13. Click *Finish* to finish the configuration.



14. The DSO-1000D will now appear under Network Devices in the Configuration Panel.

Functionality Check

15. Click the *Open Visa Test Panel* to send a remote command to the DSO-1000D.

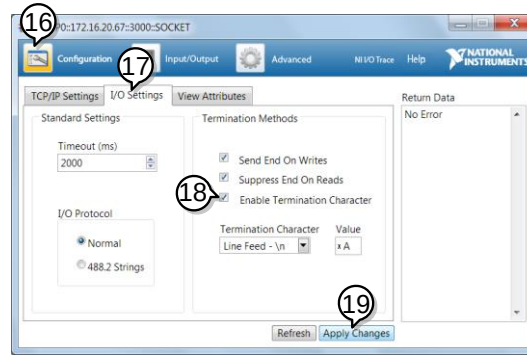


16. Click on the *Configuration* icon.

17. Select the *I/O Settings* tab.

18. Mark the *Enable Termination Character* checkbox. Make sure the termination character is a line feed (/n, value: xA).

19. Click *Apply Changes*.

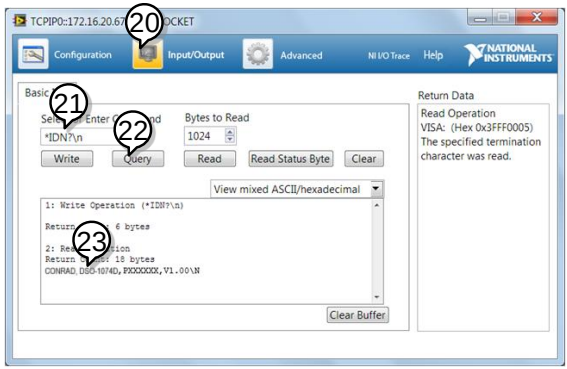


20. Click the *Input/Output* icon.

21. Make sure the *IDN? query is selected in the *Select or Enter Command* drop box.

22. Click on *Query*.

23. The manufacturer, model number, serial number and firmware version will be displayed in the buffer. For example: CONRAD,DSO-1074D,PXXXXXX,V1.00



Note

For further details about remote control and remote commands, please see the DSO-1000D programming manual.

MAINTENANCE

Two types of maintenance operations are available: calibrate vertical accuracy, and compensate the probe. Run these operations when using the DSO-1000D in a new environment.

How to use SPC function

Background

Signal Path Compensation (SPC) is used to compensate the internal signal path due to ambient temperature. SPC is able to optimize the accuracy of the oscilloscope with respect to the ambient temperature.

Panel Operation

1. Press the *Utility* key.

2. Press *System* from the bottom menu.

3. Press *SPC* from the side menu. A message showing a brief introduction to SPC appears on the screen.

Note

Disconnect all probes and cables from all channels before calibrating.

The DSO needs to be warmed up for at least 30 minutes before using the SPC function.

---

4. Press *Start* on the side menu to start SPC calibration.

5. The SPC Calibration will proceed one channel at a time, from channel 1 to channel 4. It will take approximately 10 minutes in total.

Abort

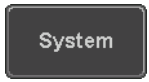
6. Press Abort to abort the calibration.

Vertical Accuracy Calibration

Panel Operation

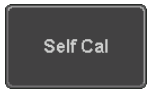
1. Press the *Utility* key.

2. Press *System* from the bottom menu.

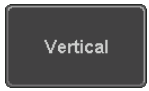


3. Press *more 1 of 3* from the side menu.

4. Press *Self Cal* on the side menu.

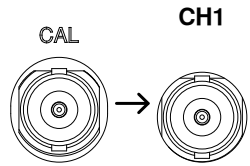


5. Press *Vertical* on the side menu.

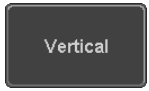


6. A message appears to "Now performing vertical calibration…
   CH1
   Connect the CAL output to channel, then press the Vertical key".

7. Connect the calibration signal from the rear panel (CAL port) to the Channel 1 input with a BNC cable.



8. Press *Vertical* again after connecting CAL to the channel 1 input.



   The calibration for Channel 1 starts and ends automatically, in less than 5 minutes. A message is displayed when the calibration procedure has ended.

