*02_0509_01-HW

VOLTCRAFT®

DIGITAL STORAGE OSCILLOSCOPE
ⒼⒷ OPERATING INSTRUCTIONS

Item No. :
12 24 34   GDS-1062A / 60 MHz
12 24 35   GDS-1152A / 150 MHz

CE

Version 05/09

TABLE OF CONTENTS

1. INTRODUCTION

Dear Customer,

In purchasing this Voltcraft® product, you have made a very good decision for which we would like to thank you.

Voltcraft® - In the field of measuring, charging and network technology, this name stands for high-quality products which perform superbly and which are created by experts whose concern is continuous innovation.

From the ambitious hobby electronics enthusiast to the professional user, products from the Voltcraft® brand family provide the optimum solution even for the most demanding tasks. And the remarkable feature is: we offer you the mature technology and reliable quality of our Voltcraft® products at an almost unbeatable price-performance ratio. In this way, we aim to establish a long, fruitful and successful co-operation with our customers.

We wish you a great deal of enjoyment with your new Voltcraft® product!

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12. INDEX

2. SAFETY INSTRUCTIONS

This chapter contains important safety instructions that should be followed when operating and storing the oscilloscope. Read the following before any operation to ensure your safety and to keep the oscilloscope in the best condition.

Safety Symbols

These safety symbols may appear in this manual or on the oscilloscope.

Warning: Identifies conditions or practices that could result in injury or loss of life.

WARNING

Caution: Identifies conditions or practices that could result in damage to the oscilloscope or to other objects or property.

CAUTION

DANGER High Voltage

Attention: Refer to the Manual

Protective Conductor Terminal

Earth (Ground) Terminal

Safety Guidelines

General Guideline	• Make sure the BNC input voltage does not exceed 300V peak.

• 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 heavy objects on the oscilloscope.
• Avoid severe impact or rough handling that may damage the oscilloscope.
• Avoid discharges of static electricity on or near the oscilloscope.
• Use only mating connectors, not bare wires, for the terminals.
• Do not block the cooling fan vent.
• Do not perform measurements at power sources and building installation sites (Note below).
• The oscilloscope should only be disassembled by a qualified technician.

(Measurement categories) EN 61010-1:2001 specifies the measurement categories and their requirements as follows. The GDS-1000A falls under category II.

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

Power Supply	• AC Input voltage: 100 ~ 240V AC, 47 ~ 63Hz
	• The power supply voltage should not fluctuate more than 10%.
	• Connect the protective grounding conductor of the AC power cord to an earth ground.

WARNING

Applicable model & probe		GDS-1152A
Position x 10	Attenuation Ratio	10:1
	Bandwidth	DC ~ 150MHz
	Input Resistance	10MΩ when used with 1MΩ input
	Input Capacitance	17pF approx.
	Maximum Input Voltage	500V CAT I, 300V CAT II (DC+Peak AC) Derating with frequency
Position x 1	Attenuation Ratio	1:1
	Bandwidth	DC ~ 6MHz
	Input Resistance	1MΩ when used with 1MΩ input
	Input Capacitance	47pF approx.
	Maximum Input Voltage	300V CAT I, 150V CAT II (DC+Peak AC) Derating with frequency
Operating Cond.	Temperature	−10°C ~ 55°C
	Relative Humidity	≤85% @35°C
Safety Standard	EN 61010-031 CAT II	

* Note: GW Instek reserves the right to change the probe model type at anytime without notice for probe model types of similar specification.

11. DISPOSAL

In order to preserve, protect and improve the quality of environment, protect human health and utilise natural resources prudently and rationally, the user should return unserviceable product to relevant facilities in accordance with statutory regulations. The crossed-out wheeled bin indicates the product needs to be disposed separately and not as municipal waste.

Probe Specifications

GDS-1062A/1152A Probe

Applicable model & probe		GDS-1062A
Position x 10	Attenuation Ratio	10:1
	Bandwidth	DC ~ 60MHz
	Input Resistance	10M when used with 1M input
	Input Capacitance	23pF approx.
	Maximum Input Voltage	500V CAT I, 300V CAT II (DC+Peak AC) Derating with frequency
Position x 1	Attenuation Ratio	1:1
	Bandwidth	DC ~ 6MHz
	Input Resistance	1MΩ when used with 1MΩ input
	Input Capacitance	128pF approx.
	Maximum Input Voltage	300V CAT I, 150V CAT II (DC+Peak AC) Derating with frequency
Operating Cond.	Temperature	−10°C ~ 55°C
	Relative Humidity	≤85% @35°C
Safety Standard		EN 61010-031 CAT II

Fuse	• Fuse type: T1A/250V
⚠	• To ensure fire protection, replace the fuse only with the specified type and rating.
	• Disconnect the power cord before replacing the fuse.
	• Make sure the cause of fuse blowout is fixed before replacing the fuse.
Cleaning the oscillo-scope	• Disconnect the power cord before cleaning the oscilloscope.
	• Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid into the oscilloscope.
	• Do not use chemicals containing harsh products 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%
	• Altitude: < 2000m
	• Temperature: 0°C to 50°C

(Pollution Degree) EN 61010-1:2001 specifies pollution degrees and their requirements as follows. The oscilloscope 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, nonconductive 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
	• Relative Humidity: < 85%
	• Temperature: -10°C to 60°C

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 0.75mm2 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.

	Average	2, 4, 8, 16, 32, 64, 128, 256
Cursors and Measurement	Voltage	Vpp, Vamp, Vavg, Vrms, Vhi, Vlo, Vmax, Vmin, Rise Preshoot/ Overshoot, Fall Preshoot/ Overshoot
	Time	Freq, Period, Rise Time, Fall Time, + Width, – Width, Duty Cycle
	Delay	FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF
	Cursors	Voltage difference (ΔV) and Time difference (ΔT) between cursors
	Auto Counter	Resolution: 6 digits, Accuracy: ±2% Signal source: All available trigger source except the Video trigger
Control Panel Function	Autoset	Automatically adjust Vertical Volt/div, Horizontal Time/div, and Trigger level
	Save/Recall	Up to 15 sets of measurement conditions and waveforms
Display	LCD	5.6 inch, TFT, brightness adjustable
	Resolution (dots)	234 (Vertical) x 320 (Horizontal)
	Graticule	8 x 10 divisions
	Display Contrast	Adjustable
Interface	USB Slave Connector	USB1.1 & 2.0 full speed compatible (printers and flash disk not supported)
	SD Card Slot	Image (BMP) and waveform data (CSV)
Probe Compensation Signal	Frequency range	1kHz ~ 100kHz adjustable, 1kHz step
	Duty cycle	5% ~ 95% adjustable, 5% step
	Amplitude	2Vpp±3%
Power Source	Line Voltage	100V~240V AC, 47Hz~63Hz
	Power Consumption	18W, 40VA maximum
	Fuse Rating	1A slow, 250V
Operation Environment	Ambient temperature 0 ~ 50°C Relative humidity ≤ 80% @35°C	
Storage Environment	Ambient temperature –10°C to 60°C Relative humidity ≤ 80% @60°C	
Dimensions	341.5(W) x 162.3 (H) x 159 (D) mm	
Weight	Approx. 2.5kg	

Common specifications

Vertical	Sensitivity	2mV/div~10V/Div (1-2-5 increments)
	Accuracy	± (3% x |Readout|+0.1div + 1mV)
	Bandwidth	See model-specific specifications
	Rise Time	See model-specific specifications
	Input Coupling	AC, DC, Ground
	Input Impedance	1MΩ±2%, ~15pF
	Polarity	Normal, Invert
	Maximum Input	300V (DC+AC peak), CAT II
	Math Operation	+, –, ×, FFT, FFT rms
	Offset Range	2mV/div~50mV/div: ±0.4V
		100mV/div~500mV/div: ±4V
		1V/div~5V/div: ±40V
		10V/div : ±300V
Trigger	Sources	CH1, CH2, Line, EXT
	Modes	Auto, Normal, Single, TV, Edge, Pulse
	Coupling	AC, DC, LF rej, HF rej, Noise rej
	Sensitivity	See model-specific specifications
	Holdoff	40ns ~ 2.5s
External trigger	Range	DC: ±15V, AC: ±2V
	Sensitivity	See model-specific specifications
	Input Impedance	1MΩ±2%, ~15pF
	Maximum Input	300V (DC+AC peak), CATII
Horizontal	Range	1ns/div~50s/div, 1-2.5-5 increment
		Roll: 250ms/div – 50s/div
	Modes	Main, Window, Window Zoom, Roll, X-Y
	Accuracy	±0.01%
	Pre-Trigger	10 div maximum
	Post-Trigger	1000 div
X-Y Mode	X-Axis Input	Channel 1
	Y-Axis Input	Channel 2
	Phase Shift	±3° at 100kHz
Signal Acquisition	Real-Time	1G Sa/s maximum
	Equivalent	25G Sa/s maximum
	Vertical Resolution	8 bits
	Record Length	1M (2 channel), 2M(1 channel) points maximum
	Acquisition	Normal, Peak Detect, Average
	Peak Detection	10ns (500ns/div ~ 50s/div)

3. GETTING STARTED

The Getting started chapter introduces the oscilloscope's main features*, appearance, and set up procedure. * firmware V1.0.

Main Features

Model name	Frequency bandwidth	Input channels
GDS-1062A (BN 12 24 34)	DC – 60MHz (–3dB)	2
GDS-1152A (BN 12 24 35)	DC – 150MHz (–3dB)	2
Performance	• 1 GS/s real-time sampling rate • 25GS/s equivalent-time sampling rate • 2M points record length • Up to 10ns peak detection • 2mV~10V vertical scale • 1ns ~ 50s time scale	
Features	• 5.6 inch color TFT display • Saving and recalling setups and waveforms • 27 automatic measurements • Multi-language menu (12 languages) • Math operation: Addition, Subtraction, multiplication, FFT, FFT RMS • Edge, video, pulse width trigger • Compact size: (W) 310 x (D) 140 x (H) 142 mm • Probe factor from 1X~100X	
Interface	• SD card interface for saving and recalling data • Calibration output • External trigger input • USB slave interface for remote control	

Panel Overview

Front Panel
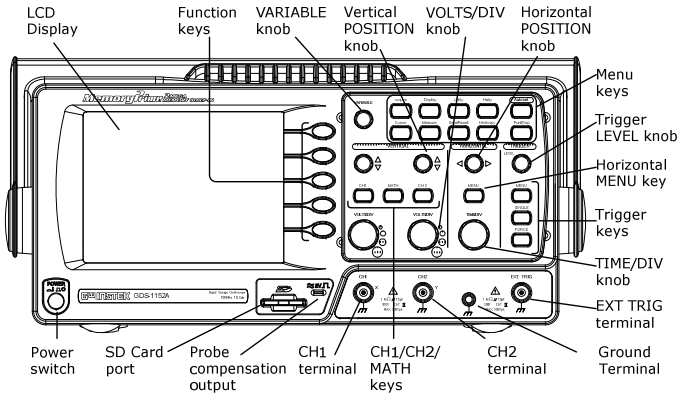
LCD display   TFT color, 320 x 234 resolution, wide angle view LCD display.

Function keys: F1 (top) to F5 (bottom)		Activates the functions which appear in the left side of the LCD display.
Variable knob	VARIABLE	Increases or decreases values and moves to the next or previous parameter.
Acquire key	Acquire	Configures the acquisition mode (page 21).
Display key	Display	Configures the display settings (page 23).
Cursor key	Cursor	Runs cursor measurements (page 22).

GDS-1000A Series Specifications

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

Model-specific specifications

GDS-1062A (BN 12 24 34)	Bandwidth (–3dB)	DC coupling: DC ~ 60MHz
		AC coupling: 10Hz ~ 60MHz
	Bandwidth Limit	20MHz (–3dB)
	Trigger Sensitivity	0.5div or 5mV (DC ~ 25MHz)
		1.5div or 15mV (25MHz~60MHz)
	External Trigger	~ 50mV (DC~25MHz)
	Sensitivity	~ 100mV (25MHz~60MHz)
	Rise Time	< 5.8ns approx.
GDS-1152A (BN 12 24 35)	Bandwidth (–3dB) DC coupling:	DC ~ 150MHz
		AC coupling: 10Hz ~ 150MHz
	Bandwidth Limit	20MHz (–3dB)
	Trigger Sensitivity	0.5div or 5mV (DC ~ 25MHz)
		1.5div or 15mV (25MHz~100MHz)
	External Trigger	~ 50mV (DC~25MHz)
	Sensitivity	~ 100mV (25MHz~100MHz)
	Rise Time	< 2.3ns approx.

10. APPENDIX

Fuse Replacement

Procedure   1. Remove the power cord and remove the fuse socket using a minus driver.
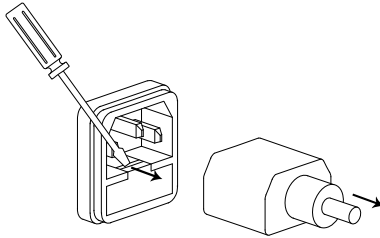
2. Replace the fuse in the holder.

