Digital Storage Oscilloscope

GDS-2000 Series

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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

• 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

• 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.
SAFETY INSTRUCTIONS

Fuse

- 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.

WARNING

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 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

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Appearance

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Tilt stand ........................................................ 21
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Series lineup

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

<table>
<thead>
<tr>
<th>Model name</th>
<th>Frequency bandwidth</th>
<th>Input channels</th>
<th>Ext. trigger input</th>
<th>Advanced delay trigger</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDS-2062</td>
<td>60MHz</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>GDS-2102</td>
<td>100MHz</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>GDS-2202</td>
<td>200MHz</td>
<td>2</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>GDS-2064</td>
<td>60MHz</td>
<td>4</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>GDS-2104</td>
<td>100MHz</td>
<td>4</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>GDS-2204</td>
<td>200MHz</td>
<td>4</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

The differences between 2 and 4 channel model appearance are in the horizontal key, trigger key, variable knob, and external trigger input layout.
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
- 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 page168.
Appearance

GDS-2064/2104/2204 Front Panel

- LCD display
- F1-F5 function keys
- Variable knob
- ON/STBY key
- Main keys
- Trigger key & knob
- Horizontal key
- Horizontal Position knob
- Time/Div knob
- Vertical Position knob
- Channel key
- Volts/Div knob
- Probe comp. output
- Menu On/Off key
- USB port
- Math key
- Ground terminal
- CH1-4 input

GDS-2062/2102/2202 Front Panel

- LCD display
- F1-F5 keys
- ON/STBY key
- Math key
- Main keys
- Horizontal Position knob
- Variable knob
- Trigger knob
- Trigger menu key
- Horizontal menu key
- Time/Div knob
- Probe comp. output
- Menu On/Off key
- USB port
- Volts/Div knob
- CH1,2 input
- Ground terminal
- CH1,2 key
- Ext. trigger input

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 page22.

Acquire key
- Configures acquisition mode (page84).

Display key
- Configures display settings (page90).

Utility key
- Configures or shows hardcopy (page125), printer configuration (page145), interface (page149), system info (page115), date/time (page116), menu language (page115), Go-No Go (page68), calibration (page157), and probe compensation (page158).

Hardcopy key
- Prints out display image (page145) or transfers data to USB flash drive (page125).

Program key + Auto test key
- Edits, runs, and stops program operation (page77).
Cursor key

Configures and runs cursor measurements (page 59).

Measure key

Configures and runs automatic measurements (page 54).

Help key

Shows Help contents on the LCD display (page 45).

Save/Recall key

Saves and recalls waveform, image, and panel setup (page 118).

Auto Set key

Finds signals and sets the appropriate horizontal / vertical / trigger settings (page 48).

Run/Stop key

Freezes (Stop) or continues (Run) signal acquisition (page 49).

Trigger menu key

Configures trigger settings (page 105).

Trigger knob

Sets trigger level (page 105).

Horizontal menu key

Configures horizontal view (page 94).

Horizontal position knob

Sets the horizontal position of waveforms (page 94).

Time/Div knob

Selects the horizontal scale (page 95).

Vertical position knob

Sets the vertical position of waveforms (page 101).

Channel menu key

Configures the vertical scale and coupling mode for each channel (page 101).

Volts/Div knob

Selects the vertical scale (page 101).

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 (page 63).

USB host port

Type A, 1.1/2.0 compatible. Prints out display image (page 145) or transfers data (page 118).

Menu On/Off key

Shows or hides menu in the LCD display (page 93).

Probe compensation output

Outputs 2Vp-p, square signal for probe compensation (page 158) or demonstration. Can be used for generic purpose (page 52) as well.

External trigger input

For 2ch model only. Accepts external trigger signal (page 105). Input impedance: 1MΩ±2%.
**Rear Panel**

- **Power switch**
  - Turns the main power on (I) / off (O).
- **Power cord socket**
  - Accepts AC mains, 100 ~ 240V, 50/60Hz.
  - Holds AC main fuse, T2A/250V.
  - For power up sequence, see page 22.
  - For fuse replacement procedure, see page 163.
- **RS232C port**
  - Accepts DB-9 RS-232C connector for remote control (page 150).
- **GPIB port (optional)**
  - Accepts 24 pin male GPIB connector for remote control (page 152).
- **USB slave port**
  - Accepts type B connector for remote control (page 149) or PC software connection. USB 1.1/2.0 full speed compatible.
- **USB host port**
  - Accepts type A connector for display image printout (page 145) or data transfer (page 118). Simultaneous use with the front panel host port is not allowed. Type A, 1.1/2.0 full speed compatible.
- **Go-No Go output**
  - Outputs Go-No Go test result (page 68) as 10us pulse signal.
- **Calibration output**
  - Outputs the signal for vertical scale accuracy calibration (page 157).

