Digital Storage Oscilloscope

GDS-2000 Series

USER MANUAL
GW INSTEK PART NO.

ISO-9001 CERTIFIED MANUFACTURER

The information in this manual was correct at the time of printing. However, Good Will continues to improve products and reserves the rights to change specification, equipment, and maintenance procedures at any time without notice.

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Table of Contents

SAFETY INSTRUCTIONS

This chapter contains important safety instructions that you must follow when operating GDS-2000 and when keeping it in storage. Read the following before any operation to insure your safety and to keep the best condition for GDS-2000.

Safety Symbols

These safety symbols may appear in this manual or on GDS-2000.

 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-2000 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-2000.
- Avoid severe impacts or rough handling that leads to damaging GDS-2000.
- Do not discharge static electricity to GDS-2000.
- 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-2000 unless you are qualified.

(Measurement categories) EN 61010-1:2001 specifies the measurement categories and their requirements as follows. GDS-2000 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.

Fuse

WARNING

- Fuse type: T2A/250V
- Make sure the correct type of fuse is installed before power up.
- To ensure fire protection, replace the fuse only with the specified type and rating.
- Disconnect the power cord before fuse replacement.
- Make sure the cause of fuse blowout is fixed before fuse replacement.

Cleaning GDS-2000

- Disconnect the power cord before cleaning.
- Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid.
- Do not use 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)
- Relative Humidity: < 80%
- Altitude: < 2000m
- Temperature: 0°C to 50°C

(Pollution Degree) EN 61010-1:2001 specifies the pollution degrees and their requirements as follows. GDS-2000 falls under degree 2.

Pollution refers to “addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity”.

- Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence.
- Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.

Storage environment

- Location: Indoor
- Relative Humidity: < 85%
- Temperature: 0°C to 50°C

Power cord for the United Kingdom

When using GDS-2000 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 engaged in a live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

GETTING STARTED

This chapter describes GDS-2000 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-2000 Series Overview

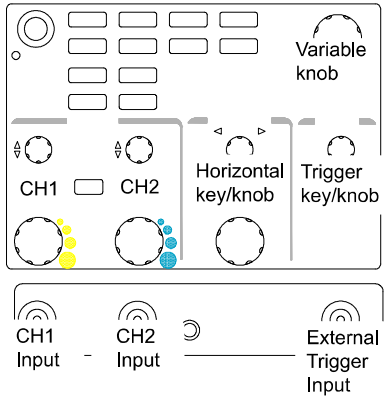
Series lineup

GDS-2000 series consists of 6 models, divided into 2-channel and 4-channel versions.

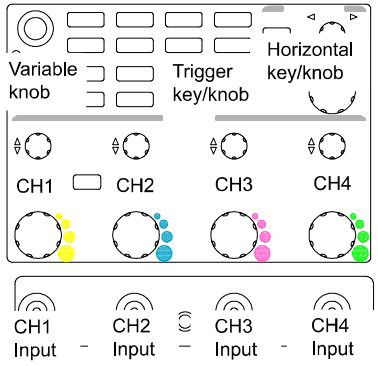
Model name	Frequency bandwidth	Input channels	Ext. trigger input	Advanced delay trigger
GDS-2062	60MHz	2	Yes	Yes
GDS-2102	100MHz	2	Yes	Yes
GDS-2202	200MHz	2	Yes	Yes
GDS-2064	60MHz	4	No	No
GDS-2104	100MHz	4	No	No
GDS-2204	200MHz	4	No	No

The differences between 2 and 4 channel model appearance are in the horizontal key, trigger key, variable knob, and external trigger input layout.

2-Channel model



4-Channel model



Main Features

Performance

- High sampling rate: up to 1GS/S real-time, 25GS/s equivalent-time
- Deep memory: 25k points record length
- Minimum 10ns peak detection

Feature

- Wide selection range: 60MHz to 200MHz bandwidth, 2 or 4 channels
- Powerful display: 5.6 in. color TFT, wide viewing angle, 8x12 divisions waveform support
- Battery operation
- Automatic measurements: maximum 27 types
- FFT analysis
- Triggers: Edge, Video, Pulse Width
- Advanced Delay trigger (for 2CH model only)
- Program and play mode
- Color printout of display contents
- Go-No Go test
- Built-in Help

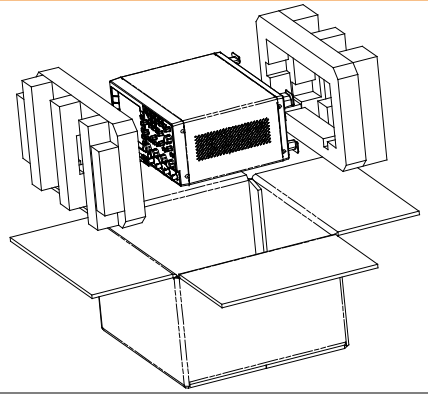
Interface

- USB host port: front and rear panel, to printers and storage devices
- USB slave port, RS-232C port, GPIB port (option): for remote control
- USB slave port for PC software connection
- Optional USB number pad input.
- Calibration output
- Go-No Go output
- External trigger input (for 2CH model only)

Package Contents

Check the contents before using GDS-2000.

Opening the box



Contents

- Main unit
- Probe set

  GDS-2062: GTP-060A x 2

  GDS-2064: GTP-060A x 4

  GDS-2102: GTP-100A x 2

  GDS-2104: GTP-100A x 4

  GDS-2202: GTP-250A x 2

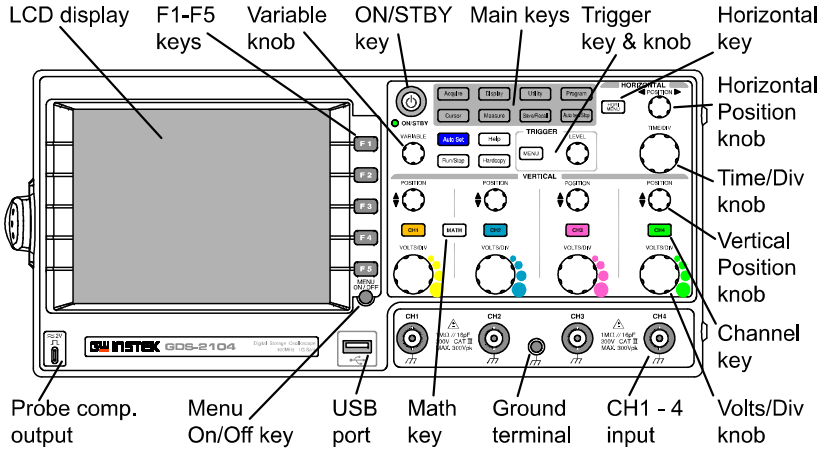
  GDS-2204: GTP-250A x 4
- Power cord
- User manual (this document)

Note

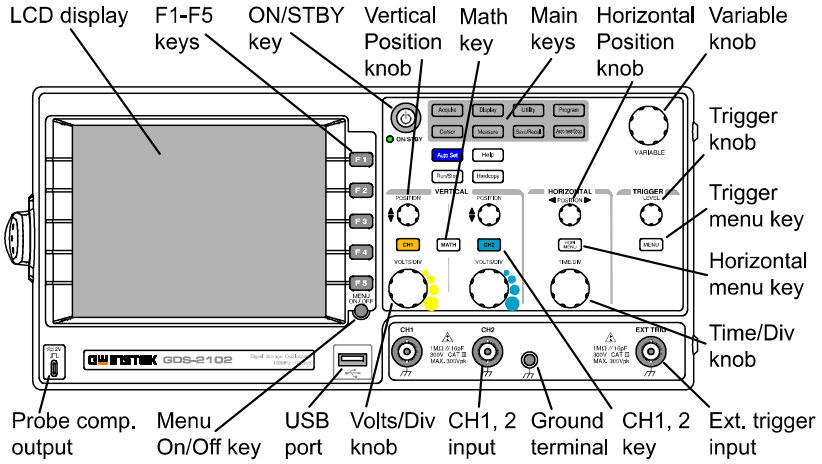
- For detailed specification of probe, see page198.
- Program manual, PC software, and USB driver are downloadable from GWInstek website. Visit www.gwinstek.com.tw, GDS-2000 corner.

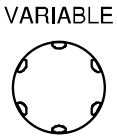
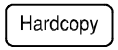
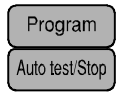
Appearance

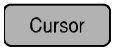
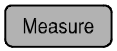
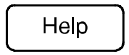
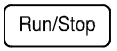
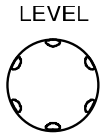
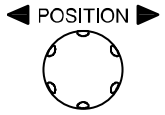
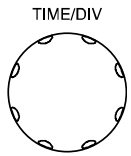
GDS-2064/2104/2204 Front Panel

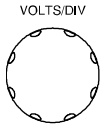
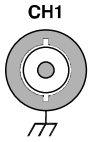
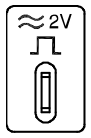
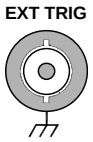


GDS-2062/2102/2202 Front Panel

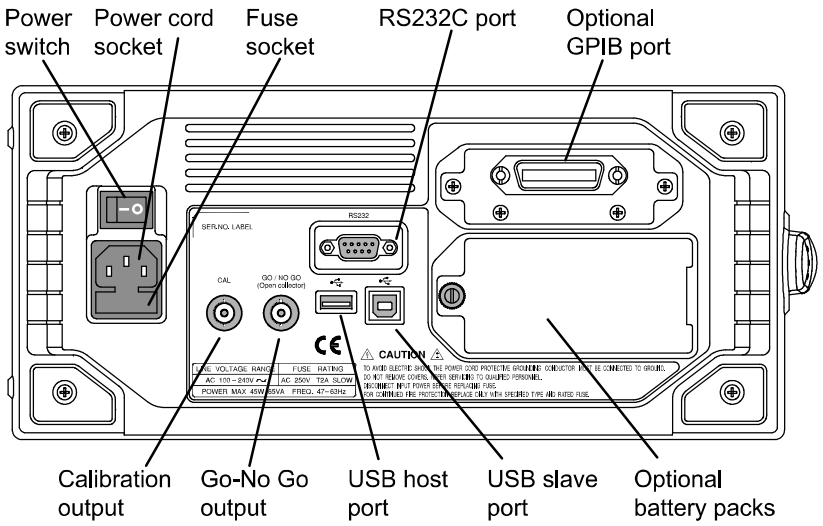


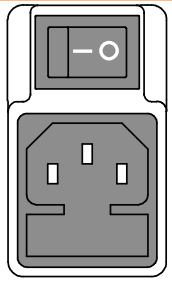
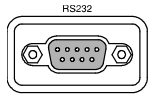
LCD display	TFT color, 320 x 234 resolution, wide angle view LCD display.	
F1 ~ F5 function keys		Activates the functions which appear on the left side of the LCD display.
Variable knob		Increases/decreases value or moves to the next/previous parameter.
On/Standby key		Switches between the power On state (green indicator) and standby state (red indicator). For power up sequence, see page23.
Acquire key		Configures acquisition mode (page94).
Display key		Configures display settings (page103).
Utility key		Configures or shows hardcopy (page142), printer configuration (page167), interface (page177), system info (page132), date/time (page133), menu language (page132), Go-No Go (page78), calibration (page186), and probe compensation (page187).
Hardcopy key		Prints out display image (page167) or transfers data to USB flash drive (page142).
Program key + Auto test key		Edits, runs, and stops program operation (page87).

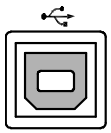
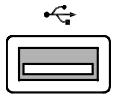
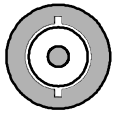
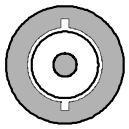
Cursor key		Configures and runs cursor measurements (page68).
Measure key		Configures and runs automatic measurements (page60).
Help key		Shows Help contents on the LCD display (page49).
Save/Recall key		Saves and recalls waveform, image, and panel setup (page135).
Auto Set key		Finds signals and sets the appropriate horizontal / vertical / trigger settings (page53).
Run/Stop key		Freezes (Stop) or continues (Run) signal acquisition (page55).
Trigger menu key		Configures trigger settings (page122).
Trigger knob		Sets trigger level (page122).
Horizontal menu key		Configures horizontal view (page108).
Horizontal position knob		Sets the horizontal position of waveforms (page108).
Time/Div knob		Selects the horizontal scale (page109).

Vertical position knob		Sets the vertical position of waveforms (page116).
Channel menu key		Configures the vertical scale and coupling mode for each channel (page116).
Volts/Div knob		Selects the vertical scale (page116).
Input terminal		Accepts input signals. Input impedance: 1MΩ±2%.
Ground terminal		Accepts the DUT ground lead for common ground.
Math key		Configures and runs math operation (page73).
USB host port		TypeA, 1.1/2.0 compatible. Prints out display image (page167) or transfers data (page135).
Menu On/Off key		Shows or hides menu in the LCD display (page106).
Probe compensation output		Outputs 2Vp-p, square signal for probe compensation (page187) or demonstration. Can be used for generic purpose (page58) as well.
External trigger input		For 2ch model only. Accepts external trigger signal (page122). Input impedance: 1MΩ±2%.

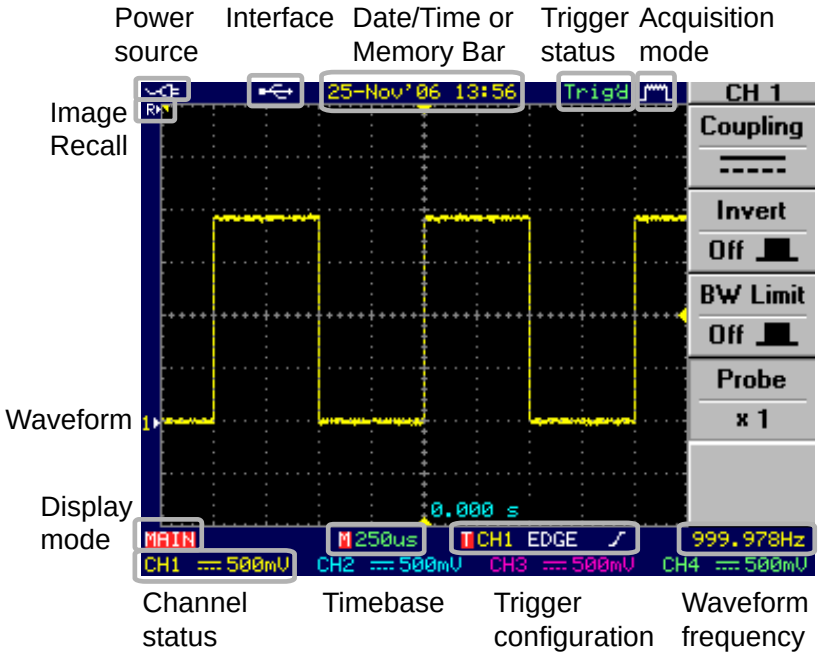
Rear Panel



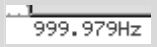
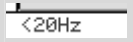
Power switch		Power switch turns the main power On (I) / Off (O).
Power cord socket		Power cord socket accepts AC mains, 100 ~ 240V, 50/60Hz.
Fuse socket		Fuse socket holds AC main fuse, T2A/250V.
		For power up sequence, see page23.
		For fuse replacement procedure, see page193.
RS232C port		Accepts DB-9 RS-232C connector for remote control (page178).
GPIB port (optional)		Accepts 24 pin male GPIB connector for remote control (page180).

Battery packs (optional)		Holds 2 packs of Li-Ion battery for portable usage (page183).
USB slave port		Accepts typeB connector for remote control (page177) or PC software connection. USB 1.1/2.0 full speed compatible.
USB host port		Accepts typeA connector for display image printout (page167) or data transfer (page135). Simultaneous use with the front panel host port is not allowed. TypeA, 1.1/2.0 full speed compatible.
Go-No Go output	GO / NO GO (Open collector) 	Outputs Go-No Go test result (page78) as 10us pulse signal.
Calibration output	CAL 	Outputs the signal for vertical scale accuracy calibration (page186).

Display



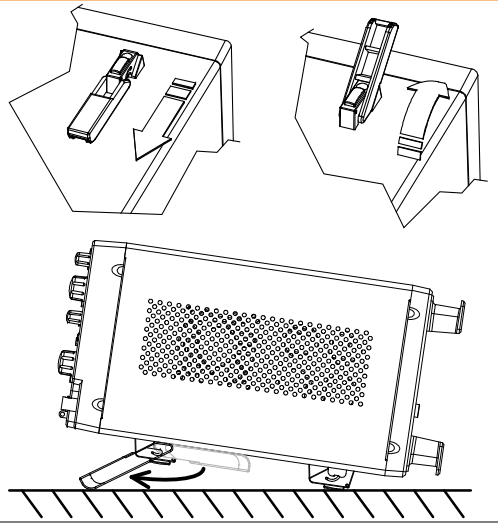
Waveforms	Shows input signal waveforms.	
	Channel 1: Yellow	Channel 2: Blue
	Channel 3: Pink	Channel 4: Green
Power source		AC main is the source.
		Battery (page183) is the source.
		AC main is the source: battery is installed as well.
Image recall		The "R" indicator shows that the display shows pre-recorded image, not signal waveform.
Interface	Shows the active interface for remote connection (page176) and PC software connection.	

		USB
		RS-232C
		GPIB (optional)
Date/Time		Current date and time (page133).
Memory bar		The ratio and the position of the displayed waveform compared with the internal memory (page108).
Trigger status	Trig'd	Triggered.
	Trig?	Not triggered, display not updated.
	Auto	Not triggered, display updated.
	STOP	Trigger stopped. Also appears in Run/Stop (page55).
	For trigger details, see page122.	
Acquisition mode		Normal mode
		Peak detect mode
		Average mode
	For acquisition details, see page94.	
Input signal frequency		Shows the input signal frequency.
		Indicates the frequency is less than 20Hz (lower frequency limit).
Trigger configuration	T CH1 EDGE T CH1 VIDEO	Trigger source, type, slope. (Video trigger) trigger source, polarity.
	For trigger details, see page122.	
Channel status	CH1 500mV	Channel 1, bw limit On, DC coupling, 500mV/Div
	CH1 500mV	Channel 1, bw limit Off, AC coupling, 500mV/Div
	For channel details, see page116.	

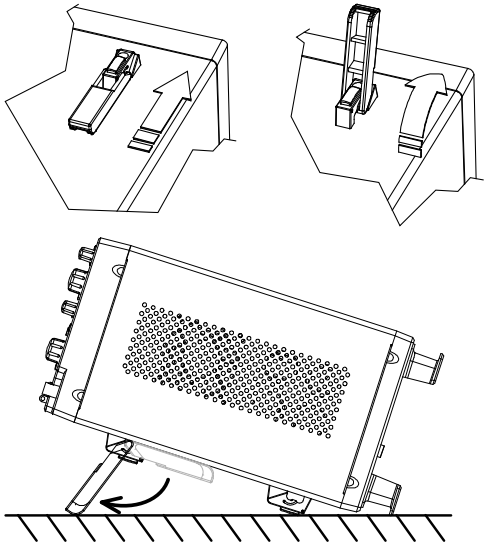
Set Up

Tilt stand

Low angle



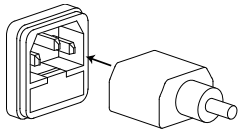
High angle



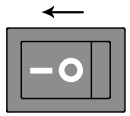
Power up

Step

1. Connect the power cord to the rear panel socket. (No need when using the battery).



2. Turn On the main power switch. I : On, O: Off.



3. The ON/STBY indicator on the front panel turns red.

4. Press the ON/STBY key. The indicator turns green and the display becomes active in 6 ~ 8 seconds.

5. The power icon on the upper left corner of the display shows the power source. When both AC mains and battery are available, AC mains is automatically selected.

AC mains

Battery

AC mains (battery also installed)

Note

GDS-2000 recovers the state right before the power OFF. The default setting can be recovered by pressing the Save/Recall key → F1 (Default Setup). For details, see page153.

First Time Use

Background

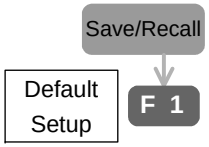
This section describes how to connect a signal, adjust the scale, and compensate the probe. Before operating GDS-2000 in a new environment, run these steps to make sure the instrument is functionally stable and that you are comfortable operating it.

1. Power On

Follow the procedure on the previous page.

2. Reset system

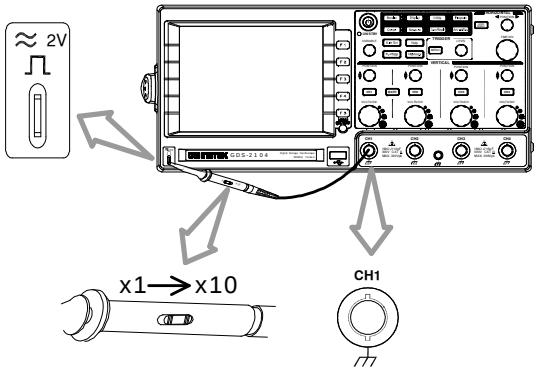
Reset the system by recalling the factory setting. Press the Save/Recall key, then F1 (Default Setup). For factory setting details, see page48.



2. Connect probe

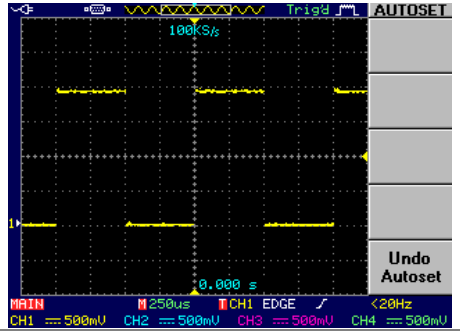
Connect the probe to Channel1 input terminal and probe compensation signal output (2Vp-p, 1kHz square wave).

Set the probe attenuation to x10.



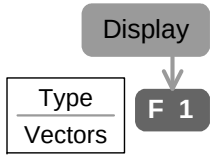
3. Capture signal (Auto Set)

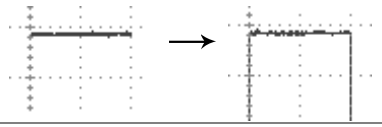
Press the Auto Set key. A square waveform appears on the center of the waveform. For Auto Set details, see page53.



4. Select vector waveform

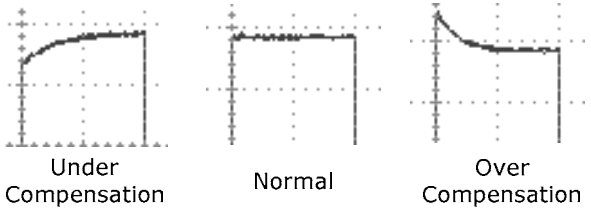
Press the Display key, then F1 (Type) twice to select the vector waveform.

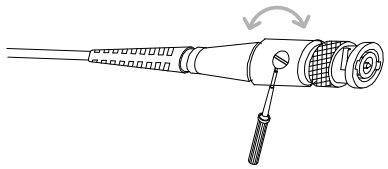




5. Compensate probe

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





6. Start operation

Continue with the other operations.