Ratings   T1A, 250V

Utility key	Utility	Configures the Hardcopy function (page 23), shows the system status (page 34), selects the menu language (page 34), runs the self calibration (page 34), and configures the probe compensation signal (page 35).
Help key	Help	Shows the Help contents on the display (page 37).
Autoset key	Autoset	Automatically configures the horizontal, vertical, and trigger settings according to the input signal (page 23).
Measure key	Measure	Configures and runs automatic measurements (page 26).
Save/Recall key	Save/Recall	Saves and recalls images, waveforms, or panel settings (page 27).
Hardcopy key	Hardcopy	Stores images, waveforms, or panel settings to an SD card (page 83).
Run/Stop key	Run/Stop	Runs or stops triggering (page 41).
Trigger level knob	TRIGGER LEVEL	Sets the trigger level (page 72).
Trigger menu key	MENU	Configures the trigger settings (page 31).
Single trigger key	SINGLE	Selects the single triggering mode (page 76).
Trigger force key	FORCE	Acquires the input signal once regardless of the trigger condition at the time (page 76).
Horizontal menu key	MENU	Configures the horizontal view (page 61).
Horizontal position knob		Moves the waveform horizontally (page 61).

TIME/DIV knob	TIME/DIV	Selects the horizontal scale (page 42).
Vertical position knob	△ ▽	Moves the waveform vertically (page 42).
CH1/CH2 key	CH 1	Configures the vertical scale and coupling mode for each channel (page 21).
VOLTS/DIV knob	VOLTS/DIV	Selects the vertical scale (page 43).
Input terminal	CH1	Accepts input signals: 1MJ±2% input impedance, BNC terminal.
Ground terminal		Accepts the DUT ground lead to achieve a common ground.
MATH key	MATH	Performs math operations (page 53).
SD card connector	SD	Facilitates transferring waveform data, display images, and panel settings (page 81).
Probe compensation output	≈2V⊓	Outputs a 2Vp-p, square signal for compensating the probe (page 96) or demonstration.
External trigger input	EXT TRIG	Accepts an external trigger signal (page 70).
Power switch	POWER	Powers the oscilloscope on or off.

Autoset does not catch the signal well.

The Autoset function cannot catch signals under 30mV or 30Hz.

Please operate the oscilloscope manually. See page 76 for details.

I want to clean up the cluttered panel settings.

Recall the default settings by pressing the Save/Recall key—Default Setting.

For default setting contents, see page 36.

The saved display image is too dark on the background.

Use the Inksaver function which reverses the background color. For details, see page 35.

The accuracy does not match the specifications.

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.

The SD card slot does not accept my card.

Make sure is: 1. a standard SD card (MMC and SDHC is not supported), 2. 2GB or less, and 3. formatted as FAT or FAT32.

The oscilloscope will not allow a 2M waveform to be saved.

Make sure that only 1 channel is active. Make sure that the signal has been triggered and that the STOP or Single key has been pressed.

Ensure the time base is slower than 10 ns/div. See page 80.

For more information, contact your local dealer or GWInstek at www.gwinstek.com.tw / marketing@goodwill.com.tw.

9. FAQ

- The input signal does not appear in the display.
- I want to remove some contents from the display.
- The waveform does not update (frozen).
- The probe waveform is distorted.
- Autoset does not catch the signal well.
- I want to clean up the cluttered panel settings.
- The accuracy does not match the specifications.
- The SD card slot does not accept my card.
- The oscilloscope will not allow a 2M waveform to be saved.

The input signal does not appear in the display.

Make sure you have activated the channel by pressing the CH key.

I want to remove some contents from the display.

To clear the math result, press the Math key again.

To clear the cursor, press the Cursor key again.

To clear the Help contents, press the Help key again.

The waveform does not update (frozen).

Press the Run/Stop key to unfreeze the waveform. See page 26 for details. For trigger setting details, see page 70.

If this does not help, press the CH key. If the signal still does not appear, press the Autoset key.

The probe waveform is distorted.

You might need to compensate the probe. For details, see page 96.

Note that the frequency accuracy and duty factor are not specified for probe compensation waveforms and therefore it should not be used for other reference purposes.

Rear Panel

Fuse socket   Power cord socket   CAL output   USB port
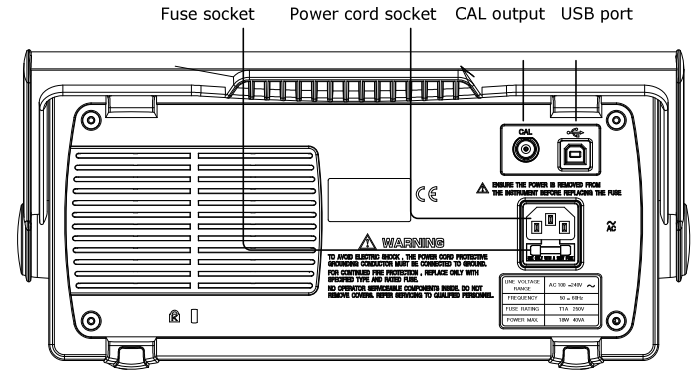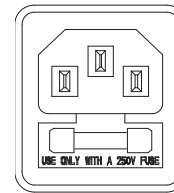
Power cord socket		Power cord socket accepts the AC mains, 100 ~ 240V, 50/60Hz.
Fuse socket		The fuse socket holds the AC main fuse, T1A/250V. For the fuse replacement procedure, see page100.
USB slave port		Accepts a type B (slave) male USB connector for remote controlling the oscilloscope (page 77).
Calibration output	CAL	Outputs the calibration signal used in vertical scale accuracy calibration (page 95).
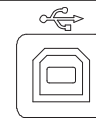
Display

Waveform marker   Waveform position Trigger status Acquisition

Menu

Vertical status   Horizontal status   Frequency Trigger condition

Waveforms	Channel 1: Yellow	Channel 2: Blue
Trigger status	Trig'd	A signal is being triggered
	Trig?	Waiting for a trigger condition
	Auto	Updating the input signal regardless of trigger conditions
	STOP	Triggering is stopped
	For trigger setting details, see page 70.	
Input signal frequency	Updates the input signal frequency (the trigger source signal) in real-time. "< 20Hz" Indicates that the signal frequency is less than the lower frequency limit (20Hz) and thus not accurate.	
Trigger configuration	Shows the trigger source, type, and slope. In case of the Video trigger, shows the trigger source and polarity.	
Horizontal status Vertical status	Shows the channel configurations: coupling mode, vertical scale, and horizontal scale.	

4. Press Wavetype repeatedly to select the *standard* square wave.

5. Press the Autoset key. The compensation signal will appear in the display.

6. Press the Display key, then *Type* to select the vector waveform.
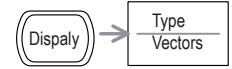
7. Turn the adjustment point on the probe until the signal edge becomes sharp.

Over Compensation   Normal   Under Compensation
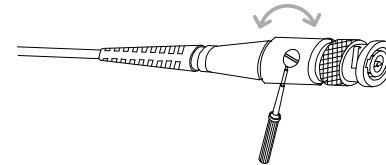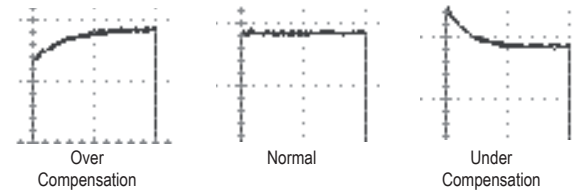
8. When finished, connect the calibration signal to the Channel 2 input and repeat the procedure.

```
Done!!

●●●●●●●●●●●●●
```
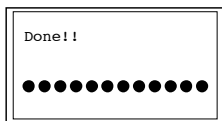
9. The calibration is completed and the display goes back to the previous state.

Probe Compensation

Procedure

1. Connect the probe between Channel1 input and the probe compensation output (2Vp-p, 1kHz square wave) on the front panel. Set the probe attenuation to x10.

2. Press the Utility key.
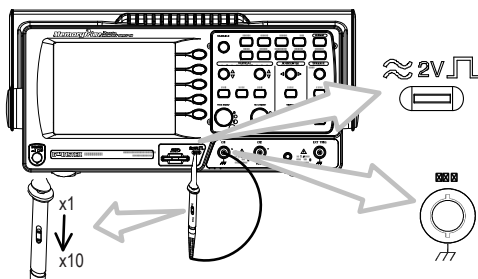
Utility

3. Press *ProbeComp*.

ProbeComp
Menu
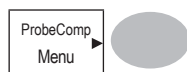
Setting up the Oscilloscope

Background   This section describes how to set up the oscilloscope properly including adjusting the handle, connecting a signal, adjusting the scale, and compensating the probe. Before operating the oscilloscope in a new environment, run these steps to make sure the oscilloscope is functionally stable.

Procedure

1. Pull both bases of the handle out slightly.

2. Turn to one of the three preset positions.
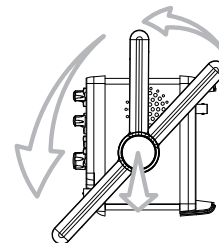
3. Connect the power cord.
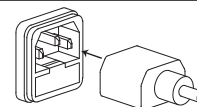
4. Press the power switch. The display will become active in approximately 10 seconds.

POWER

5. Reset the system by recalling the factory settings. Press the Save/Recall key, then *Default Setup*. For details regarding the factory settings, see page 91.

Save/Recall → Default Setup

6. Connect the probe between the Channel1 input terminal and probe compensation signal output (2Vp-p, 1kHz square wave).

7. Set the probe attenuation to x10.
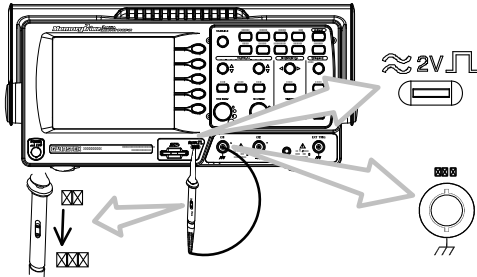
8. Press the Autoset key. A square waveform will appear in the center of the display. For details on Autoset, see page 23.

Autoset

9. Press the Display key, then *Type* and select the vector waveform type.

Display
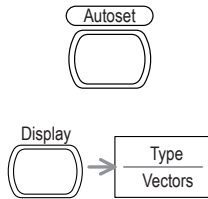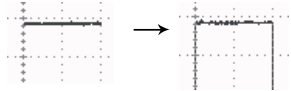
Type
Vectors

10. Turn the adjustment point on the probe to flatten the square waveform edge.

Over Compensation

Normal

Under Compensation
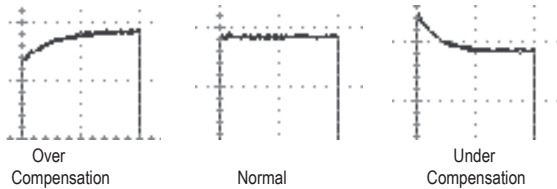
8. MAINTENANCE

Two types of maintenance operations are available: calibrating the vertical resolution, and compensating the probe. Run these operations when using the oscilloscope in a new environment.

Vertical Resolution Calibration

Procedure

1. Press the Utility key.

Utility

2. Press *More*.

More ▶

3. Press *Self Cal Menu*.

Self CAL Menu ▶

4. Press *Vertical*. The message *"Set CAL to CH1, then press F5"* appears at the bottom of the display.

Vertical

5. Connect the calibration signal between the rear panel CAL out terminal and the Channel1 input.

CAL   CH1

6. Press F5. The calibration automatically starts.

7. The Channel1 calibration will complete in less than 5 minutes.

Ch1 calibration 1/3

●●●●●●●○○○○○○
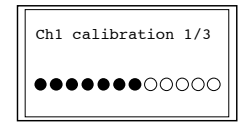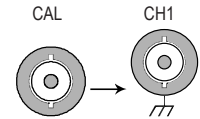
3. Press Recall Waveform. The display shows the available source and destination options.

Recall ▶ Waveform

4. Press Source repeatedly to select the file source, internal memory or external SD card. Use the Variable knob to change the memory location (W1 ~ W15).

Source ------- Memory

VARIABLE

Memory	Internal memory, W1 ~ W15
SD card	External flash drive, no practical limitation on the amount of files. The waveform file must be placed in the root directory to be recognized.

5. Press Destination. Use the Variable knob to select the memory location.

Destination

VARIABLE
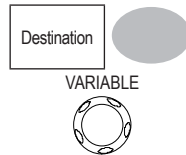
RefA, B	Internally stored reference waveforms A, B

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

Recall

Note ⚠ The file will not be saved if the power is turned Off or the SD card is disconnected before completion.

File utilities To edit the SD card contents (create/ delete/ rename files and folders), press *File Utilities*. For details, see page 81.

File Utilities

11. Setting up the oscilloscope is completed. You may continue with the other operations.

4. QUICK REFERENCE

This chapter lists the oscilloscope menu tree, operation shortcuts, built-in help coverage, and default factory settings. Use this chapter as a handy reference to access the oscilloscope functionalities.