**Battery packs (optional)**

- Holds 2 packs of Li-Ion battery for portable usage (page 155).
### Display

- **Power source**: AC main is the source. Battery (page 155) 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 (page 148) and PC software connection.

### Waveforms

- **Shows input signal waveforms.**
  - Channel 1: Yellow
  - Channel 2: Blue
  - Channel 3: Pink
  - Channel 4: Green

### Trigger configuration

- **Trigger source, type, slope** (Video trigger) trigger source, polarity.

### Acquisition mode

- **Normal mode**
- **Peak detect mode**
- **Average mode**

For acquisition details, see page 84.

### Input signal frequency

- **Shows the input signal frequency.** Indicates the frequency is less than 20Hz (lower frequency limit).

### Trigger

- **CH1 EDGE**: Trigger source, type, slope. (Video trigger) trigger source, polarity.

For trigger details, see page 105.

### Channel status

- **CH1**: Channel 1, bw limit On, DC coupling, 500mV/Div
- **CH1**: Channel 1, bw limit Off, AC coupling, 500mV/Div

For channel details, see page 101.
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. \(\bigcirc\): On, \(\bigcirc\): 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.

Note

GDS-2000 recovers the state right before the power OFF. The default setting can be recovered by pressing the Save/Recall key \(\rightarrow\) F1 (Default Setup). For details, see page136.
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 page44.

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 page48.

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.

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.

Menu tree / shortcut

<table>
<thead>
<tr>
<th>Menu tree / shortcut</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convention</td>
<td>Press F1</td>
</tr>
<tr>
<td>F1</td>
<td>Press F1</td>
</tr>
<tr>
<td>F1 ~ F4</td>
<td>Select one from F1 to F4 and press it</td>
</tr>
<tr>
<td>F1 ÷ VAR</td>
<td>Press F1, then use the Variable knob</td>
</tr>
<tr>
<td>Auto Set key</td>
<td>Press the function key itself (AutoSet in this case)</td>
</tr>
<tr>
<td>Acquire key</td>
<td>Select acquisition mode</td>
</tr>
<tr>
<td></td>
<td>F1-F3</td>
</tr>
<tr>
<td></td>
<td>Select average number (only in average mode)</td>
</tr>
<tr>
<td></td>
<td>F3</td>
</tr>
<tr>
<td></td>
<td>Select memory length</td>
</tr>
<tr>
<td></td>
<td>F5</td>
</tr>
<tr>
<td></td>
<td>2/4/8/16/32/64/128/256</td>
</tr>
<tr>
<td></td>
<td>Mem Leng</td>
</tr>
<tr>
<td></td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>500/25000 (1CH)</td>
</tr>
<tr>
<td></td>
<td>500/12500 (2CH)</td>
</tr>
<tr>
<td></td>
<td>500/5000 (3/4CH)</td>
</tr>
<tr>
<td>Auto Set key</td>
<td>Automatically find signal and set scale</td>
</tr>
<tr>
<td></td>
<td>Auto Set</td>
</tr>
<tr>
<td></td>
<td>Undo Auto Set (available for 5 seconds)</td>
</tr>
<tr>
<td></td>
<td>F5</td>
</tr>
</tbody>
</table>

Help

Built-in Help
**Auto test/Stop key**

Auto test/Stop → See Program key (page31)

**CH1 ~ 4 key**

- **CH1**
  - Coupling
  - Invert
  - BW Limit
  - Probe
- **F 1**
  - Select coupling mode
- **F 2**
  - Turn waveform invert On/Off
- **F 3**
  - Turn bandwidth limit On/Off
- **F 4**
  - Select probe attenuation factor
  - x1/ x10/ x100

**Cursor key**

- **Cursor**
  - Select cursor source channel
- **F 1**
  - Select active horizontal cursor
- **F 2**
  - Select active vertical cursor

**Display key**

- **Display**
  - Select waveform display type
  - Waveform accumulation On/Off
  - F1
  - Dots
  - Accumulate
  - Off
  - Refresh
  - F2, F3 (display refresh when On)
  - Set display contrast
  - F4 VAR
  - Select display grid
  - F5