9. Repeat the above step for Channel 2, 3* and 4* when prompted.

   *4 channel models only.

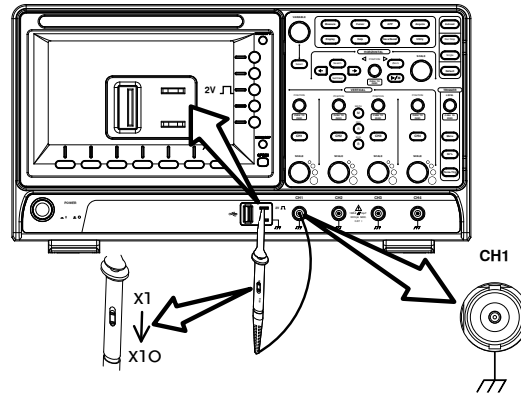
10. When the calibration for all channels has completed, the display goes back to the default state.

Probe Compensation

Panel Operation

1. Connect the probe between the Channel 1 input and the probe compensation output (default set as 2Vp-p, 1kHz square wave) on the front panel. Set the probe attenuation to x10.

2. Alternatively, the probe compensation frequency can be changed. See page 124 for details.



3. Press the *CH1* key to activate CH1.

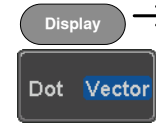
4. Set the *Coupling* to DC from the bottom menu.

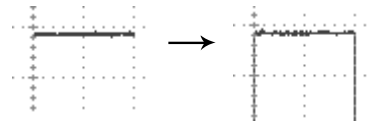
5. Set the Probe attenuation to *Voltage, 10X*.

Page 102

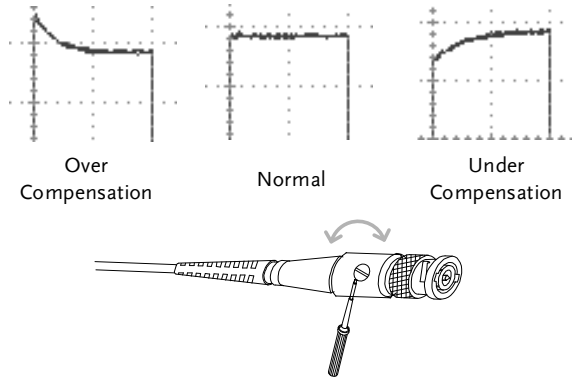
6. Press the *Autoset* key. The compensation signal appears on the display.

7. Press the *Display* key, then set the display type to *Vector*.





8. Turn the adjustment point on the probe to make the waveform as square as possible.



FAQ

- I connected the signal but it does not appear on the display.
- I want to remove the (Measurement result / FFT result / Help contents) from the display.
- The waveform does not update (frozen).
- The probe waveform is distorted.
- Autoset does not catch the signal well.
- The display image printout is too dark on the background.
- The accuracy doves not match the specification.

I connected the signal but it does not appear on the display.

Make sure you have activated the channel by pressing the Channel key (the channel key lights up).

I want to remove the (Measurement result / FFT result / Help contents) from the display.

To clear automatic measurement results, press the Measure key, select Remove Measurement and choose Remove All. See page 50.

To clear individual measurements from the screen, press the Measure key, select Display All and choose Off. See page 52.

To clear the FFT result, press the Math key twice. See page 66 for details.

To clear the Help result, press the Help key again. See page 35 for

details.

The waveform does not update (frozen).

Press the Run/Stop key to unfreeze the waveform. See page 40 for details.

If this does not help, the trigger mode might be set to Single. Press the Single key to exit Single mode. See page 40 for Single trigger details.

The probe waveform is distorted.

You might need to compensate the probe. For details, see page 186.

Autoset does not catch the signal well.

The Autoset function cannot catch signals under 10mV or 20Hz. Please use the manual operation. See page 38 for Autoset details.

The display image printout is too dark on the background.

Use the Ink Saver function which reverses the background color. For details, see page 169.

The accuracy doves not match the specification.