Menu Tree and Shortcuts

Convenions	Examples
Normal	= Press the functional key for "Normal"
Average ⇄	= Repeatedly press the functional key for "Average"
Normal ~ Average	= Select a menu from "Normal" to "Average" and press its functionality key
Normal	= Press the functionality key for "Normal", and then use the Variable knob
VAR ◯	

3. Press *Recall Setup*.

Display ▶
Refs.

4. Press *Source* repeatedly to select the file source, internal or external memory. Use the Variable knob to change the memory.
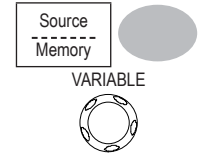
Source
- - - - - -
Memory

VARIABLE

Memory	Internal memory, S1 ~ S15
SD card	External card, no practical limitation on the amount of file. The setup file must be placed in the root directory to be recognized.

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

Recall

Note ⚠ The file will not be saved if the power is turned Off or the SD card is disconnected before completion.

File utilities	To edit SD card contents (create/ delete/ rename files and folders), press *File Utilities*. For details, see page 81.

File
Utilities

Recalling a waveform

Procedure	1. (For recalling from an external SD card) Insert the card into the slot.
	2. Press the Save/Recall key.
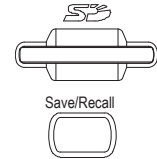
Save/Recall

Recalling a reference waveform to the display

Procedure

1. The reference waveform must be stored in advance.

2. Press the Save/Recall key. Save/Recall

   Save/Recall

3. Press *Display Refs*. The reference waveform display menu appears.

   Display Refs. ▶

4. Select the reference waveform, Ref A or Ref B, and press it. The waveform appears on the display and the period and amplitude of the waveform appears in the menu.

   Ref.A Off

   Ref.A Off
   200mV
   250uS

5. To clear the waveform from the display, press *RefA/B* again.

   Ref.A Off
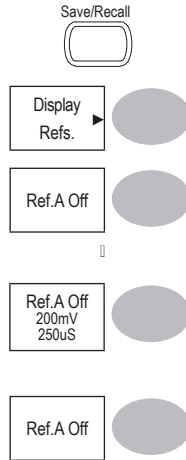
Recalling panel settings

Procedure

1. (For recalling from an external SD card) Insert the card into the slot.

   SD

2. Press the Save/Recall key.

   Save/Recall

Acquire — Select acquisition mode

Normal ~ Peak-Detect

Select average number

Normal		
Average	2/ 4/ 8/ 16/ 32/ 64/ 128/ 256	Average ⇄
Peak Detect		Turn Delay on/off
Delay On	On/ Off	Delay On ⇄
Sample Rate 500MS/s		

CH1/2 key

CH 1 — Turn channel on/off

CH 1/2 ⇄

Select coupling mode

Coupling ∿	∿ ▭ ☒ ⊥	Coupling ⇄
Invert Off	On/ Off	Invert waveform
		Invert ⇄
BW Limit Off	On/ Off	Turn bandwidth limit on/off
		BW Limit ⇄
Probe x1	x1/ x10/ x100	Select probe attenuation
		Probe(1x~100x)
Expand Center	Center/Ground	Expand type
		Expand ⇄

Cursor key 1/2

Cursor

Source	
CH1	→ CH1/ 2/ MATH
X1 -5.000uS 0.000uV	
X2 5.000uS 0.000uV	
X1X2 10.00uS 100.0kHz 0.000uV	
X Y	

Turn cursor on/off

Cursor ⇄

Move X1 cursor

X1   VAR ○

Move X2 cursor

X2   VAR ○

Move both X1 and X2 cursor

X1X2   VAR ○

Switch to Y cursor

X   Y

Cursor key 2/2

Cursor

Source	
CH1	→ CH1/ 2/ MATH
Y1 123.4mV	
Y2 22.9mV	
Y1Y2 16.0V	
X Y	

Turn cursor on/off

Cursor ⇄

Move Y1 cursor

Y1   VAR ○

Move Y2 cursor

Y2   VAR ○

Move both Y1 and Y2 cursor

Y1Y2   VAR ○

Switch to X cursor

X   Y

Recalling the default panel settings

Procedure	1. Press the Save/Recall key.	Save/Recall
Default panel setup	2. Press *Default Setup*. The factory installed setting will be recalled.	Default Setup

Setting contents   The following is the default panel setting contents.

Acquisition	Mode: Normal	
Channel	Coupling: DC	Invert: Off
	BW limit: Off	voltage: x1
Cursor	Source: CH1	Horizontal: None
	Vertical: None	
Display	Type: Vectors	Accumulate: Off
	Graticule:	
Horizontal	Scale: 2.5us/Div	Mode: Main Timebase
Math	Type: + (Add)	Channel: CH1+CH2
	Position: 0.00 Div	Unit/Div: 2V
Measure	Item: Vpp, Vavg, Frequency, Duty cycle, Rise Time	
Trigger	Type: Edge	Source: Channel1
	Mode: Auto	Slope:
	Coupling: DC	Rejection: Off
	Noise Rejection: Off	
Utility	SaveImage, InkSaver Off	

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

Save/Recall   Save/Recall

Note ⚠ The file will not be saved if the power is turned off or the SD card is disconnected before completion.

7. Together with the current setup/waveform/ image, the last saved waveform file (one from W1 ~ W15) and setup file (one from S1 ~ S15) are also included in the folder.

| File utilities | To edit SD card contents (create/ delete/ rename files and folders), press *File Utilities*. For details, see page 81. | File Utilities |

Recall

File type/source/destination

Item	Source	Destination
Default panel setup	• Factory installed setting	Current front panel
Reference waveform	• Internal memory: A, B	Current front panel
Panel setup (DSxxxx.set)	• Internal memory: S1 ~ S15 • External memory: SD card	Current front panel
Waveform data (DSxxxx.csv)	• Internal memory: W1 ~ W15 • External memory: SD card	Reference waveform A, B
SD Card restriction	The GDS-1000A series accepts the following SD card. Size: 2GB or less Format: FAT or FAT32	

Display key

Display		Select waveform type
Type Vectors	Vectors/ Dots	Type ⮌ Waveform accumulate On/Off
Accumulate Off	On/ Off	Accumulate ⮌ Refresh accumulation
Refresh		Refresh ⮌ Set display contrast
Contrast — ☀ +		Contrast VAR ⟳
Full ▶	⊞ / ⊞ / ☐	Select display grid ⊞ ⮌

Autoset key

Autoset
Automatically find the signal and set the scale
Autoset

Hardcopy key

Hardcopy
See Utility key (page 83)

Help key

Help
Turn help mode on/off
Help ⮌
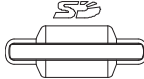
Horizontal menu key

MENU		
Main		Select main (default) display
		Main
Window		Select window mode
		Window TIME/DIV ⟳
Window Zoom		Zoom in window mode
		Window Zoom
Roll		Select window roll mode
		Roll
XY		Select XY mode
		XY

Math key 1/2 (+/-/x)

MATH

Operation CH1+CH2	▶	CH1+CH2 CH1-CH2 CH1xCH2 FFT FFT rms
Position 0.00 Div		-12div ~ +12div
Unit/Div 2V		2mV/div~10V/div

Math on/off

Math ⇄

Select math operation type (+/–/x/FFT/ FFT rms)

Operation ⇄

Set result position

Position VAR ⟳

Math result Volt/Div

Unit/Div VOLTS/DIV(CH2)

Saving all (panel settings, display image, waveform)

Procedure

1. (For saving to an external SD card) Insert the card into the slot.

2. Press the Save/Recall key twice to access the Save menu.
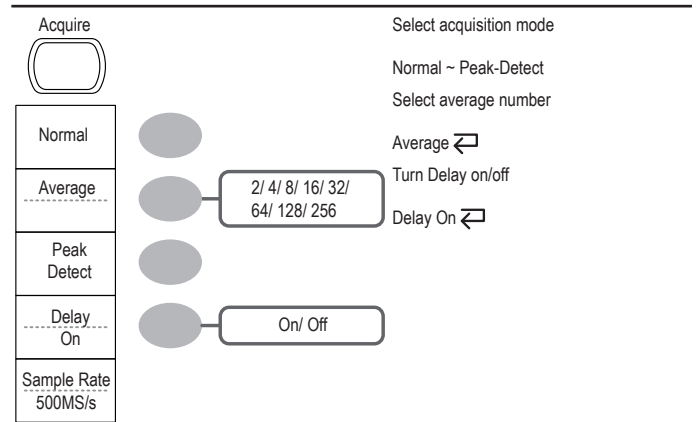
3. Press *Save All*. The following information will be saved.

Save All ▶

Setup file (Axxxx.set)	Two types of setups are saved: the current panel setting and the last internally saved settings (one of S1 ~ S15).
Display image (Axxxx.bmp)	The current display image in the bitmap format.
Waveform data (Axxxx.csv)	Two types of waveform data are saved: the currently active channel data and the last internally saved data (one of W1 ~ W15).

4. Press *Ink Saver* repeatedly to invert the background color (on) or not (off) for the display image.

Ink Saver Off

5. Press *Destination*.

Destination SD Card

SD Normal	Save to the SD card with a 4k waveform memory length.
SD 1M	Save to the SD card with a 1M waveform memory length. For 2 channel operation only.
SD 2M	Save to the SD card with a 2M waveform memory length. For single channel operation only.

Saving the display image

Background	Saving the display image can be used as a screen capture or it can be used as a reference waveform.
Procedure	1. (For saving to an external SD card) Insert the card into the slot.

2. Press the Save/Recall key twice to access the Save menu.

Save/Recall   Save/Recall

3. Press *Save Image*.

Save
Image

4. Press *Ink Saver* repeatedly to invert the background color (on) or not (off).

Ink Saver
Off

5. Press *Destination*.

Destination
SD Card

SD card	External card, no practical limitation on the amount of files. When saved, the image file will be placed in the root directory.

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

Save

Note ⚠ The file will not be saved if the power is turned off or the SD card is disconnected before completion.

File utilities	To edit SD card contents (create/ delete/ rename files and folders), press File Utilities. For details, see page 81.

File
Utilities

Math key 2/2 (FFT/FFT rms)

MATH

Operation		CH1+CH2
FFT		CH1-CH2
		CH1xCH2
		FFT
		FFT rms

Source		
CH1		CH1/2

Window		Flattop/
Hanning		Rectangular/
		Blackman/
		Hanning

Position		
0.00 Div		-12div ~ +12div

Unit/Div		
1dB		20/10/5/2/1 dB
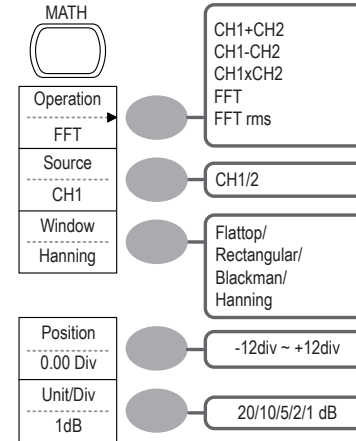
Math on/off

Math ↩
Select math operation type (+/–/x/FFT/ FFT rms)

Operation ↩
Select FFT source channel

Source ↩
Select FFT window

Window ↩
Select FFT result position

Position VAR ◯
Select vertical scale

Unit/Div ↩

Measure key

Measure		Measure		
Vpp 1:204mV 2: 300mV	→	Source 1 - - - - - - - CH1		
Vavg 1: 1.93mV 2: 28.0mV	→	Source 2 - - - - - - - CH2		View all/Select Measurements (Voltage/ Time/Delay)
Frequency 1: 1.000kHz 2: 3.003kHz	→	Voltage - - - - - - - Vpp	→	
Duty Cycle 1: 50.01% 2: 49.88%	→	⎍⎍		
Rise Time 1. 76.20us 2. 70.11us	→	Previous Menu		
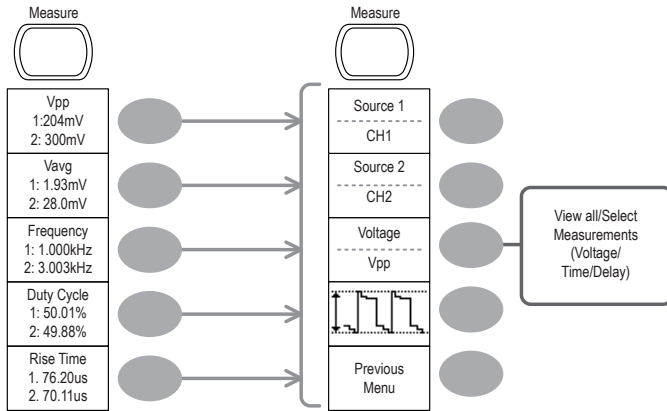
Turn on/off measurement — Measure ⇄

Select measurement type — Voltage/Time/Delay ⇄

Select measurement item — VAR ◯ or Icon(F3) ⇄ / VAR ◯

Go back to previous menu — Previous Menu

Run/Stop key

Run/Stop — Freeze/unfreeze waveform or trigger
Run/Stop ⇄
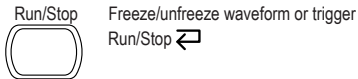
4. Press *Source*. Use the Variable knob to select the source signal.