**Hardcopy key**

- **Hardcopy**
  - Hardcopy
  - See Utility key (page38)

**Help key**

- **Help**
  - Turn help mode On/Off

**Horizontal menu key**

- **HORI MENU**
  - 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)

<table>
<thead>
<tr>
<th>Function</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select math operation (+/-/×/÷)</td>
<td>F1</td>
</tr>
<tr>
<td>Select channel combination</td>
<td>F2</td>
</tr>
<tr>
<td>Set result position</td>
<td>F4, VAR</td>
</tr>
<tr>
<td>Math result vertical scale</td>
<td>F5</td>
</tr>
</tbody>
</table>

Math key (2/2)

<table>
<thead>
<tr>
<th>Function</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select math operation type (FFT)</td>
<td>F1</td>
</tr>
<tr>
<td>Select FFT source channel</td>
<td>F2</td>
</tr>
<tr>
<td>Select FFT window</td>
<td>F3</td>
</tr>
<tr>
<td>Select FFT result position</td>
<td>F4, VAR</td>
</tr>
<tr>
<td>Select vertical scale</td>
<td>F5</td>
</tr>
</tbody>
</table>


Measure key (1/2)

<table>
<thead>
<tr>
<th>Function</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select source channel 1</td>
<td>F1</td>
</tr>
<tr>
<td>Select source channel 2</td>
<td>F2</td>
</tr>
<tr>
<td>Select measurement type</td>
<td>F3</td>
</tr>
<tr>
<td>Select measurement item</td>
<td>VAR or F4</td>
</tr>
<tr>
<td>Go back to previous menu</td>
<td>F5</td>
</tr>
</tbody>
</table>

Measure key (2/2)

<table>
<thead>
<tr>
<th>Function</th>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch between Individual mode and Display All mode</td>
<td>Measure</td>
</tr>
<tr>
<td>Select channel for Display All mode</td>
<td>F1 ~ F4</td>
</tr>
<tr>
<td>Clear Display All mode</td>
<td>F5</td>
</tr>
</tbody>
</table>

Measure
Program key (1/2)

- Select Program Edit mode
  - F1

- Select program step
  - F2

- Select edit item
  - F3

- Save edited program
  - F5

Program key (2/2)

- Select Program Play mode
  - F1

- Select program loop count
  - F2

- Select first step (From:)
  - F3

- Select last step (To:)
  - F3

- Start /stop program running
  - F5

Run/Stop key

- Run/Stop
- Freeze/unfreeze signal acquisition
- Run/Stop

Save/Recall key (1/9)

- Save/Recall
- Default Setup
  - F1

- Display Refs.
  - F2

- Save Setup
  - F3

- Save Waveform
  - F4

- More
  - F5

Save/Recall key (2/9)

- Display Refs.
  - F1

- Save Refs.
  - F2

- Save Setup
  - F3

- Save Waveform
  - F4

- More
  - F5

Recall default setup
- F1

Save/Recall key (3/9)

- Display Refs.
  - F1

- Save Refs.
  - F2

- Save Setup
  - F3

- Save Waveform
  - F4

- More
  - F5

Select Display Refs menu
- F1

Select ref. waveform A On/Off
- F2

Select ref. waveform B On/Off
- F3

Select ref. waveform C On/Off
- F4

Select 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

Destination:
- USB: F3
- Memory/USB: F4

File Utilities:
- (USB only): F5
- To File Utilities: 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

Destination:
- USB: F3
- Memory/USB/Refs.: F4

File Utilities:
- (USB only): F5
- To File Utilities: F5

Save/Recall key (5/9)

Save All
- 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

Ink Saver:
- Off: F2

File Utilities:
- (USB only): F5
- To File Utilities: F5

Save/Recall key (6/9)

Recall Setup
- Select Recall Setup menu: F1
- Select setup source: F2 [VAR]
- Recall setup: F4
- Go to USB flash drive contents edit mode: F5

Recall:
- USB/Memory: F4

File Utilities:
- (USB only): F5
- To File Utilities: F5
### Quick Reference (7/9)

