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# Digital Storage Oscilloscope

GDS-1000 Series

## USER MANUAL

**GW INSTEK PART NO. 82DS-11020M01**

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ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

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# SAFETY INSTRUCTION

This chapter contains important safety instructions that you must follow when operating GDS-1000 and when keeping it in storage. Read the following before any operation to insure your safety and to keep the best condition for GDS-1000.

## Safety Symbols

These safety symbols may appear in this manual or on GDS-1000.

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





## Safety Guidelines

**General Guideline**

 CAUTION

- 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 any heavy object on GDS-1000.
- Avoid severe impacts or rough handling that leads to damaging GDS-1000.
- Do not discharge static electricity to GDS-1000.
- Use only mating connectors, not bare wires, for the terminals.
- Do not block the cooling fan opening.
- Do not perform measurement at power source and building installation site (Note below).
- Do not disassemble GDS-1000 unless you are qualified as service personnel.

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

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

**Power Supply**

 WARNING

- AC Input voltage: 100 ~ 240V AC, 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, to avoid electrical shock.



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| | |
|---|---|
| Fuse<br>⚠ WARNING | • Fuse type: T1A/250V<br>• Make sure the correct type of fuse is installed before power up.<br>• To ensure fire protection, replace the fuse only with the specified type and rating.<br>• Disconnect the power cord before fuse replacement.<br>• Make sure the cause of fuse blowout is fixed before fuse replacement. |
| Cleaning GDS-1000 | • Disconnect the power cord before cleaning.<br>• Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid.<br>• Do not use chemical containing harsh material such as benzene, toluene, xylene, and acetone. |
| Operation Environment | • Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below)<br>• Relative Humidity: < 80%<br>• Altitude: < 2000m<br>• Temperature: 0°C to 50°C<br>(Pollution Degree) EN 61010-1:2001 specifies the pollution degrees and their requirements as follows. GDS-1000 falls under degree 2.<br>Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity".<br>• Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.<br>• Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.<br>• Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled. |





| | |
|---|---|
| Storage environment | • Location: Indoor<br>• Relative Humidity: < 85%<br>• Temperature: 0°C to 50°C |

## Power cord for the United Kingdom

When using GDS-1000 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 colours 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 the letter E or by the earth symbol ⏚ or coloured Green or 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, 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 moulded mains connector that requires removal /replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if a engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.



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# GETTING STARTED

This chapter describes GDS-1000 in a nutshell, including its main features and front / rear panel introduction. After going through the overview, follow the Set Up section to properly set up operation environment.

## GDS-1000 Series Overview

### Series lineup

| Model name | Frequency bandwidth | Input channels |
|---|---|---|
| GDS-1022 | DC – 25MHz (–3dB) | 2 |
| GDS-1042 | DC – 40MHz (–3dB) | 2 |
| GDS-1062 | DC – 60MHz (–3dB) | 2 |
| GDS-1102 | DC – 100MHz (–3dB) | 2 |





### Main Features

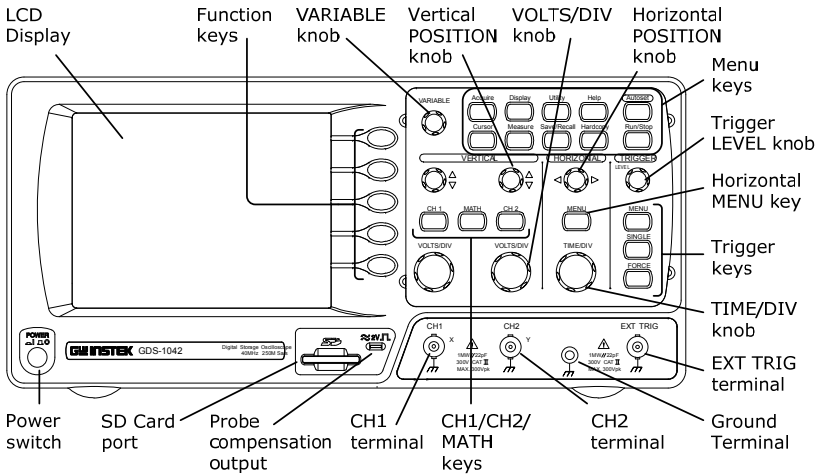
| | |
|---|---|
| Performance | • 250MSa/S real-time sampling rate<br>• 25GS/s equivalent-time sampling rate<br>• 4k points record length per channel<br>• Up to 10ns peak detection |
| Feature | • 5.6 inch color TFT display<br>• Saving and recalling setups and waveforms<br>• 18 types automatic measurements<br>• 6-digit real-time frequency counter<br>• Multi-language menu<br>• Math operation: Add, Subtract, FFT<br>• Edge, TV-line, Pulse Width trigger<br>• Built-in Help<br>• Compact size: (W) 310 x (D) 140 x (H) 142 mm |
| Interface | • SD card port for data saving/recalling<br>• Calibration output<br>• External trigger input |



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# Panel Overview

## Front Panel




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

Function keys — Activates the functions which appear on the left side of the LCD display.

Variable knob — VARIABLE — Increases/decreases value or move to the next/previous parameter.

Acquire key — Acquire — Configures acquisition mode (page51).

Display key — Display — Configures display settings (page54).





Utility key — Utility — Configures Hardcopy (page77), system info (page70), menu language (page71), calibration (page92), and probe compensation (page93).

Help key — Help — Shows Help contents on the LCD display (page36).

Autoset key — Autoset — Finds signals and sets the appropriate horizontal / vertical / trigger settings (page38).

Cursor key — Cursor — Runs cursor measurements (page46).

Measure key — Measure — Configures and runs automatic measurements (page43).

Save/Recall key — Save/Recall — Saves and recalls image, waveform, panel setup (page72).

Hardcopy key — Hardcopy — Transfers data to SD card (page77).

Run/Stop key — Run/Stop — Freezes the signal view (page39).

Trigger level knob — TRIGGER LEVEL — Sets the trigger level (page64).

Trigger menu key — MENU — Configures trigger settings (page64).

Single trigger key — SINGLE — Selects the single trigger mode (page70).

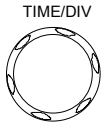
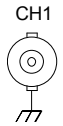
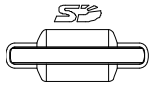
Trigger force key — FORCE — Forces the trigger level to 50% of the signal amplitude (page70).

Horizontal menu key — MENU — Configures horizontal view (page56).

Horizontal position knob — Sets the horizontal position of waveforms (page56).



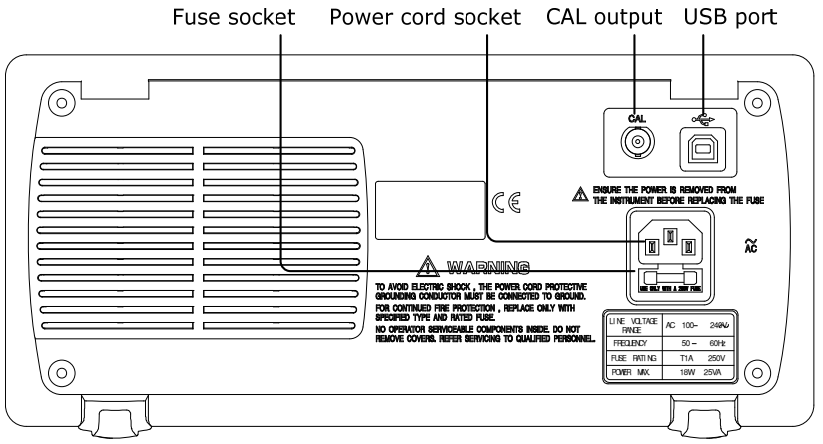
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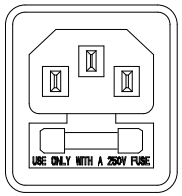
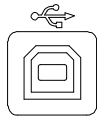
| | | |
|---|---|---|
| TIME/DIV knob |  | Selects the horizontal scale (page56); Fine (clockwise) or coarse (counterclockwise). |
| Vertical position knob |  | Sets the vertical position of waveforms (page60). |
| CH1/CH2 key |  | Configures the vertical scale and coupling mode for each channel (page60). |
| VOLTS/DIV knob |  | Selects the vertical scale (page60); Fine (clockwise) or coarse (counterclockwise). |
| Input terminal |  | Accepts input signals: 1MΩ±2% input impedance, BNC terminal. |
| Ground terminal |  | Accepts the DUT ground lead for common ground. |
| MATH key |  | Performs math operation (page48). |
| SD card port |  | Facilitates transferring waveform data and display image (page72). |
| Probe compensation output |  | Outputs 2Vp-p, square signal for probe compensation (page93) or demonstration. |
| External trigger input |  | Accepts external trigger signal (page64). |
| Power switch |  | Powers on or off the oscilloscope. |





## Rear Panel

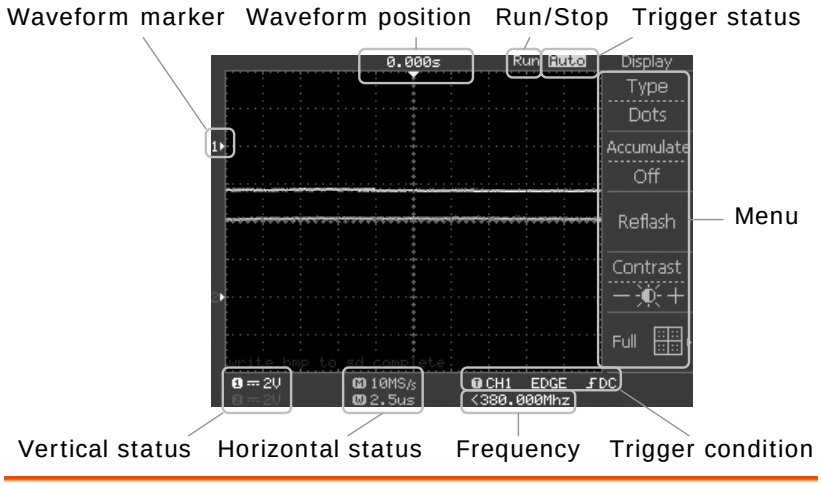



| | | |
|---|---|---|
| Power cord socket |  | Power cord socket accepts AC mains, 100 ~ 240V, 50/60Hz. |
| Fuse socket | | Fuse socket holds AC main fuse, T1A/250V.<br>For fuse replacement procedure, see page97. |
| USB slave port |  | Accepts typeB male connector for PC software connection (reserved for future use). |
| Calibration output |  | Outputs the signal for vertical scale accuracy calibration (page92). |



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## Display




| | | |
|---|---|---|
| Waveforms | Shows input signal waveforms. | |
| | Channel 1: Yellow Channel 2: Blue | |
| Trigger status | Trig'd | Triggered. |
| | Trig? | Not triggered, display not updated. |
| | Auto | Not triggered, display updated. |
| | STOP | Trigger stopped. Also appears in Run/Stop (page39). |
| | For trigger details, see page64. | |
| Input signal frequency | Shows the input signal frequency. | |
| | "< 20Hz" Indicates that the frequency is less than 20Hz (lower frequency limit). | |
| Trigger configuration | Shows the trigger source, type, and slope. In case of Video trigger, shows trigger source and polarity. | |
| Channel status | Shows the channel , coupling mode, vertical scale, and horizontal scale. | |
| | For channel details, see page60. | |





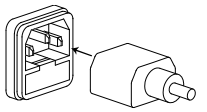
# Set Up

**Background**

This section describes how to connect a signal, adjust the scale, and compensate the probe. Before operating GDS-1000 in a new environment, run these steps to make sure the oscilloscope is functionally stable and to help becoming familiar with it.