Measurement: page50 Configuration: page92

Remote control: page176

QUICK REFERENCE

This chapter describes GDS-2000 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. Key bindings for the optional USB number pad operation are also included.

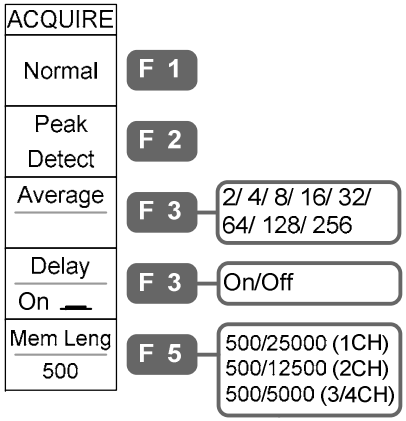
Menu tree / shortcut

Menu Tree / Operation Shortcuts

Convention

F1	= Press F1
F1↵	= Press F1 repeatedly
F1 ~ F4	= Select one from F1 to F4 and press it
F1→VAR ◌	= Press F1, then use the Variable knob
Auto Set	= Press the function key itself (AutoSet in this case)

Acquire key



Select acquisition mode	F1~F3
Select average number (only in average mode)	F3↵
Select delay On/Off	F4↵
Select memory length	F5↵

Auto Set key

Auto Set	Automatically find signal and set scale	Auto Set
	Undo Auto Set (available for 5 seconds)	F5

Auto test/Stop key

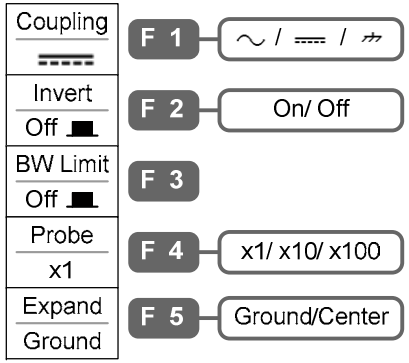
Auto test/Stop

→ See Program key (page34)

Recalls memory setting S1 (not during program mode)

CH1 ~ 4 key

CH1



Select coupling mode

F1↵

Turn waveform invert On/Off

F2↵

Turn bandwidth limit On/Off

F3↵

Select probe attenuation factor

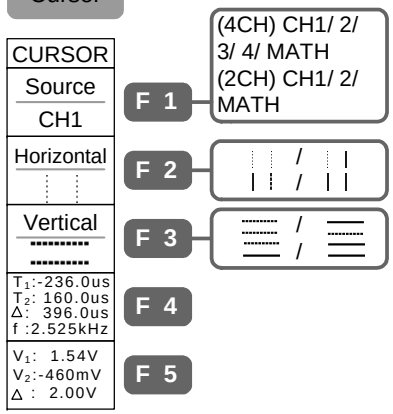
F4↵

Toggle from expanding waveforms from ground or the centre of the desplay

F5↵

Cursor key

Cursor



Select cursor source channel

F1↵

Select active horizontal cursor

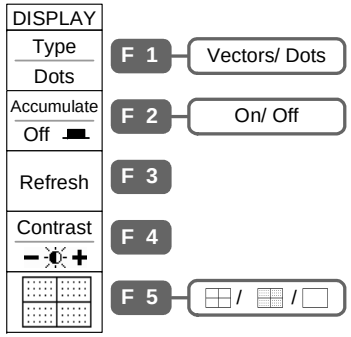
F2↵

Select active vertical cursor

F3↵

Display key

Display



Select waveform display type

F1↵

Waveform accumulation On/Off

F2↵, F3 (display refresh when On)

Set display contrast

F4→VAR

Select display grid

F5↵

Hardcopy key

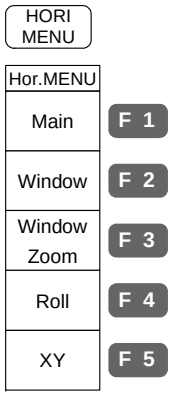
Hardcopy

→ See Utility key (page41)

Help key

Help — Turn help mode On/Off Help

Horizontal menu key



Select main (default) display

F1

Select Window mode and zoom

F2→TIME/DIV ◌, F3

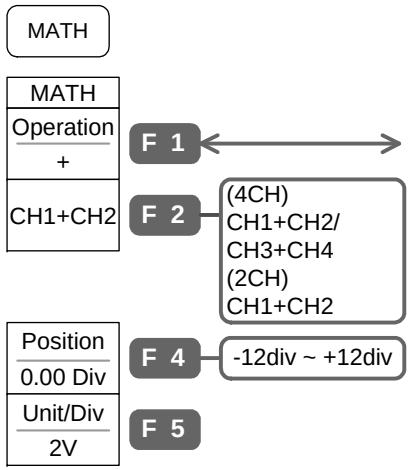
Select windows roll mode

F4

Select XY mode

F5

Math key (1/2)



Select math operation (+/–/x)

F1↵

Select channel combination

F2↵

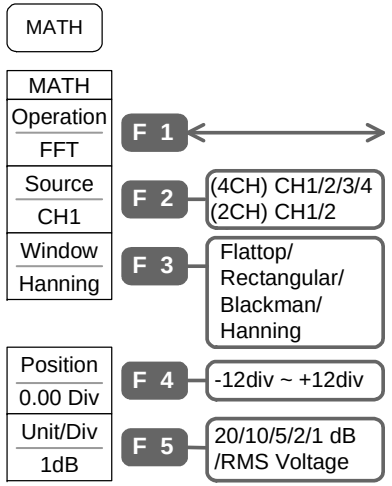
Set result position

F4→VAR ◌

Math result vertical scale

F5→VOLTS/DIV ◌

Math key (2/2)



Select math operation type (FFT)

F1↵

Select FFT source channel

F2↵

Select FFT window

F3↵

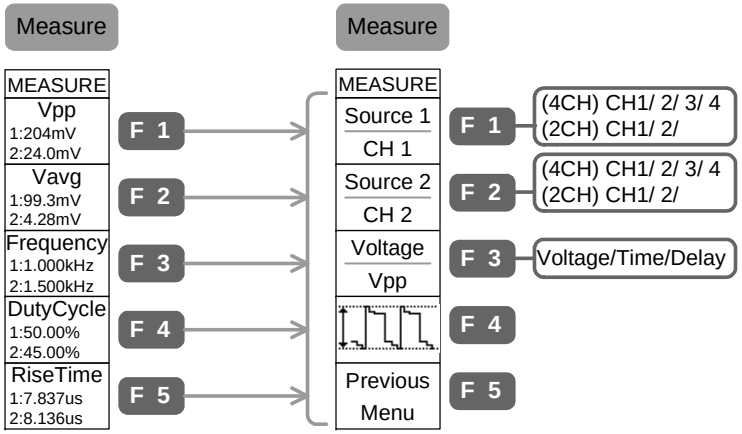
Select FFT result position

F4→VAR ◌

Select vertical scale

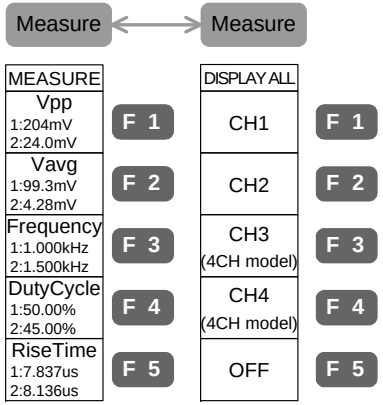
F5↵

Measure key (1/2)



Select source channel 1	F1 ↵
Select source channel 2	F2 ↵
Select measurement type	F3 ↵
Select measurement item	VAR ◌ or F4 ↵
Go back to previous menu	F5

Measure key (2/2)



Switch between Individual mode and Display All mode

Measure ↵

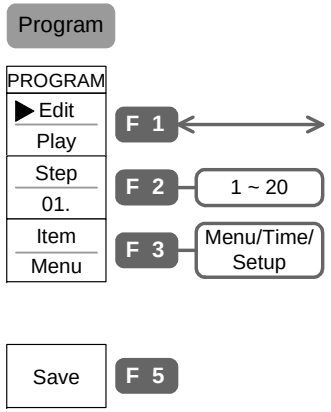
Select channel for Display All mode

F1 ~ F4

Clear Display All mode

F5 ↵

Program key (1/2)



Select Program Edit mode

F1 ↵

Select program step

F2→VAR ◌

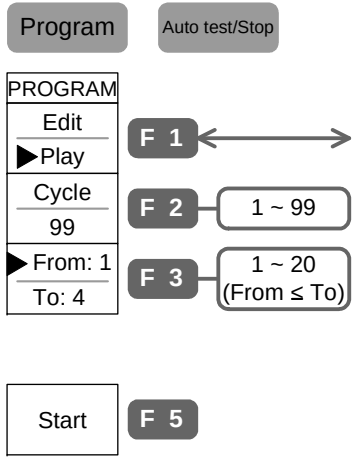
Select edit item

F3 ↵

Save edited program

F5

Program key (2/2)



Select Program Play mode

F1 ↵

Select program loop count

F2→VAR ◌

Select first step (From:)

F3 ↵→VAR ◌

Select last step (To:)

F3 ↵→VAR ◌

Start /stop program running

F5 (start), Auto test/Stop (stop)

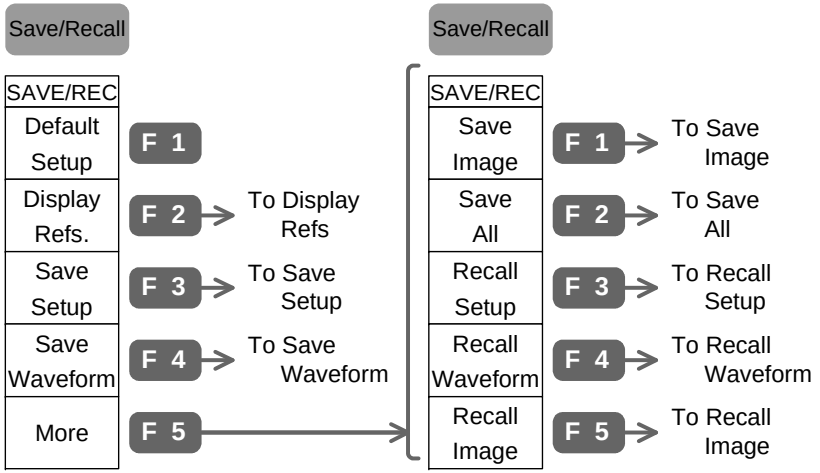
Run/Stop key

Run/Stop

Freeze/unfreeze signal acquisition

Run/Stop ↵

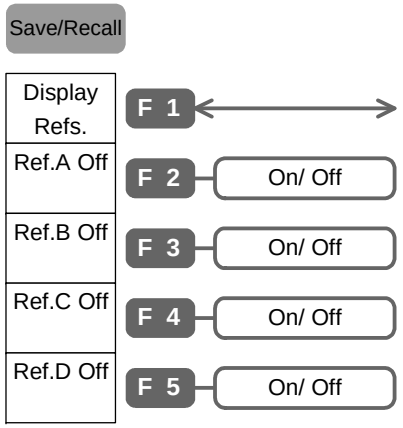
Save/Recall key (1/9)



Recall default setup	F1

Save/Recall key (2/9)

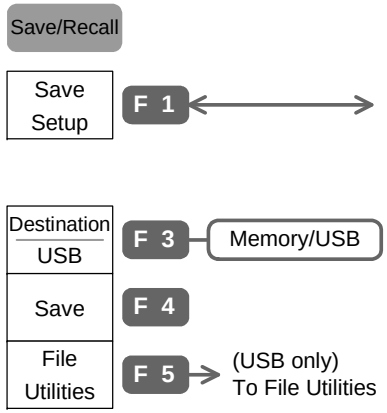
Display Refs.



Select Display Refs menu	F1 ↵
Turn ref. waveform A On/Off	F2 ↵
Turn ref. waveform B On/Off	F3 ↵
Turn ref. waveform C On/Off	F4 ↵
Turn ref. waveform D On/Off	F5 ↵

Save/Recall key (3/9)

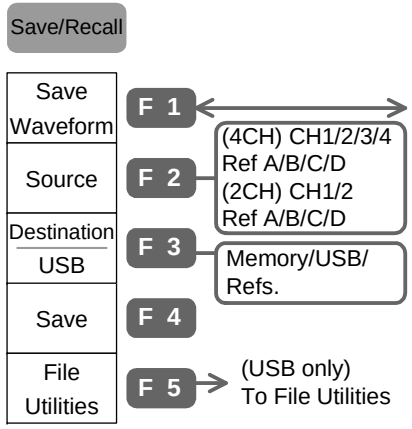
Save Setup



Select Save Setup menu	F1 ↵
Select destination	F3 ↵ → VAR ◌
Save setup	F4
Go to USB flash drive contents edit mode	F5

Save/Recall key (4/9)

Save Waveform



Select Save Waveform menu	F1 ↵
Select waveform source	F2 ↵
Select waveform destination	F3 ↵ → VAR ◌
Save waveform	F4
Go to USB flash drive contents edit mode	F5

Save/Recall key (5/9)

Save All

Save/Recall

Save All	F 1	
Ink Saver Off	F 2	On/ Off
Destination USB	F 3	
Save	F 4	
File Utilities	F 5	(USB only) To File Utilities

Select Save All menu

F1 ↵

Turn ink saver On/Off

F2 ↵

Select destination

F3 ↵ → VAR ◌

Save all

F4

Go to USB flash drive contents edit mode

F5

Save/Recall key (6/9)

Recall Setup

Save/Recall

Recall Setup	F 1	
Source USB	F 2	USB/Memory
Recall	F 4	
File Utilities	F 5	(USB only) To File Utilities

Select Recall Setup menu

F1 ↵

Select setup source

F2 ↵ → VAR ◌

Recall setup

F4

Go to USB flash drive contents edit mode

F5

Save/Recall key (7/9)

Recall Waveform

Save/Recall

Recall Waveform	F 1	
Source USB	F 2	USB/Memory
Destination	F 3	
Recall	F 4	
File Utilities	F 5	(USB only) To File Utilities

Select Recall Waveform menu

F1 ↵

Select waveform source

F2 ↵ → VAR ◌

Select waveform destination

F3 ↵ → VAR ◌

Recall waveform

F4

Go to USB flash drive contents edit mode

F5

Save/Recall key (8/9)

Recall Image

Save/Recall

Recall Image	F 1	
Source USB	F 2	
Ref Image On	F 3	
Recall	F 4	
File Utilities	F 5	To File Utilities

Select Recall Image menu

F1 ↵

Select image source

F2 → VAR ◌

Show or recall image

F3 ↵

Recall image

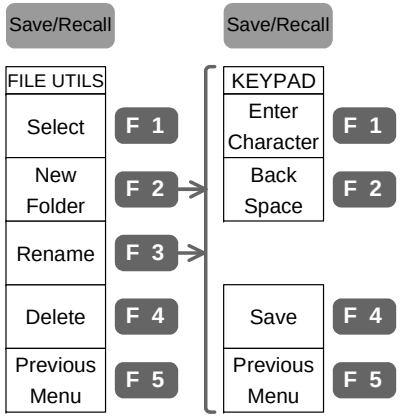
F4

Go to USB flash drive contents edit mode

F5

Save/Recall key (9/9)

File Utilities



Select file/folder or enter into sub folder

VAR ◌ → F1

Create new folder or rename folder/file

F2,F3 (Enter new folder or rename menu)

VAR ◌ → F1 (Enter character)

F2 (Backspace)

F4 (Save new folder)

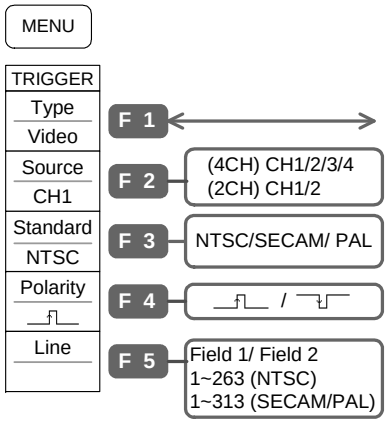
F5 (Go back to previous menu)

Delete folder/file

F4

Trigger key (1/5)

Video



Select Video trigger type

F1 ↵

Select trigger source

F2 ↵

Select video standard

F3 ↵

Select video polarity

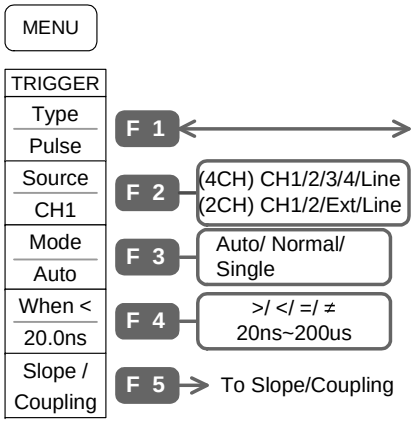
F4 ↵

Select video line

F5 ↵ → VAR ◌

Trigger key (2/5)

Edge/Pulse



Select Edge/Pulse trigger type

F1 ↵

Select trigger source

F2 ↵

Select trigger mode

F3 ↵

Select pulse trigger condition and pulse width

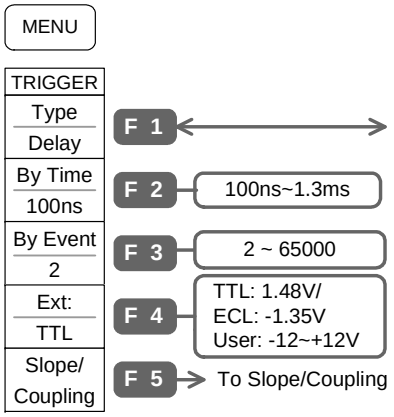
F4 ↵ → VAR ◌

Go to slope/coupling menu

F5

Trigger key (3/5)

(2CH Only)



Select Delay trigger type

F1 ↵

Select time delay mode and delay length

F2 → VAR ◌

Select event delay mode and event count

F3 → VAR ◌

Select external trigger type and adjust trigger level (User type)

F4 → VAR ◌

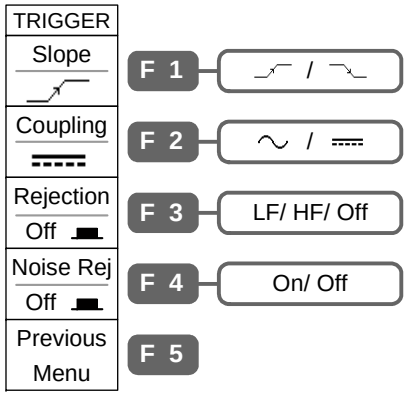
Go to slope/coupling menu

F5

Trigger key (4/5)

Slope/Coupling

MENU



Select trigger slope type

F1

Select trigger coupling mode

F2

Select Frequency Rejection

F3

Turn Noise Rejection On/Off

F4

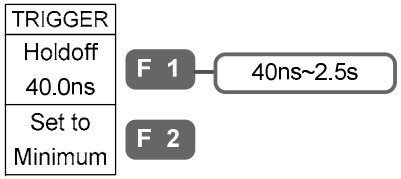
Go back to previous menu

F5

Trigger key (5/5)

Press the MENU key twice

MENU



Set Holdoff time

F1→VAR

Set Holdoff time to minimum

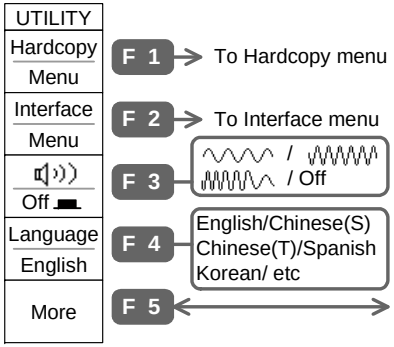
F2

Turn Auto Level trigger On/Off

F5

Utility key (1/9)

Utility



Go to Hardcopy menu

F1

Go to Interface menu

F2

Select buzzer sound

F3

Select language

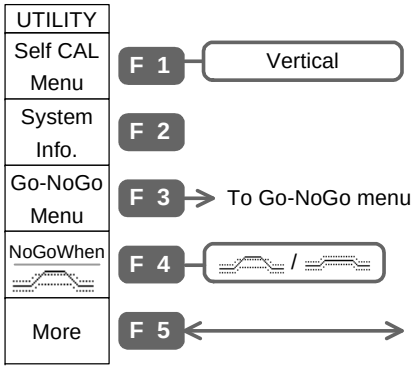
F4

Go to other menu

F5

Utility key (2/9)

Utility



Start Vertical calibration

F1→F1

Show system information

F2

Go to Go-NoGo menu

F3

Select NoGo condition

F4

Go to other menu

F5

Utility key (3/9)

Hardcopy

Utility → Hardcopy

H-COPY		
Function: Save All	F 1	SaveImage/ SaveAll/ Printer
Ink Saver: Off	F 2	On/ Off
Gray: Portrait	F 3	(Printer only) Color Portrait/ Gray Portrait
Ratio: 50%	F 4	(Printer only) 5 ~ 75
Previous Menu	F 5	

Select Hardcopy function

F1

Turn Ink Saver On/Off

F2

Select printout color (only in printout mode)

F3

Select printout ratio (only in printout mode)

F4

Run Hardcopy

Hardcopy

Utility key (4/9)

Interface

Utility

Type: RS232	F 1	RS232/ USB/ GPIB
Address: 1	F 2	(GPIB only) 1 ~ 30
Baud Rate: 9600	F 2	(RS232C only) 2400/ 4800/ 9600/ 19200/ 38400
Stop Bit: 2	F 3	(RS232C only) 1/ 2
Parity: None	F 4	(RS232C only) Odd/ Even/ None
Previous Menu	F 5	

Select interface

F1

Select GPIB address

F2→VAR

Select RS-232C baud rate

F2

Select RS-232C stop bit

F3

Select RS-232C parity

F4

Utility key (5/9)

Go-NoGo

Utility

Go-NoGo		
Template: Edit	F 1	To Go-NoGo Template menu
Source: CH1	F 2	(4CH) CH1/ 2/ 3/ 4 (2CH) CH1/ 2
Violating: Stop	F 3	STOP / STOP+ / Continue / Cont.+
Go-NoGo: Off	F 4	On/ Off
Ratio: 0 / 0	F 5	

Go to Go-NoGo template menu

F1

Select Go-NoGo source channel

F2

Select violating condition

F3

Start/Stop Go-NoGo test

F4

Go-NoGo test result

F5

Utility key (6/9)

Go-NoGo Template

Utility

Template: Max	F 1	Max/ Min/Auto
Source: RefA	F 2	(Max/Min template) Max: Ref A/ W1~20 Min: Ref B/ W1~20
Source: CH1	F 2	(Auto template) (4CH) CH1/ 2/ 3/ 4 (2CH) CH1/ 2
Position: 3.00 Div	F 3	(Max/Min template) -12Div ~ +12Div
Tolerance: 0.4%	F 3	(Auto template) 0.4% ~ 40% 0.04div ~ 4.0div
Save & Create	F 4	
Previous Menu	F 5	

Select template

F1

Select template source

F2→VAR

Select template position or tolerance

F3→VAR

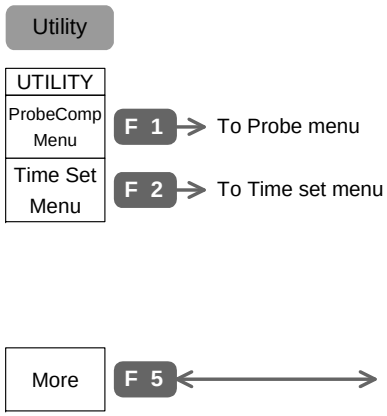
Save and create template

F4

Go to previous menu

F5

Utility key (7/9)



Go to Probe Compensation menu

F1

Go to Time Set menu

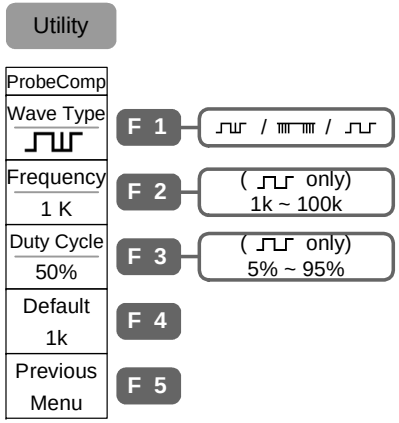
F2

Go to other menu

F5 ↵

Utility key (8/9)

Probe compensation



Select probe compensation signal

F1 ↵

Set frequency for square wave

F2→VAR ◌

Set duty cycle for square wave

F3→VAR ◌

Default compensation signal frequency

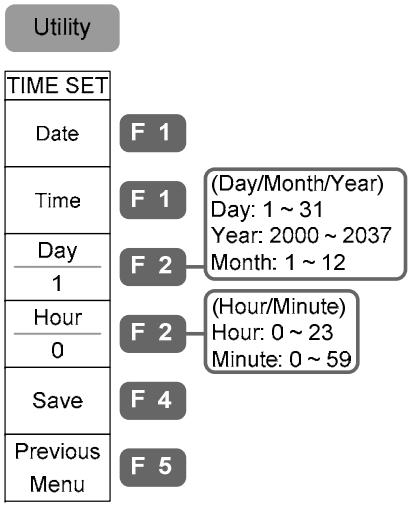
F4

Go to previous menu

F5

Utility key (9/9)

Time set



Select date/time setting

F1 ↵

Select day/month/year

F2 ↵ →VAR ◌

Select hour/minute

F2 ↵ →VAR ◌

Save date/time setting

F4

Go to previous menu

F5

USB number pad key bindings

The optional number pad operation is used to quickly store panel settings to internal memory. Below are the number pad key bindings and functions. For a full description of saving and recalling from a USB number pad see page 165.