#### Recall Waveform
- **Save/Recall key (7/9)**
  - **Recall Waveform**
    - **Save/Recall**
      - **F1**
        - Select Recall Waveform menu
      - **F2**
        - Select waveform source
      - **F3**
        - Select waveform destination
      - **F4**
        - Recall waveform
      - **F5**
        - To File Utilities
  - **Source**
    - **USB**
  - **Destination**
    - **USB/Memory**
  - **File Utilities**
    - **To File Utilities**

#### Save/Recall key (8/9)
- **Recall Image**
  - **Save/Recall**
    - **F1**
      - Select Recall Image menu
    - **F2**
      - Select image source
    - **F3**
      - Show or recall image
    - **F4**
      - Recall image
    - **F5**
      - To File Utilities
  - **Source**
    - **USB**
  - **Ref Image On**
  - **Recall**
    - **F4**
      - Go to USB flash drive contents edit mode
  - **File Utilities**
    - **To File Utilities**

### Save/Recall key (9/9)
- **File Utilities**
  - **Save/Recall**
    - **F1**
      - Select file/folder or enter into sub folder
    - **F2**
      - Create new folder or rename folder/file
    - **F3**
      - Rename
    - **F4**
      - Delete
    - **F5**
      - Go back to previous menu
  - **Source**
    - **USB**

### Trigger key (1/5)
- **Video**
  - **Menu**
    - **Trigger**
      - **Type**
        - **Video**
      - **Source**
        - **CH1**
      - **Standard**
        - **NTSC**
      - **Polarity**
        - **Video**
      - **Line**
        - **Field 1/Field 2**
          - **1~263 (NTSC)**
          - **1~313 (SECAM/PAL)**

### Inserted Image
- **GDS-2000 Series User Manual**
Trigger key (2/5)

Edge/Pulse

- **Type**
  - **Pulse**

- **Source**
  - **CH1** (4CH) or **CH1:2:3:4/Line**

- **Mode**
  - **Auto**
  - **< 20.0ns**
  - **≥ 20ns~200us**

- **Slope / Coupling**
  - **To Slope/Coupling**

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)

- **Type**
  - **Delay**

- **Mode**
  - **By Time**
  - **100ns**
  - **F2**
  - **VAR**
  - **100ns~1.3ms**

- **By Event**
  - **2**

- **Ext:**
  - **TTL** (1.48V)
  - **ECL** (-1.35V)
  - **User** (-12V~+12V)

Select Delay trigger type

- **F1**

Select time delay mode and delay length

- **F2**

Select event delay mode and event count

- **F3**

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

- **F4**

- **VAR**

Go to slope/coupling menu

- **F5**

Trigger key (4/5)

Slope/Coupling

- **TRIGGER**
  - **Slope**
  - **To Slope/Coupling**

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)

- **Previous Menu**

Set Holdoff time

- **F1**

Set Holdoff time to minimum

- **F2**

Turn Auto Level trigger On/Off

- **F5**
Utility key (1/9)

<table>
<thead>
<tr>
<th>Utility key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>To Hardcopy menu</td>
</tr>
<tr>
<td>F2</td>
<td>To Interface menu</td>
</tr>
<tr>
<td>F3</td>
<td>Select buzzer sound</td>
</tr>
<tr>
<td>F4</td>
<td>Select language</td>
</tr>
<tr>
<td>F5</td>
<td>Go to other menu</td>
</tr>
</tbody>
</table>

Utility key (2/9)

<table>
<thead>
<tr>
<th>Utility key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Start Vertical calibration</td>
</tr>
<tr>
<td>F2</td>
<td>Show system information</td>
</tr>
<tr>
<td>F3</td>
<td>To Go-NoGo menu</td>
</tr>
<tr>
<td>F4</td>
<td>Select NoGo condition</td>
</tr>
<tr>
<td>F5</td>
<td>Go to other menu</td>
</tr>
</tbody>
</table>

Utility key (3/9)

<table>
<thead>
<tr>
<th>Utility key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Select Hardcopy function</td>
</tr>
<tr>
<td>F2</td>
<td>Turn Ink Saver On/Off</td>
</tr>
<tr>
<td>F3</td>
<td>Select printout color (only in printout mode)</td>
</tr>
<tr>
<td>F4</td>
<td>Select printout ratio (only in printout mode)</td>
</tr>
<tr>
<td>F5</td>
<td>Run Hardcopy</td>
</tr>
</tbody>
</table>

Utility key (4/9)