**Steps**

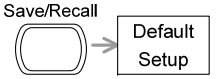
1. Connect the power cord to the rear panel socket.



2. Press the power switch. The display becomes active.

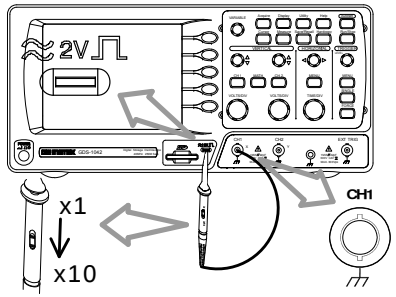



3. Reset the system by recalling the factory setting. Press the Save/Recall key, then *Default Setup*. For factory setting details, see page35.




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

5. Set the probe attenuation to x10.



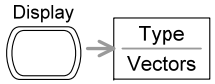


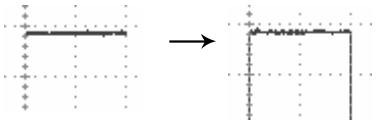

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6. Press the Autoset key. A square waveform appears on the center of the waveform. For Autoset details, see page38.

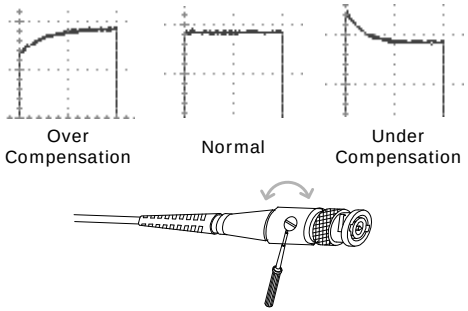



7. Press the Display key, then *Type* to select vector waveform.



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




9. Continue with other operations.

Measurements: page37 Configurations: page51





# QUICK REFERENCE

This chapter describes GDS-1000 menu tree, shortcuts to major operations, built-in Help access, and default factory settings. Use them as a handy reference to get a quick access to the functionality.

## Menu Tree / Operation Shortcuts

### Convention

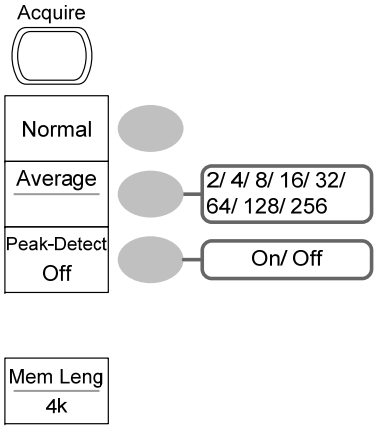
Normal = Select Normal

Average↵ = Select Average repeatedly

Normal ~ Average = Select one from Normal to Average and press it

Normal→VAR ◌ = Press Normal, then use the Variable knob

### Acquire key




Select acquisition mode

Normal ~ Peak-Detect

Select average number

Average↵

Turn peak detect on/off

Peak-Detect↵



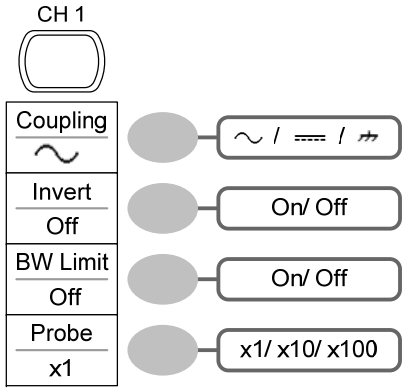
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## Autoset key




| | |
|---|---|
| Automatically find signal and set scale | Autoset |

## CH1/2 key




Turn on/off channel

CH 1/2↵

Select coupling mode

Coupling↵

Turn waveform invert On/Off

Invert↵

Turn bandwidth limit On/Off

BW Limit↵

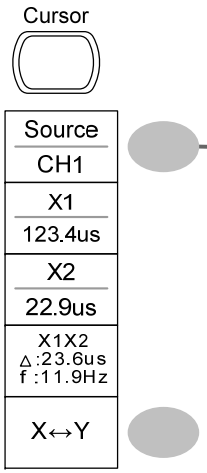
Select probe attenuation factor

Probe↵





## Cursor key



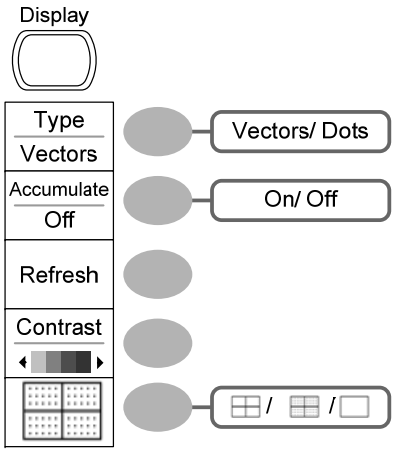

Turn on/off cursor

Cursor↵

Select X or Y cursor

X↔Y↵

## Display key




Select waveform display type

Type↵

Waveform accumulate On/Off

Accumulate↵, Refresh (refresh display when On)

Set display contrast

Contrast→VAR

Select display grid

↵



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## Hardcopy key

Hardcopy



→ See Utility key (page32)

## Help key

Help

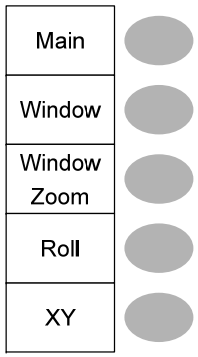


Turn help mode On/Off

Help↵

## Horizontal menu key

MENU




Select main (default) display

Main

Select Window mode and zoom

Window→TIME/DIV ◌, Window Zoom

Select windows roll mode

Roll

Select XY mode

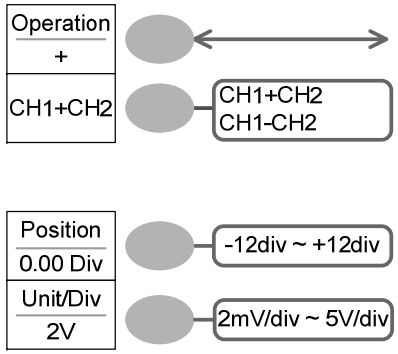
XY





## Math key

MATH




Select math operation type (+/–)

Operation↵

Select addition/subtraction

CH1+/-CH2↵

Set result position

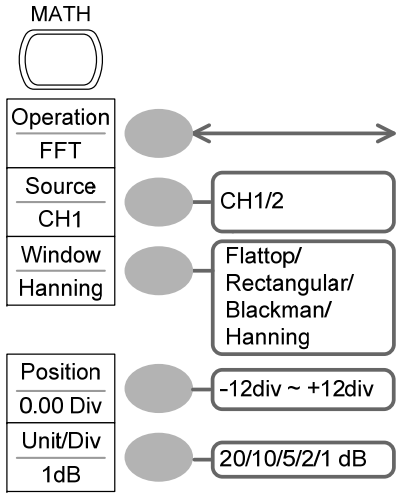
Position→VAR ◌

Math result Volt/Div

Unit/Div→VAR ◌

## Math key (cont.)

MATH




Select math operation type (FFT)

Operation↵

Select FFT source channel

Source↵

Select FFT window

Window↵

Select FFT result position

Position→VAR ◌

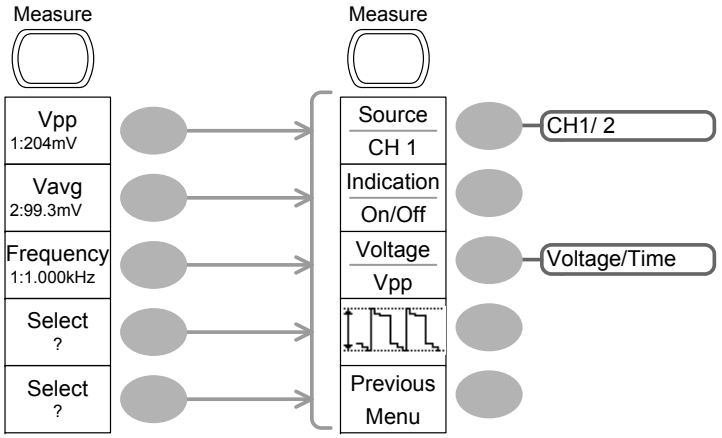
Select vertical scale

Unit/Div↵



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## Measure key




| | |
|---|---|
| Turn on/off measurement | Measure↵ |
| Select source channel | Source↵ |
| Display measurement result | Indication↵ |
| Select measurement type | Voltage/Time↵ |
| Select measurement item | VAR ◌ or Icon↵ |
| Go back to previous menu | Previous Menu |