Num Lock ON			Num Lock OFF	
Key		Binding	Key	Binding
0	*	Save to S1 memory	0 **	Recall from S1 memory
1	*	S2 memory	1 **	S2 memory
2	*	S3 memory	2 **	S3 memory
3	*	S4 memory	3 **	S4 memory

4	*	S5 memory
5	*	S6 memory
6	*	S7 memory
7	*	S8 memory
8	*	S9 memory
9	*	S10 memory
/		MENU ON/OFF key
Enter		Auto Set

The following settings apply with only when the number lock is on.

* Saves panel settings to internal memory numbers S1-S10.

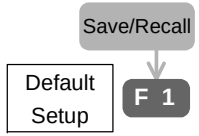
4	**	S5 memory
. del	**	S6 memory
6	**	S7 memory
7	**	S8 memory
8	**	S9 memory
9	**	S10 memory
/		MENU ON/OFF key
Enter		Auto Set

The following settings apply with only when the number lock is off.

** Recalls panel settings from internal memory numbers S1-S10.

Default Settings

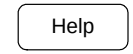
Here is the default factory installed panel setting which appears when pressing the Save/Recall key→F1 before customization (Default Setup).



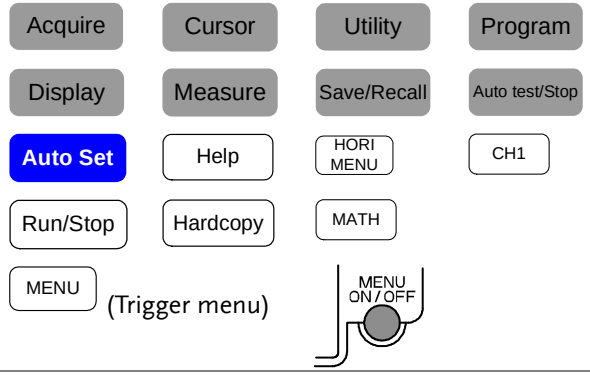
Acquisition	Mode: Normal	Memory length: 500
Channel	Scale: 2V/Div	CH1: On, CH2/3/4: Off
	Coupling: DC	Invert: Off
	BW limit: Off	Probe attenuation: x1
Cursor	Source: CH1	Horizontal: None
	Vertical: None	
Display	Accumulate: Off	Graticule:
Go-NoGo	Go-No: Off	Source: CH1
	Violating: Stop	
Horizontal	Scale: 2.5us/Div	Mode: Main
Math	Type: + (Add)	Channel: CH1+CH2
	Position: 0.00 Div	Unit/Div: 2V
	Math Off	
Measure	Source1, 2: CH1, CH2	Type: VPP, Avg, Freq, Duty Cycle, Risetime
Program	Mode: Edit	Step: 1
Trigger	Type: Edge	Source: Channel1
	Mode: Auto	Slope:
	Coupling: DC	Rejection: Off
	Noise Rejection: Off	
Utility	Square wave probe, 1k, 50% duty cycle	Hardcopy: save image, ink saver on
	Sound: Off	GPIB, Address 8

Built-in Help

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

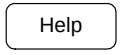


Applicable keys



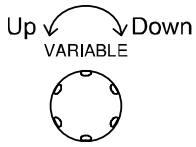
Panel operation

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

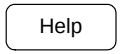


2. Press each key to access its help contents. (example: Acquire key)

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



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



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 page50
- Configurations → from page92

Channel activation

Activate channel	To activate an input channel, press the Channel key. The LED turns On and the input signal waveform appears on the display.	CH1 → CH1
De-activate channel	To disable the channel, press the Channel key again. If the display menu is different from the Channel menu, press twice (the first press shows the Channel menu).	CH1 → CH1
Default setup	When the default setup is recalled (Save/Recall key → F1), Channel 1 automatically turns On. Channel 2, 3, and 4 becomes Off.	
Auto Set	The Auto Set (page53) does NOT automatically activate the channels to which input signals are connected.	

Auto Set

Background

Auto Set function automatically configures the panel settings to position the input signal to the best viewing condition. GDS-2000 automatically configures the following parameters.

- Horizontal scale
- Vertical scale
- Trigger source channel

The Auto Set function also retains the memory length settings configured in the Acquire menu* (page 98).

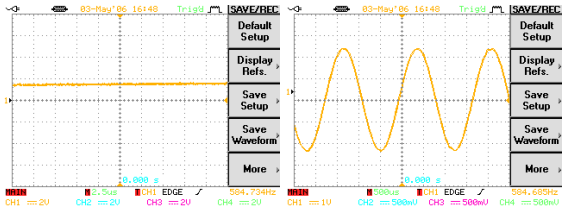
*Firmware 2.0 or greater

Panel operation

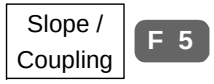
1. Connect the input signal to GDS-2000 and press the Auto Set key.

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

Before After



3. To undo Auto Set, press F5 (Undo). This feature is available for 5 seconds after Auto Set is activated.



Limitation

Auto Set does not work in the following situation.

- Input signal frequency is less than 20Hz
- Input signal amplitude is less than 30mV

Note

The Auto Set key function can be duplicated with a USB number pad using the Enter key. See page 106.

Run/Stop

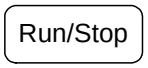
Background

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

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

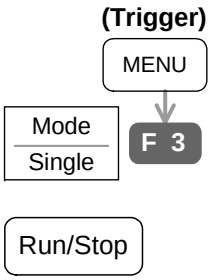
Freeze waveform by Run/Stop key

1. Press the Run/Stop key once. The waveform and signal acquisition freezes. To unfreeze, 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 details, see page122. Note: pressing the Run/Stop key only updates the waveform once – it does not switch to Run mode (continuous update).



Waveform operation

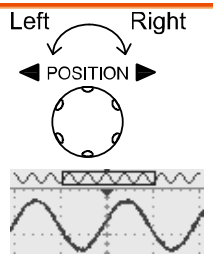
The waveform can be moved or scaled in both Run and Stop mode, but in different manners. For details, see page108 (Horizontal position/scale) and page116 (Vertical position/scale).

Horizontal position/scale

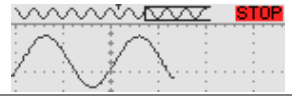
For more detailed configuration, see page108.

Set horizontal position

The horizontal position knob moves the waveform left/right. As the waveform moves, the memory bar appears on the top of the display, indicating the portion of displayed waveform in the memory.

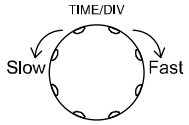


Stop mode — In the Stop mode, the memory bar moves along with the waveform until it reaches the end of the memory.



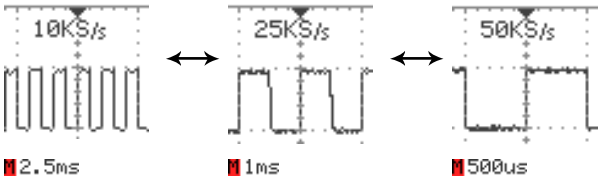
Select horizontal scale

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

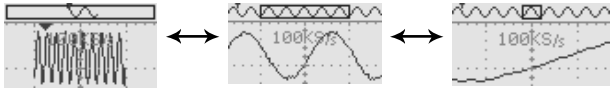


Range — 1ns/Div ~ 10s/Div, 1-2-5 increment

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



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

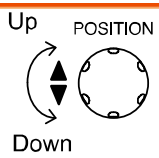


Vertical position/scale

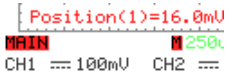
For more detailed configuration, see page116.

Set vertical position

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



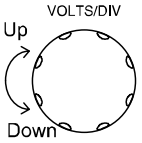
As the waveform moves, the vertical position of the cursor appears at the bottom left corner of the display.



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

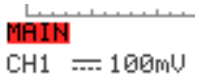
Select vertical scale

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



Range: 2mV/Div ~ 5V/Div, 1-2-5 increment

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

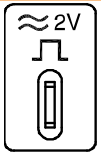


Stop mode: In Stop mode, the vertical scale setting can be changed but the shape of the waveform does not change until the next acquisition.

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. For probe compensation details, see page187.



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

Waveform type

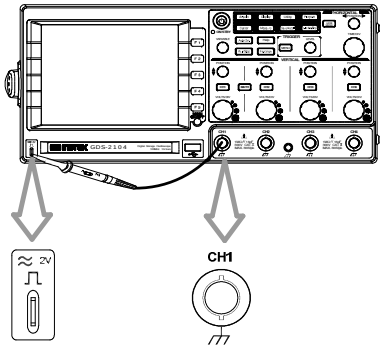
Square waveform for probe compensation. 1k ~ 100kHz, 5% ~ 95%.

Demonstration signal to show the effect of peak detection. See page94 for peak detection mode details.

Demonstration signal to show the effect of long memory. See page96 for memory length details.

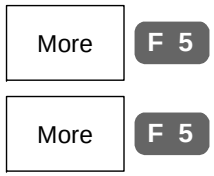
View compensation waveform

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



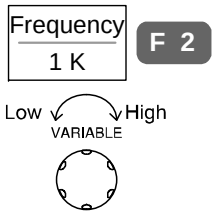
2. Press the Utility key.

3. Press F5 (More) twice.



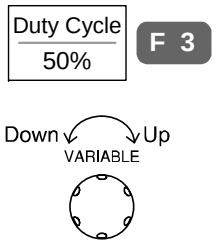
4. Press F1 (Wave type) repeatedly to select the wave type.

5. (For square wave only) To change the frequency, press F2 (Frequency) and use the Variable knob.



Range 1kHz ~ 100kHz

6. (For square wave only) To change the duty cycle, press F3 (Duty Cycle) and use the Variable knob.



Range 5% ~ 95%

Probe compensation

For probe compensation details, see page187.

Automatic Measurement

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

Measurement items

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

Voltage measurement	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

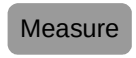
	Vavg		Averaged voltage of the first cycle
	Vrms		RMS (root mean square) voltage
	ROVShoot		Rise overshoot voltage
	FOVShoot		Fall overshoot voltage
	RPREShoot		Rise preshoot voltage
	FPREShoot		Fall preshoot voltage
Time measurement	Freq		Frequency of the waveform
	Period		Waveform cycle time (=1/Freq)
	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)
Delay measurement	FRR		Time between: Source 1 first rising edge and Source 2 first rising edge
	FRF		Time between: Source 1 first rising edge and Source 2 first falling edge

	FFR		Time between: Source 1 first falling edge and Source 2 first rising edge
	FFF		Time between: Source 1 first falling edge and Source 2 first falling edge
	LRR		Time between: Source 1 first rising edge and Source 2 last rising edge
	LRF		Time between: Source 1 first rising edge and Source 2 last falling edge
	LFR		Time between: Source 1 first falling edge and Source 2 last rising edge
	LFF		Time between: Source 1 first falling edge and Source 2 last falling edge

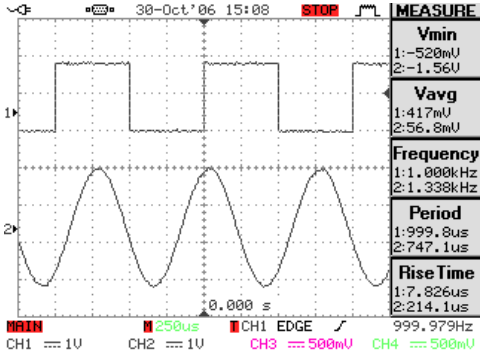
Individual mode

Individual mode shows five selected measurement items, two channels each, on the menu bar.

View measurement result

1. Press the Measure key. 

2. The measurement results for two selected channels appear on the menu bar, constantly updated. Press F1 ~ F5 to change the measurement item.



F 1
F 2
F 3
F 4
F 5

Select measurement item

3. The selection menu appears. Press F1 (Source 1) repeatedly to select the first source channel.

Source 1 / CH 1 — F 1

4. Press F2 (Source 2) repeatedly to select the second source channel.

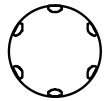
Source 2 / CH 2 — F 2

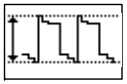
5. Press F3 repeatedly to select the measurement type: Voltage, Time, and Delay.

Voltage / Vpp — F 3

6. Use the Variable knob or press F4 repeatedly to select the measurement item.

VARIABLE





F 4

7. Press F5 (Previous Menu) to confirm the item selection and to go back to the measurement results view.

Previous Menu — F 5

Display All mode

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

View measurement result

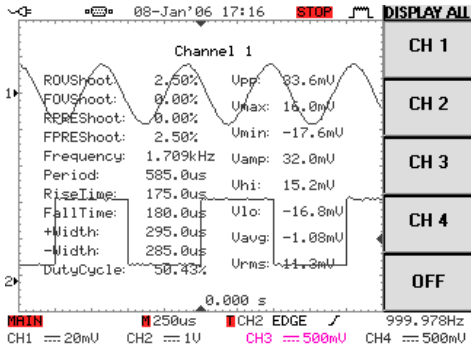
1. Press the Measure key twice.

Measure
Measure

2. Press the channel for which the measurement results need to be observed.

CH1 — F 1

3. The results of Voltage and Time type measurement appear on the display.



4. Press F5 (OFF) to clear the measurement results from the display.

OFF — F 5

Delay type

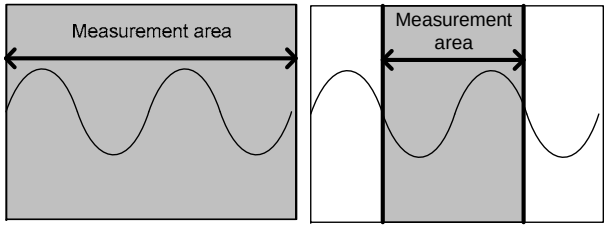
Delay type measurement is not available in this mode. Use the Individual measurement mode (page62) instead.

Gated Display All mode

Display All mode can be customized to limiting measurement to a "gated" area between cursors. Gating is useful for measuring a magnified waveform or when using a fast time base.

The diagram below indicates how the gating function works

Display All (Gating Off) Display All (Gating On)

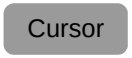


View measurement results

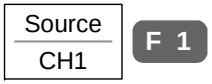
1. Press the Measure key twice.

2. Press the channel for which the measurement results need to be observed.

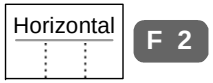
3. Press Cursor key to bring up the cursor menu.



4. Press F1 (Source) repeatedly to select the source channel.



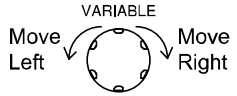
5. Press F2 (Horizontal) repeatedly to activate the horizontal cursor(s).



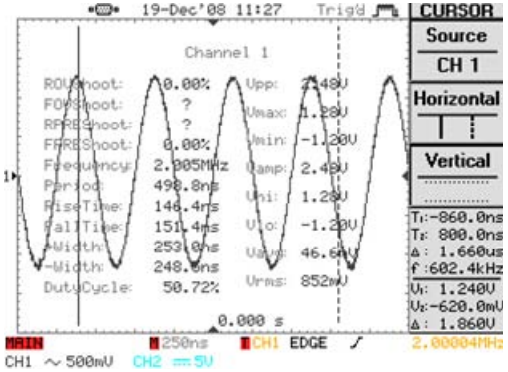
Range

⋮ ⋮	Horizontal cursor not activated (disabled)
❙ ⋮	Left cursor movable, right cursor position fixed
⋮ ❙	Right cursor movable, left cursor position fixed
❙ ❙	Left and right cursor movable together

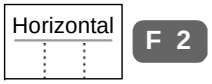
6. Use the Variable knob to move the cursor(s) left or right.



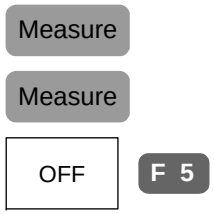
When the cursors are moved all displayed measurements are updated in real-time.



7. To turn off gating, Press F2 (Horizontal) repeatedly to disable both horizontal cursors.



8. To clear the measurement results, press the Measure key twice, followed by OFF (F5).



Cursor Measurement

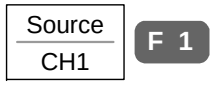
Cursor line, horizontal or vertical, shows the position and value of the waveform and math operation result. These results cover voltage, time, frequency and other math operations. When the cursors (horizontal, vertical or both) are activated, they will be shown on the main display when the menu is turned off (page 106).

Use horizontal cursor

Panel operation/ Range

1. Press the Cursor key.

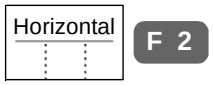
2. Press F1 (Source) repeatedly to select the source channel.



Range

4CH model	CH1, 2, 3, 4, Math
2CH model	CH1, 2, Math

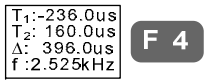
3. Press F2 (Horizontal) repeatedly to activate the horizontal cursor.



Range

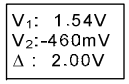
⋮ ⋮	Horizontal cursor not activated
❙ ⋮	Left cursor movable, right cursor position fixed
⋮ ❙	Right cursor movable, left cursor position fixed
❙ ❙	Left and right cursor movable together

4. The cursor position information appears on F4 menu.



Parameter	
T_1	Time position of the left cursor (relative to 0)
T_2	Time position of the right cursor
Δ	The time distance between the left and right cursor
f	The time distance (Δ) converted to frequency

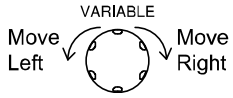
5. The cursor position information appears on the F5 menu. (vertical cursors are deactivated)



F 5

Parameter	
V_1	Voltage level of the left cursor
V_2	Voltage level of the right cursor
Δ	The voltage difference between the left and right cursor

6. Use the Variable knob to move the cursor left or right. The F5 content changes accordingly.

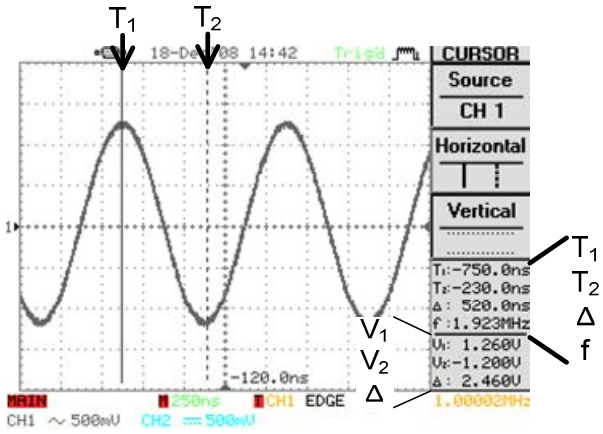


Note:

Please note that the vertical voltage information is shown as the default voltage, therefore the horizontal voltage information will only appear if the vertical cursors are deactivated.

See page 71 for more information about deactivating the vertical cursors.

Example



FFT Math

The FFT Math has different F4 content. For FFT math details, see page76.

F 4

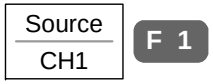
f_1	Frequency position of the left cursor
f_2	Frequency position of the right cursor
Δ	The frequency distance between the left and right cursor
Div	The frequency distance per horizontal division

Use vertical cursor

Panel operation/ Range

1. Press the Cursor key.

2. Press F1 (Source) repeatedly to select the source channel.



Range

4CH model CH1, 2, 3, 4, Math

2CH model CH1, 2, Math

3. Press F2 (Vertical) repeatedly to activate the vertical cursor.

Range

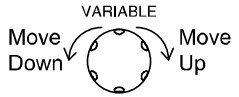
.....	Vertical cursor not activated
———	Upper cursor movable, lower cursor position fixed
———	Lower cursor movable, upper cursor position fixed
———	Upper and lower cursor movable together

4. The cursor position information appears on F5 menu.

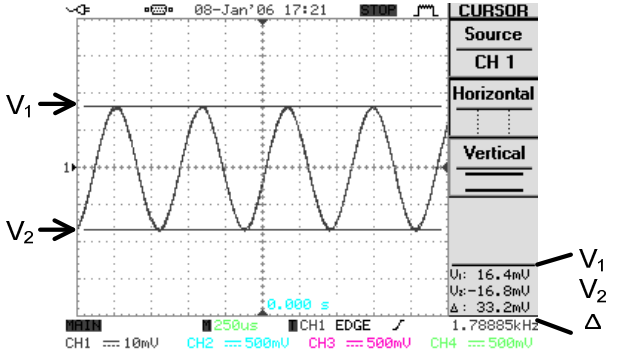
Parameter

V_1	Voltage level of the upper cursor
V_2	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. The F5 content changes accordingly.