Source
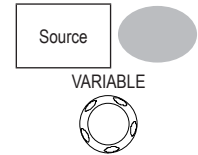
VARIABLE

CH1 ~ CH2 — Channel 1 ~ 2 signal
Math — Math operation result
RefA, B — Internally stored reference waveforms A, B

1. Press *Destination* repeatedly to select the file destination. Use the Variable knob to select the memory location.

Destination
- - - - - - -
Memory

VARIABLE
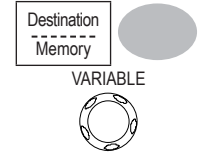
Memory — Internal memory, W1 ~ W15

SD Normal — Save to the SD card with a 4k waveform memory length.
SD 1M — Save to the SD card with a 1M waveform memory length. For 2 channel operation only.
SD 2M — Save to the SD card with a 2M waveform memory length. For single channel operation only.
Ref — Internal reference waveform, A/B

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

Save

Note ⚠ The file will not be saved if the power is turned off or the SD card is disconnected before completion.

File utilities — To edit SD card contents (create/ delete/ rename files and folders), press File Utilities. For details, see page 81.

File
Utilities

4. Press *Destination* repeatedly to select the saved location. Use the Variable knob to change the internal memory location (S1 ~ S15).

```
Destination
- - - - - - -
  Memory
```
VARIABLE
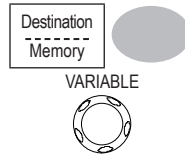
| Memory | Internal memory, S1 ~ S15 |
| SD card | External card, no practical limitation for the amount of file. When saved, the setup file will be placed in the root directory. |

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

```
Save
```

Note ⚠ The file will not be saved if the power is turned off or the SD card is disconnected before completion.

File utilities — To edit SD card contents (create/ delete/ rename files and folders), press *File Utilities*. For details, see page 81.
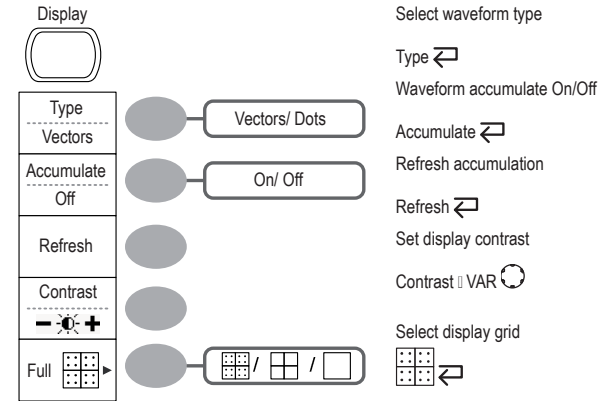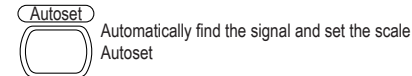
```
File
Utilities
```

Saving the waveform

Procedure
1. (For saving to an external SD card) Insert the card into the slot.

2. Press the Save/Recall key twice to access the Save menu.
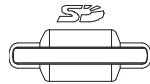
Save/Recall   Save/Recall

3. Press *Save Waveform*.

```
Save
Waveform ▶
```

Save/Recall key 1/9

Save/Recall ⟷ Save/Recall

| Default Setup |
| Recall Setup ▶ | → To Recall Setup |
| Recall Waveform ▶ | → To Recall Waveform |

Save Setup ▶	→ To Save Setup
Save Waveform ▶	→ To Save Waveform
Save Image ▶	→ To Save Image
Save All ▶	→ To Save All

| Display Refs. ▶ | → To Display Refs |
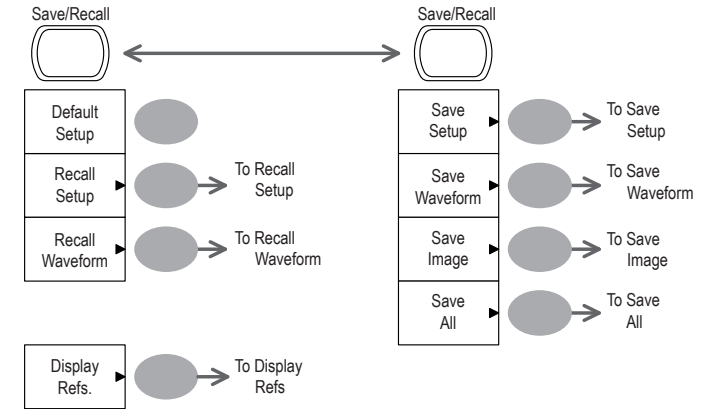
Switch to Save or Recall menu   Save/Recall ⇄

Recall default setup   Default Setup

Save/Recall key 2/9

Recall Setup

| Recall Setup ▶ | ⟷ | Select other menu   Recall Setup ⇄ |
| Source Memory | Memory/SD Card | Select setup source   Source ⇄ VAR ◯ |

| Recall | | Recall setup   Recall |
| File Utilities | (SD Card only) To File Utilities | Go to SD card file utilities   File Utilities |

Save/Recall key 3/9

Recall Waveform

Recall Waveform ▶	⬭ ⟷	Select other menu Recall Waveform ⇄
Source Memory	⬭— Memory/SD Card	Select waveform source Source ⇄ VAR ◯
Destination	⬭— RefA/B	Select waveform destination Destination VAR ◯
Recall	⬭	Recall waveform Recall
File Utilities	⬭→ (SD Card only) To File Utilities	Go to SD card file utilities File Utilities

Save/Recall key 4/9

Display Refs.

Display Refs. ▶	⬭ ⟷	Select other menu Display Refs. ⇄
Ref.A Off	⬭— On/ Off	Turn ref. waveform A on/off Ref.A ⇄
Ref.B Off	⬭— On/ Off	Turn ref. waveform B on/off Ref.B ⇄

Save

This section describes how to save data using the Save/Recall menu.

File type/source/destination

Item	Source	Destination
Panel setup (xxxx.set)	• Panel settings	• Internal memory: S1 ~ S15 • External memory: SD card
Waveform data (xxxx.csv)	• Channel 1, 2 • Math operation result • Reference waveform A, B	• Internal memory: W1 ~ W15 • Reference waveform A, B • External memory: SD card
Display image (xxxx.bmp)	• Display image	• External memory: SD card
Save All	• Display image (xxxx.bmp) • Waveform data (xxxx.csv) • Panel settings (xxxx.set)	• External memory: SD card
SD Card restriction	The GDS-1000A series accepts the following SD card. Size: 2GB or less Format: FAT or FAT32	

Saving the panel settings
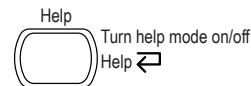
Procedure	1. (For saving to an external SD card) Insert the card into the slot.	
	2. Press the Save/Recall key twice to access the Save menu.	Save/Recall Save/Recall
	3. Press *Save Setup*.	Save Setup ▶
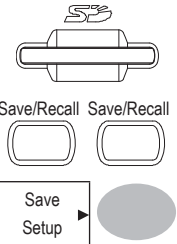
2. Press the Utility key.

Utility

3. Press *Hardcopy* Menu.

Hardcopy ▶
Menu

4. Press *Function* repeatedly to select *Save Image* or *Save All*.

Function
Save All

5. To invert the color in the display image, press *Ink Saver*. This turns *Ink Saver* on or off.

Ink Saver
- - - - - - -
Off

6. Press *Mem Leng* repeatedly to select SD *Normal* or SD *1M/2M*. SD Normal and SD 1M/2M sets the waveforms to a 4k and 1M/2M memory length when saving, respectively.

Mem Leng
- - - - - - -
SD Normal
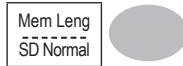
   1M memory length is available when both CH1 and CH2 are active; 2M memory length is available when a single channel is active only.

7. Press the Hardcopy key. The file or folder will be saved to the root directory of the SD card.

Hardcopy

Save/Recall key 5/9

Save Setup		Select other menu

Save Setup ▶

Save Setup ⇄
Select destination

Destination Memory → Memory/SD card

Destination ⇄ VAR ○
Save setup

Save

Save
Go to SD card file utilities

File Utilities → (SD Card only) To File Utilities

File Utilities

Save/Recall key 6/9
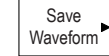
Save Waveform		Select other menu

Save Waveform ▶

Save Waveform ⇄
Select source

Source → CH1/2Math Ref A/B

Source ⇄ VAR ○
Select destination

Destination Memory → Memory SD Normal/SD 1M SD 2M/Refs.
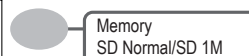
Destination ⇄ VAR ○
Save waveform

Save

Save
Go to SD card file utilities
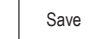
File Utilities → (SD Card only) To File Utilities

File Utilities

Save/Recall key 7/9

Save Setup

| Save Setup ▶ | ⬭ | ⟷ | ⟶ | Select other menu |

Save Image ⏎
Turn on/off ink saver

Ink Saver ⏎
Save image

Save
Go to SD card file utilities

File Utilities

Destination Memory	⬭ — Memory/SD card
Save	⬭
File Utilities	⬭ ⟶ (SD Card only) To File Utilities

Save/Recall key 8/9

Save All

| Save Image ▶ | ⬭ | ⟷ | Select other menu |

Save All ⏎
Turn on/off ink saver

Ink Saver ⏎
Select destination

Destination ⏎ VAR ◯
Save all

Save
Go to SD card file utilities

File Utilities

Ink Saver Off	⬭ — On / Off
Destination SD Normal	⬭ — SD Normal / SD 1M
Save	⬭
File Utilities	⬭ ⟶ (SD Card only) To File Utilities

---

3. When editing is completed, press Save. The file/folder creation or rename will be completed.

| Save | ⬭ |

Deleting a folder or file

1. Move the cursor to the folder or file location and press *Delete*. The message *"Press F4 again to confirm this process"* appears at the bottom of the display.

| Delete | ⬭ |

2. If the file/folder still needs to be deleted, press *Delete* again to complete the deletion. To cancel the deletion, press any other key.

| Delete | ⬭ |
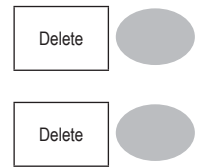
Quick Save (HardCopy)

Background   The Hardcopy key works as a shortcut for saving display images, waveform data, and panel settings into an SD card.

[Hardcopy]

Hardcopy key can be configured into two types of operations: save image and save all (image, waveform, setup).

Using the Save/Recall key can also save files with more options. For details, see page 85.

[Save/Recall]

Functionalities

| Save image (*.bmp) | Saves the current display image into an SD card. |
| Save all | Saves the following items into an SD card. |

- Current display image (*.bmp)
- Current system settings (*.set)
- Current waveform data (*.csv)
- Last stored system settings (*.set)
- Last stored waveform data (*.csv)

SD Card restriction   The GDS-1000A series accepts the following SD card.
Size: 2GB or less   Format: FAT or FAT32

Procedure   1. Insert an SD card to the slot.

Save
Image ▶ ⬭

Destination
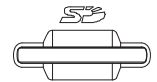
SD Card

3. Press *File Utilities*. The display shows the
   SD card contents.

File
Utilities ⬭

4. Use the Variable knob to move the cursor.
   Press *Select* to go into the folder or go back
   to the previous directory level.

VARIABLE

Select ⬭
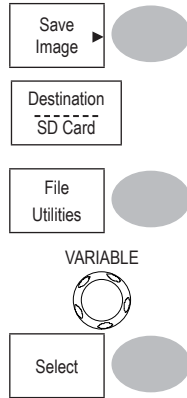
SD card indicator	When an SD card is inserted into the oscilloscope, an indicator appears at the right bottom corner of the display. (The SD card shouldn't be removed when a file is saved or retrieved from the SD card).

SD card
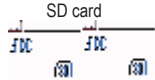
Creating a new folder / renaming a file or folder	1. Move the cursor to the file or folder location and press *New Folder* or *Rename*. The file/folder name and the character map will appear on the display.

New
Folder ⬭

Rename ⬭

2. Use the Variable knob to move the pointer
   to the characters. Press *Enter* Character to
   add a character or *Back Space* to delete a
   character.