## Run/Stop key



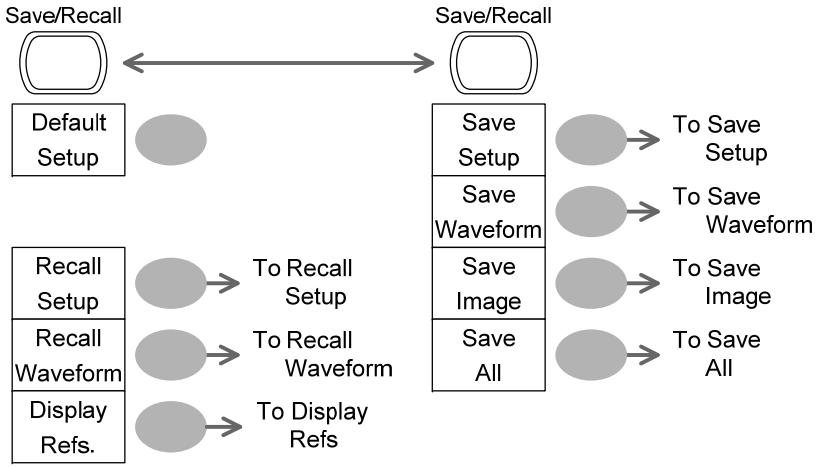

Freeze/unfreeze waveform or trigger

Run/Stop↵



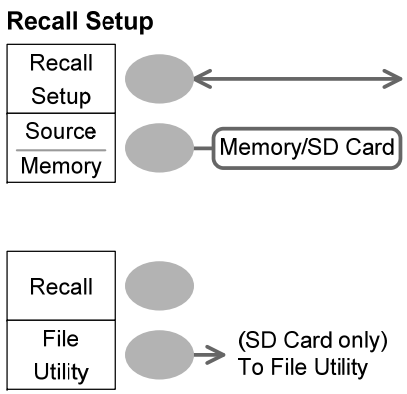


## Save/Recall key




| | |
|---|---|
| Select Save or Recall menu | Save/Recall↵ |
| Recall default setup | Default Setup |

## Save/Recall key (cont.)



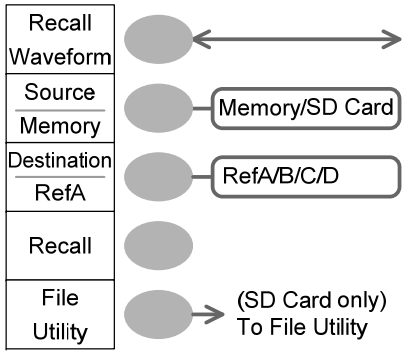

| | |
|---|---|
| Select other menu | Recall Setup↵ |
| Select setup source | Source↵→VAR ◌ |
| Recall setup | Recall |
| Go to SD card file utility | File Utility |



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Save/Recall key (cont.)

**Recall Waveform**




Select other menu

Recall Waveform↵

Select waveform source

Source↵→VAR

Select waveform destination

Destination→VAR

Recall waveform

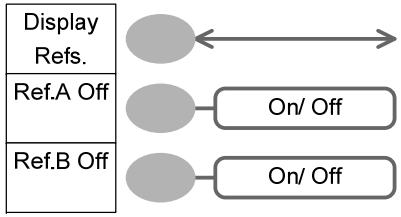
Recall

Go to SD card file utility

File Utility

Save/Recall key (cont.)

**Display Refs.**




Select other menu

Display Refs.↵

Turn ref. waveform A On/Off

Ref.A↵

Turn ref. waveform B On/Off

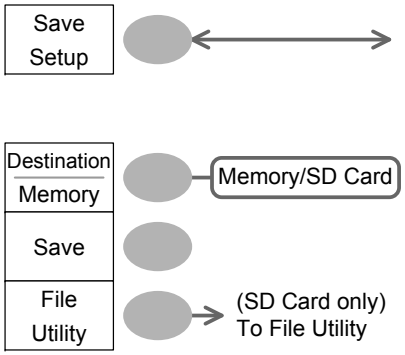
Ref.B↵





Save/Recall key (cont.)

**Save Setup**




Select other menu

Save Setup↵

Select destination

Destination↵→VAR

Save setup

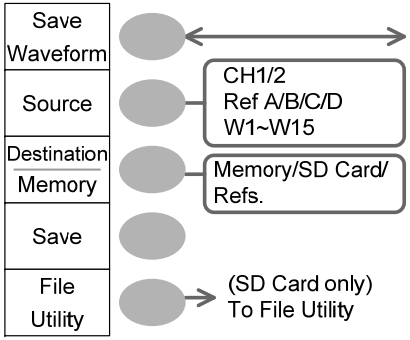
Save

Go to file utility

File Utility

Save/Recall key (cont.)

**Save Waveform**




Select other menu

Save Waveform↵

Select source

Source↵→VAR

Select destination

Destination↵→VAR

Save waveform

Save

Go to file utility

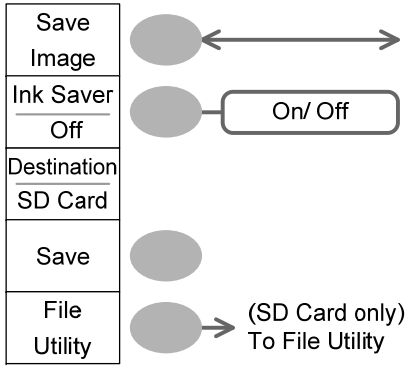
File Utility



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Save/Recall key (cont.)

**Save Image**




Select other menu

Save Image↵

Turn on/off ink saver

Ink Saver↵

Save image

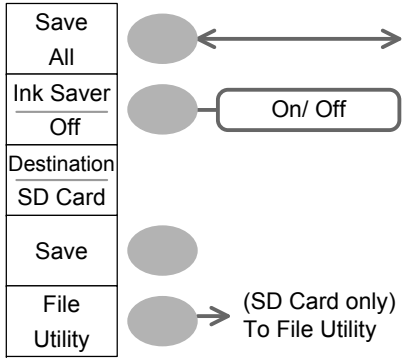
Save

Go to file utility

File Utility

Save/Recall key (cont.)

**Save All**




Select other menu

Save All↵

Turn on/off ink saver

Ink Saver↵

Save all

Save

Go to file utility

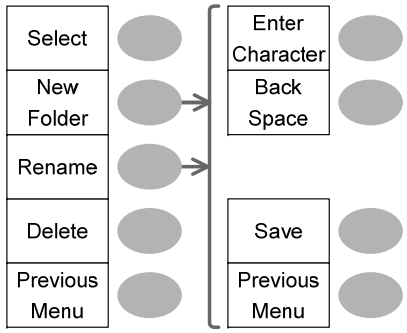
File Utility





Save/Recall key (cont.)

**File Utilities**




Select file/folder

VAR ◌→Select

Create or rename folder/file

New Folder/Rename

VAR ◌→Enter character / Backspace / Save / Previous menu

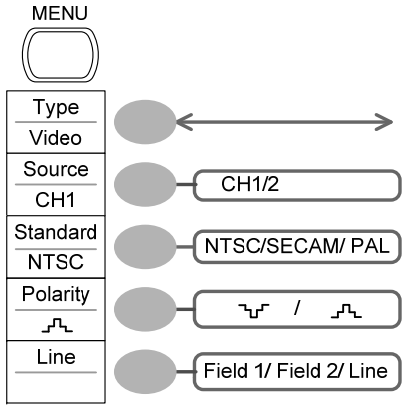
Delete folder/file

Delete

Go to previous menu

Previous menu

## Trigger key




Select video trigger type

Type↵

Select trigger source

Source↵

Select video standard

Standard↵

Select video polarity

Polarity↵

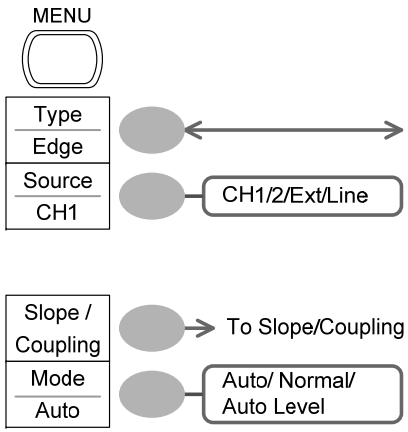
Select video line

Line↵→VAR ◌



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## Trigger key (cont.)




Select edge trigger type

Edge↵

Select trigger source

Source↵

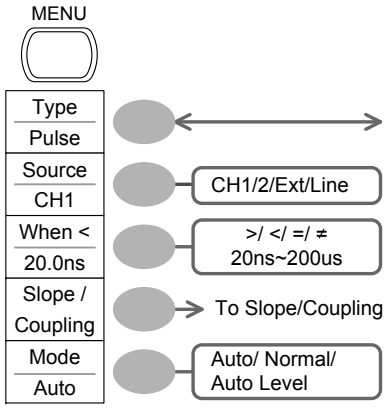
Go to slope/coupling menu

Slope/Coupling

Select trigger mode

Mode↵

## Trigger key (cont.)




Select pulse trigger type

Type↵

Select trigger source

Source↵

Select pulse trigger condition and pulse width

When↵→VAR

Go to slope/coupling menu

Slope/Coupling

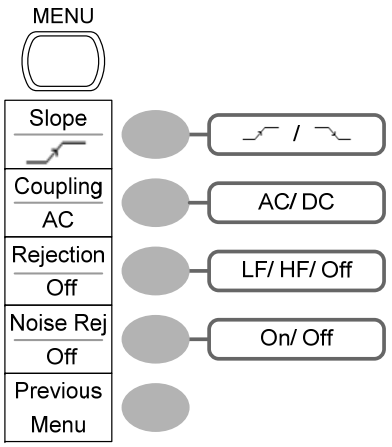
Select trigger mode

Mode↵





## Trigger key (cont.)




Select trigger slope type

Slope↵

Select trigger coupling mode

Coupling↵

Select frequency rejection

Rejection↵

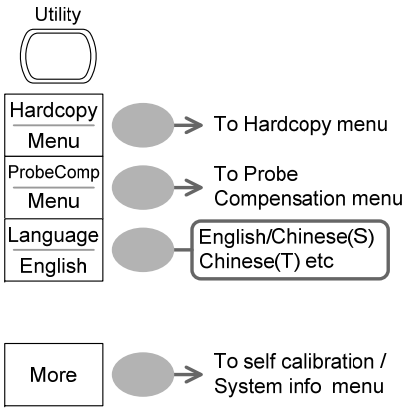
Turn on/off noise rejection

Noise Rej↵

Go back to previous menu

Previous Menu

## Utility key




Go to hardcopy menu

Hardcopy

Go to probe compensation menu

ProbeComp

Select language

Language↵

Go to self calibration / system information menu

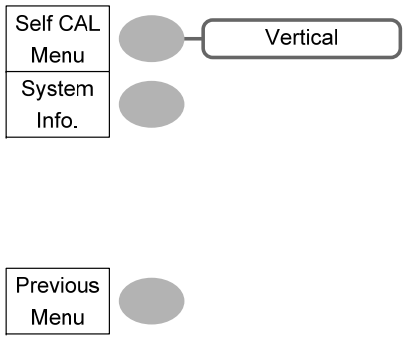
More



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Utility key (cont.)