Make sure the device is powered On for at least 30 minutes, within +20°C~+30°C. This is necessary to stabilize the unit to match the specification.

For more information, contact your local dealer or Conrad company at http://www.conrad.de/.

APPENDIX

Updating the Firmware

Background

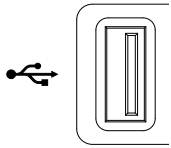
New firmware can be downloaded from the Conrad company website in the DSO products section.

Place a copy of the firmware onto the root directory of a USB memory stick.

Panel Operation

1. Put the USB drive that contains the firmware into the front panel USB port.

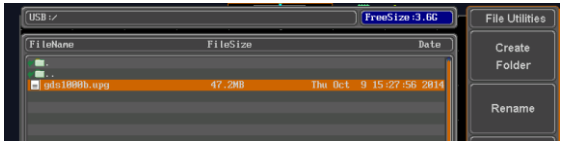
Front panel



2. Press the *Utility* key.

3. Press *File Utilities* from the bottom menu.

4. Use the *Variable* knob to highlight the upgrade file.



5. Press the *Select* key to begin the installation of the upgrade file.

6. A message will appear asking you to confirm this process.

Press the *Select* key again to confirm the installation of the firmware.

Alternatively, press any other key to cancel the installation.

7. Wait for the installation process to complete. When the installation has completed you will be prompted to restart the oscilloscope.

Installing Optional Apps

Installing Optional Apps

Background

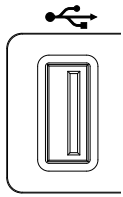
The DSO-1000D has optional software apps that can be downloaded free of charge.

To download the latest apps, see the Conrad company website: www.conrad.de or contact your nearest distributor.

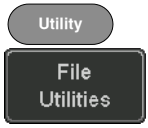
Steps

1. Download the app and copy it to the root directory of a USB flash drive.

2. Insert the USB flash drive that contains the desired app into the front panel USB A port.

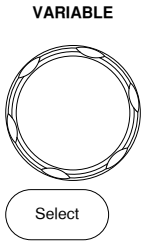


3. Press the *Utility* key then the *File Utilities* soft-key.



4. Navigate to the desired file in the USB file path.

   When the desired activation key file has been found, press the *Select* key to start the installation.



5. The installation will complete in a few seconds. When finished a pop-up message will appear asking you to restart the DSO-1000D.

6. Restart the DSO-1000D.

Uninstalling Optional Apps

Background

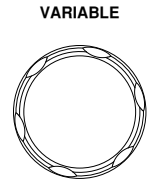
Any optional apps that were installed can be uninstalled from the APP menu. Pre-installed apps, such as the Go-NoGo app cannot be uninstalled.

For the latest information regarding the optional apps, see the Conrad company website: www.conrad.de or contact your nearest distributor.

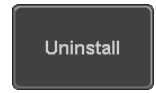
Steps

1. Press the *APP* key.

2. Highlight the app that you want to uninstall with the *Variable* knob.



3. Press *Uninstall* twice from the side menu to uninstall the selected app.



x2

DSO-1000D Specifications

The specifications apply when the DSO-1000D is powered on for at least 30 minutes under +20°C~+30°C.

Model-specific

DSO-1074D	Channels	4
	Bandwidth	DC ~ 70MHz (–3dB)
	Rise Time	5ns
	Bandwidth Limit	20MHz
DSO-1104D	Channels	4
	Bandwidth	DC ~ 100MHz (–3dB)
	Rise Time	3.5ns
	Bandwidth Limit	20MHz