VARIABLE

Enter
Character ⬭

Back
Space ⬭

Save/Recall key 9/9

File Utilities				Select file / folder

Select ⬭

Entcr
Character ⬭

VAR ⟳ Select

Create or rename folder/file

New
Folder ⬭

Back
Space ⬭

New Folder/Rename

Rename ⬭

VAR ⟳ Enter character / Backspace /

Delete ⬭

Save ⬭

Save / Previous menu

Delete folder/file

Previous
Menu ⬭

Previous
Menu ⬭

Delete

Go to previous menu

Previous menu

Trigger key 1/6

Trigger Type	Trigger Holdoff	Select Trigger type or Trigger

MENU ⟷ MENU

Holdoff menu

Type
Edge ▶

Holdoff
40.0ns

Type ⤶

Source
CH1

Set to
Minimum

Slope /
Coupling ▶

Mode

Auto

Trigger key 2/6

Video Trigger

Save Image	⬤ ⟷
Source CH1	⬤ — CH1/2
Standard NTSC	⬤ — NTSC/SECAM/PAL
Polarity ⎍	⬤ — ⎍ / ⎍
Line	⬤ — Field1/Field2/Line

Select video trigger type

Type ⮌
Select trigger source

Source ⮌
Select video standard

Standard ⮌
Select video polarity

Polarity ⮌
Select video field/line

Line ⮌   VAR ⟳

Trigger key 3/6

Edge Trigger

Type Edge	⬤ ⟷
Source CH1	⬤ — CH1/2Ext/Line

Select edge trigger type

Edge ⮌
Select trigger source

Source ⮌

Slope / Coupling	⬤ → To Slope / Coupling
Mode Auto	⬤ — Auto / Normal

Slope/Coupling
Select trigger mode

Mode ⮌

Setup file format

Format	xxxx.set (proprietary format)		
	A setup file saves or recalls the following settings.		
Contents	Acquire	• mode	
	Cursor	• source channel	• cursor on/off
		• cursor location	
	Display	• dots/vectors	• accumulation on/off
		• grid type	
	Measure	• item	
	Utility	• hardcopy type	• ink saver on/off
		• language	
	Horizontal	• display mode	• scale
		• position	
	Trigger	• trigger type	• source channel
		• trigger mode	• video standard
		• video polarity	• video line
		• pulse timing	• slope/coupling
	Channel (vertical)	• vertical scale	• vertical position
		• coupling mode	• invert on/off
		• bandwidth limit on/off	• probe
	Math	• operation type	• source channel
		• vertical position	• unit/div
		• FFT window	

Using the SD card file utilities

Background	When an SD card is inserted into the oscilloscope, files utilities (file deletion, folder creation and file/folder renaming) are available from the front panel.
SD Card restriction	The GDS-1000A series accepts the following SD card. Size: 2GB or less Format: FAT or FAT32
Procedure	1. Insert an SD card into the card slot. 2. Press the Save/Recall key. Select any save or recall function. For example SD card destination in the Save image function.
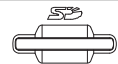
Save/Recall

(Example)

Waveform data format	One division includes 25 points of horizontal and vertical data. The vertical point starts from the center line. The horizontal point starts from the leftmost waveform.	
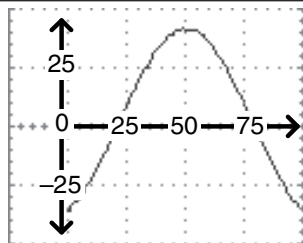
The time or amplitude represented by each data point depends on the vertical and horizontal scale. For example:
Vertical scale: 10mV/div (4mV per point)
Horizontal scale: 100us/div (4us per point)

Waveform Memory Depth	The memory depth is limited to 1 M points when both channels are activated or 2M points when only a single channel is activated. However the full memory depth is only available after a signal is triggered and the STOP or Single key has been pressed. There are a number of conditions when all of the available memory is not utilized due to a limited number of different sample rates. This can be caused by an un-triggered signal, or a time/div setting that is too fast to display all the points on screen. Note: 2M point memory lengths are only available for time bases slower than 10ns/div on a single channel, and 1 M point memory lengths are only available for time bases slower than 25ns/div on two channels. When the scope is running the number of points displayed on screen is limited to 4000. Equivalent time sampling is always limited to 4000 points on screen at any one time.
Waveform file contents: other data	A waveform file also includes the following information. • Memory length • trigger level • source channel • vertical position • vertical offset • time base • vertical scale • probe attenuation • coupling mode • horizontal view • waveform last dot address • horizontal scale • date and time • sampling period • sampling mode

Trigger key 4/6

Pulse Trigger

Type Pules		
Source CH1		CH1/2/Ext/Line
When < 20.0ns		>/</=/≠ 20ns~10s
Slope / Coupling		To Slope / Coupling
Mode Auto		Auto / Normal

Select pulse trigger type

Type ⇄

Select trigger source

Source ⇄

Select pulse trigger condition and pulse width

When ⇄   VAR ⟳

Go to slope/coupling menu (page 73)

Slope/Coupling

Select trigger mode

Mode ⇄

Trigger key 5/6

Coupling/Slope

Slope		⌐ / ¬
Coupling AC		AC/DC
Rejection Off		LF/HF/Off
Noise Rej Off		On/Off
Previous Menu		

Select trigger slope type

Slope ⇄

Select trigger coupling mode

Coupling ⇄

Select frequency rejection

Rejection ⇄

Turn noise rejection on/off

Noise Rej ⇄

Go back to previous menu

Previous Menu

Trigger key 6/6

Trigger Holdoff
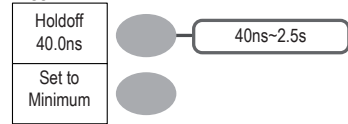
Holdoff 40.0ns	○	40ns~2.5s	Select Holdoff time
Set to Minimum	○		VAR ↻
			Set to minimum Holdoff time
			Set to Minimum ⏎

Utility key 1/4

Utility
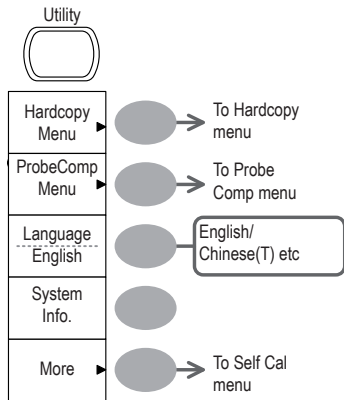
Hardcopy Menu ▶	○ →	To Hardcopy menu	Go to hardcopy menu
			Hardcopy
			Go to probe compensation menu
ProbeComp Menu ▶	○	To Probe Comp menu	ProbeComp
			Select language
Language English	○	English/ Chinese(T) etc	Language ⏎
			Show system information
System Info.	○		System Info.
			Go to self calibration menu
More ▶	○ →	To Self Cal menu	More

Utility key 2/4

Calibration
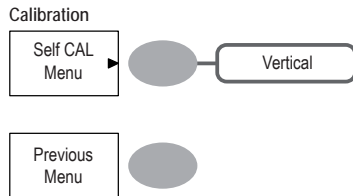
Self CAL Menu ▶	○ →	Vertical	Enter self calibration
			Self CAL
			Go to previous menu
Previous Menu	○		Previous Menu

7. SAVE/RECALL

The save function allows saving display images, waveform data, and panel settings into the oscilloscope's internal memory or an external SD card. The recall function allows recalling the default factory settings, waveform data, and panel settings from the oscilloscope's internal memory or an external SD card.

File Structures

Three types of file are available: display image, waveform file, and panel settings.

Display image file format

Format	xxxx.bmp (Windows bitmap format)
Contents	The current display image in 234 x 320 pixels, color mode. The background color can be inverted (Ink saver function).

Waveform file format

Format		xxxx.csv (Comma-separated values format which can be opened in spreadsheet applications such as Microsoft Excel)
Waveform type	CH1, 2	Input channel signal
	Math	Math operation result (page 85)
Storage location	Internal memory	The oscilloscope's internal memory, which can hold 15 waveforms.
	External SD card	An SD card (SD 2G or less, FAT or FAT32 format) can hold practically an unlimited number of waveforms.
	Ref A, B	Two reference waveforms are used as a buffer to recall a waveform in the display. You have to save a waveform into internal memory or an SD card, then copy the waveform into the reference waveform slot (A or B), and then recall the reference waveform into the display.

System Settings

The system settings show the oscilloscope's system information and allow changing the language.

Viewing the system information

Procedure	1. Press the Utility key.

Utility

In the Single trigger mode	2. Press System Info. The upper half of the display shows the following information. • Manufacturer • Model • Serial number • Firmware version

System Info.

3. Press any other key to go back to the waveform display mode.

More

Selecting the language

Parameter	Language selection differs according to the region to which the oscilloscope is shipped. • English • Chinese (traditional) • Chinese (simplified) • Others
Procedure	1. Press the Utility key.

Utility

2. Press *Language* repeatedly to select the language.

Language
English

Utility key 3/4

Hardcopy

Function Save All	Save Image SaveAll
Ink Saver Off	On / Off
Mem Leng SD Normal	SD Normal SD 1M
Previous Menu	
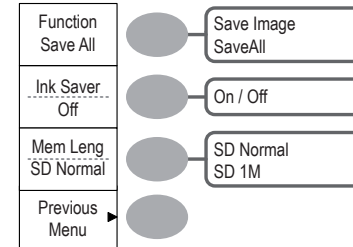
Select Hardcopy function

Function ⇄
Turn on/off Inksaver

Ink Saver ⇄
Set the memory length

Mem Leng ⇄
Go to previous menu

Previous Menu ⇄

Utility key 4/4

Probe compensation

Wave Type	ЛЛ / ЛЛ
Frequency 1K	(ЛЛ only) 1k ~ 100k
Duty Cycle 50%	(ЛЛ only) 5% ~ 95%
Default 1kHz	
Previous Menu	
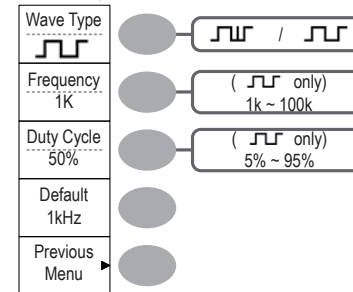
Select probe compensation signal

Wave Type ⇄
Set frequency for square wave

Frequency VAR ◯
Set duty cycle for square wave

Duty Cycle VAR ◯
Go to previous menu

Previous Menu

Default Settings

Here are the factory installed panel settings which appear when pressing the Save/Recall key *Default Setup*.

Save/Recall

⬭ → Default Setup

Acquisition	Mode: Normal	
Channel	Scale: 2V/Div	Invert: Off
	Coupling: DC	Probe attenuation voltage: x1
	BW limit: Off	Channel 1 & 2: On
Cursor	Source: CH1	Cursor: Off
Display	Type: Vectors	Accumulate: Off
	Grid:	
Horizontal	Scale: 2.5us/Div	Mode: Main Timebase
Math	Type: + (Add)	Position: 0.00 Div
Measure	Item: Vpp, Vavg, Frequency, Duty Cycle, Rise Time	
Trigger	Type: Edge	Source: Channel1
	Mode: Auto	Slope:
	Coupling: DC	Rejection: Off
	Noise Rejection: Off	
Utility	Hardcopy: SaveImage, InkSaver Off	ProbeComp: Square wave, 1k, 50% duty cycle

Remote Control Interface

The Remote control interface section describes how to set up the USB interface for PC connection. The details of remote control commands are described in the GDS-1000A Programming Manual.

USB connection	PC side	Type A, host
	GDS-1000A side	Type B, slave
	Speed	1.1/2.0 (full speed)
Procedure	1. Connect the USB cable to the USB slave port.	

2. When the PC asks for the USB driver, select dso_cdc_1000.inf (Windows XP) or dso_vista_cdc.inf (Vista 32bit) which are downloadable from the GW website, www.gwinstek.com.tw, GDS-1000A product corner.

3. On the PC, activate a terminal application such as MTTTY (Multi-Threaded TTY). To check the COM port No., see the Device Manager in the PC. For WindowsXP, select Control panel　System　Hardware tab.

4. Run this query command via the terminal application.
*idn?
This command should return the manufacturer, model number, serial number, and firmware version in the following format.
GW, GDS-1152A, XXXXXXX, V1.00

5. Configuring the command interface is completed. Refer to the programming manual for the remote commands and other details.

Manually triggering the signal

Note	This section describes how to manually trigger the input signals when the oscilloscope does not capture them. This section applies to the Normal and Single trigger mode, since in the Auto trigger mode, the oscilloscope keeps updating the input signal regardless of the trigger conditions.	
To acquire the signal regarless of trigger conditions	To acquire the input signal regardless of the trigger condition, press the Force key. The oscilloscope captures the signals once.	FORCE
In the Single trigger mode	Press the Single key to start waiting for the trigger condition. To break out of the Single mode, press the Run/Stop key. The trigger mode changes to the Normal mode.	SINGLE Run/Stop

Built-in Help

The Help key shows the contents of the built-in help support. When you press a function key, its descriptions appear in the display.

Help

Applicable keys

Acquire Display Utility Help Autoset

Cursor Measure Save/Recall Hardcopy Run/Stop

(Vertical) (Horizontal) (Trigger)

CH 1 MATH CH 2 MENU MENU

SINGLE

FORCE
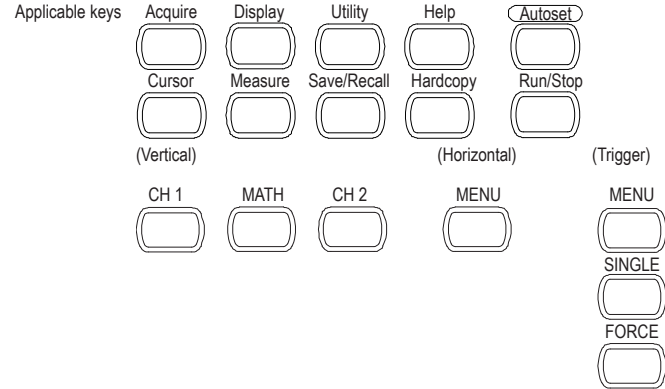
Procedure

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

   Help

2. Press a functional key to access its help contents. (example: Acquire key)

   Acquire

3. Use the Variable knob to scroll the Help contents up and down.

   VARIABLE

4. Press the Help key again to exit the Help mode.

   Help

5. MEASUREMENT

The Measurement chapter describes how to properly observe a signal using the oscilloscope's basic functions, and how to observe a signal in a detailed manner using some of the advanced functions such as :

Automatic measurements, cursor measurements, and math operations.