**Calibration / System information**




Enter self calibration

Self CAL

Show system information

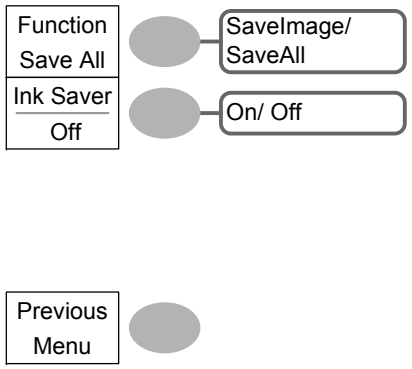
System Info

Go to previous menu

Previous Menu

Utility key (cont.)

**Hardcopy**




Select Hardcopy function

Function↵

Turn on/off inksaver

Ink Saver↵

Go to previous menu

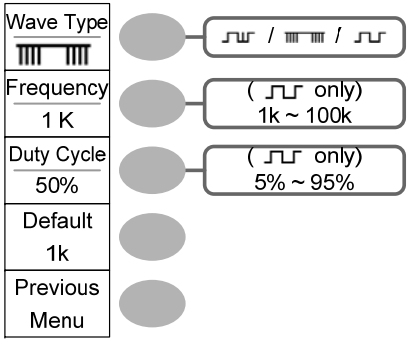
Previous Menu↵





Utility key (cont.)

**Probe compensation**




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

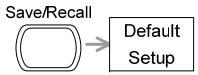
Previous Menu



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# Default Settings

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




| | | |
|---|---|---|
| Acquisition | Mode: Normal | |
| Channel | Scale: 2V/Div | CH1: On, CH2: Off |
| | Coupling: DC | Invert: Off |
| | BW limit: Off | Probe attenuation: x1 |
| Cursor | Source: CH1 | Cursor: Off |
| 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 | Source: CH1 | Measurement: Off |
| Trigger | Type: Edge | Source: Channel1 |
| | Mode: Auto | Slope: |
| | Coupling: DC | Rejection: Off |
| | Noise Rejection: Off | |
| Utility | SaveImage, InkSaver Off | Language: English |
| | Square wave probe, 1k, 50% duty cycle | Hardcopy: save image |



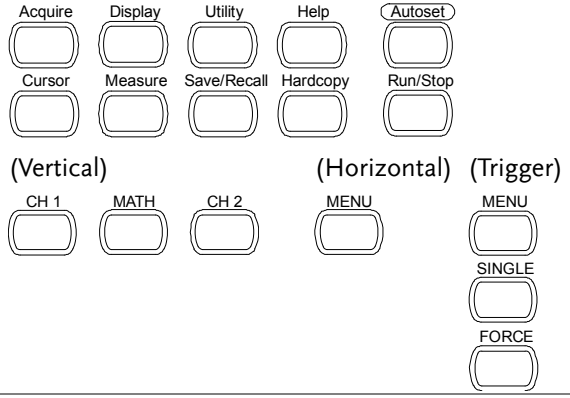


# Built-in Help

The Help key shows help contents. When each functional key is pressed, simple explanations of major functionalities appear on the display.




Applicable keys




Panel operation

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




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




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




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






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# MEASUREMENT

## Basic Measurement

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

- Measurements → from page37
- Configurations → from page51

### Channel activation

| | |
|---|---|
| Activate channel | To activate an input channel, press the Channel key. The waveform appears on the display.   |
| De-activate channel | To disable the channel, press the Channel key again. If the display menu is other than the Channel menu, press twice (the first pressing just activates the Channel menu).   |
| Default setup | When the default setup is recalled (Save/Recall key → *Default Setup*), Channel 1 automatically turns On. Channel 2 becomes Off. |
| Autoset  | The Autoset (page38) does NOT automatically activate the channels to which input signals are connected. |





### Autoset

| | |
|---|---|
| Background | Autoset function automatically configures the panel settings to position the input signal to the best viewing condition. GDS-1000 automatically configures the following parameters.<br>• Horizontal scale<br>• Vertical scale<br>• Trigger source channel |
| Panel operation | 1. Connect the input signal to GDS-1000 and press the Autoset key.  <br>2. The waveform appears in the center of the display.<br>3. To undo Autoset, press *Undo*. This feature is vailable for 5 seconds after Autoset is activated.   |
| Limitation | Autoset does not work in the following situation.<br>• Input signal frequency less than 20Hz<br>• Input signal amplitude less than 30mV |



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## Run/Stop

| | |
|---|---|
| Background | By default, the waveform on the display is constantly updated (Run mode). Freezing the waveform (Stop mode) allows flexible observation and analysis. To enter the Stop mode, two methods are available: pressing the Run/Stop key or using Single Trigger mode.<br>Stop mode icon When in Stop mode, the Stop icon appears at the top of the display. |
| Freeze waveform by Run/Stop key | 1. Press the Run/Stop key once. The waveform freezes. To unfreeze the waveform, press the Run/Stop key again.   |
| Freeze waveform by Single Trigger mode | 2. In the single trigger mode, the waveform always stays in the Stop mode, and is updated only when the Run/Stop key is pressed. For trigger details, see page64. Note: pressing the Run/Stop key only updates the waveform once – it does not switch to Run mode (continuous update).   |
| Waveform operation | The waveform can be moved or scaled in both Run and Stop mode, but in different manners. For details, see page56 (Horizontal position/scale) and page60 (Vertical position/scale). |





## Horizontal position/scale

For more detailed configuration, see page56.

| | |
|---|---|
| Set horizontal position | The horizontal position knob moves the waveform left/right.  |
| Select horizontal scale | To select the timebase (scale), turn the TIME/DIV knob; left (slow) or right (fast).  <br>Range 1ns/Div ~ 10s/Div, 1-2-5 increment<br>The corresponding sampling rate appears on the upper side of the display. The timebase indicator appears on the lower side.<br>Stop mode In the Stop mode, the memory bar and waveform size changes according to the scale. |

## Vertical position/scale

For more detailed configuration, see page60.

| | |
|---|---|
| Set vertical position | To move the waveform up or down, turn the vertical position knob for each channel. <br>As the waveform moves, the vertical position of the cursor appears at the bottom left corner of the display.<br>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).  <br>Range 2mV/Div ~ 5V/Div, 1-2-5 increments |



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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.

## 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 page93.

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

Waveform type

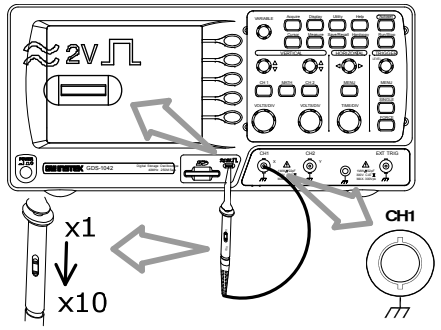
- Square waveform used for probe compensation. 1k ~ 100kHz, 5% ~ 95%.
- Demonstration signal for showing the effects of peak detection. See page51 for peak detection mode details.
- Demonstration signal for showing the effects of long memory.

View compensation waveform

1. Connect the probe between the compensation signal output and Channel input.







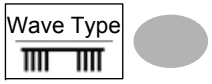

2. Press the Utility key.



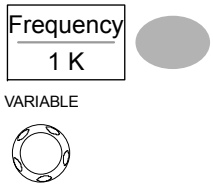

3. Press *ProbeComp*.




4. Press Wave type repeatedly to select the wave type.

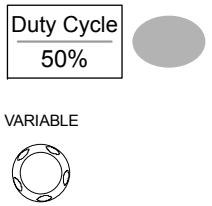



5. (For ⎍ only) To change the frequency, press *Frequency* and use the Variable knob.




Range 1kHz ~ 100kHz

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




Range 5% ~ 95%

Probe compensation — For probe compensation details, see page93.



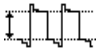
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# Automatic Measurement

Automatic measurement function measures and updates major items for Voltage, Time, and Delay type.

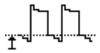
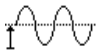
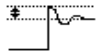
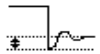
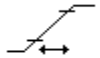
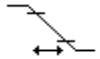
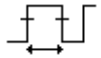
## Measurement items

| Overview | Voltage type | Time type |
|---|---|---|
| | Vpp<br>Vmax<br>Vmin<br>Vamp<br>Vhi<br>Vlo<br>Vavg<br>Vrms<br>ROVShoot<br>FOVShoot<br>RPREShoot<br>FPREShoot | Frequency<br>Period<br>RiseTime<br>FallTime<br>+Width<br>-Width<br>Dutycycle |

| | | | |
|---|---|---|---|
| Voltage measurement | 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 | 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) |



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## Measurement

View measurement result

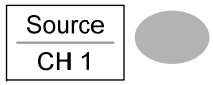
1. Press the Measure key.




2. The Channel 1 and Channel 2 measurement results appear on the menu bar, constantly updated. Press the menu to change the measurement item for each location.

Select measurement item

1. The selection menu appears. Press *Source* repeatedly to select the first source channel.

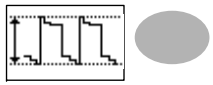



2. Press the third menu repeatedly to select the measurement type: *Voltage* or *Time*.

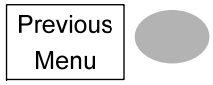



3. Use the Variable knob or press the icon repeatedly to select the measurement item.



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




Indication mode

Pressing *Indication* and turning on the indication mode allows the measurement result appear in the display regardless of the menu contents.








# Cursor Measurement

Cursor line, horizontal or vertical, shows the position and value of the waveform and math operation result.

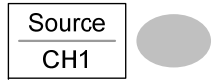
## Use horizontal cursor

Panel operation/ Range

1. Press the Cursor key to activate the cursors which appear in the display.

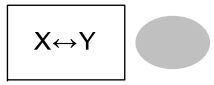



2. Press *Source* repeatedly to select the source channel.

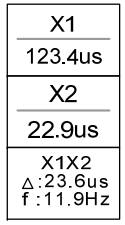



| Range | CH1, 2, Math |
|---|---|

3. Press *X↔Y* to select the horizontal (X1&X2) cursor.




4. The cursor position information appears in the menu.




| Parameter | |
|---|---|
| X1 | Time position of the left cursor |
| X2 | Time position of the right cursor |
| Δ | The time distance between the left and right cursor |
| f | The time distance (Δ) converted to frequency |



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5. Use the Variable knob to move the cursor left or right. The contents changes accordingly.