Example



Note: FFT Math

The FFT Math has different F5 content. For FFT math details, see page76.

M_1	Magnitude of the left cursor
M_2	Magnitude of the right cursor
Δ	The frequency distance between the left and right cursor

Math Operation

Overview

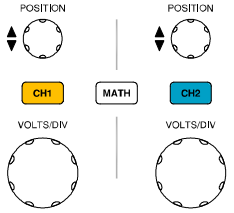
Background	Math operation runs addition, subtraction, multiplication, or FFT using the input signals and shows the result on the display. The resulted waveform characteristics can be measured using the cursors.	
Addition (+)	Adds amplitude of two signals.	
	Channel pairs	4CH model: Channel 1 + 2, 3 + 4 2CH model: Channel1 + 2
Subtraction (–)	Extracts the amplitude difference between two signals.	
	Channel pairs	4CH model: Channel 1 – 2, 3 – 4 2CH model: Channel1 – 2
Multiplication (*)	Multiplies amplitude of two signals.	
	Channel pairs	4CH model: Channel 1 * 2, 3 * 4 2CH model: Channel1 * 2
FFT	Runs FFT calculation on a signal. Four types of FFT windows are available: Hanning, Flattop, Rectangular, and Blackman.	
	Channel	4CH model: Channel 1, 2, 3, 4 2CH model: Channel 1, 2
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)
Blackman FFT window	Frequency resolution	Bad
	Amplitude resolution	Very good
	Suitable for....	Amplitude measurement on periodic waveform

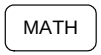
Addition/Subtraction/Multiplication

Panel operation

1. Activate the channel pairs.
   4CH model: CH1&2, 3&4
   2CH model: CH1&2



2. Press the Math key.



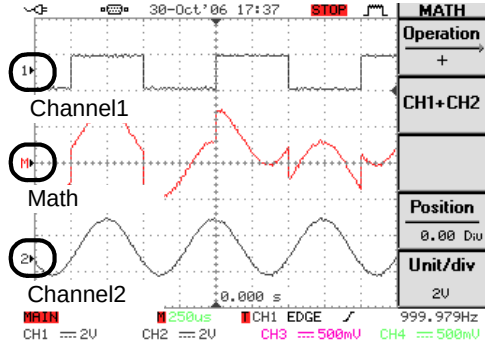
3. Press F1 (Operation) repeatedly to select addition (+), subtraction (–), or multiplication (x).

4. (For 4CH model only) press F2 repeatedly to select the channel pairs, 1&2 or 3&4.

CH1+CH2 **F 2**

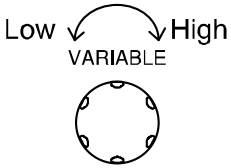
5. The math measurement result appears on the display. The vertical scale (fixed) of math waveform appears in F5 (Unit/div).

Unit/Div
2V
F 5



6. To move the math waveform vertically, press F4 (Position) and use the Variable knob.

Position
0.00 Div
F 4



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

MATH

FFT

Panel operation

1. Press the Math key.

MATH

2. Press F1 (Operation) repeatedly to select FFT.

Operation
FFT
F 1

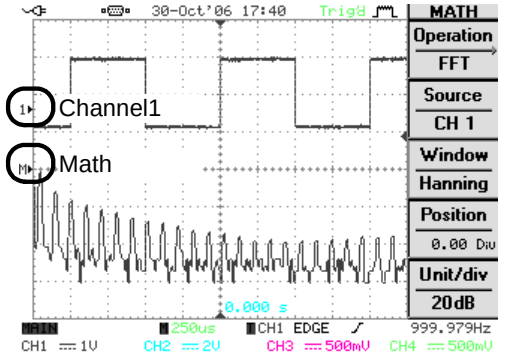
3. Press F2 repeatedly to select the source channel.

Source
CH1
F 2

4. Press F3 repeatedly to select the FFT window type.

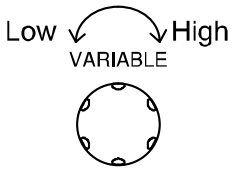
Window
Hanning
F 3

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 F4 (Position) and use the Variable knob.

Position
0.00 Div
F 4



Range –12.00 Div ~ +12.00 Div

7. To select the vertical scale of FFT waveform, press F5 (Unit/Div) repeatedly. RMS Voltage can also be selected instead of dB.

   Unit/Div 1dB F 5

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

   RMS Voltage

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

   MATH

Go-NoGo Test

Overview

Background

Go-NoGo test checks if a waveform fits inside the user-specified maximum and minimum amplitude boundary (template). The test result comes out in three ways: menu contents, buzzer sound, and pulse signal output from the rear panel terminal.

Test parameters

item	default setting	setup details
Buzzer sound when the test fails (NoGo)	Off	page79
NoGo criteria: in or out of the boundary	Out	page79
Test signal	Channel 1	page80
Test continue or stop when NoGo occurs	Stop	page80
Boundary (template) – select minimum and maximum as separate waveforms or create both boundaries from a single waveform	Min/Max separately	page81

Default setting

To recall the default setting, press the Save/Recall key, then press F1 (Default Setup). See page48 for details.

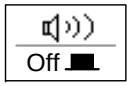
Save/Recall → Default Setup F 1

Edit: Buzzer sound

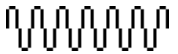
Panel operation

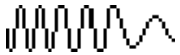
1. Press the Utility key.

2. Press F3 repeatedly to select the buzzer for test fail (NoGo) notification.



F 3

 High pitch

 Middle pitch

 Low pitch

 Sound Off

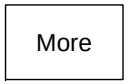
Note

The buzzer setting also affects the vertical resolution calibration (page186) – the buzzer notifies the completion of calibration.

Edit: NoGo when

1. Press the Utility key.

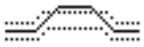
2. Press F5 (More).

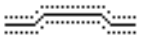


F 5

3. Press F4 (NoGo When) repeatedly to select the NoGo condition.

F 4

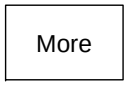
 NoGo when waveform is outside of the boundary

 NoGo when waveform is inside the boundary

Edit: Source signal

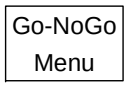
1. Press the Utility key.

2. Press F5 (More).



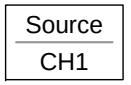
F 5

3. Press F3 (Go-NoGo Menu).



F 3

4. Press F2 (Source) repeatedly to select the channel to be tested. (Note: the selected channel is automatically activated)

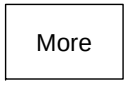


F 2

Edit: Continue or stop after NoGo

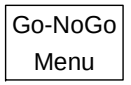
1. Press the Utility key.

2. Press F5 (More).



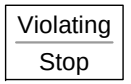
F 5

3. Press F3 (Go-NoGo Menu).



F 3

4. Press F3 (Violating) repeatedly to select whether to continue or stop test after the NoGo condition is met.



F 3

Stop — The test stops when the NoGo condition is met. The buzzer does not sound.

Stop+	The test stops and the buzzer sounds when the NoGo condition is met.
Continue	The test continues even when the NoGo condition is met. The buzzer does not sound.
Continue+	The test continues even when the NoGo condition is met. The buzzer also sounds.

Note — If the sound is turned Off in the buzzer setting (page79), the sound is not produced even when selecting Stop/Continue+.

Edit: Template (boundary)

Background — The NoGo template sets the upper and lower amplitude boundary. Two methods are available: Min/Max and Auto.

Min/Max — Selects the upper boundary (Max) and lower boundary (Min) as separate waveforms, from the internal memory.

Advantage: The template shape and the distance (allowance) between the source signal are fully customizable.

Disadvantage: The waveforms (templates) have to be stored internally prior to this selection.

Auto — Creates the upper and lower boundary together from an input signal, not from internally stored waveform.

Advantage: No need to store the waveforms prior to this selection.

Disadvantage: The template shape is proportional to the source signal. The distance (allowance) between the source signal and upper/lower template are always symmetrical.

Min/Max setting

1. Make sure the source signal, on which the templates are based, appears on the display.
2. Press the Utility key.

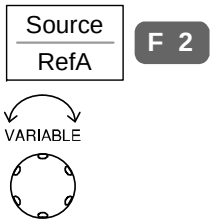
3. Press F5 (More).

4. Press F3 (Go-NoGo Menu).

5. Press F1 (Template Edit).

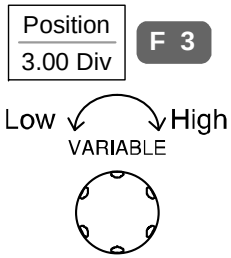
6. Press F1 (Template) repeatedly to select the upper (Max) or lower (Min) boundary template.

7. Press F2 (Source). Use the Variable knob to select the template from internally stored waveform. For waveform store procedure, see page146.



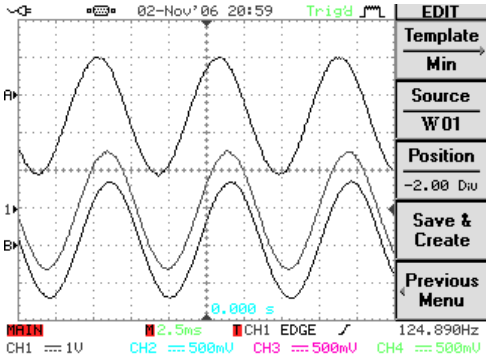
Max	(marked as waveform "A" in thd display) Maximum boundary: RefA, W1 ~ 20 internal memory
Min	(marked as waveform "B" in the display) Minimum boundary: RefB, W1 ~ 20 internal memory

8. Press F3 (Position). Use the Variable knob to move the waveform amplitude level.



9. Repeat step 9, 10, 11 for the other template setting, Min or Max.

10. When the templates are set, press F4 (Save & Create) to save them.



Auto setting

1. Make sure the source signal, on which the templates are based, appears on the display.
2. Press the Utility key.

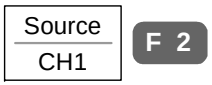
3. Press F5 (More).

4. Press F3 (Go-NoGo Menu).

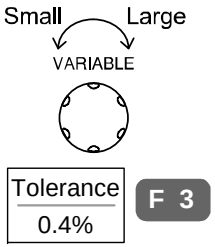
5. Press F1 (Template Edit).

6. Press F1 repeatedly to Auto position.

7. Press F2 repeatedly to select the signal channel on which the template is created.



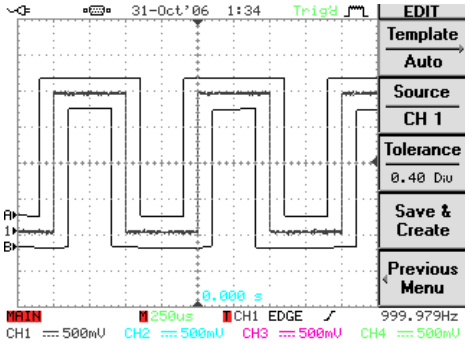
8. The template appears on the screen as waveform A (maximum) and waveform B (minimum). Use the Variable knob to set the tolerance range. The template in the display changes accordingly.



9. If necessary, press F3 (tolerance) repeatedly to select the tolerance unit: percentage (%) or division (div).

10. When the templates are set, press F4 (Save & Create) to save it.

Save & Create F 4



Run Go-NoGo test

This section assumes all Go-NoGo settings (page78) are completed.

Panel operation

1. Press the Utility key.

Utility

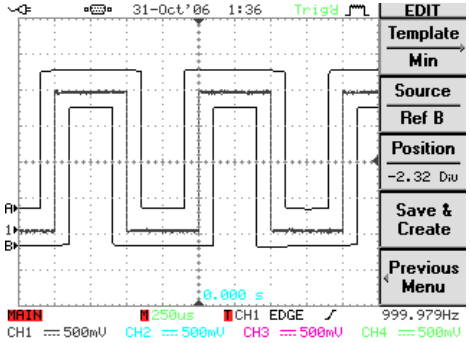
2. Press F5 (More).

More F 5

3. Press F3 (Go-NoGo Menu).

Go-NoGo Menu F 3

4. Make sure the source signal and the templates (boundary) both appear on the display.



5. Press F4 (Go-NoGo). The Go-NoGo test starts running and stops according to the continue/stop condition (page80). To stop the test manually, Press F4 again.

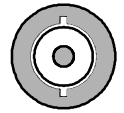
Go-NoGo On F 4

6. The test results appear in F5 menu. The denominator (lower side) shows the number of completed test. The numerator (upper side) shows the number of failed test (NoGo).

Ratio: 3/6 F 5

7. The Go/NoGo terminal (open collector) on the rear panel sends out a 5Vpp, 10us pulse signal to external device every time the NoGo condition is met.

GO / NO GO (Open collector)



Program

Overview

Background

Program function measures input signals using cursors or automatic measurement functions, in user-defined sequence, duration, loop count, and panel settings. This feature is useful for automated and repetitive measurement, such as in assembly line or quality inspection test.

Parameter

Program set	1 set
Program step	Maximum 20 steps
Measurement item	Cursor or Automatic measurement
Time (duration) per step	1 ~ 99 seconds, or user activation
Program loop	1 ~ 99 loops, the first and last step settable

Programming step

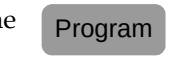
1. Show the target waveform on the display and decide the type of measurement that needs to be done: Horizontal/Vertical Cursor or Automatic measurement.
2. Setup the other panel configurations: trigger, acquisition, horizontal/vertical scale, etc. Save the settings to the internal memory. See page145 for details.
3. Edit the program (page88) using the internally stored panel setup.
4. Run the program (page90).

Edit program

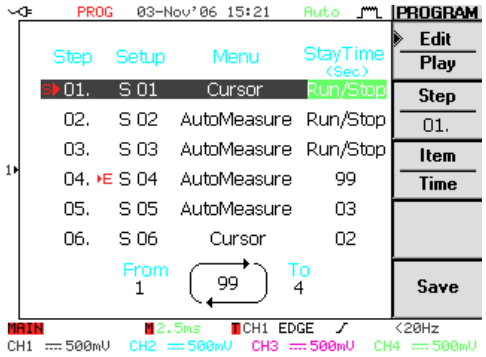
This section assumes that the panel setting is already defined and saved (step 1 and 2 in the previous page).

Panel operation

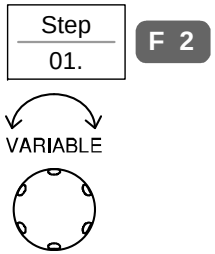
1. Press the Program key. The display changes into program edit mode.



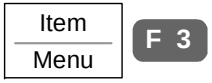
2. Press F1 (Edit/Play) to select the Edit side.



3. Press F2 (Step). Use the Variable knob to select the step that needs to be edited. The cursor on the display moves accordingly.



4. Press F3 (Item) repeatedly to select the three parameters for a step: panel setup, menu (Cursor or Automatic measurement), and time.



Setup	Selects the panel setup stored in the internal memory. S01 ~ S20. For panel setup store/recall details, see page145 (save) or page155 (recall).
Menu	Selects the measured item: Cursor or Automatic measurement.
Time	Sets the duration of the step, 1 ~ 99 seconds or user control (Run/Stop). When Run/Stop is selected, the program freezes at that step until the user presses the Run/Stop key.

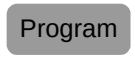
5. Continue the above for all program steps. When completed, press F5 (Save) to confirm and save the program.

Run program

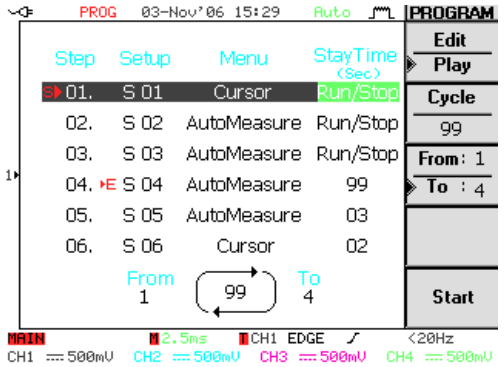
This section assumes that the program editing (see previous page) is completed.

Panel operation

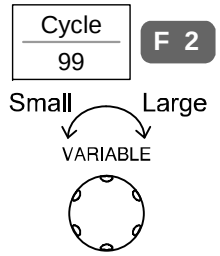
1. Press the Program key. The display changes into program mode.



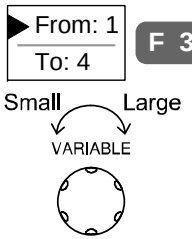
2. Press F1 (Edit/Play) repeatedly to select the Play side.



3. Press F2 (Cycle). Use the Variable knob to select the number of program loop: 1 ~ 99.

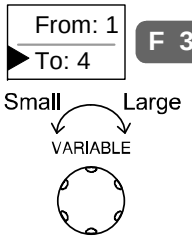


4. Press F3 (From/To) to select the From: side. Use the Variable knob to select the program start step: 1 ~ 20. The "S" mark appears in the selected step.



S▶01. S 01 Cursor Run/Stop

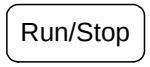
5. Press F3 (From/To) to select the To: side. Use the Variable knob to select the program end step: 1 ~ 20. Note that the To: step must be larger or equal to the From: step. The "E" mark appears in the selected step.



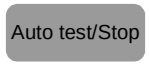
04. ▸E S 04 AutoMeasure 99

6. Press F5 (Start). The display changes into program running mode and starts executing the first step.

7. The message "Press Run/Stop key to continue" on the bottom of the display shows the user has to activate the next step manually. Press the Run/Stop key to move to the next step.



8. To stop the program manually, press the Auto test/Stop key. When all steps are completed, the program stops running.



CONFIGURATION

Acquisition

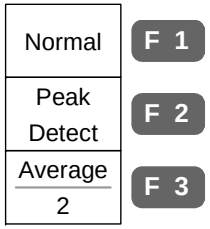
Acquisition process samples the analog input signals and converts them into digital format for internal processing.

Select acquisition mode

Panel operation

1. Press the Acquire key.

2. Select the acquisition mode from F1 (Normal) ~ F3 (Average). The acquisition icon on the top right corner of the display changes accordingly.

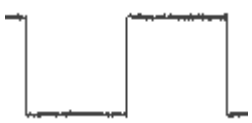


Range

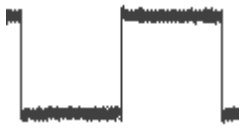
Normal		All of the acquired data is used to draw the waveform.
Peak Detect		Only the minimum and maximum value pairs for each acquisition interval (bucket) are used. This mode is useful for catching abnormal glitches in the signal.
Average		Multiple acquired data are averaged. This mode is useful for drawing a noise-free waveform. To select the average number, press F3 repeatedly. Average number: 2, 4, 8, 16, 32, 64, 128, 256

Example

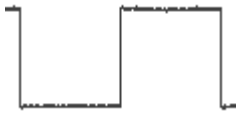
Normal



Peak Detect



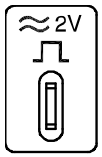
Average (2 times)



Average (256 times)

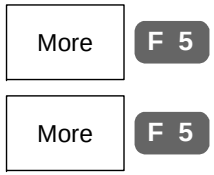
Peak detect effect using probe comp. waveform

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 F5 (More) twice.

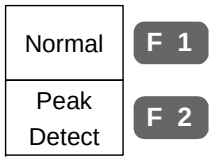


4. Press F1 (Wave Type) and select the ⎍ waveform.

5. Press the Auto Set key. GDS-2000 positions the waveform in the center of the display.

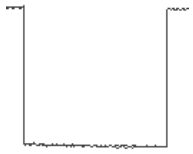
6. Press the Acquire key.

7. Press F2 (Peak Detect) or F1 (Normal) and see that in the Peak detection mode, spike noise is captured.



Peak Detect

Normal



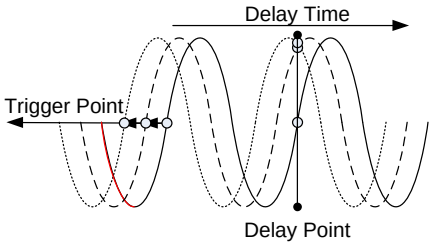
Select delay on/off

Background

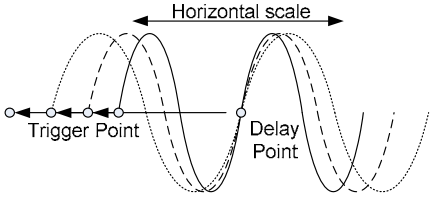
When delay time is ON, the displayed output is delayed for a defined amount of time from the trigger point. Using the delay function is useful for observing an area of the waveform that occurs some time after the trigger point.

Delay on

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

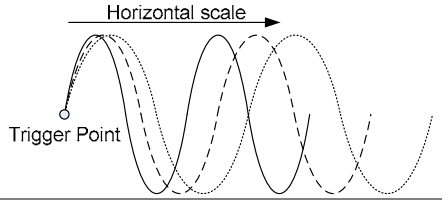


When the horizontal scale is changed the delay point will stay centered on the screen whilst the tripper point will move (leftwards when magnifying).



Delay off

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

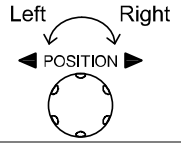


Panel operation

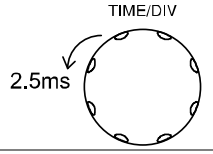
1. Press the Acquire key.

2. Press F4 (Delay On/Off) to turn delay on of off.

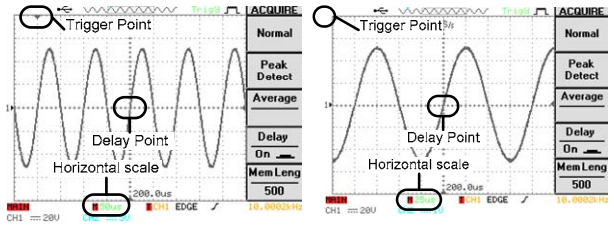
3. Use the Horizontal Position knob to increase or decrease the delay time when Delay is set to On.



4. Adjust the horizontal scale to zoom into the waveform.

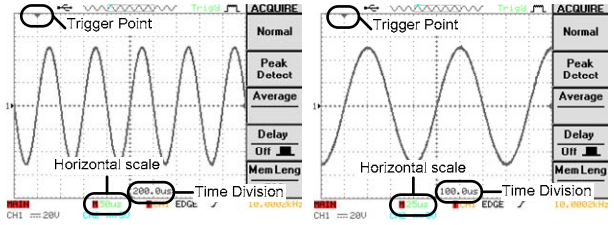


Example
Delay on



Above it can be seen that the trigger point moves off the display area when the horizontal scale is decreased. The delay point will remain in the center of the screen when the horizontal scale is increased or decreased.