<table>
<thead>
<tr>
<th>Utility key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Select interface</td>
</tr>
<tr>
<td>F2</td>
<td>Select GPIB address</td>
</tr>
<tr>
<td>F3</td>
<td>Select RS-232C baud rate</td>
</tr>
<tr>
<td>F4</td>
<td>Select RS-232C stop bit</td>
</tr>
<tr>
<td>F5</td>
<td>Select RS-232C parity</td>
</tr>
</tbody>
</table>
### Utility key (5/9)

#### Go-NoGo

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Go to Go-NoGo template menu</td>
</tr>
<tr>
<td>F2</td>
<td>Select Go-NoGo source channel</td>
</tr>
<tr>
<td>F3</td>
<td>Select violating condition</td>
</tr>
<tr>
<td>F4</td>
<td>Start/Stop Go-NoGo test</td>
</tr>
<tr>
<td>F5</td>
<td>Go-NoGo test result</td>
</tr>
</tbody>
</table>

### Utility key (6/9)

#### Go-NoGo Template

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Select template</td>
</tr>
<tr>
<td>F2</td>
<td>Select template source</td>
</tr>
<tr>
<td>F3</td>
<td>Select template position or tolerance</td>
</tr>
<tr>
<td>F4</td>
<td>Save and create template</td>
</tr>
<tr>
<td>F5</td>
<td>Go to previous menu</td>
</tr>
</tbody>
</table>

### Utility key (7/9)

#### Utility

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Go to Probe Compensation menu</td>
</tr>
<tr>
<td>F2</td>
<td>Go to Time Set menu</td>
</tr>
<tr>
<td>F3</td>
<td>Go to other menu</td>
</tr>
</tbody>
</table>

### Utility key (8/9)

#### Probe compensation

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Select probe compensation signal</td>
</tr>
<tr>
<td>F2</td>
<td>Set frequency for square wave</td>
</tr>
<tr>
<td>F3</td>
<td>Set duty cycle for square wave</td>
</tr>
<tr>
<td>F4</td>
<td>Default compensation signal frequency</td>
</tr>
<tr>
<td>F5</td>
<td>Go to previous menu</td>
</tr>
</tbody>
</table>
Default Settings

Here is the factory installed panel setting which appears when pressing the Save/Recall key→F1 (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 |
| 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 |

Utility key (9/9)

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

Time set
Utility
TIME SET
Date
Time

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**

- Acquire
- Cursor
- Utility
- Program
- Display
- Measure
- Save/Recall
- Auto test/Stop
- Auto Set
- Run/Stop
- Hardcopy
- MATH
- MENU

**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.

**Help**

**GDS-2000 Series User Manual**

**MEASUREMENT**

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- Run program ........................................ 80
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 page 46
- Configurations → from page 82

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.

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).

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 (page 48) 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

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.

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
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 page105. 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 page94 (Horizontal position/scale) and page101 (Vertical position/scale).

Horizontal position/scale

For more detailed configuration, see page94.

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.

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 moves along with the waveform until it reaches the end of the memory.

Stop mode icon  
In the Stop mode, the memory bar and waveform size changes according to the scale.
Vertical position/scale

For more detailed configuration, see page 101.

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 page 158.

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 page 84 for peak detection mode details.

Demonstration signal to show the effect of long memory. See page 86 for memory length details.

View compensation waveform

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

2. Press the Utility key.

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.

   Frequency
   Low                High
   Range 1kHz ~ 100kHz

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

   Duty Cycle
   Down                Up
   Range 5% ~ 95%

Probe compensation
For probe compensation details, see page 158.