Common

Vertical Sensitivity	Resolution	8 bit: 1mV~10V/div
	Input Coupling	AC, DC, GND
	Input Impedance	1MΩ// 16pF approx.
	DC Gain Accuracy	1mV: ±4% full scale >2mV: ±3% full scale
	Polarity	Normal & Invert
	Maximum Input Voltage	300Vrms
	Offset Position Range	1mV/div : ±1.25V 2mV/div ~ 100mV/div : ±2.5V 200mV/div ~ 10V/div : ±125V
	Waveform Signal Process	+, -, ×, ÷, FFT, FFTrms, User Defined Expression FFT: Spectral magnitude. Set FFT Vertical Scale to Linear RMS or dBV RMS, and FFT Window to Rectangular, Hamming, Hanning, or Blackman-Harris
Trigger	Source	CH1, CH2, CH3, CH4, Line
	Trigger Mode	Auto (supports Roll Mode for 100 ms/div and slower), Normal, Single Sequence
	Trigger Type	Edge, Pulse Width, Video, Pulse Runt, Rise & Fall, Timeout, Alternate, Event-Delay(1~65535 events), Time-Delay(Duration, 4nS~10S), Bus
	Holdoff range	4ns to 10s
	Coupling	AC, DC, LF rej., Hf rej., Noise rej.
	Sensitivity	1div
External Trigger	Range	±15V
	Sensitivity	DC ~ 100MHz Approx. 100mV
	Input Impedance	1MΩ±3%~16pF
Horizontal	Timebase Range	5ns/div ~ 100s/div (1-2-5 increments) ROLL: 100ms/div ~ 100s/div
	Pre-trigger	10 div maximum
	Post-trigger	2,000,000 div maximum
	Timebase Accuracy	±50 ppm over any ≥ 1 ms time interval
	Real Time Sample Rate	1GSa/s max.
	Record Length	Max. 10Mpts
	Acquisition Mode	Normal, Average, Peak Detect, Single

	Peak Detection	2nS (typical)
	Average	selectable from 2 to 256
X-Y Mode	X-Axis Input	Channel 1; Channel 3
	Y-Axis Input	Channel 2; Channel 4
	Phase Shift	±3° at 100kHz
Cursors and Measurement	Cursors	Amplitude, Time, Gating available; Unit: Seconds(s), Hz(1/s), Phase(degree), Ration(%)
	Automatic Measurement	36 sets: Pk-Pk, Max, Min, Amplitude, High, Low, Mean, Cycle Mean, RMS, Cycle RMS, Area, Cycle Area, ROVShoot, FOVShoot, RPREShoot, FPREShoot, Frequency, Period, RiseTime, FallTime, +Width, -Width, Duty Cycle, +Pulses, -Pulses, +Edges, -Edges, FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF, Phase
	Cursors measurement	Voltage difference between cursors (ΔV) Time difference between cursors (ΔT)
	Auto counter	6 digits, range from 2Hz minimum to the rated bandwidth
Control Panel Function	Autoset	Single-button, automatic setup of all channels for vertical, horizontal and trigger systems, with undo Autoset
	Save Setup	20set
	Save Waveform	24set
Display	TFT LCD Type	7" TFT WVGA color display
	Display Resolution	800 horizontal × 480 vertical pixels (WVGA)
	Interpolation	Sin(x)/x
	Waveform Display	Dots, vectors, variable persistence (16ms~4s), infinite persistence
	Waveform Update Rate	50,000 waveforms per second, maximum
	Display Graticule	8 x 10 divisions
	Display Mode	YT, XY
Interface	USB Port	USB 2.0 High-speed host port X1, USB High-speed 2.0 device port X1
	Ethernet Port (LAN)	RJ-45 connector, 10/100Mbps with HP Auto-MDIX
	Go-NoGo BNC	5V Max/10mA TTL open collector output
	Kensington Style Lock	Rear-panel security slot connects to standard Kensington-style lock
Miscellaneous	Multi-language menu	Available
	Operation Environment	Temperature: 0°C to 50°C. Relative Humidity ≤ 80% at 40°C or below; ≤ 45% at 41°C ~ 50°C