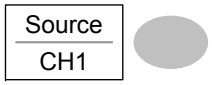

## Use vertical cursor

Panel operation/ Range

1. Press the Cursor key.

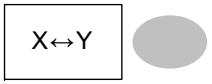



2. Press *Source* repeatedly to select the source channel.

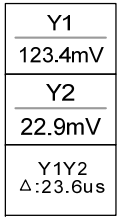



| Range | CH1, 2, Math |
|---|---|

3. Press *X↔Y* to select the vertical (Y1&Y2) cursor.




4. The cursor position information appears on the menu.




| Parameter | |
|---|---|
| Y1 | Voltage level of the upper cursor |
| Y2 | Voltage level of the lower cursor |
| Δ | The voltage difference between the upper and lower cursor |

5. Use the Variable knob to move the cursor up or down.








# Math Operation

## Overview

| | | |
|---|---|---|
| Background | Math operation runs addition, subtraction, or FFT for the input signals and shows the result on the display. The resulted waveform characteristics can be measured using the cursors. | |
| Addition (+) | Adds amplitude of CH1 & CH2 signals. | |
| Subtraction (–) | Extracts the amplitude difference between CH1 & CH2. | |
| FFT | Runs FFT calculation on a signal. Four types of FFT windows are available: Hanning, Flattop, Rectangular, and Blackman. | |
| Hanning FFT window | Frequency resolution | Good |
| | Amplitude resolution | Not good |
| | Suitable for.... | Frequency measurement on periodic waveform |
| Flattop FFT window | Frequency resolution | Not good |
| | Amplitude resolution | Good |
| | Suitable for.... | Amplitude measurement on periodic waveform |
| 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) |



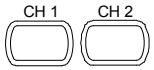
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| | | |
|---|---|---|
| Blackman FFT window | Frequency resolution | Bad |
| | Amplitude resolution | Very good |
| | Suitable for.... | Amplitude measurement on periodic waveform |

## Addition/Subtraction

Panel operation

1. Activate both CH1 and CH2.



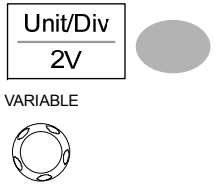

2. Press the Math key.



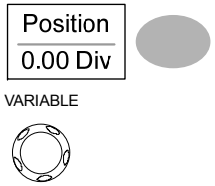

3. Press *Operation* repeatedly to select addition (+) or subtraction (–).




4. The math measurement result appears in the display. Press the vertical scale of math waveform (Unit/div) and use the Variable knob.




5. To move the math waveform vertically, press *Position* and use the Variable knob.




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








## FFT

Panel operation

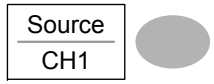
1. Press the Math key.




2. Press *Operation* repeatedly to select FFT.




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

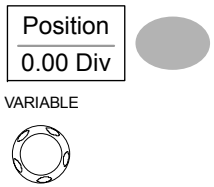



4. Press *Window* repeatedly to select the FFT window type.




5. The FFT result appears. For FFT, the horizontal scale changes from time to frequency, and the vertical scale from voltage to dB.

6. To move the FFT waveform vertically, press *Position* and use the Variable knob.




Range –12.00 Div ~ +12.00 Div

7. To select the vertical scale of FFT waveform, press *Unit/Div* repeatedly.




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

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






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# CONFIGURATION

## Acquisition

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

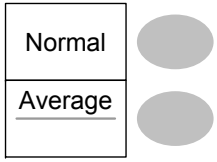
### Select acquisition mode

Panel operation

1. Press the Acquire key.




2. Select the acquisition mode between *Normal* and *Average*.




| Range | | |
|---|---|---|
| | Normal | All of the acquired data is used to draw the waveform. |
| | Average | Multiple acquired data are averaged. This mode is useful for drawing a noise-free waveform. To select the number, press Average repeatedly.<br>Average number: 2, 4, 8, 16, 32, 64, 128, 256 |





3. 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 the signal.




Peak detect effect using probe comp. waveform

1. One of the probe compensation waveforms can demonstrate peak detection mode. Connect the probe to the probe compensation output.




2. Press the Utility key.




3. Press *ProbeComp*.




4. Press *Wave Type* and select the waveform.




5. Press the Autoset key. GDS-1000 positions the waveform in the center of the display.




6. Press the Acquire key.




7. Press *Normal*.





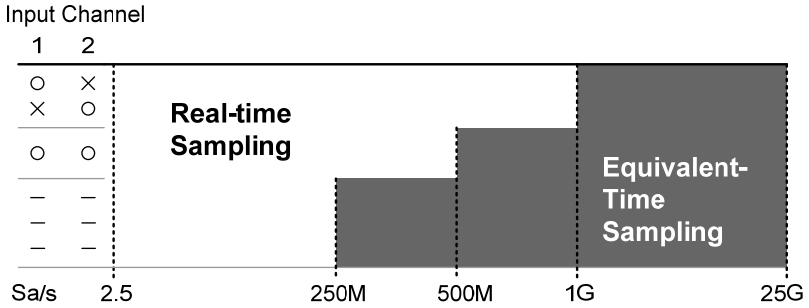

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8. Press *Peak-Detect* and see that a spike noise is captured.




## Real time vs Equivalent time sampling mode

| | | |
|---|---|---|
| Background | GDS-1000 automatically switches between two sampling modes, Real-time and Equivalent-time, according to the number of active channel and sampling rate. | |
| Parameter | Real-time sampling | One 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. |
| | Equivalent-time sampling | Multiple numbers of sampled data are accumulated to reconstruct a single waveform. Restores greater waveform details but takes longer to update the waveform. This mode is used when the sampling rate becomes higher. |
| Switching threshold | Number of active channel / sampling mode | |








# Display

## Select waveform drawing (vector/dot)

Panel operation

1. Press the Display key.




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




| | | |
|---|---|---|
| Range | Dots | Only the sampled dots are displayed. |
| | Vectors | Both the sampled dots and the connecting line are displayed. |

## Accumulate waveform

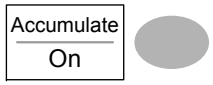
| | |
|---|---|
| Background | Accumulation preserves the old waveform drawings and overwrites new waveforms on top of it. It is useful for observing waveform variation. |

Panel operation

1. Press the Display key.




2. Press *Accumulate* to turn On waveform accumulation.




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




## Set display contrast

Panel operation

1. Press the Display key.






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2. Press *Contrast*.




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




## Freeze the waveform (Run/Stop)

For more details about Run/Stop mode, see page39.

Panel operation

1. Press the Run/Stop key. To unfreeze the waveform, press the Run/Stop key again.




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

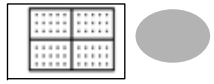
## Select display grid

Panel operation

1. Press the Display key.




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



Range



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



Shows only the center X and Y frame.



Shows only the outer frame.





# Horizontal View

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

## Move waveform position horizontally

Panel operation

The horizontal position knob moves the waveform left/right.



Run mode

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

Stop mode

In Stop mode, the waveform moves until it reaches the end of the memory.

## Select horizontal scale

Select horizontal scale

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




Range 1ns/Div ~ 10s/Div, 1-2-5 increment

The corresponding sampling rate appears on the upper side of the display. The timebase indicator appears on the lower side.

Run mode

In Run mode, the waveform size keep their proportion. When the timebase becomes slower, it automatically switches to Scan mode (see the next page).

Stop mode

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



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## Select waveform update mode

| | |
|---|---|
| Background | The display update mode is switched automatically or manually according to timebase and trigger. The indicator on the bottom left of the display shows the current mode. |
| Main mode | Updates the whole displayed waveform at once. Automatically selected when the timebase (sampling rate) is fast.<br>Timebase ≤50ms/div (≥500Sa/s)<br>Trigger all modes |
| Scan mode | Updates the waveform gradually from the left side of the display to the right. The waveform position is fixed. Automatically selected when the timebase (sampling rate) is slow.<br>Timebase ≥100ms/div (≤250Sa/s)<br>Trigger Auto mode only<br>Note: When the update mode switches from Main to Scan, GDS-1000 automatically selects the Auto trigger mode. See page64 for trigger details. |
| Roll mode | Updates and moves the waveform gradually from the right side of the display to the left. Manually selected when the timebase (sampling rate) is slow.<br>Timebase ≥250ms/div (≤100Sa/s)<br>Trigger all modes |

Select Roll mode manually

1. Press the Horizontal menu key.








2. Press *Roll*. The waveform starts scrolling from the right side of the display. The update mode indicator shows Roll mode.




Note

The Roll mode locks the timebase to be at least 250ms/div (100Sa/s). If faster timebase or sampling rate is required, get out of the Roll mode by pressing *Main*.




## Zoom waveform horizontally

Panel operation/ range

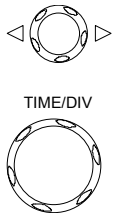
1. Press the Horizontal Menu key.




2. Press *Window*.




3. Use the horizontal position knob to move the zoom range sideways, and TIME/DIV knob to change the zoom range width.




The width of the bar in the middle of the display is the actual zoomed area.

Zoom range 1ns ~ 1ms

4. Press *Window Zoom*. The specified range gets zoomed.






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5. To go back to the original view, press *Main*.



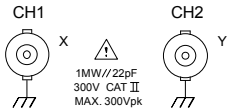

## Show waveform in X-Y mode

Background

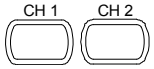
The X-Y mode compares the voltage of Channel 1 and Channel 2 waveforms in a single display. This mode is useful for observing the phase relationship between the two.

Panel operation

1. Connect the signals to Channel 1 (X-axis) and Channel 2 (Y-axis).




2. Make sure both Channel 1 and 2 are activated. Press the Channel key if necessary.




3. Press the Horizontal menu key.




4. Press *XY*. The display shows two waveforms in X-Y format; Channel 1 as X-axis, Channel 2 as Y-axis.




5. Horizontal Position knob and Time/Div knob are disabled under the X-Y mode. To move the waveform position, use the vertical position knob: Channel 1 knob moves the waveform horizontally, Channel 2 knob vertically.







# Vertical View (Channel)

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

## Move waveform position vertically

Panel operation

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



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

Panel operation

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




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

Range

2mV/Div ~ 5V/Div, 1-2-5 increments

Stop mode

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



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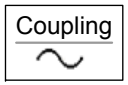
## Select coupling mode

Panel operation

1. Press the Channel key.




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




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 voltage 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.