Example
Delay off



As can be seen above, the trigger point doesn't move when the horizontal scale is decreased or the time division is decreased.

Select waveform memory length

Background

Memory length defines the amount of waveform data (points) included in each trigger event. Two modes are available: short and long.

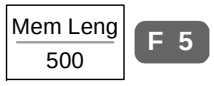
The waveform memory length that is configured is also retained for the Auto Set function (page 53).

Short mode	Each waveform includes fewer points and is updated rapidly. It is useful for observing the shape of fast-changing waveform such as Frequency Modulation.
Long mode	Each waveform includes more points and is updated relatively slowly. It is useful for observing the details of single-shot phenomenon such as spike noise.

Panel operation

5. Press the Acquire key.

6. Press F5 (Mem Leng) to select the memory length (points), short or long.



Range (memory point)

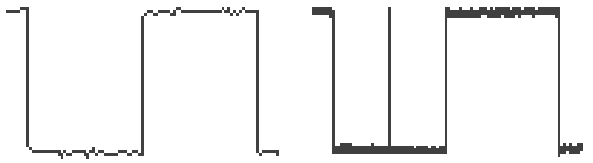
500	Short memory length; useful for catching high frequency signal.
5000	Long memory length when three or four channels are active.
12500	Long memory length when two channels are active.
25000	Long memory length when only one channel is active.

Example FM signal

Short memory (better) Long memory

Example Spike noise

Short memory Long memory (better)

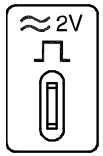


Note

The display always shows 250 points (300 when the menu is turned Off) regardless of the memory length. In short memory length, all 500 points can be observed. In long memory length, either the memory points are condensed into 500 points (Real-time sampling mode) or all points can be observed (Equivalent-time sampling mode). For sampling mode details, see page102.

Long memory effect using probe comp. waveform

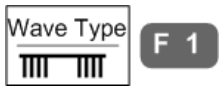
1. One of the probe compensation waveform can demonstrate long memory mode. Connect the probe to the output.



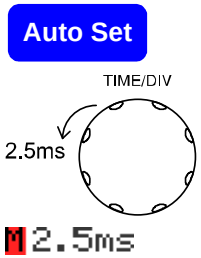
2. Press the Utility key.

3. Press F5 (More) twice.

4. Press F1 (Wave Type) and select the waveform.

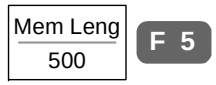


5. Press the Auto Set key. GDS-2000 positions the waveform in the center of the display. Set the horizontal scale to 2.5ms to observe the whole waveform shape.

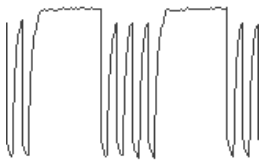


6. Press the Acquire key.

7. Press F5 (Mem Leng) repeatedly to switch between short and long memory length.



Short memory



Long memory

Real time vs Equivalent time sampling mode

Background		GDS-2000 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.

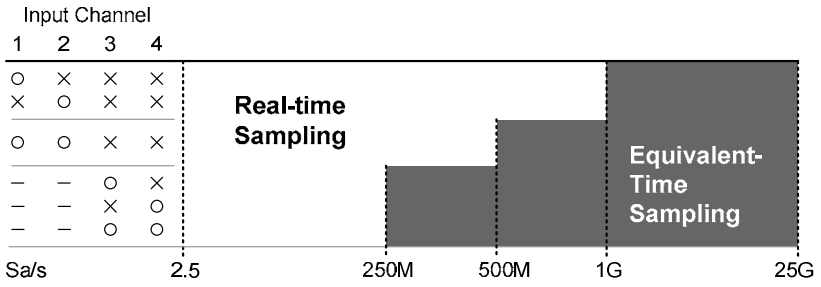
Real-time / Equivalent-time sampling threshold

Input channel:

○ Activated

× Not activated

— Does not matter



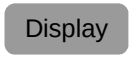
Display

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

Select waveform drawing (vector/dot)

Panel operation

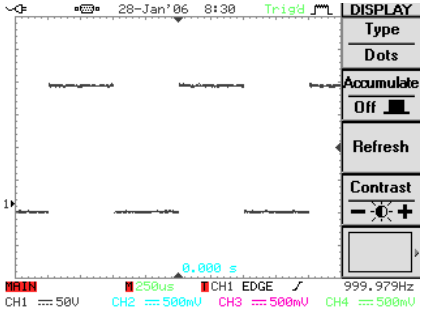
1. Press the Display key.



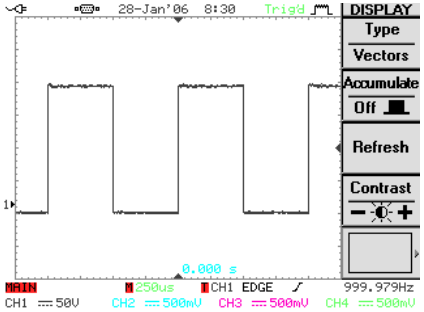
2. Press F1 (Type) repeatedly to select the waveform drawing.

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

Example: Dots (square wave)



Example: Vectors (square wave)



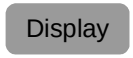
Accumulate waveform

Background

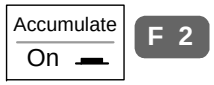
Accumulation preserves the old waveform drawings and overwrites new waveforms on top of it. It is useful for observing waveform variation.

Panel operation

1. Press the Display key.



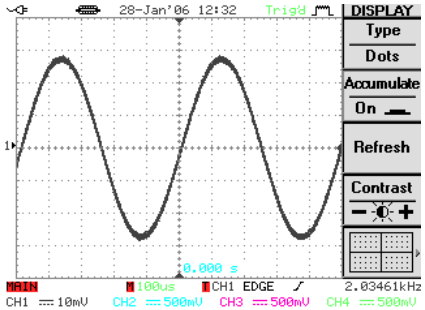
2. Press F2 (Accumulate) to turn On waveform accumulation.



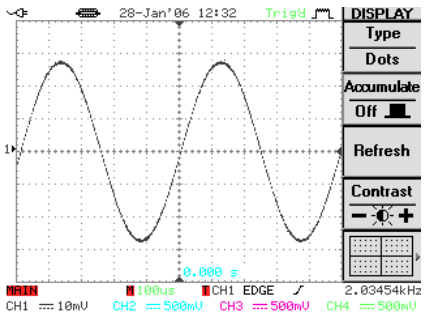
3. To clear the accumulation and start over (refresh), press F3 (Refresh).

Example

Accumulation On



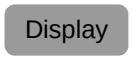
Accumulation Off



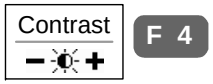
Set display contrast

Panel operation

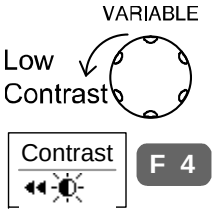
1. Press the Display key.



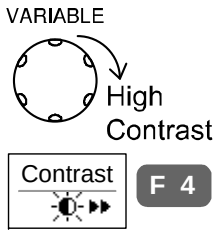
2. Press F4 (Contrast).



3a. Turn the Variable knob left to lower the contrast (dark display).



3b. Turn the Variable knob right to raise the contrast (bright display).

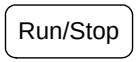


Freeze the waveform (Run/Stop)

For more details about Run/Stop mode, see page55.

Panel operation

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



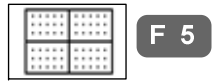
2. The waveform and the trigger freezes. The trigger indicator on the top right of the display shows Stop.

Select display grid

Panel operation

1. Press the Display key.

2. Press F5 (Grid type) repeatedly to select the grid.



Range

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

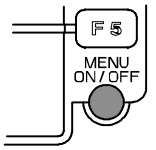
Shows only the center X and Y frame.

Shows only the outer frame.

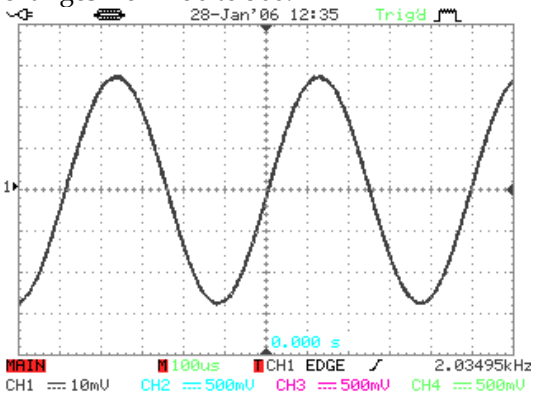
Turn Off menu

Panel operation

1. Press the MENU ON/OFF key below F1 ~ F5.

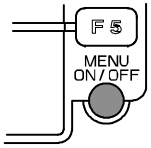


2. The menu disappears. The waveform points changes from 250 to 300.

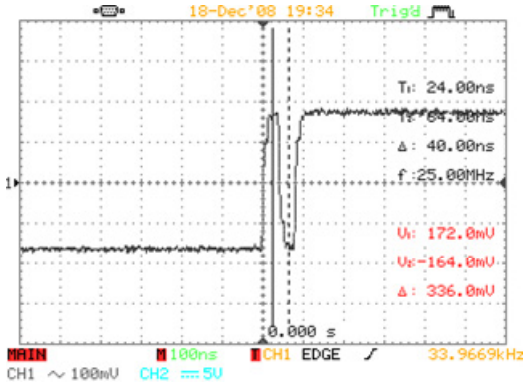


3. To display/remove cursor information while the menu is display is turned off, press the CURSOR key.

4. Press the MENU ON/OFF key again.



5. The cursor information is overlaid on the display.



Note

If using the USB number pad, the forward slash key can also be used as the MENU ON/OFF key.

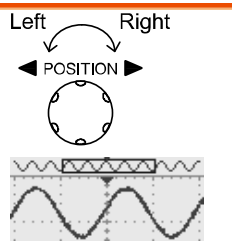
Horizontal View

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

Move waveform position horizontally

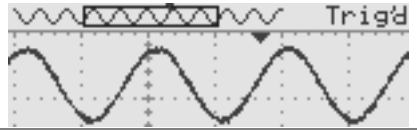
Panel operation

The horizontal position knob moves the waveform left/right. As the waveform moves, the memory bar appears on the top of the display indicating the portion of displayed waveform in the memory.



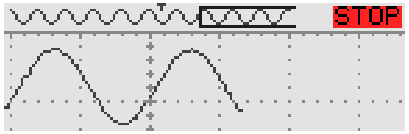
Run mode

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



Stop mode

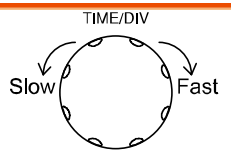
In Stop mode, the memory bar moves along with the waveform until it reaches the end of the memory.



Select horizontal scale

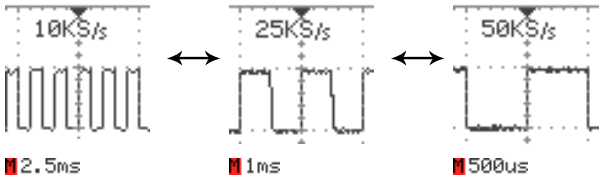
Select horizontal scale

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



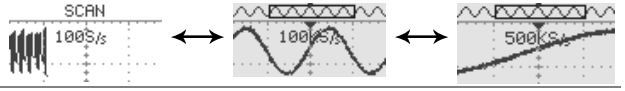
Range 1ns/Div ~ 10s/Div, 1-2-5 increment

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



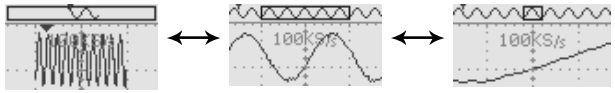
Run mode

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



Stop mode

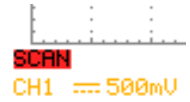
In Stop mode, the memory bar and waveform size changes according to the scale.



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

MAIN Updates the whole displayed waveform at once. Automatically selected when the timebase (sampling rate) is fast.

Timebase ≤50ms/div (≥500Sa/s)

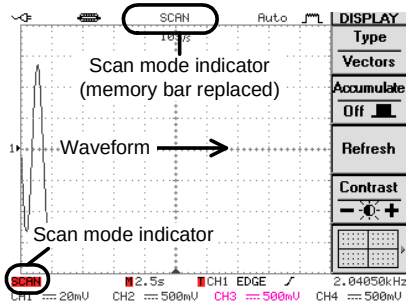
Trigger all modes

Scan mode

SCAN 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.

Timebase ≥100ms/div (≤250Sa/s)

Trigger Auto mode only



Note

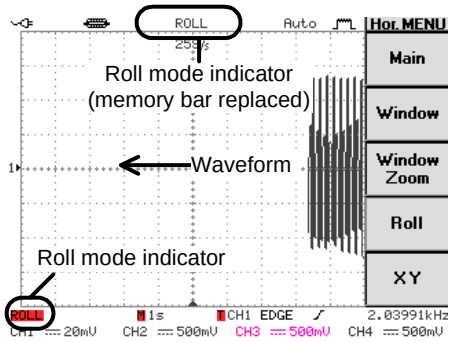
- When the update mode switches from Main to Scan, GDS-2000 automatically selects the Auto trigger mode. See page122 for trigger details.
- To view the signal peak clearly in Scan mode, turn on the Peak detection (page94).

Roll mode

ROLL 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.

Timebase ≥250ms/div (≤100Sa/s)

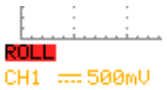
Trigger all modes



Select Roll mode manually

1. Press the Horizontal menu key. HORI MENU

2. Press F4 (Roll). The waveform starts scrolling from the right side of the display. The update mode indicator shows Roll mode. Roll F 4



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 F1 (Main). Main F 1

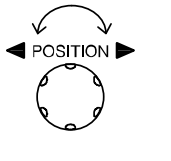
Zoom waveform horizontally

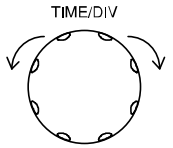
Panel operation/ range

1. Press the Horizontal Menu key. HORI MENU

2. Press F2 (Window) key. Window F 2

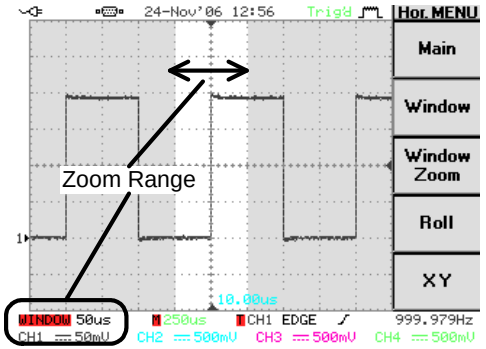
3. The WINDOW indicator, which shows the zoom range, appears on the bottom left corner of the display. Use the horizontal position knob to move the zoom range sideways, and TIME/DIV knob to change the zoom range width.





WINDOW 50us

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

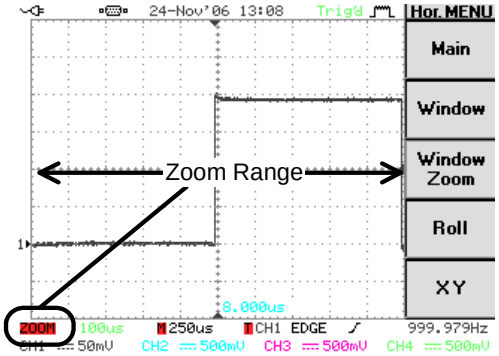


Zoom range 1ns ~ 1ms

4. Press F3 (Window Zoom). The specified range gets zoomed. The ZOOM indicator appears on the bottom left side of the display.

Window Zoom F 3

ZOOM



5. To go back to the original view, press F1 (Main).

Main F 1

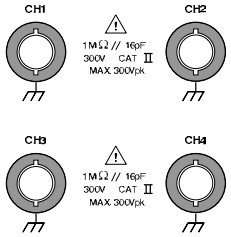
Show waveform in X-Y mode

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), Channel 2 (Y-axis), Channel 3* (Y2-axis) and Channel 4* (Y3-axis).

   *4 channel models only.

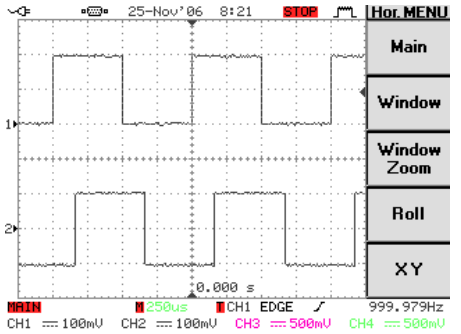


2. Make sure both Channel 1 and 2 are activated (LED On). Press the Channel key if necessary.

   4 channel models can also have channel 3 and 4 activated for simultaneous XY display.

CH1 CH2

CH3 CH4



3. Press the Horizontal menu key.

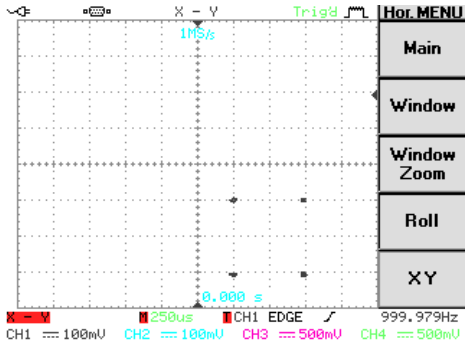
HORI MENU

4. Press F5 (XY). The display shows two waveforms in X-Y format; Channel 1 as X-axis, Channel 2 as Y-axis.

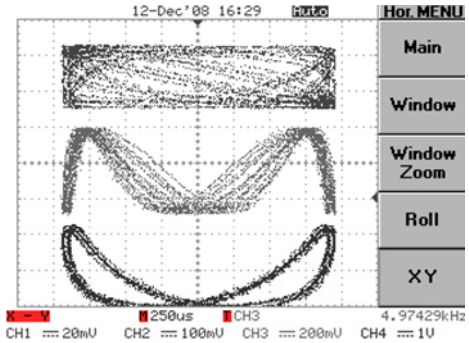
   4 channel models will show three different Y axes. X1-Y1, X1-Y2 and X1-Y3.

XY F 5

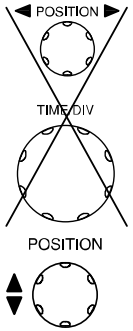
2 channel (X-Y)



4 Channel (X-Y, X1-Y2,X1-Y3)



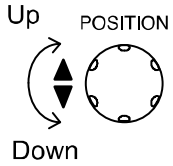
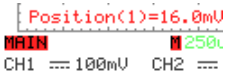
5. Horizontal Position knob and Time/Div knob are disabled under the X-Y mode. To move the waveform position, use the vertical position knob: Channel 1 knob moves the waveform horizontally, Channel 2 knob vertically.



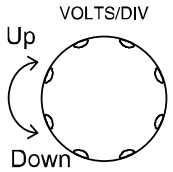
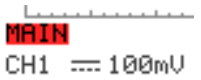
Vertical View (Channel)

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.

Select coupling mode

Panel operation

1. Press the Channel key. CH1
2. Press F1 (Coupling) repeatedly to select the coupling mode. Coupling F 1

Range

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

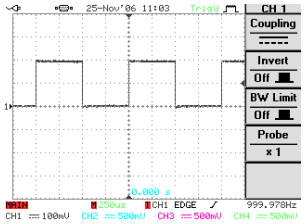
Ground coupling mode. The display shows only the zero voltage level as a horizontal line. This mode is useful for measuring the signal voltage with respect to the ground level.

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.

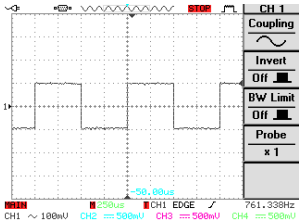
Example

Observing the AC portion of the waveform using AC coupling

DC coupling



AC coupling



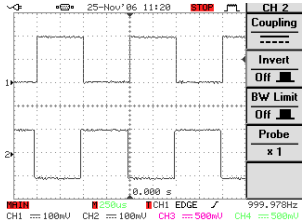
Invert waveform vertically

Panel operation

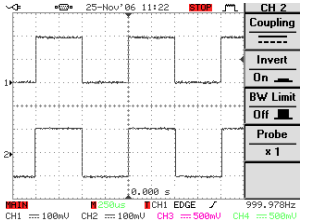
1. Press the Channel key. CH1
2. Press F2 (Invert) to invert the waveform. Invert Off F 2

Example

CH2 (below) Invert Off



CH2 (below) Invert On



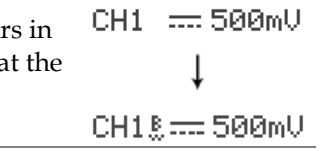
Limit bandwidth

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.

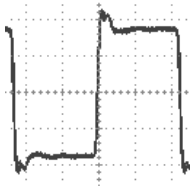
Panel operation

3. Press the Channel key. CH1
4. Press F3 (BW Limit) to turn Off the limitation. BW Limit Off F 3
5. The BW icon appears in the channel indicator at the bottom of the display.

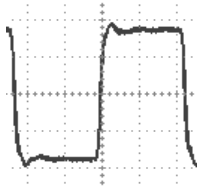


Example

BW Limit Off



BW Limit On



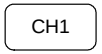
Select probe attenuation level

Background

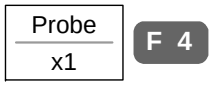
A signal probe has an attenuation switch to lower the original DUT signal level to the oscilloscope input range, if necessary. The probe attenuation selection adjusts the vertical scale so that the voltage level on the display reflects the real value on DUT.

Panel operation

1. Press the Channel key.



2. Press F4 (Probe) repeatedly to select the attenuation level.



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

(x1)

(x10)

(x100)

Range

x1, x10, x100

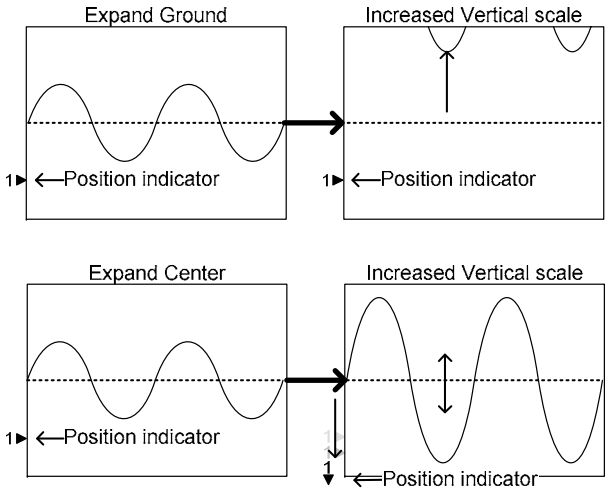
Note

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

Expand the vertical scale -ground / center

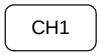
Background

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

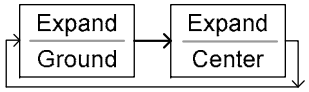


Panel operation

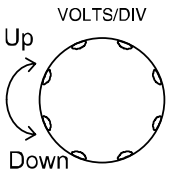
1. Press the Channel key.