Basic Measurements

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

Activating a channel

Activating a channel	To activate an input channel, press the Channel key, CH1 or CH2. The channel indicator appears at the left side of the display and the channel icon changes accordingly.

CH 1   CH 2
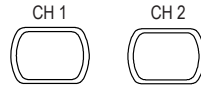
3. Press *Source* repeatedly to select the trigger source.
Range   Channel 1, 2, Ext

> Source
> CH1

4. Press *Mode* repeatedly to select the trigger mode, Auto or Normal. To select the Single trigger mode, press the Single key.
Range   Auto, Normal

> Mode
> Auto

SINGLE
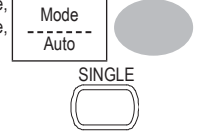
5. Press *When* repeatedly to select the pulse condition. Then use the Variable knob to set the pulse width.

Condition > , < , = , ≠
Width   20ns ~ 10s

> When <
> 20.0ns

VARIABLE

6. Press *Slope/Coupling* to set trigger slope and coupling.

> Slope /
> Coupling ▶

7. Press *Slope* repeatedly to select the trigger slope, which also appears at the bottom of the display.
Range   Rising edge, falling edge

> Slope

8. Press Coupling repeatedly to select the trigger coupling.
Range   DC, AC

> Coupling
> AC

9. Press Rejection to select the frequency rejection mode.
Range   LF, HF, Off

> Rejection
> Off

10. Press Noise Rej to turn the noise rejection on or off.
Range   On, Off

> Noise Rej
> Off

11. Press Previous menu to go back to the previous menu.

> Previous
> Menu

Configuring the video trigger

Procedure
1. Press the Trigger menu key.

MENU

2. Press *Type* repeatedly to select video trigger. The video trigger indicator appears at the bottom of the display.

Type
Video
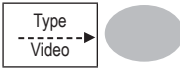
3. Press *Source* repeatedly to select the trigger source channel.
   Range   Channel 1, 2,

Source
CH1

4. Press *Standard* repeatedly to select the video standard.
   Range   NTSC, PAL, SECAM

Standard
NTSC

5. Press *Polarity* repeatedly to select the video signal polarity.
   Range   positive, negative

Polarity

Line

6. Press *Line* repeatedly to select the video field line. Use the Variable knob to select the video line.

VARIABLE

Field	1, 2
Video line	NTSC: 1 ~ 262 (Even), 1 ~ 263 (Odd)
	PAL/SECAM: 1 ~ 312 (Even),
	1 ~ 313 (Odd)

Configuring the pulse width trigger

Procedure
1. Press the Trigger menu key.

MENU

2. Press *Type* repeatedly to select pulse width trigger. The pulse width trigger indicator appears at the bottom of the display.

Type
Pulse
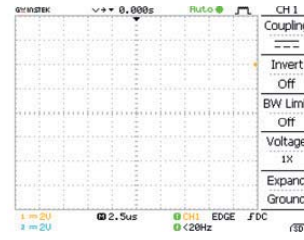
Channel 1 off   Channel 1 on

Channel indicator

Channel icon
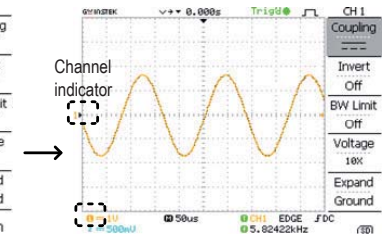
De-activating a channel   To de-activate the channel, press the Channel key twice (once if the channel menu is already selected).

Using Autoset

Background   The Autoset function automatically configures the panel settings to the best viewing conditions, in the following way.
- Selecting the horizontal scale
- Positioning the waveform horizontally
- Selecting the vertical scale
- Positioning the waveform vertically
- Selecting the trigger source channel
- Activating the channels

Procedure
1. Connect the input signal to the oscilloscope and press the Autoset key.

Autoset

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

Before Autoset   After Auoset

Undo option
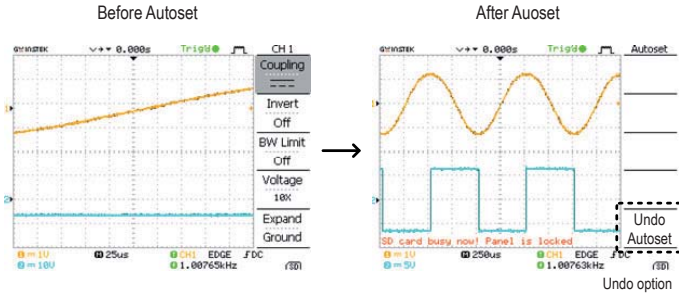
Undoing the Autoset	To undo the Autoset, press *Undo* (available for a few seconds).	Undo
Adjusting the trigger level	If the waveform is still unstable, try adjusting the trigger level up or down by using the Trigger Level knob.	LEVEL
Limitation	Autoset does not work in the following situation. • Input signal frequency less than 20Hz • Input signal amplitude less than 30mV	

Running and stopping the trigger

| Background | In the trigger Run mode, the oscilloscope constantly searches for a trigger condition and updates the signal into the display when the condition is met.
In the trigger Stop mode, the oscilloscope stops triggering and thus the last acquired waveforms stay in the display. The trigger icon at the top of the display changes into Stop mode.
When the scope is running the number of points displayed on screen is limited to 4000. Equivalent time sampling is always limited to 4000 points on screen at any one time. |

Configuring the edge trigger

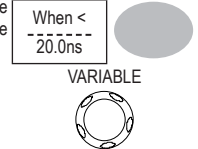| Procedure | 1. Press the Trigger menu key. | MENU |
	2. Press *Type* repeatedly to select edge trigger.	Type / Edge
	3. Press *Source* repeatedly to select the trigger source. Range Channel 1, 2, Line, Ext	Source / CH1
	4. Press *Mode* repeatedly to select the Auto or Normal trigger mode. To select the single trigger mode, press the Single key. Range Auto, Normal	Mode / Auto SINGLE
	5. Press *Slope/coupling* to enter into the trigger slope and coupling selection menu.	Slope / Coupling
	6. Press *Slope* repeatedly to select the trigger slope, rising or falling edge. Range Rising edge, falling edge	Slope
	7. Press *Coupling* repeatedly to select the trigger coupling, DC or AC. Range DC, AC	Coupling / AC
	8. Press *Rejection* to select thefrequency rejection mode. Range LF, HF, Off	Rejection / Off
	9. Press *Noise Rej* to turn the noise rejection on or off. Range On, Off	Noise Rej / Off
	10. Press *Previous* menu to go back to the previous menu.	Previous Menu
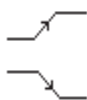
Trigger slope		Triggers on the rising edge.
		Triggers on the falling edge.
Trigger coupling	AC	Triggers only on AC component.
	DC	Triggers on AC+DC component.
Frequency rejection	LF	Puts a high-pass filter and rejects the frequency below 50kHz.
	HF	Puts a low-pass filter and rejects the frequency above 50kHz.
Noise rejection		Rejects noise signals.
Trigger level	LEVEL	Using the trigger level knob moves the trigger point up or down.

Configuring Holdoff

Background	Holdoff function defines the waiting period before GDS-1000A starts triggering again after a trigger point. The holdoff function is especially useful for waveforms with two or more repetitive frequencies or periods that can be triggered.
Panel operation	1. Press the Trigger menu key twice. MENU MENU 2. To set the Holdoff time, use the Variable knob. The resolution depends on the horizontal scale. Range 40ns~2.5s VARIABLE Short Long Pressing *Set to Minimum* sets the Holdoff time to the minimum, 40ns. Holdoff 40.0ns
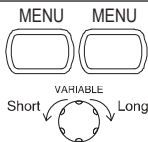
⚠ Note: The holdoff function is automatically disabled when the waveform update mode is in Roll mode.

Pressing the Trigger Run/Stop key switches between the Run and Stop mode.

Run/Stop

Trigger Run mode — Auto or Trig icon

Trigger Stop mode — Stop icon
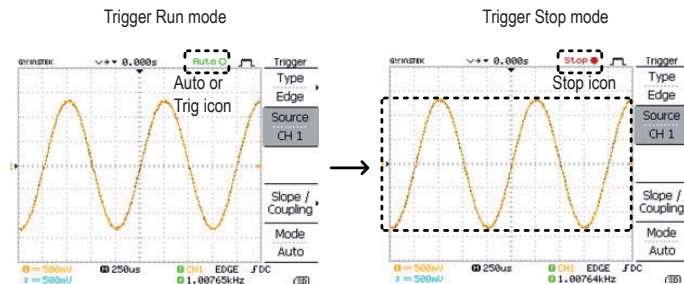
Waveform operation	Waveforms can be moved or scaled in both the Run and Stop mode. For details, see page 61 (Horizontal position/scale) and page 65 (Vertical position/scale).

Changing the horizontal position and scale

For more detailed configurations, see page 61.

Setting the horizontal position	The horizontal position knob moves the waveform left or right. The position indicator moves along with the waveform and the distance from the center point is displayed as the offset in the upper side of the display.
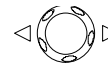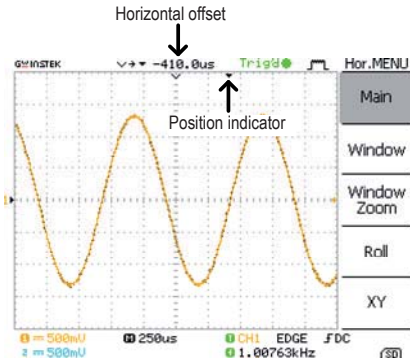
Horizontal offset

Position indicator

| Selecting the horizontal scale | To select the timebase (scale), turn the TIME/DIV knob; left (slow) or right (fast). | TIME/DIV |

Range — 1ns/Div ~ 10s/Div, 1-2.5-5 increment

Horizontal scale: 50us/div   ←→   Horizontal scale: 250us/div
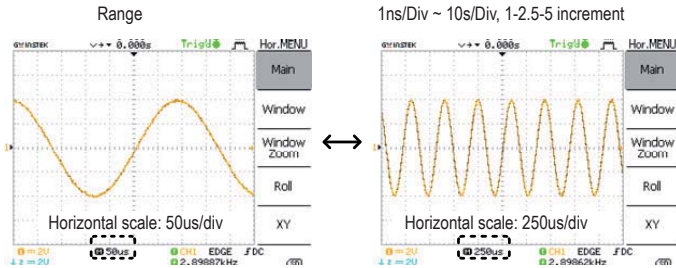
Changing the vertical position and scale

For more detailed configuration, see page 65.

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

The Auto trigger status appears in the upper right corner of the display.
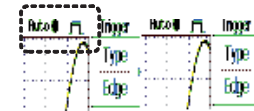
| Single | The oscilloscope acquires the input signals once when a trigger event occurs, then stops acquiring. | SINGLE |

Pressing the Single key triggers on the input signals again. The Single trigger status appears in the upper right corner of the display.
(Searching)   (Triggered)

| Normal | The oscilloscope acquires and updates the input signals only when a trigger event occurs. |

The Normal trigger status appears in the upper right corner of the display.
(Searching)   (Triggered)

| Holdoff | The holdoff function defines the waiting period before GDS-1000A starts triggering again after a trigger point. The Holdoff function ensures a stable display. |

Video standard (video trigger)	NTSC	National Television System Committee
	PAL	Phase Alternative by Line
	SECAM	SEquential Couleur A Mémoire

| Sync polarity (video trigger) | | Positive polarity |
| | | Negative polarity |

Video line (video trigger)		Selects the trigger point in the video signal.
		field 1 or 2
	line	1~263 for NTSC, 1~313 for PAL/SECAM

Pulse condition (pulse trigger)	Sets the pulse width (20ns ~ 10s) and the triggering condition.
	> Longer than = Equal to
	< Shorter than ≠ Not equal to

Trigger

The Trigger function configures the conditions by which the oscilloscope captures the incoming signals.

Trigger type

Edge	Triggers when the signal crosses an amplitude threshold in either positive or negative slope.
Video	Extracts a sync pulse from a video format signal and triggers on a specific line or field.
Pulse	Triggers when the pulse width of the signal matches the trigger settings.