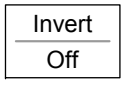
## Invert waveform vertically

Panel operation

1. Press the Channel key.




2. Press *Invert* to invert the waveform.








## Limit bandwidth

Background

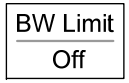
Bandwidth limitation puts the input signal into a 20MHz (−3dB) low-pass filter. This function is useful for cutting off high frequency noise to see the clear waveform shape.

Panel operation

1. Press the Channel key.

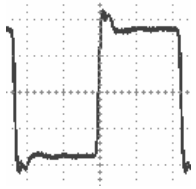



2. Press *BW Limit* to turn Off the limitation.

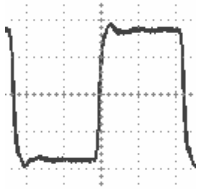



Example

BW Limit Off



BW Limit On



## Select probe attenuation level

Background

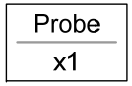
A signal probe has an attenuation switch to lower the original DUT signal level to the oscilloscope input range, if necessary. The probe attenuation selection adjusts the vertical scale so that the voltage level on the display reflects the real value on DUT.

Panel operation

1. Press the Channel key.




2. Press *Probe* repeatedly to select the attenuation level.






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3. 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 just changes the voltage scale on the display. |





# Trigger

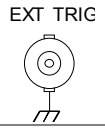
Trigger configures the condition GDS-1000 captures the incoming signal.

## Trigger type overview

| | |
|---|---|
| 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 is too narrow or too wide compared to the setting. |

## Trigger parameter overview

| | | |
|---|---|---|
| Trigger source | CH1 ~ 4 | Channel 1 ~ 4 input signals |
| | Line | AC mains signal |
| | Ext | External trigger input signal |




| | | |
|---|---|---|
| Trigger mode | Auto | GDS-1000 generates an internal trigger if there is no trigger event, to make sure waveforms are constantly updated regardless of trigger events. Select this mode especially when viewing rolling waveform at slower timebase. |
| | Normal | GDS-1000 acquires waveform only when a trigger event occurs. |



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| | | |
|---|---|---|
| | Single | GDS-1000 acquires waveform once when a trigger event occurs, then stop acquiring. Press the Single key to enter the single mode.   |
| | Auto level | In addition to behaving like the Auto mode, GDS-1000 automatically adjusts the trigger level to the center amplitude of the waveform. |
| Video standard (video trigger) | NTSC | National Television System Committee |
| | PAL | Phase Alternative by Line |
| | SECAM | SEquential Couleur A Memoire |
| 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 ~ 200us) and the triggering condition. | |
| | > Longer than | = Equal to |
| | < Shorter than | ≠ Not equal to |
| Trigger slope |  | Triggers on the rising edge. |
| |  | Triggers on the falling edge. |
| Trigger coupling | AC | Triggers only on the AC component. |
| | DC | Triggers on AC+DC component. |



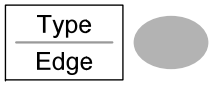


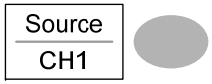
| | | |
|---|---|---|
| Frequency rejection | LF | Puts a high-pass filter and rejects the frequency below 50kHz. |
| | HF | Puts a low-pass filter and rejects the frequency above 50kHz. |
| Noise rejection | Rejects noise signal. | |

## Use edge trigger

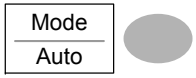
Panel operation

1. Press the Trigger menu key.  

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

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

   Range Channel 1, 2, Line, Ext

4. Press *Mode* repeatedly to select the trigger mode.  

   Range Auto, Normal, Auto Level

5. Press *Slope/coupling* to set trigger slope and coupling.  

6. Press *Slope* repeatedly to select the trigger slope, which also appears at the bottom of the display.  

   Range Rising edge, falling edge



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7. Press *Coupling* repeatedly to select the trigger coupling.

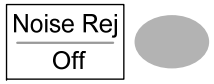
   Range DC, AC

8. Press *Rejection* to select the frequency rejection mode.

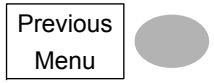
   Range LF, HF, Off

9. Press *Noise Rej* to turn the noise rejection On/Off.

   Range On, Off

10. Press *Previous* menu to go back to the previous menu.

## Use video trigger

Panel operation

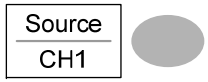
1. Press the Trigger menu key.

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

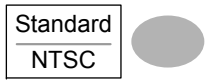
   
   

3. Press *Source* repeatedly to select the trigger source channel.

   Range Channel 1, 2

4. Press *Standard* repeatedly to select the video standard.





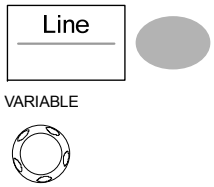
Range NTSC, PAL, SECAM

5. Press *Polarity* repeatedly to select the video signal polarity.

   Range positive, negative

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

   Field 1, 2

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

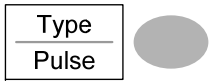
## Use pulse width trigger

Panel operation

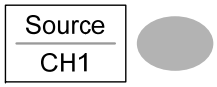
1. Press the Trigger menu key.

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

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

   Range Channel 1, 2, Line, Ext

4. Press *Mode* repeatedly to select the trigger mode.

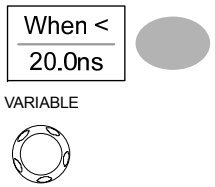
   
   



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Range Auto, Normal, Single, Auto Level

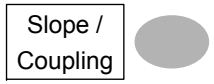
5. Press *When* repeatedly to select the pulse condition. Then use the Variable knob to set the pulse width.



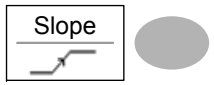

Condition > , < , = , ≠

Width 20ns ~ 200us

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




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



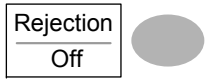

Range Rising edge, falling edge

8. Press *Coupling* repeatedly to select the trigger coupling.



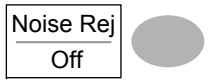

Range DC, AC

9. Press *Rejection* to select the frequency rejection mode.



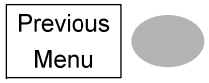

Range LF, HF, Off

10. Press *Noise Rej* to turn the noise rejection On/Off.




Range On, Off

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








## Use single trigger mode

Panel operation

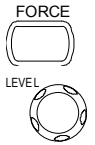
1. Press the Single trigger key. The single trigger mode becomes activated. To deactivate single trigger, press the Single trigger key again.




## Force trigger level to 50% of input signal amplitude

Panel operation

1. Press the trigger Force key. The trigger level automatically becomes 50% of the input signal amplitude. For manual adjustment, use the trigger Level knob.






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# System Setting

## View system information

Panel operation

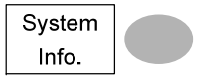
1. Press the Utility key.




2. Press *More*.

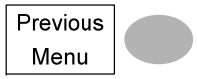



3. Press *System Info*. The upper half of the display shows the system information in the following format.




- Manufacturer
- Model
- Serial number
- Firmware version

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




## Select menu language

Parameter

Language selection differs according to the region to which GDS-1000 is shipped.

- English
- Chinese (traditional)
- Chinese (simplified)

Panel operation

1. Press the Utility key.




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








# SAVE/RECALL

## File Format/Utility

### Display image file format

| | |
|---|---|
| Format | DSxxxx.bmp or Axxxx.bmp (Windows bitmap format) |
| Contents | The current display image in 234 x 320 pixels, color format. The background color can be inverted (Ink saver function). |

### Waveform file format

| | | |
|---|---|---|
| Format | DSxxxx.csv or Axxxx.csv (Comma-separated values format, can be opened in spreadsheet applications such as Microsoft Excel) | |
| Waveform type | CH1, 2 | Input channel signal |
| | Math | Math operation result (page48) |
| Storage location | W1 ~ W15 | Waveform file stored in the internal memory. Stored waveforms can be copied to SD card for transfer, or to Ref. A, B for showing on the display (W1 ~ W15 waveforms cannot be directly recalled on the display). |



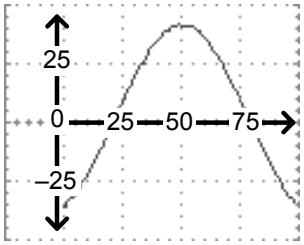
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| | |
|---|---|
| Ref A, B | Reference waveform stored in the internal memory, separate from W1 ~ W15. From Ref A/B, waveforms can be recalled directly on the display with amplitude and frequency information. Useful for reference purpose in measurements. |

**Contents: waveform data**

The waveform data can be used for detailed analysis. It consists of horizontal and vertical position of the waveform for the entire memory length.

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 length or voltage level which each data point represents differs according to the vertical and horizontal scale. For example:

Vertical scale: 10mV/div ( 4mV per point)

Horizontal scale: 100us/div (4us per point)

**Contents: other data**

The following information is also included in the waveform file.

- Memory length
- source channel
- vertical offset
- vertical scale
- coupling mode
- waveform last dot address
- date and time
- trigger level
- vertical position
- time base
- probe attenuation
- horizontal view
- horizontal scale
- sampling period
- sampling mode





## Setup file format

**Format**

DSxxxx.set or Axxxx.set (proprietary format)

The setup file saves or recalls the following setting.

**Contents**

| | | |
|---|---|---|
| Acquire | • mode | • memory length |
| Cursor | • source channel<br>• cursor location | • cursor on/off |
| Display | • dots/vectors<br>• grid type | • accumulation on/off |
| Measure | • item | • source channel |
| Utility | • hardcopy type<br>• menu language | • ink saver on/off |
| Horizontal | • display mode<br>• position | • scale |
| Trigger | • trigger type<br>• trigger mode<br>• video polarity<br>• pulse timing | • source channel<br>• video standard<br>• video line<br>• slope/coupling |
| Channel (vertical) | • vertical scale<br>• coupling mode<br>• bandwidth limit on/off | • vertical position<br>• invert on/off<br>• probe attenuation |
| Math | • operation type<br>• vertical position<br>• FFT window | • source channel<br>• unit/div |



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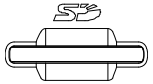
## SD card utility

**Background**

For SD card, file deletion, folder creation, file/folder rename are available from the front panel. This feature is not available for internally stored files.

**Panel operation**

1. Connect the card to the card slot.




2. Press the Save/Recall key. Select any save or recall functionality, for example SD card destination in Save image function.




(Example)

Save Image

Destination
SD Card

3. Press *File Utility*. The display shows the SD card contents in root directory.

File Utility

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




Select

**Create new folder / Rename 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 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.