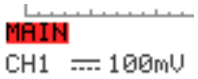
2. Press F5 (Expand Ground/Expand Center) to toggle between the two modes.



3. 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.



Trigger

Trigger configures the condition GDS-2000 captures the incoming signal.

Trigger type overview

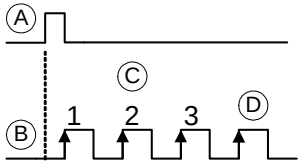
Edge (+Delay)

Triggers when the signal crosses an amplitude threshold in either positive or negative slope.

(for 2CH models only) The advanced Delay trigger works in tandem with the edge trigger, by waiting for a specified time or number of event before the edge trigger starts. This method allows pinpointing a location in a long series of trigger events.

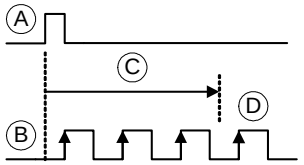
Note: when using the delay trigger, trigger source is limited to Channel 1 or 2.

Delay trigger example (by event)



A Ext. trigger input
B Source (CH1 or 2)
C Delay event count (3)
D First triggering point

Delay trigger example (by time)



A Ext. trigger input
B Source (CH1 or 2)
C Delay time length
D First triggering point

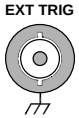
Video

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	(For 2CH models only) external trigger input signal 
Trigger mode	Auto	GDS-2000 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-2000 acquires waveform only when a trigger event occurs.
	Single	GDS-2000 acquires waveform once when a trigger event occurs, then stop acquiring. Press the Run/Stop key to acquire waveform again. Run/Stop
Auto level	When turning this function ON, GDS-2000 automatically adjusts the trigger level to the center amplitude of the waveform.	
Holdoff	The holdoff function defines the waiting period before GDS-2000 starts triggering again after a trigger point. The Holdoff function ensures a stable display.	
Video standard	NTSC	National Television System Committee

(video trigger)	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 time (delay trigger)	Sets the delay time (100ns ~ 1.3ms) between the trigger event and the real trigger timing.	
Trigger event (delay trigger)	Sets the number of events (2 ~ 65000) passed after the trigger event, until the real trigger timing.	
Ext. input level (delay trigger)	Sets the amplitude threshold level for the external trigger input signal.	
	TTL	1.48V
	ECL	1.35V
	User	–12V ~ +12V, user-set level
Trigger slope		Triggers on the rising edge.
		Triggers on the falling edge.
Trigger coupling		Triggers only on the AC component.
		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.

Setup Holdoff and Auto level

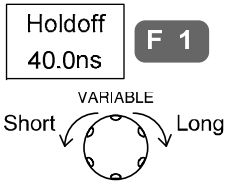
Background Holdoff function defines the waiting period before GDS-2000 starts triggering again after a trigger point. Auto level function automatically adjusts the trigger level to the center amplitude of the waveform.

Panel operation

1. Press the Trigger menu key twice.

2. To set the Holdoff time, press F1 (Holdoff) and use the Variable knob. The resolution depends on the horizontal scale.

   Range 40ns~2.5s

   Pressing F2 (Set to Minimum) sets the Holdoff time to the minimum, 40ns.

   Note: The holdoff function is automatically disabled when the waveform update mode is in Roll or Scan mode (page110).

3. To turn Auto Level On/Off, press F5 (Auto Level).

Use edge trigger

Panel operation

1. Press the Trigger menu key.

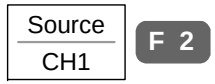
2. Press F1 repeatedly to select edge trigger. The edge trigger indicator appears at the bottom of the display.

   From left: channel, edge trigger, slope

3. Press F2 repeatedly to select the trigger source.

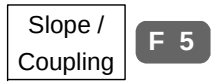
   Range Channel 1 ~ 4, Line, Ext

4. Press F3 repeatedly to select the trigger mode.

   Range Auto, Normal, Single

5. Press F5 (Slope/coupling) to set trigger slope and coupling.

6. Press F1 (Slope) repeatedly to select the trigger slope, which also appears at the bottom of the display.

   Range Rising edge, falling edge

7. Press F2 (Coupling) repeatedly to select the trigger coupling.

   Range DC, AC

8. Press F3 (Rejection) to select the frequency rejection mode.

Range LF, HF, Off

9. Press F4 (Noise Rej) to turn the noise rejection On/Off.

Range On, Off

10. Press F5 (Previous menu) to go back to the previous menu.

Use advanced delay trigger (2CH model)

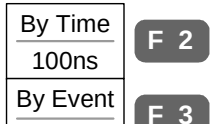
Panel operation

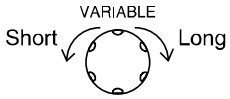
1. Make sure the edge trigger source is set to CH1 or CH2. If not, GDS-2000 automatically selects CH1 as the source.

2. Press F1 repeatedly to select Delay trigger.

From left: channel, delay trigger, slope

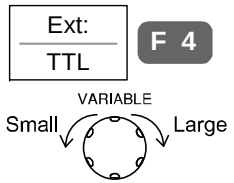
3. Press F2 (By time) or F3 (By event) and use the Variable knob to select the delay time or event after the first trigger condition.





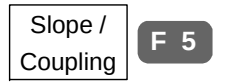
Range 100ns ~ 1.3ms (by time)
2 ~ 65000 (by event)

4. Press F4 (Ext) repeatedly to select the threshold level for the external trigger input.



Range TTL (1.48V), ECL (1.35V), User (–12V ~ +12V)

5. Press F5 (Slope/Coupling) to set the slope and coupling condition for external trigger input signal. Note that this setting does not affect the trigger source signal (Channel 1 or 2).

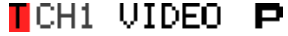


Use video trigger

Panel operation

1. Press the Trigger menu key. MENU

2. Press F1 repeatedly to select video trigger. The video trigger indicator appears at the bottom of the display. Type / Video — F 1

   From left: channel, video trigger, polarity

3. Press F2 repeatedly to select the trigger source channel. Source / CH1 — F 2

   Range Channel 1 ~ 4

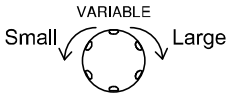
4. Press F3 repeatedly to select the video standard. Standard / NTSC — F 3

   Range NTSC, PAL, SECAM

5. Press F4 repeatedly to select the video signal polarity. Polarity — F 4

   Range positive, negative

6. Press F5 repeatedly to select the video field line. Use the Variable knob to select the video line. Line — F 5

   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. MENU

2. Press F1 repeatedly to select pulse width trigger. The pulse width trigger indicator appears at the bottom of the display. Type / Pulse — F 1

   From left: channel, pulse width trigger, slope

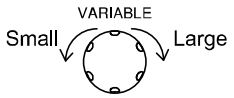
3. Press F2 repeatedly to select the trigger source. Source / CH1 — F 2

   Range Channel 1 ~ 4, Line, Ext

4. Press F3 repeatedly to select the trigger mode. Mode / Auto — F 3

   Range Auto, Normal, Single

5. Press F4 repeatedly to select the pulse condition. Then use the Variable knob to set the pulse width. When < / 20.0ns — F 4

   Condition > , < , = , ≠

   Width 20ns ~ 200us

6. Press F5 to set trigger slope and coupling. Slope / Coupling — F 5

7. Press F1 (Slope) repeatedly to select the trigger slope, which also appears at the bottom of the display.

Range Rising edge, falling edge

8. Press F2 (Coupling) repeatedly to select the trigger coupling.

Range DC, AC

9. Press F3 (Rejection) to select the frequency rejection mode.

Range LF, HF, Off

10. Press F4 (Noise Rej) to turn the noise rejection On/Off.

Range On, Off

11. Press F5 (Previous menu) to go back to the previous menu.

System Info / Language / Clock

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

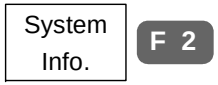
View system information

Panel operation

1. Press the Utility key.

2. Press F5 (More).

3. Press F2 (System Info). The upper half of the display shows the system information in the following format.



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

4. Press any other key (for example F5 (More) to go back to the waveform display mode.

Select menu language

Parameter

The following is the list of menu language available by default. Language selection differs according to the region to which GDS-2000 is shipped.

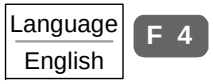
- English
- Chinese (traditional)
- Chine (simplified)
- Korean

- Spanish
- Russian
- Dutch
- Italian
- Portuguese
- Japanese
- German
- Polish
- French

Panel operation

1. Press the Utility key.

2. Press F4 (Language) repeatedly to select the language.

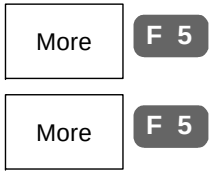


Set date and time

Panel operation/ parameter

1. Press the Utility key.

2. Press F5 (More) twice.



3. Press F2 (Time Set Menu).

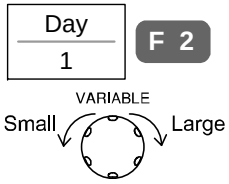
4. Press F2 (Year/ Month/ Date) repeatedly. Use the Variable knob to change the value.

Year	2000 ~ 2037
Month	1 ~ 1 2
Day	1 ~ 31

5. Press F4 (Save) to confirm the value.

6. Press F1 (Date) to switch to the Time setting menu.

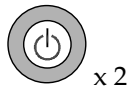
7. Press F2 (Hour/ Minute) repeatedly. Use the Variable knob to change the value.



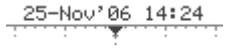
Hour	0 ~ 23
Minute	0 ~ 59

8. Press F4 (Save) to confirm the value.

9. Turn Off the display and turn it On again (power cycle).



10. Make sure the date/time setting is correctly reflected at the top of the display.



SAVE/RECALL

File Format/Utility

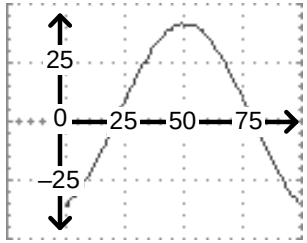
Display image file format

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 ~ 4	Input channel signal
	Math	Math operation result (page73)
Storage location	W1 ~ W20	Waveform file stored in the internal memory. Stored waveforms can be copied to USB flash drive for transfer, or to Ref. A ~ D for showing on the display (W1 ~ W20 waveforms cannot be directly recalled on the display).
	Ref A ~ D	Reference waveform stored in the internal memory, separate from W1 ~ W20. From Ref A ~ D, 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 • cursor location	• cursor on/off
	Display	• dots/vectors • grid type	• accumulation on/off
	Measure	• item	• source channel
	Utility	• hardcopy type • interface type • buzzer type • Go-NoGo cond.	• ink saver on/off • RS-232 config • GPIB address • menu language
	Program	• step contents • start/stop steps	• loop count
	Horizontal	• display mode • position	• scale
	Trigger	• trigger type • trigger mode • video polarity • pulse timing	• source channel • video standard • video line • slope/coupling
	Channel (vertical)	• vertical scale • coupling mode • bandwidth limit on/off	• vertical position • invert on/off • probe attenuation
	Math	• operation type • vertical position • FFT window	• source channel • unit/div

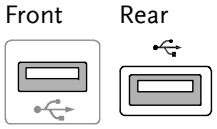
USB flash drive file utility

Background

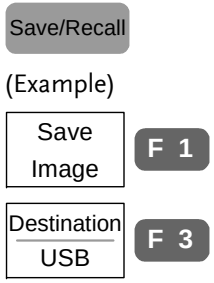
For USB flash drive, file deletion, folder creation, file/folder rename are available from the front panel. This feature is not available for internally stored files.

Panel operation

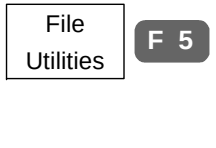
1. Connect the drive to the front or rear panel USB port. Note: Only one host connection, front or rear, is allowed at a time.

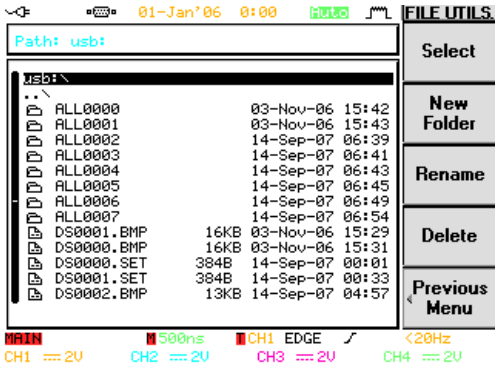


2. Press the Save/Recall key. Select any save or recall functionality, for example USB destination in Save image function.

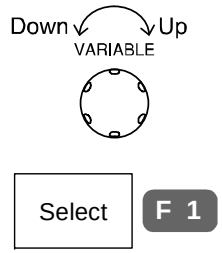


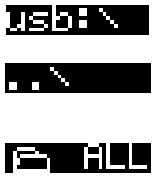
3. Press F5 (File Utilities). The display shows the USB flash drive contents, root directory.





4. Use the Variable knob to move the cursor. Press F1 (Select) to go into the folder or go back to the previous directory level.





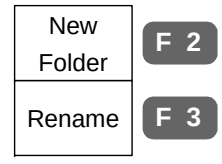
Go back to the root directory

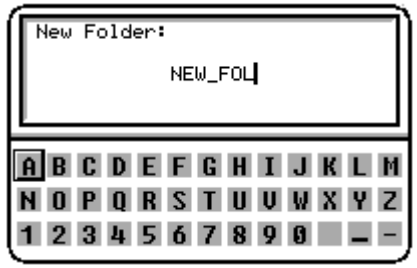
Go back to the previous (higher) directory

Go into the folder

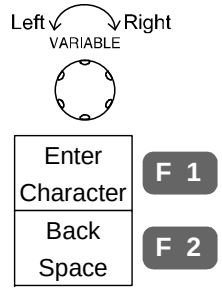
Create new folder / Rename file or folder

1. Move the cursor to the file or folder location and press F2 (New Folder) or F3 (Rename). The file/folder name and the character map appear on the display.





2. Use the Variable knob to move the pointer to the characters. Press F1 (Enter Character) to add a character or F2 (Back Space) to delete a character.



3. When editing is completed, press F4 (Save). A new folder or a new folder/file name is created.

Save F 4

4. Press F5 (Previous Menu) to go back to the previous menu.

Previous Menu F 5

Delete folder/file

1. Move the cursor to the folder or file location and press F4 (Delete). A message appears at the bottom of the display, asking additional confirmation.

Delete F 4

```
Press F4 again to confirm this process.
```

2. If the file/folder still needs to be deleted, press F4 (Delete) again to complete deletion. To cancel deletion, press any other key.

Delete F 4

3. The USB flash drive content is updated. Press F5 (Previous Menu) to go back to Save/Recall menu.

Previous Menu F 5

Quick Save (HardCopy)

Background

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

Hardcopy

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

The printing operation is described in page167.

Using the Save/Recall key can also save files but with more configurations. For details, see page144.

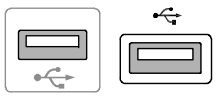
Save/Recall

Functionality

Save image (*.bmp)	Saves the current display image into a USB flash drive connected to the front or rear panel terminal.
Save all	Saves the following items into a USB flash drive connected to the front or rear panel terminal. • Current display image (*.bmp) • Current system setup (*.set) • Current waveform data (*.csv) • Last stored system setup (*.set) • Last stored waveform data (*.csv)
Print out	Prints out the display image to an external printer connected to USB port. For details, see page167.

Panel operation

1. Connect the drive to the front or rear panel USB port. Note: Only one host connection, front or rear, is allowed at a time.



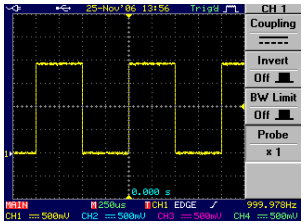
2. Press the Utility key.

3. Press F1 (Hardcopy Menu).

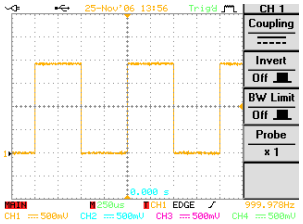
4. Press F1 (Function) repeatedly to select Save image or Save all.

5. To invert the color for the saved or printed display image, press F2 (Ink Saver) and turn On the Ink Saver.

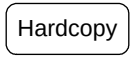
Ink Saver On (normal)



Ink Saver Off (inverted)



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



Save

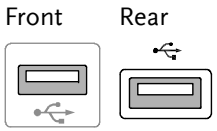
File type/source/destination

Item	Source	Destination
Panel setup (DSxxxx.set)	• Front panel settings	• Internal memory: S1 ~ S20 • External memory: USB
Waveform data (DSxxxx.csv)	• Channel 1 ~ 4 • Math operation result • Reference waveform A ~ D	• Internal memory: Reference waveform A ~ D, W1 ~ W20 • External memory: USB
Display image (DSxxxx.bmp)	• Display image	• External memory: USB
Save All	• Display image (Axxxx.bmp) • Waveform data (Axxxx.csv) • Front panel settings (Axxxx.set)	• External memory: USB
Printer driver (DSxxx.pdv)	• Printer driver	• External memory: USB

Save panel setting

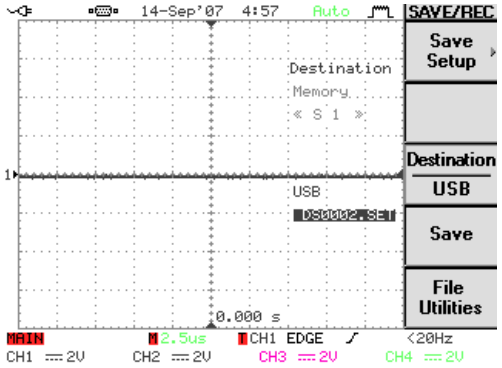
Panel operation

7. (For saving to an external USB flash drive) Connect the drive to the front or rear panel USB port.
   Note: Only one host connection, front or rear, is allowed at a time.

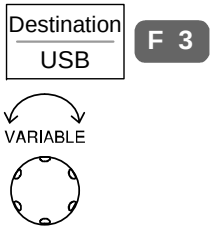


8. Press the Save/Recall key.

9. Press F3 (Save Setup). The display shows the available file destinations.



10. Press F3 (Destination) repeatedly to select the saved location. Use the Variable knob to change the memory location (S1 ~ S20) or the file name (DSxxxx.set).



Memory	Internal memory, S1 ~ S20

USB	External flash drive, no practical limitation on the amount of file. When saved, the setup file is placed in the root directory.

11. Press F4 (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 USB drive is taken out before the message.

USB file utility

To edit USB flash drive contents (create/ delete/ rename files and folders), press F5. For details, see page139.

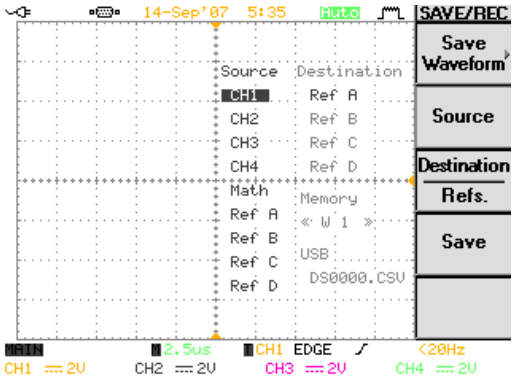
Save waveform

Panel operation

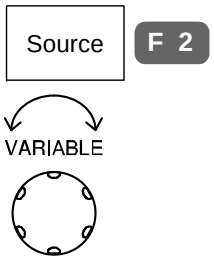
1. (For saving to an external USB flash drive) Connect the drive to the front or rear panel USB port.
   Note: Only one host connection, front or rear, is allowed at a time.

2. Press the Save/Recall key.

3. Press F4 (Save Waveform). The display shows the available source and destination options.

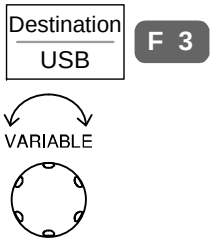


4. Press F2 (Source). Use the Variable knob to select the source signal.



CH1 ~ CH2 (2CH model)	Channel 1 ~ 2 signal
CH1 ~ CH4 (4CH model)	Channel 1 ~ 4 signal
Math	Math operation result (page73)
RefA ~ D	Internally stored reference waveforms A ~ D

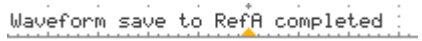
5. Press F3 (Destination) repeatedly to select the file destination. Use the Variable knob to select the memory location or file name.



Memory	Internal memory, W1 ~ W20

USB	External flash drive, no practical limitation on the amount of file. When saved, the waveform file is placed in the root directory.
Ref	Internal reference waveform, A~D

6. Press F4 (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 USB drive is taken out before the message.

USB file utility

To edit USB flash drive contents (create/ delete/ rename files and folders), press F5. For details, see page139.

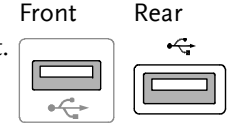
PC software (FreeWave)

Saving waveform is also available through the proprietary PC software, downloadable from GWInstek website.

Save display image

Panel operation

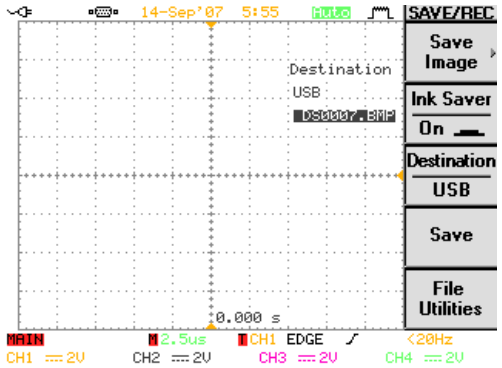
1. Connect the drive to the front or rear panel USB port. Note: Only one host connection, front or rear, is allowed at a time.



2. Press the Save/Recall key.

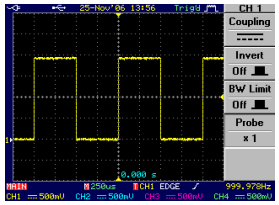
3. Press F5 (More).

4. Press F1 (Save Image). The display shows the available file destinations.

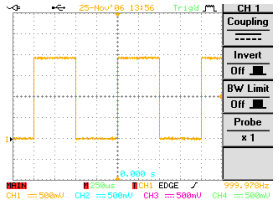


5. Press F2 (Ink Saver) repeatedly to invert the background color (On) or not (Off).

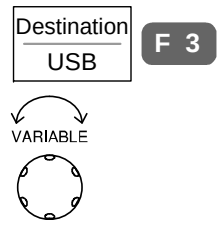
Ink Saver On (normal)



Ink Saver Off (inverted)



6. Press F3 (Destination). Use the Variable knob to select the file name.



USB	External flash drive, no practical limitation on the amount of file. When saved, the image file is placed in the root directory.