Indicators	Edge/Pulse	Video
	(CH1, Edge, Rising edge, standard) DC coupling)	(CH1, Video, Positive polarity, NTSC

Trigger parameter

Trigger source	CH1, 2	Channel 1, 2 input signals
	Line	AC mains signal
	Ext	External trigger input signal

EXT TRIG

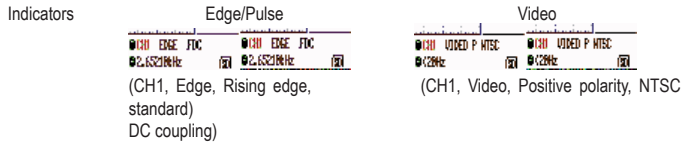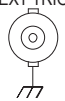| Trigger mode	Auto	The oscilloscope updates the input signal regardless of the trigger conditions (if there is no trigger event, the oscilloscope generates an internal trigger). Select this mode especially when viewing rolling waveforms at a slow timebase.

As the waveform moves, the vertical position of the cursor appears at the bottom left corner of 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 VOLTS/DIV knob; left (down) or right (up).	VOLTS/DIV
	Range	2mV/Div ~ 10V/Div, 1-2-5 increments

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

	Stop mode	In Stop mode, the vertical scale setting can be changed but the waveform shape stays the same.

Using the probe compensation signal

Background	This section introduces how to use the probe compensation signal for general usage, in case the DUT signal is not available or to get a second signal for comparison. For probe compensation details, see page 96.	

Note that the frequency accuracy and duty factor are not guaranteed. Therefore the signal should not be used for reference purpose.

Waveform type		Square waveform used for probe compensation. 1k ~ 100kHz, 5% ~ 95%.
		Demonstration signal for showing the effects of peak detection.
View the probe compensation	1. Connect the probe between the compensation signal output and Channel input.	

Waveform

2. Press the Utility key.
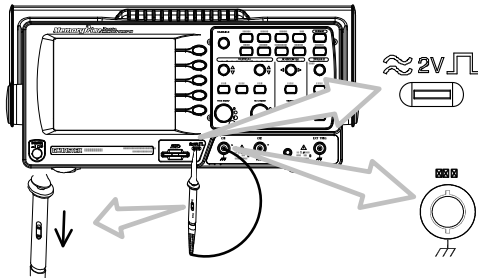
Utility

3. Press *ProbeComp*.

ProbeComp
Menu ▶
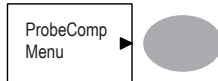
4. Press Wave type repeatedly to select the wave type.

Wave Type

5. (For ⎍ only) To change the frequency, press Frequency and use the Variable knob.

    Range   1kHz ~ 100kHz

Frequency
1 K
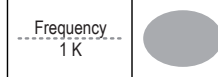
VARIABLE

6. (For ⎍ only) To change the duty cycle, press Duty Cycle and use the Variable knob.

    Range   5% ~ 95%

Duty Cycle
50%

VARIABLE

Probe compensation   For probe compensation details, see page 96.

---
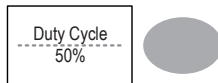
3. Use the variable knob to edit the voltage or current attenuation.

VARIABLE

4. The voltage scale in the channel indicator changes accordingly. There is no change in the waveform shape.

Range   x1, x10, x100

Note   The attenuation factor adds no influence on the real signal; it only changes the voltage scale on the display.

Limiting the waveform bandwidth

Background	Bandwidth limitation puts the input signal into a 20MHz (3dB) low-pass filter. This function is useful for cutting off high frequency noise to see the clear waveform shape.
Procedure	1. Press the Channel key. CH1
	2. Press *BW Limit* to turn on or off the limitation. When turned on, the BW indicator appears next to the Channel indicator in the display.
Example	BW Limit Off BW Limit On

BW Limit
Off
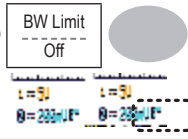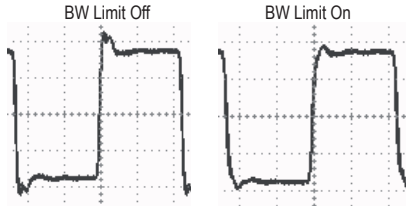
Selecting the probe attenuation level

Background	A signal 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, not the attenuated level.
Procedure	1. Press the Channel key. CH1
	2. Press the Probe repeatedly to select the attenuation level.

Probe
x1

Automatic Measurements

Automatic measurement function measures input signal attributes and updates them in the display. Up to 5 automatic measurement items can be updated at any one time on the side menus. All automatic measurement types can be displayed on screen if necessary.

Measurement items

Overview	Voltage type		Time type		Delay type	
	Vpp		Frequency		FRR	
	Vmax		Period		FRF	
	Vmin		RiseTime		FFR	
	Vamp		FallTime		FFF	
	Vhi		+Width		LRR	
	Vlo		-Width		LRF	
	Vavg		Dutycycle		LFR	
	Vrms				LFF	
	ROVShoot					
	FOVShoot					
	RPREShoot					
	FPREShoot					

Voltage measurement items		
Vpp		Difference between positive and negative peak voltage (=Vmax Vmin)
Vmax		Positive peak voltage.
Vmin		Negative peak voltage.
Vamp		Difference between global high and global low voltage (=Vhi Vlo)
Vhi		Global high voltage.

	Vlo		Global low voltage.
	Vavg		Averaged voltage of the first cycle.
	Vrms		RMS (root mean square) voltage.
	ROVShoot		Rise overshoot voltage.
	FOVShoot		Fall overshoot voltage.
	RPREShoot		Rise preshoot voltage.
	FPREShoot		Fall preshoot voltage.
Time measurement items	Freq		Frequency of the waveform.
	Period		Waveform cycle time (=1/Freq).
	Risetime		Rising time of the pulse (~90%).
	Falltime		Falling time of the pulse (~10%).
	+Width		Positive pulse width.
	−Width		Negative pulse width.
	Duty Cycle		Ratio of signal pulse compared with whole cycle =100x (Pulse Width/Cycle)
Delay measurement items	FRR		Time between: Source 1 first rising edge and Source 2 first rising edge

1. Press the Channel key.

CH1

2. Press F5 to toggle between Expand Center and Expand Ground.

Expand
Center

3. To change the vertical scale, turn the VOLTS/DIV knob; left (down) or right (up).

VOLTS/DIV
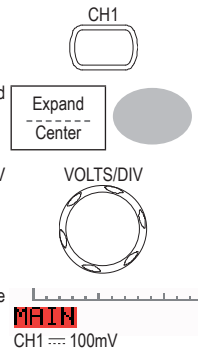
The vertical scale indicator on the bottom left of the display changes accordingly.

MAIN
CH1 ⎓ 100mV

Inverting the waveform vertically

Procedure
1. Press the Channel key.

CH1

2. Press *Invert*. The waveform becomes inverted (upside down) and the Channel indicator in the display shows a down arrow.

Invert
Off

Original   Inverted
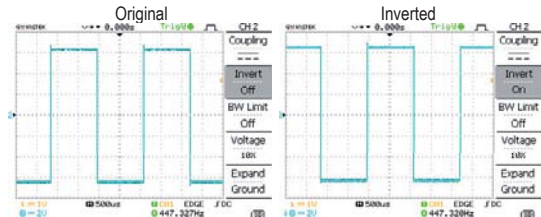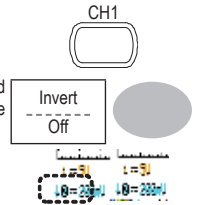
2. Press *Coupling* repeatedly to select the coupling mode.

Coupling
∿

Range		
‒ ‒ ‒ ‒		DC coupling mode. The whole portion (AC and DC) of the signal appears on the display.
⏚		Ground coupling mode. The display shows only the zero voltage level as a horizontal line. This mode is useful for measuring the signal amplitude with respect to the ground level.
∿		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 signal.

Expand Vertical Scale Centre / Ground

Background   Normally when the vertical scale is increased, the scaled image is centered from ground. However a signal with a voltage bias could be obscured when the vertical scale is increased. The Expand Center function expands the image from the center of the signal, rather than ground.
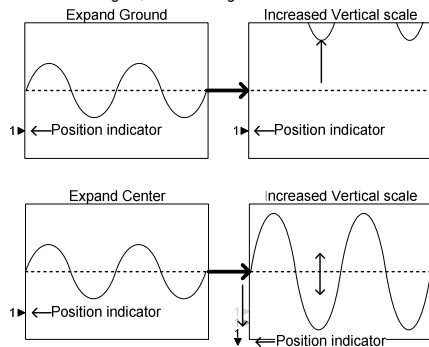

Expand Ground   Increased Vertical scale

1► ←Position indicator   1► ←Position indicator

Expand Center   Increased Vertical scale

1► ←Position indicator   1► ←Position indicator

| 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
LRF		Time between: Source 1 first rising edge and Source 2 last falling edge
LFR		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

Automatically measuring the input signals

Viewing the measurement result
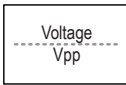
1. Press the Measure key.

Measure

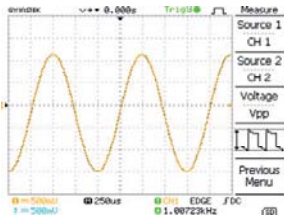2. The measurement results appear on the menu bar, constantly updated. 5 measurement slots (F1 to F5) can be customized.
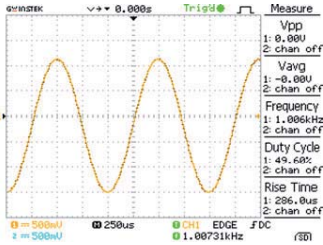
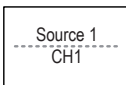| Editing a measurement item	3. Press the corresponding menu key (*F1~F5*) to select the measurement slot to be edited.	Voltage Vpp
	4. The editing menu appears.	
Change measurement item	5. Use the Variable knob to select a different measurement item.	VARIABLE
Change measurement source	6. Press *F1* repeatedly to change Source1 from CH1 to CH2 or MATH. Range CH1, 2, Math	Source 1 CH1
	7. Press *F2* repeatedly to change the channel for Source2. Range CH1, 2, Math	Source 2 CH2

Example

Main mode → XY mode
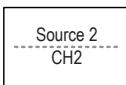
XY mode
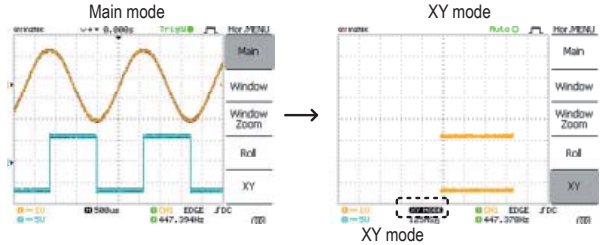
Vertical View (Channel)

The Vertical view section describes how to set the vertical scale, position, bandwidth limitation, coupling mode, and attenuation.

Moving the waveform position vertically

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

Selecting the vertical scale

Procedure	To change the vertical scale, turn the VOLTS/DIV knob; left (down) or right (up).	VOLTS/DIV
Range	2mV/Div ~ 10V/Div, 1-2-5 increments	

Selecting the coupling mode

Procedure	1. Press the Channel key.	CH 1

Example

Setting the zoom width   Zooming in

Zooming width

Viewing waveforms in the X-Y mode

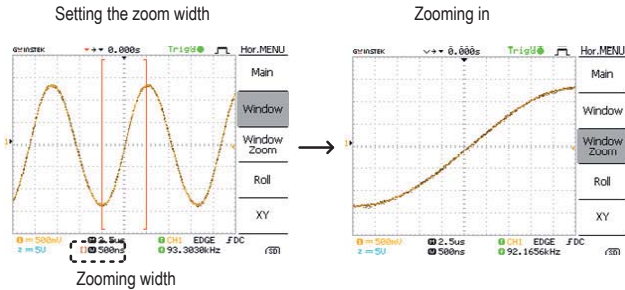| Background	The X-Y mode compares the voltage of Channel 1 and Channel 2 waveforms in a single display. This mode is useful for observing the phase relationship between the two waveforms.
Procedure	1. Connect the signals to Channel 1 (X-axis) and Channel 2 (Y-axis).
	2. Make sure both Channel 1 and 2 are activated.
	3. Press the Horizontal key.
	4. Press XY. The display shows two waveforms in XY format; Channel 1 as X axis, Channel 2 as Y-axis.
Adjusting the X-Y mode waveform	Horizontal position CH1 Position knob Horizontal scale CH1 Volts/Div knob Vertical position CH2 Position knob Vertical scale CH2 Volts/Div knob

CH1   CH2

MENU

XY

View all measurements	8. Press *F3* to view all measurement items.

Voltage
Vpp
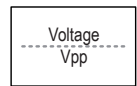
9. All the measurements appear in the center of the screen.
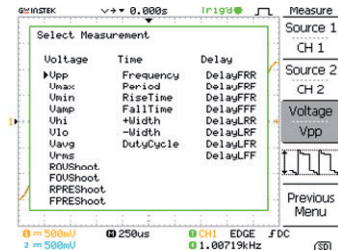
10. Press *F3* to return.

Note	All the editing operations can still be performed when viewing all the measurement items.