Enter Character

Back Space

3. When editing is completed, press *Save*. A new folder or a new folder/file name is created.

Save

4. Press *Previous Menu* to go back to the previous menu.

Previous Menu

**Delete folder/file**

1. Move the cursor to the folder or file location and press *Delete*. A message appears at the bottom of the display, asking additional confirmation.

Delete

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

Delete

3. The SD card content is updated. Press *Previous Menu* to go back to Save/Recall menu.

Previous Menu



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# Quick Save (HardCopy)

**Background**

The Hardcopy key works as a shortcut for saving or printing out information.




Once set, subsequent file saving only requires pressing the Hardcopy key. Hardcopy key can be configured into two operations: save image and save all (image, waveform, setup).

Using the Save/Recall key can also save files but with more configurations. For details, see page79.

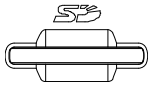



**Functionality**

| | |
|---|---|
| Save image (*.bmp) | Saves the current display image into an SD card connected to the front or rear panel terminal. |
| Save all | Saves the following items into an SD card connected to the front or rear panel terminal.<br>• Current display image (*.bmp)<br>• Current system setup (*.set)<br>• Current waveform data (*.csv)<br>• Last stored system setup (*.set)<br>• Last stored waveform data (*.csv) |

**Panel operation**

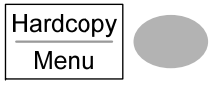
1. Connect the SD card to the slot.




2. Press the Utility key.



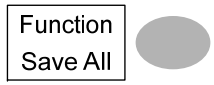

3. Press *Hardcopy Menu*.








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




5. To invert the color for the saved or printed display image, press *Ink Saver* and turn On the Ink Saver.




6. To save the image or folder, press the Hardcopy key. The file or folder is saved to the root directory of the SD card.






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# Save

## File type/source/destination

| Item | Source | Destination |
|---|---|---|
| Panel setup (DSxxxx.set) | • Front panel settings | • Internal memory: S1 ~ S15<br>• External memory: SD card |
| Waveform data (DSxxxx.csv) | • Channel 1, 2<br>• Math operation result<br>• Reference waveform A, B | • Internal memory: Reference waveform A, B, W1 ~ W15<br>• External memory: SD card |
| Display image (DSxxxx.bmp) | • Display image | • External memory: SD card |
| Save All | • Display image (Axxxx.bmp)<br>• Waveform data (Axxxx.csv)<br>• Front panel settings (Axxxx.set) | • External memory: SD card |

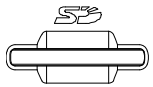




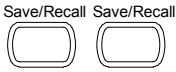
## Save panel setting

Panel operation

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



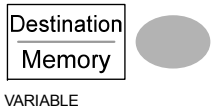

2. Press the Save/Recall key twice.




3. Press *Save Setup*. The display shows the available file destinations.




4. Press *Destination* repeatedly to select the saved location. Use the Variable knob to change the memory location (S1 ~ S15) or the file name (DSxxxx.set).







| | |
|---|---|
| Memory | Internal memory, S1 ~ S15 |
| SD card | External card, no practical limitation on the amount of file. When saved, the setup file is placed in the root directory. |

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




Note The file will not be saved if the power is turned Off or SD card is taken out before the message.



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File utility

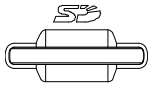
To edit SD card contents (create/ delete/ rename files and folders), press *File Utility*. For details, see page75.



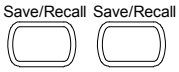

## Save waveform

Panel operation

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



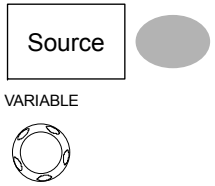
2. Press the Save/Recall key twice.




3. Press *Save Waveform*. The display shows the available source and destination options.

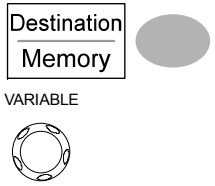



4. Press *Source*. Use the Variable knob to select the source signal.




| | |
|---|---|
| CH1 ~ CH2 | Channel 1 ~ 2 signal |
| Math | Math operation result (page48) |
| RefA, B | Internally stored reference waveforms A, B |

5. Press *Destination* repeatedly to select the file destination. Use the Variable knob to select the memory location or file name.








| | |
|---|---|
| Memory | Internal memory, W1 ~ W15 |
| SD card | External card, no practical limitation on the amount of file. When saved, the waveform file is placed in the root directory. |
| Ref | Internal reference waveform, A/B |

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




Note The file will not be saved if the power is turned Off or SD card is taken out before the message.

File utility

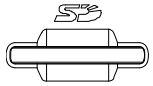
To edit SD card contents (create/ delete/ rename files and folders), press *File Utility*. For details, see page75.



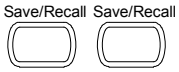

## Save display image

Panel operation

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



2. Press the Save/Recall key twice.




3. Press *Save Image*. The display shows the available file destinations.



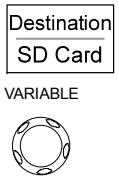

4. Press *Ink Saver* repeatedly to invert the background color (On) or not (Off).






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5. Press *Destination*. Use the Variable knob to select the file name.




| | |
|---|---|
| SD card | External card, no practical limitation on the amount of file. When saved, the image file is placed in the root directory. |

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




Note The file will not be saved if the power is turned Off or SD card is taken out before the message.

File utility

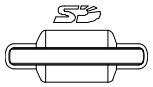
To edit SD card contents (create/ delete/ rename files and folders), press *File Utility*. For details, see page75.



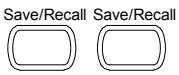

## Save All

Panel operation

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



2. Press the Save/Recall key twice.








3. Press *Save All*. The display shows the available file destinations. The following files are saved, contained in a folder.

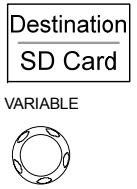



| | |
|---|---|
| Setup file (Axxxx.set) | Two types of setups are saved: the current panel setting and the last internally saved setting (one of S1 ~ S15). |
| Display image (Axxxx.bmp) | The current display image in bitmap format. |
| Waveform data (Axxxx.csv) | Two types of waveform data are saved: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




5. Press *Destination*. Use the Variable knob to select the file name.




| | |
|---|---|
| SD card | External card, no practical limitation on the amount of file. When saved, the folder is placed in the root directory. |

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






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Note The file will not be saved if the power is turned Off or SD card is taken out before the message.

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 utility

To edit SD card contents (create/ delete/ rename files and folders), press *File Utility*. For details, see page75.








# 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<br>• External memory: SD card | • Current front panel |
| Waveform data (DSxxxx.csv) | • Internal memory: W1 ~ W15<br>• External memory: SD card | • Reference waveform A, B |

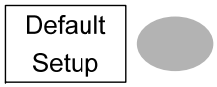
## Recall default panel setting

Panel operation

1. Press the Save/Recall key.




2. Press *Default Setup*. The factory installed setting is recalled and replaces the current panel setting.




Setting contents The following is the default setting contents.

Acquisition Mode: Normal



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| | | |
|---|---|---|
| Channel | Scale: 2V/Div | CH1: On, CH2/3/4: Off |
| | Coupling: DC | Invert: Off |
| | BW limit: Off | Probe attenuation: x1 |
| Cursor | Source: CH1 | Horizontal: None |
| | Vertical: None | |
| Display | Type: Dots | 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 | Source1: CH1 | Measurement: Off |
| Trigger | Type: Edge | Source: Channel1 |
| | Mode: Auto | Slope:  |
| | Coupling: DC | Rejection: Off |
| | Noise Rejection: Off | |
| Utility | SaveImage, InkSaver Off | |





## Recall reference waveform on the display

Panel operation

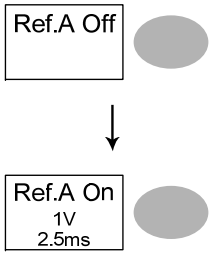
1. The reference waveform must be stored in advance. See page81 for waveform store details.
2. Press the Save/Recall key.



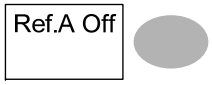

3. Press *Display Refs*. The reference waveform display menu appears.




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




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



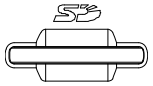



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## Recall panel setting

Panel operation

1. (For recalling from an external SD card) Connect the card to the slot.



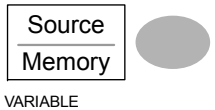
2. Press the Save/Recall key.




3. Press *Recall Setup*. The display shows the available file sources.




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







| | |
|---|---|
| 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.




Note 

The file will not be saved if the power is turned Off or SD card is taken out before the message.

File utility

To edit SD card contents (create/ delete/ rename files and folders), press *File Utility*. For details, see page75.



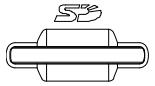





## Recall waveform

Panel operation

1. (For recalling from an external SD card) Connect the card to the slot.



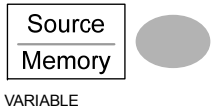
2. Press the Save/Recall key.




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




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) or the file name (DSxxxx.csv).







| | |
|---|---|
| Memory | Internal memory, W1 ~ W15 |
| SD card | External flash drive, no practical limitation on the amount of file. 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.







| | |
|---|---|
| RefA, B | Internally stored reference waveforms A, B |



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




Note The file will not be saved if the power is turned Off or SD card is taken out before the message.

File utility

To edit SD card contents (create/ delete/ rename files and folders), press *File Utility*. For details, see page75.








# MAINTENANCE

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

## Vertical Resolution Calibration

Panel operation

1. Press the Utility key.




2. Press *More*.



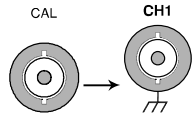

3. Press *Self Cal Menu*.




4. Press *Vertical*. A message appears at the bottom of the display.

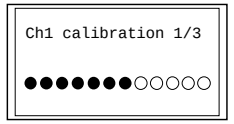



5. Connect the calibration signal from the rear panel CAL out to Channel1 input.




6. Press the specified key and start calibration.

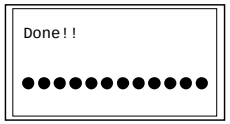
7. The calibration for Channel1 starts and ends automatically in less than 5 minutes.






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8. When finished, connect the calibration signal to Channel2 and repeat the procedure.

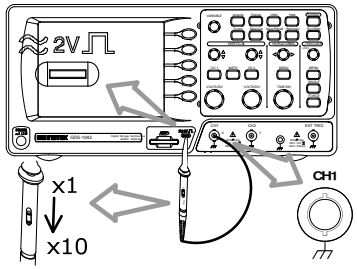



9. When the calibration for all channels are completed, the display goes back the default state.

## Probe Compensation

Panel operation

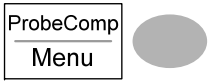
1. Connect the probe between Channel1 input and the probe compensation output (2Vp-p, 1kHz square wave) on the front panel. Set the probe attenuation to x10.