7. Press F4 (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 USB drive is taken out before the message.

USB file utility

To edit USB flash drive contents (create/ delete/ rename files and folders), press F5. For details, see page139.

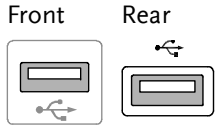
PC software (FreeWave)

Saving display image is also available through proprietary PC software, downloadable from GWInstek website.

Save All

Panel operation

1. Connect the drive to the front or rear panel USB port. Note: Only one host connection, front or rear, is allowed at a time.

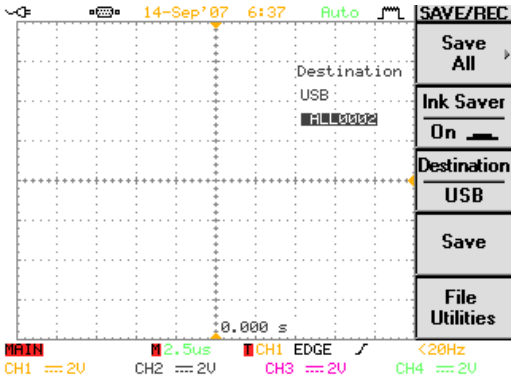


2. Press the Save/Recall key.

3. Press F5 (More).

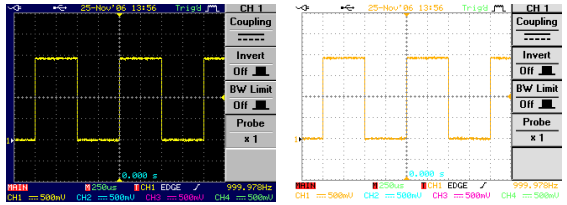
4. Press F2 (Save All). The display shows the available file destinations. The following files are saved, contained in a folder.

Setup file (Axxxx.set)	Two types of setups are saved: the current panel setting and the last internally saved setting (one of S1 ~ S20).
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 ~ W20).

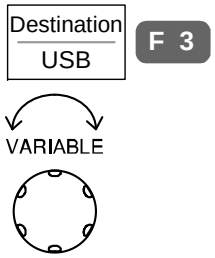


5. Press F2 (Ink Saver) repeatedly to invert the background color (On) or not (Off) for the display image.

Ink Saver On (normal) Ink Saver Off (inverted)



6. Press F3 (Destination). Use the Variable knob to select the file name.



USB	External flash drive, no practical limitation on the amount of file. When saved, the folder is placed in the root directory.

7. Press F4 (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 USB drive is taken out before the message.

8. Together with the current setup/waveform/ image, the last saved waveform file (one from W1 ~ W20) and setup file (one from S1 ~ S20) are also included in the folder.

USB file utility

To edit USB flash drive contents (create/ delete/ rename files and folders), press F5. For details, see page139.

Recall

File type/source/destination

Item	Source	Destination
Default panel setup	• Factory installed setting	• Current front panel
Reference waveform	• Internal memory: A ~D	• Current front panel
Panel setup (DSxxxx.set)	• Internal memory: S1 ~ S20 • External memory: USB	• Current front panel
Waveform data (DSxxxx.csv)	• Internal memory: W1 ~ W20 • External memory: USB	• Reference waveform A ~ D
Display image (DSxxxx.bmp)	• External memory: USB	• Display
Printer Driver (DSxxxx.drv)	• External memory: USB	• Internal printer configuration

Recall default panel setting

Panel operation

1. Press the Save/Recall key. [Save/Recall]

2. Press F1 (Default Setup). The factory installed setting is recalled and replaces the current panel setting. [Default Setup] [F 1]

Setting contents	The following is the default (factory) setting contents.	
Acquisition	Mode: Normal	Memory length: 500
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: 	
Go-NoGo	Go-No: Off	Source: CH1
	NoGo when:	Violating: Stop
Horizontal	Scale: 2.5us/Div	Mode: Main Timebase
Math	Type: + (Add)	Channel: CH1+CH2
	Position: 0.00 Div	Unit/Div: 2V
Measure	Source1, 2: CH1, CH2	Type: VPP, Freq, FRR
Program	Mode: Edit	Step: 1
Trigger	Type: Edge	Source: Channel1
	Mode: Auto	Slope: 
	Coupling: DC	Rejection: Off
	Noise Rejection: Off	
Utility	SaveImage, InkSaver Off	GPIB, Address 8
	Sound: Off	

Recall reference waveform on the display

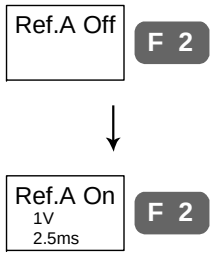
Panel operation

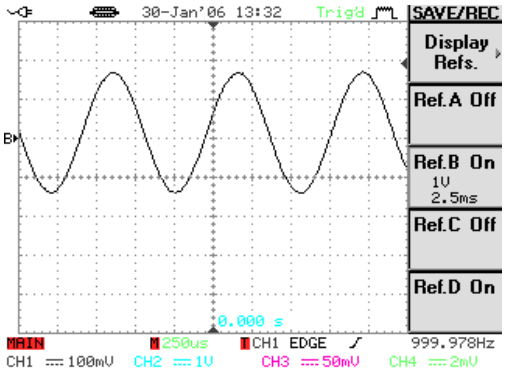
1. The reference waveform must be stored in advance. See page 146 for waveform store details.

2. Press the Save/Recall key.

3. Press F2 (Display Refs). The reference waveform display menu appears.

4. Select the reference waveform from F1 (Ref A) to F4 (Ref D) and press it. The waveform appears on the display and the period and amplitude of the waveform appears in the menu.



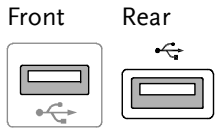


5. To clear the waveform from the display, press F1 ~ F4 key again.

Recall panel setting

Panel operation

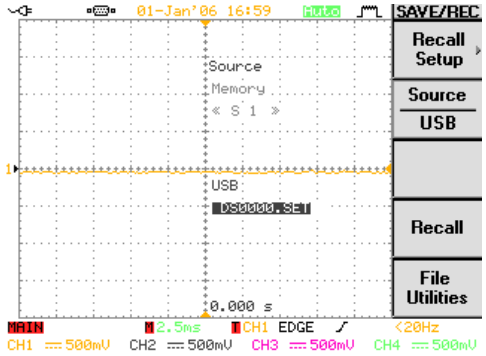
1. (For recalling from an external USB flash drive) Connect the drive to the front or rear panel USB port. Note: Only one host connection, front or rear, is allowed at a time.



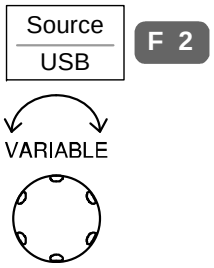
2. Press the Save/Recall key.

3. Press F5 (More).

4. Press F3 (Recall Setup). The display shows the available file sources.



5. Press F2 (Source) repeatedly to select the file source, internal memory or external USB. Use the Variable knob to change the memory location (S1 ~ S20) or the file name (DSxxxx.set).



Memory	Internal memory, S1 ~ S20
USB	External flash drive, no practical limitation on the amount of file. The setup file must be placed in the root directory to be recognized.

6. Press F4 (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 USB drive is taken out before the message.

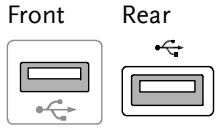
USB file utility

To edit USB flash drive contents (create/ delete/ rename files and folders), press F5. For details, see page139.

Recall waveform

Panel operation

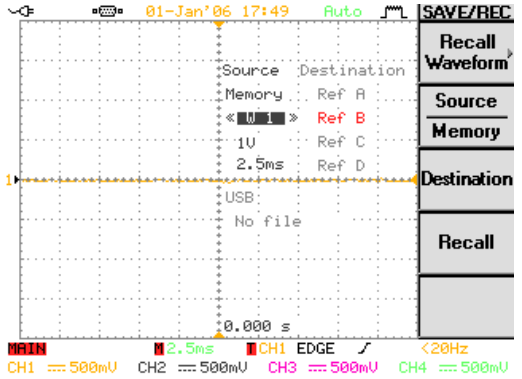
1. (For recalling from an external USB flash drive) Connect the drive to the front or rear panel USB port. Note: Only one host connection, front or rear, is allowed at a time.



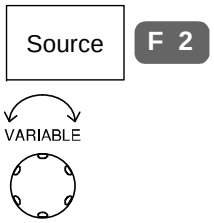
2. Press the Save/Recall key.

3. Press F5 (More).

4. Press F4 (Recall Waveform). The display shows the available source and destination options.

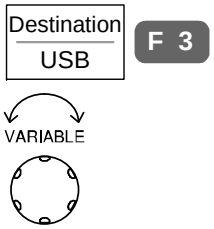


5. Press F2 (Source) repeatedly to select the file source, internal memory or external USB. Use the Variable knob to change the memory location (S1 ~ S20) or the file name (DSxxxx.csv).



Memory	Internal memory, W1 ~ W20
USB	External flash drive, no practical limitation on the amount of file. The waveform file must be placed in the root directory to be recognized.

6. Press F3 (Destination). Use the Variable knob to select the memory location.



RefA ~ D	Internally stored reference waveforms A ~ D

7. Press F4 (Save) 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 USB drive is taken out before the message.

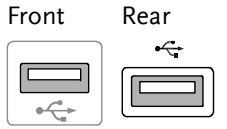
USB file utility

To edit USB flash drive contents (create/ delete/ rename files and folders), press F5. For details, see page139.

Recall image

Panel operation

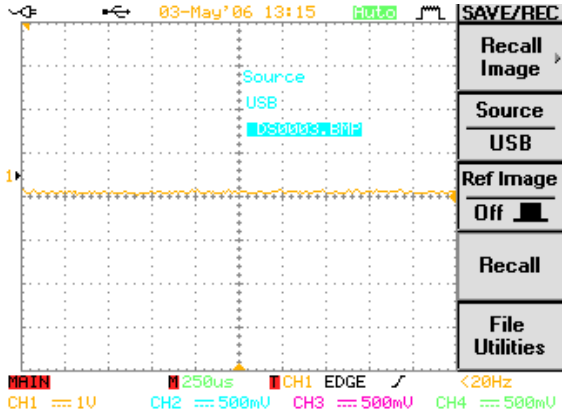
1. Connect the USB drive to the front or rear panel USB port.
Note: Only one host connection, front or rear, is allowed at a time.



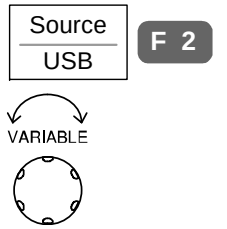
2. Press the Save/Recall key.

3. Press F5 (More).

4. Press F5 (Recall Image). The display shows the available source options.

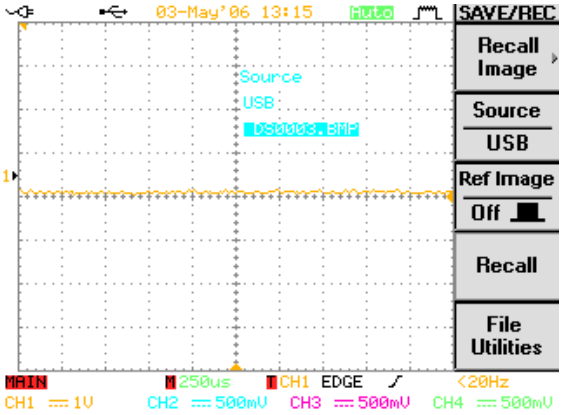


5. To select the source image file, press F2 (Source) and use the Variable knob.



6. To show the image on the display, press F3 (Ref Image) ON or F4 (Recall).

7. The image appears on the display and the "R" indicator appears at the top left corner of the display.



8. To clear the image off the display, press F3 (Ref Image) OFF.

Special Save Functions

Customize Default settings

Background

The GDS-2000 allows the default settings to be customized. All the settings can be customized to the default settings, except those in the Program menu. The default settings can recalled through the save/record menu (page 153).

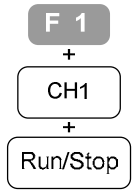
In the event that the factory settings need to set as the default again, see page 163.

Panel operation

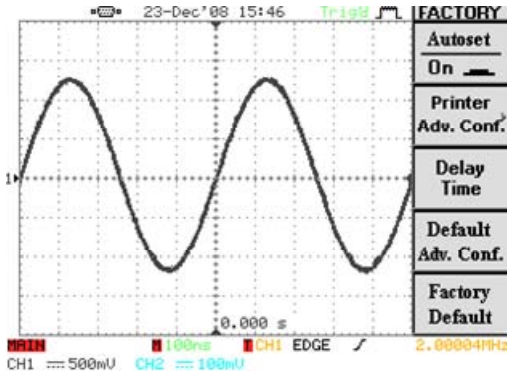
1. Change all the settings on the DSO to suit. For example the following can be adjusted:
   - Channel X on/off
   - Vertical scale
   - Horizontal scale
   - Auto measurement functions (Vavg, Vpp, Frequency, Duty Cycle, Rise Time)

   See page 48/135 for factory settings to see what settings can be configured as the default settings.

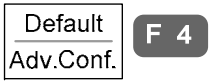
2. Press the F4, CH1 and Run/Stop key together to access the factory menu.



3. The Factory menu appears.



4. Press F4 to save the current settings as the default settings.



To recall the default settings or to restore the factory settings see page 153 and 163 respectively.

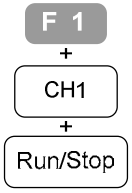
Recall factory default settings

Background

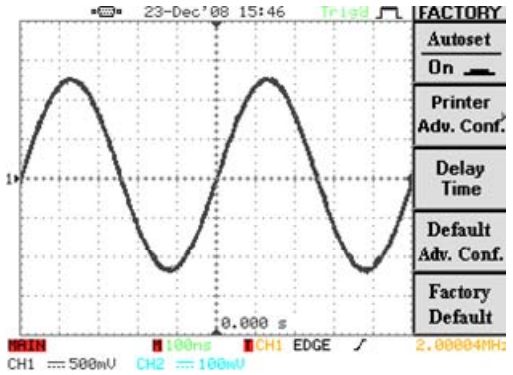
The GDS-2000 allows the default settings to be customized. If the default settings have been customized and the original factory settings are needed, the following procedure can be used.

Panel operation

1. Press the F4, CH1 and Run/Stop key together to access the factory menu.



2. The Factory menu appears.



3. Press F5 to recall the original factory settings.

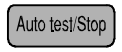
Quick setting recall

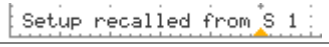
Background

The quick setting recall function allows the usually complicated setting recall operation a lot simpler. The Auto test/Stop key can be used to recall panel setup memory, however this function is limited to only the S1 internal memory slot.

Panel Operation

1. Press the Auto test/Stop key to recall S1 panel setup.





Note

This function is only applicable when the DSO is not in program mode.

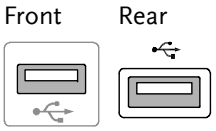
USB number pad recall/save panel setting

Background

An external USB number pad can be used to quickly save and recall up to 10 panel settings from internal memory.

Panel operation

1. Connect the USB number pad to the front or rear panel USB port.
   Note: Only one host connection, front or rear, is allowed at a time.

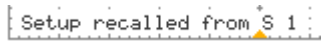


2. To save the current panel setting, ensure the number lock is activated. Press the Num Lock key on the USB number pad if needed.

3. Press the numbers 0-9 to save to memory slots S1-S10.

4. To recall the current panel setting, ensure the number lock is off. Press the Num Lock key on the USB number pad if needed.

5. Press the numbers 0-9(excluding 5) to recall to memory slots S1-S10.



PRINT OUT

Display printout is also available using proprietary PC software, downloadable from GWInstek website.

Overview

Printout step

Listed below are the steps that have to be followed when printing out the display image through USB connector.

1. Connect the printer to the USB host port
2. Configure the interface to printout mode
3. Configure the content and printout
4. Printout

The sections below deal with driver selection, export and import.

5. Printer configuration
6. Exporting printer drivers
7. Importing printer drivers

1 Connect printer

1. Connect the printer to the USB host port, front or rear panel.

Front panel

Rear panel

USB Note

Using the front and rear USB host port at the same time is forbidden (Example: printer to the rear panel, storage device to the front panel).

If printing from the rear USB port, the GDS-2000 interface must be assigned as RS232 via the UTILITY menu.

2 Configure interface

Panel operation

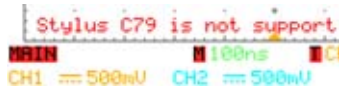
1. Press the Utility key.

2. Press F2 (Interface menu).

3. Press F1 (Type) repeatedly to select USB if printing from the front USB port or RS232 if printing from the rear USB port.

4. If the printer is supported an auto detect message will be displayed.

If the printer is not supported an error message will appear, along with the Printer menu.



Note If the printer is not supported, please proceed to the printer driver selection, page 171

5. Press F5 (Previous menu). Previous Menu F 5

6. Press F1 (Hardcopy menu). Hardcopy Menu F 1

7. Press F1 (Function) repeatedly to select Printer. Function Printer F 1

3 Configure content

Panel operation

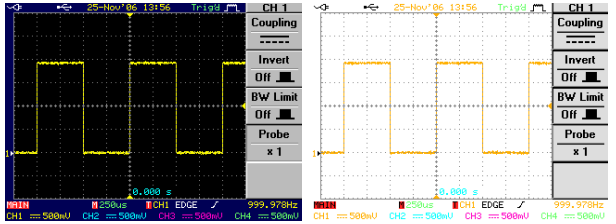
1. Press the Utility key. Utility

2. Press F1 (Hardcopy Menu). Hardcopy Menu F 1

3. Press F1 (Function) repeatedly to select Printer if it is not selected yet. Function Printer F 1

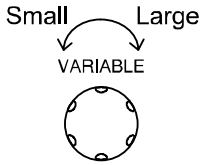
4. To invert the color for the saved or printed display image, press F2 (Ink Saver) and turn On the Ink Saver. Ink Saver On F 2

Ink Saver On (normal) Ink Saver Off (inverted)



5. To select black/white or color printing, press F3 (Portrait) repeatedly; Gray (b&w) or Color. Gray Portrait F 3

6. To select the printed size, press F4 (Ratio). Use the Parameter knob to change the ratio with respect to the real display size. Ratio 50% F 4



Range 10% ~ 100%

4 Printout

Press the Hardcopy key. The display image is printed out. Hardcopy

5 Printer driver selection

Using the Printer menu will allow similar printer drivers to be used if the selected printer is not directly supported.

Note

Please proceed to step 6 if the printer menu has already been accessed. (Usually automatically if an unsupported printer is connected)

1. Ensure the printer is connected. Page 168.

2. Ensure the USB/RS232 port is connected. Page 6.

3. Press the F4, CH1 and Run/Stop keys together to access the Factory menu.

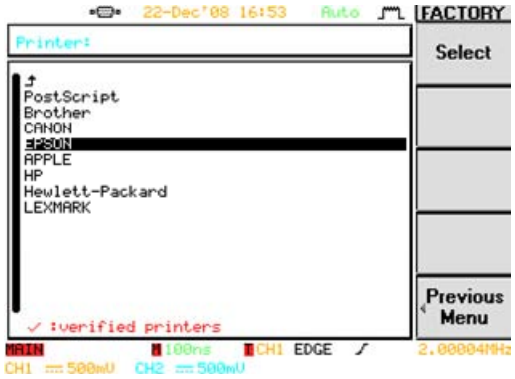
4. Press the F2 key (Printer advanced configuration).

5. Select Printer Manager (F1).

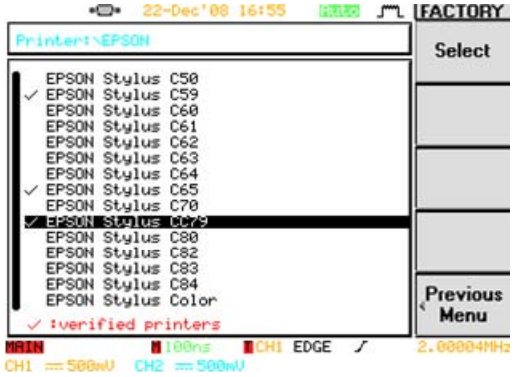
Printer Menu

6. Use the variable knob to select the correct printer brand or type.

7. Use Select (F1) to confirm selection.



8. Use the variable knob and F1 to choose a compatible printer.



9. Confirm the printer driver is compatible by printing a test sheet. (Configure) page 169.

(Print)Page 170.

10. Repeat the process with a similar printer if the driver selection is not compatible.

11. If you still cannot find a compatible printer driver, please contact your nearest distributor or check the GWInstek website to import the latest drivers.

Note

If a compatible driver has been found please export the driver and contact your local distributor or a GWInstek representative to upload your driver to ensure the best possible user experience for future iterations of the printer utility.

5 Printer driver export

If a manual driver selection is successful, it can be exported for use on other GDS-2000 DSOs.

Although GWInstek tries to ensure compatibility with as many printers as possible, some printers are not supported. The export function allows printer drivers to be exported. If a compatible driver has been found please export the driver and contact your local distributor or a GWInstek representative to upload your driver to ensure the best possible user experience for future iterations of the printer utility.

1. Ensure the printer is connected. Page 168.

2. Ensure the USB/RS232 port is configured. Page 6.

3. Ensure a printer driver has been manually selected. Page 171

4. Insert a USB flash drive into the host USB port.

5. Press the F4, CH1 and Run/Stop keys together to access the Factory menu.

6. Press the F2 key (Printer advanced configuration).

7. Press(F2) to export the printer driver.

A printer driver file will be exported to the root directory of the USB flash drive.

The file name will have a file extension of *.pdv.

DSXXX.PDV

5 Printer driver import

Printer drivers can be imported onto the GDS-2000 via the import function using a USB flash drive.

If you have trouble selecting a viable driver, please contact your local distributor or a GWInstek representative to download the latest drivers.

Note

Please ensure the USB flash drive has a printer driver file of the type (DS*.PDV) located in the root directory.

1. Ensure the printer is connected. Page 168.

2. Ensure the USB/RS232 port Page 6.
is configured.

3. Insert a USB flash drive into the host USB port.

4. Press the F4, CH1 and Run/Stop keys together to access the Factory menu.

5. Press the F2 key (Printer advanced configuration).

6. Press(F3) to import the printer driver.

REMOTE CONTROL

CONFIG

This chapter describes basic configuration of IEEE488.2 based remote control. For command list, refer to the programming manual downloadable from GWInstek website, www.gwinstek.com.tw.

Interface Configuration

Configure USB interface

USB configuration	PC side connector	Type A, host
	GDS-2000 side connector	Type B, slave
	Speed	1.1/2.0 (full speed)

Panel operation

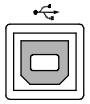
1. Press the Utility key.