On-line help	Available
Dimensions	384mmX208mmX127.3mm
Weight	2.8kg

Probe Specifications

GTP-070B-4

Applicable to: DSO-1074D

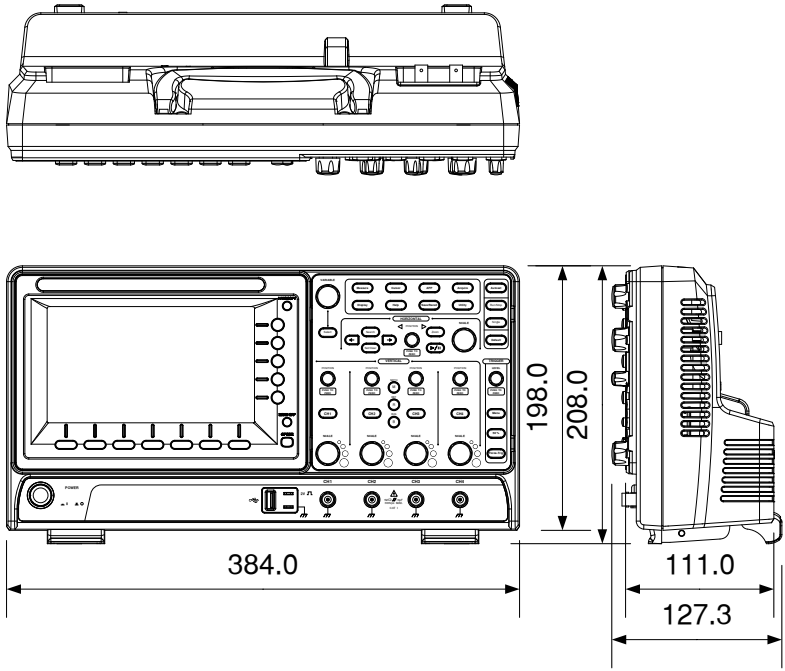
Position x10	Attenuation Ratio	10:1
	Bandwidth	DC to 70MHz
	Input Resistance	10MΩ when used with oscilloscopes with 1MΩ input
	Input Capacitance	14.5pF to 17.5pF
	Compensation Range	10pF to 35pF
	Max. Input Voltage	≤600V DC + ACpk
Position x1	Attenuation Ratio	1:1
	Bandwidth	DC to 10MHz
	Input Resistance	1MΩ (oscilloscope input resistance)
	Input Capacitance	85pF to 115pF
	Max. Input Voltage	≤200V DC + ACpk
Operating Cond.	Temperature	-10°C to 50°C
	Relative Humidity	≤85%

GTP-100B-4

Applicable to: DSO-1104D

Position X10	Attenuation Ratio	10:1
	Bandwidth	DC to 100MHz
	Input Resistance	10MΩ when used with oscilloscopes with 1MΩ input.
	Input Capacitance	14.5pF to 17.5pF
	Compensation Range	5pF to 30pF
	Max. Input Voltage	≤600V DC + ACpk
Position X1	Attenuation Ratio	1:1
	Bandwidth	DC to 10MHz
	Input Resistance	1MΩ (oscilloscope input resistance)
	Input Capacitance	85pF to 115pF
	Max. Input Voltage	≤200V DC + ACpk
Operating Cond.	Temperature	–10°C to 50°C
	Relative Humidity	≤85%

DSO-1000D Dimensions



Declaration of Conformity

We

declare that the below mentioned product

Type of Product: **Digital Storage Oscilloscope**
Model Number: **DSO-1074D, DSO-1104D**
are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (2004/108/EC & 2014/30/EU) and Low Voltage Directive (2006/95/EC & 2014/35/EU).

For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Directive, the following standards were applied:

◎ **EMC**	
EN 61326-1: EN 61326-2-1:	Electrical equipment for measurement, control and laboratory use –– EMC requirements (2013)
Conducted & Radiated Emission EN 55011: 2009+A1: 2010	Electrostatic Discharge EN 61000-4-2: 2009
Current Harmonics EN 61000-3-2: 2006+A1: 2009+A2: 2009	Radiated Immunity EN 61000-4-3: 2006+A1: 2008 +A2: 2010
Voltage Fluctuations EN 61000-3-3: 2013	Electrical Fast Transients IEC 61000-4-4: 2012
----------	Surge Immunity EN 61000-4-5: 2006
----------	Conducted Susceptibility EN 61000-4-6: 2014
----------	Power Frequency Magnetic Field EN 61000-4-8: 2010
----------	Voltage Dip/ Interruption EN 61000-4-11: 2004

Low Voltage Equipment Directive 2006/95/EC	
Safety Requirements	EN 61010-1: 2010 (Third Edition) EN 61010-2-030: 2010 (First Edition)

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