11. Press Previous Menu to confirm the item selection and to go back to the measurement results view.

Previous
Menu

Cursor Measurements

Cursor lines, horizontal or vertical, show the precise position of the input waveforms or the math operation results. The horizontal cursors can track time, voltage and frequency, whilst the vertical cursors can track voltage. All measurements are updated in realtime.

Using the horizontal cursors

Procedure	1. Press the Cursor key. The cursors appear in the display.	Cursor
	2. Press X Y to select the horizontal (X1&X2) cursor.	X Y
	3. Press Source repeatedly to select the source channel. Range CH1, 2, MATH	Source 1 CH1
	4. The cursor measurement results will appear in the menu, F2 to F4.	

Parameters	X1	Time/Voltage position of the left cursor. (relative to zero)
	X2	Time/Voltage position of the right cursor. (relative to zero)
	X1X2	The distance between the X1 and X2.
	us	The time difference between X1 and X2.
	Hz	The time distance converted to frequency.
	V	The voltage difference. (X1-X2)

| Moving the horizontal cursors | To move the left cursor, press X1 and then use the Variable knob. | X1
-5.000us
0.000uV |
| | To move the right cursor, press X2 and then use the Variable knob. | X1
5.000us
0.000uV |

| Selecting the Roll mode manually | 1. Press the Horizontal menu key. | MENU |
| | 2. Press Roll. The horizontal scale automatically becomes 250ms/div and the waveform starts scrolling from the right side of the display (If the oscilloscope is already in the Roll mode, there will be no change). | Roll |

Zooming the waveform horizontally

Procedure/range	1. Press the Horizontal Menu key.	MENU
	2. Press Window.	Window
	3. Use the horizontal position knob to move the zoom range sideways, and TIME/DIV knob to change the zoom range width.	TIME/DIV
	The width of the bar in the middle of the display is the actual zoomed area. Zoom range 1ns ~ 25s	
	4. Press Window Zoom. The specified range gets zoomed.	Window Zomm

Selecting the horizontal scale

Select horizontal scale	To select the timebase (scale), turn the TIME/DIV knob; left (slow) or right (fast).	TIME/DIV

Range   1ns/Div ~ 50s/Div, 1-2.5-5-10 increment The timebase indicator at the bottom of the display updates the current horizontal scale.

Selecting the waveform update mode

Background	The display update mode is switched automatically or manually according to the horizontal scale.
Main mode	Updates the whole displayed waveform at once. The main mode is automatically selected when the horizontal scale (timebase) is fast. Horizontal scale ≤100ms/div Trigger All modes available
Roll mode	Updates and moves the waveform gradually from the right side of the display to the left. The Roll mode is automatically selected when the horizontal scale (timebase) is 250ms or greater. When in the Roll mode, an indicator appears at the bottom of the display.

Main mode   Roll mode

Timebase   ≤250ms/div (V100Sa/s)
Trigger   Auto mode only

	To move both cursors at once, press *X1X2* and then use the Variable knob.	X1X2 10.00us 100.0kHz 0.000uV
Remove cursors	Press Cursor to remove the onscreen cursors.	Cursor

Using the vertical cursors

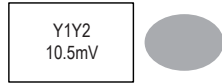|		
Procedure	1. Press the Cursor key.	Cursor
	2. Press X Y to select the vertical (Y1&Y2) cursor.	X Y
	3. Press Source repeatedly to select the source channel. Range CH1, 2, MATH	Source CH1
	4. The cursor measurement results will appear in the menu.	
	5. Press Source repeatedly to select the source channel. Range CH1, 2, MATH	Source CH1
Parameters	Y1	Voltage level of the upper cursor
	Y2	Voltage level of the lower cursor
	Y1Y2	The voltage difference between the upper and lower cursor
Moving the vertical cursors	To move the upper cursor, press *Y1* and then use the Variable knob.	Y1 123.4mV

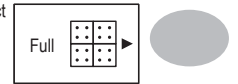|		
To move the lower cursor, press Y2 and then use the Variable knob.	Y2 12.9mV	
To move both cursors at once, press Y1Y2 and then use the Variable knob.	Y1Y2 10.5mV	
Remove cursors	Press Cursor to remove the onscreen cursors.	Cursor

2. Press the grid icon repeatedly to select the grid.

Full ▶

Parameters		Shows the full grid.
		Shows the outer frame and X/Y axis.
		Shows only the outer frame.

Horizontal View

The Horizontal view section describes how to configure the horizontal scale, position, waveform update mode, window zoom, and X-Y mode.

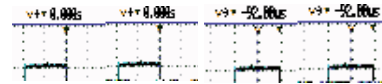### Moving the waveform position horizontally

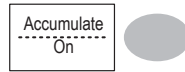| Procedure	The horizontal position knob moves the waveform left or right. The position indicator at the top of the display shows the center and current position.

◁ ▷

Center position   Moving right

2. Press *Accumulate* to turn on the waveform accumulation.

Accumulate On

3. To clear the accumulation and start it over (refresh), press *Refresh*.

Refresh

Example   Accumulation off   Accumulation on
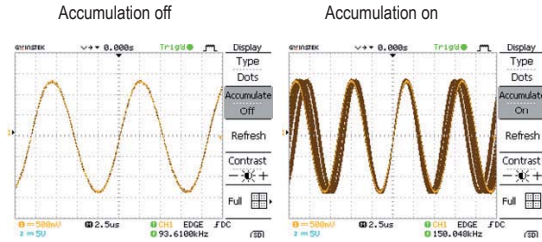
Adjusting the display contrast

Procedure
1. Press the Display key.

Display

2. Press *Contrast*.
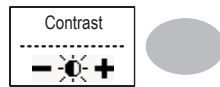
Contrast

3. Turn the Variable knob left to lower the contrast (dark display) or right to raise the contrast (bright display).

VARIABLE

Selecting the display grid

Procedure
1. Press the Display key.
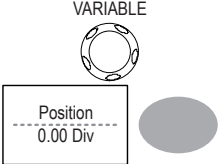
Display

Math Operations

The Math operations can add, subtract, multiply or perform FFT/FFT RMS on the input waveforms. The resulted waveform can be measured using the cursors, and saved or recalled just like normal input signals.

Overview

Addition (+)	Adds the amplitude of CH1 & CH2 signals.	
Subtraction (−)	Extracts the amplitude difference between CH1 & CH2.	
Multiplication (×)	Multiplies CH1 and CH2.	
FFT	Performs a FFT calculation on a signal. Four types of FFT windows are available: Hanning, Flattop, Rectangular, and Blackman.	
FFT RMS	Performs a FFT RMS calculation on a signal. RMS is similar to FFT, however the amplitude is calculated as RMS and not dB. Four types of FFT windows are available: Hanning, Flattop, Rectangular, and Blackman.	
Hanning FFT window	Frequency resolution	Good
	Amplitude resolution Suitable for....	Not good
	Frequency resolution	Frequency measurement on periodic waveforms
Flattop FFT window	Frequency resolution	Not good
	Amplitude resolution	Good
	Suitable for....	Amplitude 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

Adding, subtracting or multiplying signals

Procedure	
	1. Activate both CH1 and CH2.

CH1   CH2

2. Press the Math key.

MATH

3. Press Operation repeatedly to select addition (+), subtraction (–) or multiplication (×).

Operation
CH1+CH2 ▶

4. The math measurement result appears in the display.

Unit/Div
2V

5. To move the math result vertically, use the Variable knob. The position will be displayed in *Posistion*.

VARIABLE

Position
0.00 Div

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

MATH

Real time vs Equivalent time sampling mode

| Background	The oscilloscope automatically switches between two sampling modes, Real-time and Equivalenttime, according to the number of active channels and sampling rate.
Real-time sampling	Once sampled data is used to reconstruct a single waveform. Short-time events might get lost if the sampling rate gets too high. This mode is used when the sampling rate is relatively low (1GSa/s or lower).
Equivalent-time sampling	Multiple numbers of sampled data are accumulated to reconstruct a single waveform. ETS restores more waveform detail but takes longer to update the waveform. This mode is used when the sampling rate becomes higher than 1GSa/s. The maximum equivalent-time sampling rate is 25GSa/s.

Display

The Display section describes how to configure the display settings:

drawing type, waveform accumulation, contrast adjustment, and grid settings.

Selecting vector or dot drawing

Procedure	
	1. Press the Display key.

Display

2. Press *Type* repeatedly to select the waveform drawing.

Type
Vectors

| Types	Dots	Only the sampled dots are displayed.
	Vectors	The sampled dots are connected by lines.

Accumulating the waveform

Background	Accumulation preserves the old waveform drawings and overwrites new waveforms on top of it. It is useful for observing waveform variation.
Procedure	1. Press the Display key.

Display

Horizontal scale

Trigger Point

Delay Point
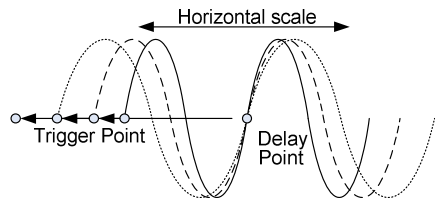
Delay off   With delay off, the trigger point is fixed. When the horizontal scale is increased the screen will be magnified according to the trigger point.
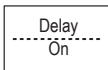
Horizontal scale

Trigger Point
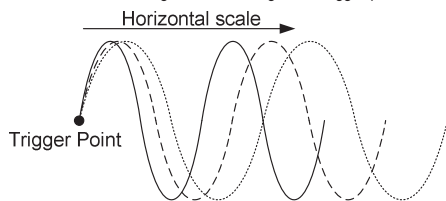
Procedure	1. Press the Acquire key.	Acquire

2. Press Delay On/Off to turn delay on of off.

Delay
On

3. Use the Horizontal Position knob to increase or decrease the delay time when Delay is set to On.

4. Use the Horizontal Position knob to increase or decrease the delay time when Delay is set to On.
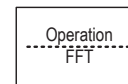
TIME/DIV

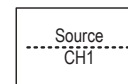## Using the FFT function

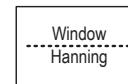Procedure   1. Press the Math key.

MATH

2. Press *Operation* repeatedly to select FFT or FFT RMS

Operation
FFT

3. Press *Source* repeatedly to select the source channel.

Source
CH1

4. Press *Window* repeatedly to select the FFT window type.

Window
Hanning

5. The FFT result appears. The horizontal scale changes from time to frequency, and the vertical scale from voltage to dB or RMS.
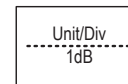
6. To move the FFT waveform vertically, use the Variable knob. The position will be updated in *Position*.

VARIABLE

Position
0.00 Div
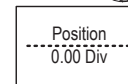
Range   −12.00 Div ~ +12.00 Div

7. To select the vertical scale of FFT waveform, press *Unit/Div*(FFT) or *Volt/Div*(FFT RMS) repeatedly.

Unit/Div
1dB

Range   1, 2, 5, 10, 20 dB/Div
              Voltage Volt/Div

8. To clear the FFT result from the display, press the Math key again.
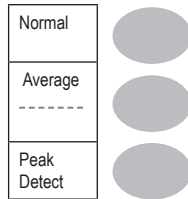
MATH

6. CONFIGURATION

The Configuration chapter describes how to configure panel settings to make measurements and observations suited to the application needs.

Acquisition

The acquisition process samples the analog input signals and converts them into digital format for internal processing. You may select the normal, average, or peak detect acquisition mode.

Selecting the acquisition mode

|			
Procedure	1. Press the Acquire key.		Acquire
	2. Select the acquisition mode between *Normal, Average* and *Peak Detect*.		Normal
			Average - - - - - - -
			Peak Detect
Range	Normal		All of the acquired data is used to draw the waveform.
	Average		Multiple data is averaged to form a waveform. This mode is useful for drawing a noise-free waveform. To select the number, press Average repeatedly. Average number: 2, 4, 8, 16, 32, 64, 128, 256
	Peak detect		To activate the Peak detect mode, press 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 a signal.

Example   The peak detect mode reveals the occasional glitch.

Normal mode   Peak detect mode
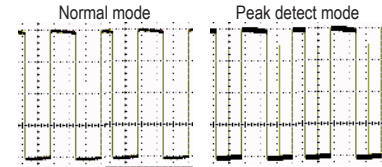
Selecting Delay mode

Background   When delay time is ON, the displayed output is delayed for a defined amount of time from the trigger point. Using the delay function is useful for observing an area of the waveform that occurs some time after the trigger point.

Delay on   The delay point will be located in the center of the display. When changing the delay time, the screen will stay centered on the delay point when delay time is turned ON. Thus the delay point will be fixed in the center of the screen.

Delay Time

Trigger Point
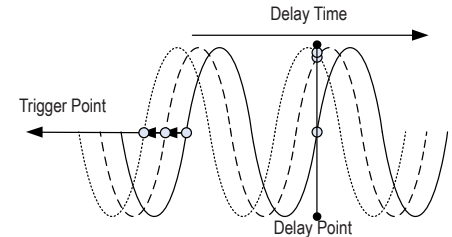
Delay Point

When the horizontal scale is changed the delay point will stay centered on the screen whilst the tripper point will move (leftwards when magnifying).