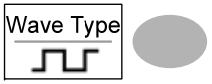

2. Press the Utility key.




3. Press *ProbeComp*.




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



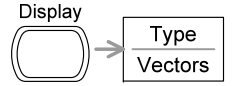


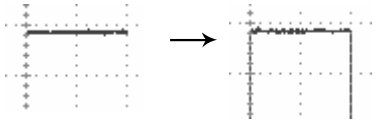



5. Press the Autoset key. The compensation signal appears on the display.

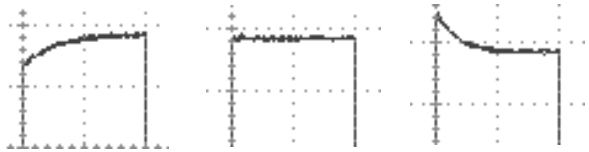


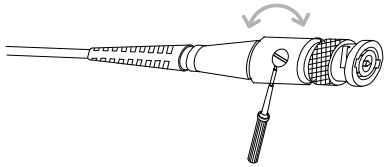

6. Press the Display key, then *Type* to select the vector waveform.



7. Turn the adjustment point on the probe until the signal edge becomes sharp.





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# FAQ


- The input signal does not appear on 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 specification.
- The SD card slot does not accept my card.


## The input signal does not appear on 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 automatic measurement result, press the Measure key twice, then Press Indication (Off). See page43 for details.

To clear FFT result, press the Math key twice. See page48 for details.

To clear Help result, press the Help key again. See page36 for details.

## The waveform does not update (frozen).

Press the Run/Stop key to unfreeze the waveform. See page39 for details.

If this does not help, the trigger mode might be set to Single. Press the Single trigger key again. See page64 for trigger setting details.





## The probe waveform is distorted.

You might need to compensate the probe. For details, see page93. Note that the frequency accuracy and duty factor are not specified for probe compensation waveform and therefore it should not be used for other reference purpose.

## Autoset does not catch the signal well.

Autoset function cannot catch signals under 30mV or 30Hz. Please use the manual operation. See page38 for Autoset details.

## I want to clean up the cluttered panel settings.

Recall the default settings by pressing Save/Recall key→Default Setting. For default setting contents, see page35.

## The saved display image is too dark on the background.

Use the Inksaver function which reverses the background color. For details, see page82.

## The accuracy does not match the specification.

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

## The SD card slot does not accept my card.

Make sure it is a standard SD card. MMC and SDHC are not supported.

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

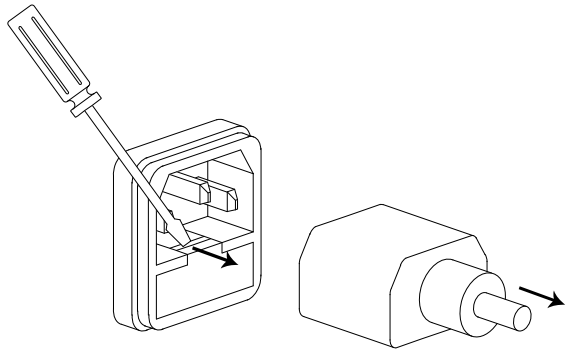


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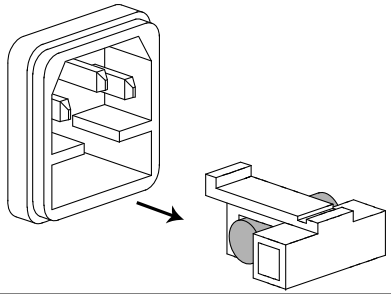
# APPENDIX

## Fuse Replacement

Step 1. Take off the power cord and remove the fuse socket using a minus driver.



2. Replace the fuse in the holder.



Rating T1A, 250V





## GDS-1000 Specification

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

### Model-specific

| | | |
|---|---|---|
| GDS-1022 | Bandwidth (−3dB) | DC coupling: DC ~ 25MHz<br>AC coupling: 10Hz ~ 25MHz |
| | Bandwidth Limit | None |
| | Trigger Sensitivity | Approx. 0.5div or 5mV |
| | External Trigger Sensitivity | ~ 50mV |
| | Rise Time | < 14ns |
| GDS-1042 | Bandwidth (−3dB) | DC coupling: DC ~ 40MHz<br>AC coupling: 10Hz ~ 40MHz |
| | Bandwidth Limit | None |
| | Trigger Sensitivity | 0.5div or 5mV (DC ~ 25MHz)<br>1.5div or 15mV (25MHz~40MHz) |
| | External Trigger Sensitivity | ~ 50mV |
| | Rise Time | < 8.75ns |
| GDS-1062 | Bandwidth (−3dB) | DC coupling: DC ~ 60MHz<br>AC coupling: 10Hz ~ 60MHz |
| | Bandwidth Limit | 20MHz (−3dB) |
| | Trigger Sensitivity | 0.5div or 5mV (DC ~ 25MHz)<br>1.5div or 15mV (25MHz~60MHz) |
| | External Trigger Sensitivity | ~ 50mV (DC~25MHz)<br>~ 100mV (25MHz~60MHz) |
| | Rise Time | < 5.8ns |
| GDS-1102 | Bandwidth (−3dB) | DC coupling: DC ~ 100MHz<br>AC coupling: 10Hz ~ 100MHz |
| | Bandwidth Limit | 20MHz (−3dB) |
| | Trigger Sensitivity | 0.5div or 5mV (DC ~ 25MHz)<br>1.5div or 15mV (25MHz~100MHz) |
| | External Trigger Sensitivity | ~ 50mV (DC~25MHz)<br>~ 100mV (25MHz~100MHz) |
| | Rise Time | < 3.5ns |



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## Common

| | | |
|---|---|---|
| Vertical | Sensitivity | 2mV/div~5V/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%, ~16pF |
| | Polarity | Normal & Invert |
| | Maximum Input | 300V (DC+AC peak), CAT II |
| | Math Operation | +, –, FFT |
| | Offset Range | 2mV/div~50mV/div: ±0.4V<br>10mV/div~500mV/div: ±4V<br>1V/div~5V/div: ±40V |
| Trigger | Sources | CH1, CH2, Line, EXT |
| | Modes | Auto-Level, Auto, Normal, Single, TV, Edge, Pulse Width, Time-Delay, Event-Delay |
| | Time Delay Range | 100ns to 1.3ms |
| | Event Delay Range | 2 to 65000 |
| | Start Trigger Level | ±12V, adjustable (for USER mode) |
| | Coupling | AC, DC, LFrej, HFrej, Noise rej |
| | Sensitivity | See model-specific specifications |
| | TV Trigger Sensitivity | 0.5div of synchronization signal |
| External trigger | Range | DC: ±15V, AC: ±2V |
| | Sensitivity | See model-specific specifications |
| | Input Impedance | 1MΩ±2%, ~16pF |
| | Maximum Input | 300V (DC+AC peak), CATII |
| Horizontal | Range | 1ns/div~10s/div, 1-2-5 increment |
| | 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 | 250M Sa/s maximum |
| | Equivalent | 25G Sa/s maximum |
| | Vertical Resolution | 8 bits |
| | Record Length | 4k points |





| | | |
|---|---|---|
| | Single shot | 4k points record, 25MHz bandwidth |
| | Acquisition | Normal, Peak Detect, Average |
| | Peak Detection | 10ns (500ns/div ~ 10s/div) |
| | 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 |
| | Cursors | Voltage difference (ΔV) and Time difference (ΔT) between cursors<br>Reciprocal of ΔT in Hertz (1/ΔT) |
| | Auto Counter | Resolution: 6 digits, Accuracy: ±2%<br>Signal source: All available trigger source except the Video trigger |
| Trigger Frequency Counter | Resolution | 6 digits |
| | Frequency Range | 20Hz minimum to rated bandwidth |
| | Accuracy | ±2% |
| | Signal Source | All 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, 25VA maximum |
| | Fuse Rating | 1A slow, 250V |
| Operation Environment | Ambient temperature 0 ~ 50°C<br>Relative humidity ≤ 80% @35°C | |
| Storage Environment | Ambient temperature –20 ~ 70°C<br>Relative humidity ≤ 80% @70°C | |
| Dimensions | 140 (D) x 142 (H) x 310 (W) mm | |
| Weight | Approx. 2.5kg | |



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# Declaration of Conformity

We
**GOOD WILL INSTRUMENT CO., LTD.**
(1) No.7-1, Jhongsing Rd., Tucheng City, Taipei County, Taiwan
(2) No. 69, Lu San Road, Suzhou City (Xin Qu), Jiangsu Sheng, China
declare, that the below mentioned product
**Type of Product: Digital Storage Oscilloscope**
**Model Number: GDS-1022, GDS-1042, GDS-1062, GDS-1102**
are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (89/336/EEC, 92/31/EEC, 93/68/EEC) and Low Voltage Directive (73/23/EEC, 93/68/EEC).
For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Directive, the following standards were applied:

◎ **EMC**

| EN 61326-1: Electrical equipment for measurement, control and laboratory use –– EMC requirements (1997 + A1:1998 + A2:2001 + A3:2003) | |
|---|---|
| Conducted Emission<br>Radiated Emission<br>EN 55011: Class A 1998 + A1:1999 + A2:2002 | Electrical Fast Transients<br>EN 61000-4-4: 2004 |
| Current Harmonics<br>EN 61000-3-2: 2000 + A2:2005 | Surge Immunity<br>EN 61000-4-5: 1995 + A1:2001 |
| Voltage Fluctuations<br>EN 61000-3-3: 1995 + A1:2001 + A2:2005 | Conducted Susceptibility<br>EN 61000-4-6: 1996 + A1:2001 |
| Electrostatic Discharge<br>EN 61000-4-2: 1995 + A1:1998 + A2:2001 | Power Frequency Magnetic Field<br>EN 61000-4-8: 1993 + A1:2001 |
| Radiated Immunity<br>EN 61000-4-3: 2002 + A1:2002 | Voltage Dip/ Interruption<br>EN 61000-4-11: 2004 |

◎ **Safety**

| Low Voltage Equipment Directive 73/23/EEC & amended by 93/68/EEC |
|---|
| Safety Requirements<br>IEC/EN 61010-1: 2001 |



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