7. Press F2 (Interface Menu).

8. Press F1 (Type) repeatedly to select USB.

9. The interface icon at the top of the display changes into USB type.

10. Connect the USB cable to the rear panel slave port.



11. When the PC asks for the USB driver, select gds2k_cdc.inf included in the FreeWave software package downloadable from GW website, www.gwinstek.com.tw, GDS-2000 product corner. The driver file automatically sets GDS-2000 as serial port COM7.

Configure RS-232C interface

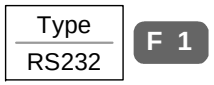
RS-232C configuration	Connector	DB-9, Male
	Baud rate	2400, 4800, 9600, 19200, 38400
	Parity	None, Odd, Even
	Data bit	8 (fixed)
	Stop bit	1, 2

Panel operation

1. Press the Utility key.

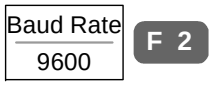
12. Press F2 (Interface Menu).

13. Press F1 (Type) repeatedly to select RS-232C.



14. The interface icon at the top of the display changes into RS-232C type.

15. To change the baud rate, press F2 (Baud Rate) repeatedly.



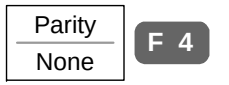
Range 2400, 4800, 9600, 19200, 38400

16. To change the stop bit, press F3 (Stop Bit) repeatedly.

Range 1, 2

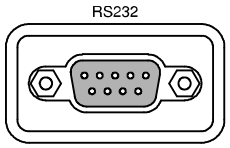
17. Data bit is fixed at 8.

18. To change the parity, press F4 (Parity) repeatedly.

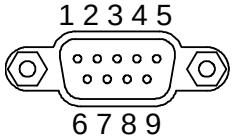


Range None, Odd, Even

19. Connect the RS-232C cable to the rear panel port: DB-9 male connector. For functionality check see page182.



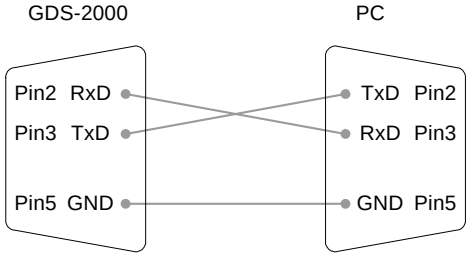
Pin assignment



2: RxD (Receive data)
3: TxD (Transmit data)
5: GND
4, 6 ~ 9: No connection

PC connection

Use the Null Modem connection as in the below diagram.



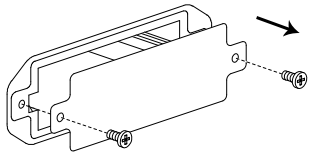
Configure GPIB interface (optional)

GPIB module installation

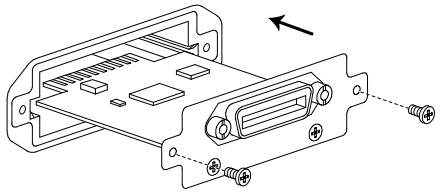
The optional GPIB module is available as a separate kit. Follow the instruction to install the module properly.

1. Turn Off the GDS-2000 power switch.

20. Take off two screws and remove the rear panel GPIB module cover.



21. Insert the GPIB module and put the screws back.



22. Turn On the GDS-2000 power switch.

Configure GPIB

1. Press the Utility key.

23. Press F2 (Interface Menu).

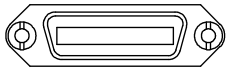
24. Press F1 (Type) repeatedly to select GPIB.

25. The interface icon at display top changes to GPIB.

26. Press F2 (Address). Use the Variable knob to change the GPIB address.

Range 1 ~ 30

27. Connect the GPIB cable to the rear panel port: 24-pin female connector.



GPIB constraints

- Maximum 15 devices altogether, 20m cable length, 2m between each device
- Unique address assigned to each device
- At least 2/3 of the devices turned On
- No loop or parallel connection

Pin assignment

Pin1	Data line 1	Pin13	Data line 5
Pin2	Data line 2	Pin14	Data line 6
Pin3	Data line 3	Pin15	Data line 7
Pin4	Data line 4	Pin16	Data line 8
Pin5	EOI	Pin17	REN
Pin6	DAV	Pin18	Ground
Pin7	NRFD	Pin19	Ground
Pin8	NDAC	Pin20	Ground
Pin9	IFC	Pin21	Ground
Pin10	SRQ	Pin22	Ground
Pin11	ATN	Pin23	Ground
Pin12	Shield (screen)	Pin24	Signal ground

USB/RS-232C remote control software

Terminal application (USB/RS-232C)

Invoke the terminal application such as MTTTY (Multi-Threaded TTY). For RS-232C, set the COM port, baud rate, stop bit, data bit, and parity accordingly.

To check the COM port No, see the Device Manager in the PC. For WinXP, Control panel → System → Hardware tab.

Functionality check

Run this query command via the terminal.

*idn?

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

GW, GDS-2064, 000000001, V1.00

PC Software (USB only)

The proprietary PC software, downloadable from GWInstek website, can be used for remote control. This mode is available only for USB interface.

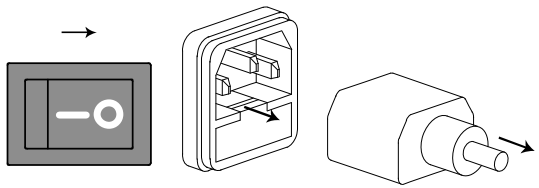
BATTERY OPERATION

The optional battery allows portable operations such as field applications. Battery packs and related internal components are factory installed items: contact the service center for new installation.

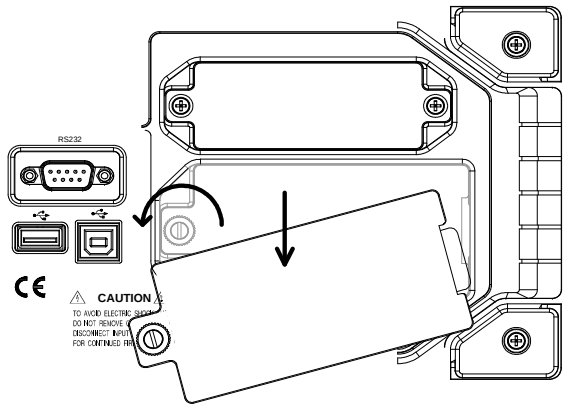
Warning ⚠ Never insert or remove the battery while the power is On.

Battery insertion

1. Turn Off the power and take off the power cord.



28. Open the rear panel battery pack cover.



29. Insert the battery packs and close the cover.

30. Turn On the power and make sure the battery icon appears at the top left corner of the display.

Rating

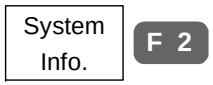
Type	Li-Ion battery x 2, 11.1V average
Running time	3 hours typical
Charging time	8 hours typical when Power Off
	16 hours typical when Power On

Battery status

1. To view the battery installation and recharge status, press the Utility key.

31. Press F5 (More).

32. Press F2 (System Info).



33. The battery status (output voltage and charging rate) appears on the lower half of the display.

BATTERY INFORMATION

	BAT.#1	BAT.#2
Voltage:	12.05V	12.04V
Capacity:	98%	94%

Note

- When the battery is not in use for a long time, take them out to prolong the battery life.
- Battery operation requires additional components that are factory installed. Merely inserting battery packs into standard GDS-2000 does not work. For new installation, contact Goodwill.

MAINTENANCE

Two types of maintenance operations are available: calibrate vertical resolution, and compensate the probe. Run these operations when using GDS-2000 in a new environment.

Vertical Resolution Calibration

Panel operation

1. Press the Utility key.

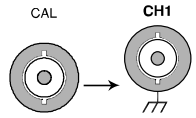
34. Press F5 (More).

35. Press F1 (Self Cal Menu).

36. Press F1 (Vertical).

37. The buzzer sounds and the message “Set CAL to CH1, then press F5” appears at the bottom of the display.

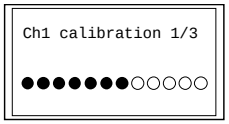
38. Connect the calibration signal from the rear panel CAL out to Channel1 input.



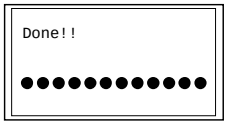
39. Press F5.

(no menu item)

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



41. When finished, connect the calibration signal to Channel2 and press F5. Channel2 calibration starts.



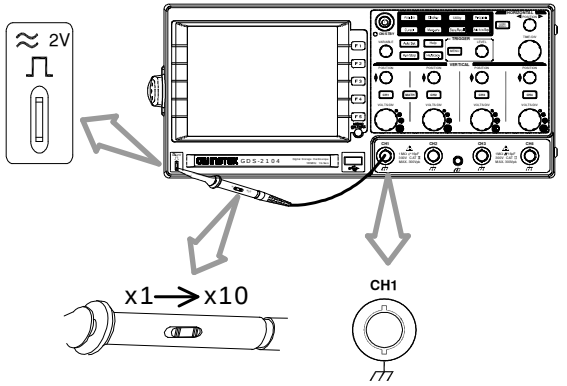
42. (for 4 Channel model only) Repeat the above step for Channel 3 and 4.

43. When the calibration for all channels is 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.



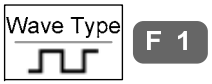
44. Press the Utility key.

45. Press F5 (More) twice.

x2

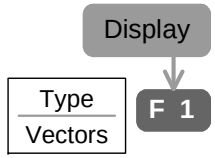
46. Press F1 (ProbeComp Menu).

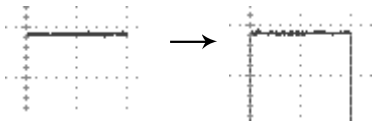
47. Press F1 (Wavetype) repeatedly to select the standard square wave.



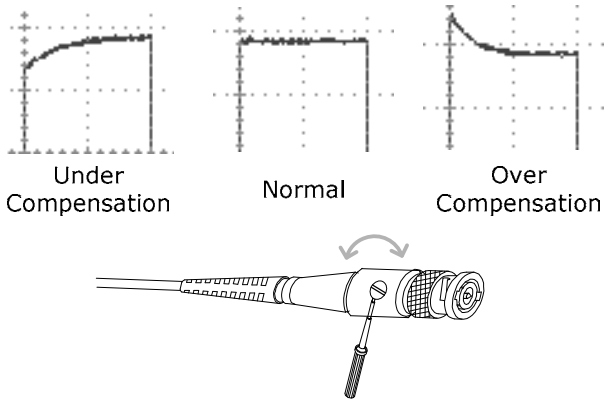
48. Press the Auto Set key. The compensation signal appears on the display.

49. Press the Display key, then F1 (Type) twice to select the vector waveform.





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



FAQ

- I pressed the Power (On/Standby) key on the front panel but nothing happens.
- I connected the signal but it does not appear on the display.
- I want to remove the (Measurement result / FFT result / Help contents) from the display.
- The waveform does not update (frozen).
- The probe waveform is distorted.
- Auto Set does not catch the signal well.
- I want to clean up the cluttered panel settings.
- The display image printout is too dark on the background.
- I want to install the optional battery pack.
  I put the battery pack in but it is not working.
- The date and time setting are not correct.
- USB does not work.
- The accuracy does not match the specification.

I pressed the Power (On/Standby) key on the front panel but nothing happens.

Make sure you turned On the rear panel Power switch. For power up sequence, see page23.

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

Make sure you have activated the channel by pressing the Channel key (the LED turns On).

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

To clear automatic measurement result, press the Measure key twice, then Press F4 (OFF). See page60 for details.

To clear FFT result, press the Math key twice. See page73 for details.

To clear Help result, press the Help key again. See page49 for details.

The waveform does not update (frozen).

Press the Run/Stop key to unfreeze the waveform. See page55 for details.

If this does not help, the trigger mode might be set to Single. Press the Trigger menu key, then F3 (Mode) to Auto. See page122 for trigger setting details.

The probe waveform is distorted.

You might need to compensate the probe. For details, see page187. 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.

Auto Set does not catch the signal well.

Autoset function cannot catch signals under 30mV or 30Hz. Please use the manual operation. See page53 for Auto Set details.

I want to clean up the cluttered panel settings.

Recall the default settings by pressing Save/Recall key→F1. For default setting contents, see page48.

The display image printout is too dark on the background.

Use the Inksaver function which reverses the background color. For details, see page167.

I want to install the optional battery pack. I put the battery pack in but it is not working.

The battery pack needs additional internal components to work properly. They are factory installed items: contact your dealer. For battery operation details, see page183.

The date and time setting are not correct.

For date and time setting details, please see page133. If it does not help, the internal battery controlling the clock might be worn out. Contact your dealer or GWInstek.

USB does not work.

Make sure you are not using the front and the rear USB host connector at the same time. Disconnect either of the USB device and try again.

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.

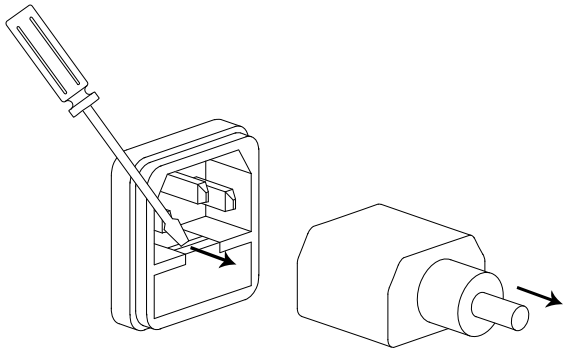
For more information, contact your local dealer or GWInstek at www.gwinstek.com.tw / marketing@goodwill.com.tw.

APPENDIX

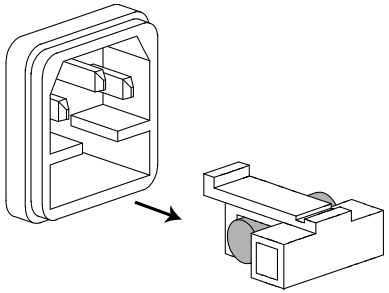
Fuse Replacement

Step

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



51. Replace the fuse in the holder.



Rating T2A, 250V

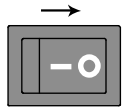
GPIB Module Installation

For GPIB interface and remote control details, see page176.

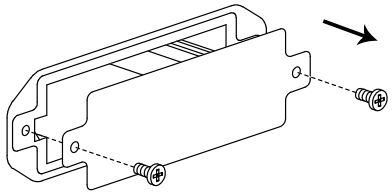
GPIB kit contents
- GPIB module
- Programming manual (programming manual is also downloadable from GWInstek website).

Step

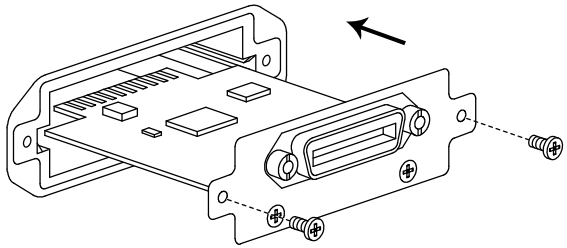
1. Turn Off the GDS-2000 power switch.



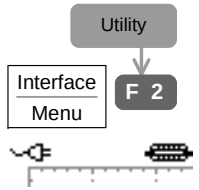
52. Take off two screws and remove the rear panel GPIB module cover.



53. Insert the GPIB module and put the screws back.



54. Turn On GDS-2000. Press the Utility key, then F2 (Interface) repeatedly. Make sure GPIB menu is selectable, and a GPIB icon appears on the top left corner of the display.



GDS-2000 Specifications

The specifications apply when GDS-2000 is powered on for at least 30 minutes under +20°C~+30°C.

Model-specific

GDS-2062	Channels	2
	Bandwidth	DC ~ 60MHz (–3dB)
	Rise time	5.8ns approx.
GDS-2064	Channels	4
	Bandwidth	DC ~ 60MHz (–3dB)
	Rise time	5.8ns approx.
GDS-2102	Channels	2
	Bandwidth	DC ~ 100MHz (–3dB)
	Rise time	3.5ns approx.
GDS-2104	Channels	4
	Bandwidth	DC ~ 100MHz (–3dB)
	Rise time	3.5ns approx.
GDS-2202	Channels	2
	Bandwidth	DC ~ 200MHz (–3dB)
	Rise time	1.75ns approx.
GDS-2204	Channels	4
	Bandwidth	DC ~ 200MHz (–3dB)
	Rise time	1.75ns approx.

Common

Vertical	Sensitivity	2mV/div~5V/Div (1-2-5 increments)
	Accuracy	± (3% x |Readout|+0.05div x Volts/div + 0.8mV)
	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~20mV/div: 0.5V 50mV/div~200mV/div: 5V 500mV/div~2V/div: 50V 5V/div: 300V
	Bandwidth Limit	20MHz (–3dB)

Trigger	Sources	CH1, CH2, Line, EXT(2ch model only), CH3, CH4(4ch model only)
	Modes	Auto-Level, Auto, Normal, Single, TV, Edge, Pulse Width, Time-Delay, Event-Delay(2ch model only)
	Coupling	AC, DC, LFrej, HFrej, Noise rej
	Sensitivity	DC~25MHz: Approx. 0.5div or 5mV 25MHz~max: Approx. 1div or 10mV
	Holdoff	40ns ~ 2.5s
External Trigger (2ch model only)	Range	±15V
	Sensitivity	DC~30MHz: ~50mV 30MHz~max: ~100mV
	Input Impedance	1MΩ±2%, ~16pF
	Maximum Input	300V (DC + AC peak), CAT II
Horizontal	Range	1ns/div~10s/div, 1-2-5 increment Roll mode: 250ms/div ~ 10s/div
	Modes	Main, Window, Window Zoom, Roll, Scan, X-Y
	Accuracy	±0.01%
	Pre-Trigger	20 div maximum
	Post-Trigger	1000 div
X-Y Mode	X-Axis Input	Channel 1
	Y-Axis Input	Channel 2
	Phase Shift	±3° at 100kHz
Signal Acquisition	Real-Time	1G Sa/s maximum
	Equivalent	25G Sa/s maximum
	Vertical Resolution	8 bits
	Record Length	25K Dots Maximum
	Acquisition	Normal, Peak Detect, Average
	Peak Detection	10ns
	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, Positive Width, Negative Width, Duty Cycle
	Delay	FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF
	Cursors	Voltage difference (ΔV) and Time difference (ΔT) between cursors

	Auto Counter	Resolution: 6 digits Accuracy: ±2% Signal source: All available trigger source except the Video trigger
Control Panel Function	Auto Set	Automatically adjust Vertical Volt/div, Horizontal Time/div, and Trigger level
	Save Setup	Internal memory: 20 sets USB Flash drive: unlimited
	Save Waveform	Internal memory: 20 sets USB Flash drive: unlimited
	Save display image	USB Flash drive: unlimited
Display	LCD	5.6 inch, TFT, brightness adjustable
	Resolution (dots)	234 (Vertical) x 320 (Horizontal)
	Graticule	8 x 10 divisions (menu On) 8 x 12 divisions (menu Off)
Interface	Go-No Go Output	5V max/ 10mA TTL open collector
	RS-232C	DTE DB 9-pin male
	GPIB (Optional)	IEEE488.2 24-pin female
	USB	Host: Flash drive, Printer Device: Remote control 2.0 full speed supported
Power Source	Line Voltage	100V~240V AC, 47Hz~63Hz
	Battery (Optional)	Li-Ion pack, 11.1V average 8 hours charge time (Power On) 3 hours operating time (depend on conditions)
Miscellaneous	Language Selection	English, Traditional Chinese, Simplified Chinese, others (depend on the region)
	On-Line Help	Available for most keys
	Real-Time Clock	Display: yy/mm/dd/hh/ss (time stamp for saved data)
Operation Environment	Ambient temperature 0 ~ 50°C Relative humidity ≤ 80% @35°C	
Storage Environment	Ambient temperature –20 ~ 70°C Relative humidity ≤ 90% @35°C	
Dimensions	254 (D) x 142 (H) x 310 (W) mm	
Weight	Approx. 4.3kg	

Probe Specifications

Model-specific

GTP-060A	Applicable to Bandwidth Rise time	GDS-2062, GDS-2064 DC ~ 60MHz @ Position x 10 5.8ns
GTP-100A	Applicable to Bandwidth Rise time	GDS-2102, GDS-2104 DC ~ 100MHz @ Position x 10 2.3ns
GTP-250A	Applicable to Bandwidth Rise time	GDS-2202, GDS-2204 DC ~ 250MHz @ Position x 10 1.4ns

Common

Position x 10	Attenuation Ratio	10:1
	Input Resistance	10MΩ when used with 1MΩ input oscilloscope
	Input Capacitance	23pF approx. for GTP-060A 15pF approx. for GTP-150A 17pF approx. for GTP-250A
	Compensation Range	10 ~ 35pF
	Maximum Input Voltage	500V CAT I, 300V CAT II (DC+Peak AC) Derating with frequency
Position x 1	Attenuation Ratio	1:1
	Bandwidth	DC ~ 6MHz
	Rise Time	58ns
	Input Resistance	1MΩ when used with 1MΩ input oscilloscope
	Input Capacitance	128pF for GTP-060A, 47pF for GTP-150A, 47pF for GTP-250A (+ oscilloscope capacitance)
	Compensation Range	10 ~ 35pF
	Maximum Input Voltage	300V CAT I, 150V CAT II (DC+Peak AC) Derating with frequency
Operating Condition	Temperature	–10°C ~ 55°C
	Relative Humidity	≤85% @35°C
Safety Standard	EN61010-031 CAT II	

Declaration of Conformity

We

GOOD WILL INSTRUMENT CO., LTD.

No. 7-1, Jhongsing Rd, Tucheng City, Taipei County 236. Taiwan.

GOOD WILL INSTRUMENT (SUZHOU) CO., LTD.

No. 69 Lushan Road, Suzhou New District Jiangsu, China.

declare that the below mentioned product

Type of Product: Digital Storage Oscilloscope
Model Number: GDS-2062, GDS-2064, GDS-2102, GDS-2104, GDS-2202, GDS-2204

are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (2004/108/EC) and Low Voltage Equipment Directive (73/23/EEC & 93/68/EEC).

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

◎ EMC	
EN 61326-1 : Electrical equipment for measurement, control and laboratory use— **EN 61326-2-1**: **EN 61326-2-2:** EMC requirements (2006)	
Conducted & Radiated Emission CISPR 11: 2003+A1: 2004 +A2: 2006	Electrostatic Discharge IEC 1000-4-2: 2001
Current Harmonics EN 61000-3-2: 2006	Radiated Immunity IEC 1000-4-3: 2006+A1: 2007
Voltage Fluctuations EN 61000-3-3:1995+A1:2001+A2:2005	Electrical Fast Transients IEC 1000-4-4: 2004+Corr.1: 2006+Corr.2: 2007
==========	Surge Immunity IEC 1000-4-5: 2005
==========	Conducted Susceptibility IEC 61000-4-6: 2003+A1: 2004+A2: 2006
==========	Power Frequency Magnetic field IEC 61000-4-8: 1993+A1: 2000
==========	Voltage Dip/Interruption IEC 61000-4-11: 2004

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

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