Automatic Measurement

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

Measurement items

<table>
<thead>
<tr>
<th>Overview</th>
<th>Voltage type</th>
<th>Time type</th>
<th>Delay type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vpp</td>
<td>Frequency</td>
<td>FR adversity</td>
<td></td>
</tr>
<tr>
<td>Vmax</td>
<td>Period</td>
<td>FR adversity</td>
<td></td>
</tr>
<tr>
<td>Vmin</td>
<td>RiseTime</td>
<td>FR adversity</td>
<td></td>
</tr>
<tr>
<td>Vamp</td>
<td>FallTime</td>
<td>FR adversity</td>
<td></td>
</tr>
<tr>
<td>Vlo</td>
<td>Width</td>
<td>LRR</td>
<td></td>
</tr>
<tr>
<td>Vavg</td>
<td>Width</td>
<td>LRF</td>
<td></td>
</tr>
<tr>
<td>Vms</td>
<td>Duty cycle</td>
<td>LFR</td>
<td></td>
</tr>
<tr>
<td>ROVShoot</td>
<td></td>
<td>LFF</td>
<td></td>
</tr>
<tr>
<td>FOVShoot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RPRESShoot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FPRESShoot</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vavg</td>
<td>Averaged voltage of the first cycle</td>
</tr>
<tr>
<td>Vrms</td>
<td>RMS (root mean square) voltage</td>
</tr>
<tr>
<td>ROVShoot</td>
<td>Rise overshoot voltage</td>
</tr>
<tr>
<td>FOVShoot</td>
<td>Fall overshoot voltage</td>
</tr>
<tr>
<td>RPREShoot</td>
<td>Rise preshoot voltage</td>
</tr>
<tr>
<td>FPRESHOot</td>
<td>Fall preshoot voltage</td>
</tr>
<tr>
<td>Freq</td>
<td>Frequency of the waveform</td>
</tr>
<tr>
<td>Period</td>
<td>Waveform cycle time (=1/Freq)</td>
</tr>
<tr>
<td>Risetime</td>
<td>Rising time of the pulse (~90%)</td>
</tr>
<tr>
<td>Falltime</td>
<td>Falling time of the pulse (~10%)</td>
</tr>
<tr>
<td>+Width</td>
<td>Positive pulse width</td>
</tr>
<tr>
<td>–Width</td>
<td>Negative pulse width</td>
</tr>
<tr>
<td>Duty Cycle</td>
<td>Ratio of signal pulse compared with whole cycle =100x (Pulse Width/Cycle)</td>
</tr>
<tr>
<td>FRR</td>
<td>Time between: Source 1 first rising edge and Source 2 first rising edge</td>
</tr>
<tr>
<td>FFF</td>
<td>Time between: Source 1 first falling edge and Source 2 first falling edge</td>
</tr>
<tr>
<td>LRR</td>
<td>Time between: Source 1 first rising edge and Source 2 last rising edge</td>
</tr>
<tr>
<td>LRF</td>
<td>Time between: Source 1 first rising edge and Source 2 last falling edge</td>
</tr>
<tr>
<td>LFR</td>
<td>Time between: Source 1 first falling edge and Source 2 last rising edge</td>
</tr>
<tr>
<td>LFF</td>
<td>Time between: Source 1 first falling edge and Source 2 last falling edge</td>
</tr>
</tbody>
</table>

**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.
Select measurement item

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

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

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

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

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

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.

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

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

Delay type

Delay type measurement is not available in this mode. Use the Individual measurement mode (page 56) instead.
Cursor Measurement

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

Use horizontal cursor

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.

5. Use the Variable knob to move the cursor left or right. The F4 content changes accordingly.

**Example**

- **T1** Time position of the left cursor
- **T2** Time position of the right cursor
- **Δ** The time distance between the left and right cursor
- **f** The time distance (Δ) converted to frequency

**FFT Math**

The FFT Math has different F4 content. For FFT math details, see page 66.

- **f1** Frequency position of the left cursor
- **f2** 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
   - \( \Delta \): 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**

![Graph showing the use of vertical cursor](image)

**Note: FFT Math**

The FFT Math has different F5 content. For FFT math details, see page 66.

- \( M_1 \): Magnitude of the left cursor
- \( M_2 \): Magnitude of the right cursor
- \( \Delta \): 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

<table>
<thead>
<tr>
<th>Window Type</th>
<th>Frequency resolution</th>
<th>Amplitude resolution</th>
<th>Suitable for....</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hanning FFT window</strong></td>
<td>Good</td>
<td>Not good</td>
<td>Frequency measurement on periodic waveform</td>
</tr>
<tr>
<td><strong>Flattop FFT window</strong></td>
<td>Frequency resolution</td>
<td>Good</td>
<td>Amplitude measurement on periodic waveform</td>
</tr>
<tr>
<td><strong>Rectangular FFT window</strong></td>
<td>Frequency resolution</td>
<td>Not good</td>
<td>Suitable for.... Amplitude measurement on periodic waveform</td>
</tr>
<tr>
<td><strong>Blackman FFT window</strong></td>
<td>Bad</td>
<td>Very good</td>
<td>Single-shot phenomenon (this mode is the same as having no window at all)</td>
</tr>
</tbody>
</table>

### 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.

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

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

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

FFT

Panel operation

1. Press the Math key.

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

3. Press F2 repeatedly to select the source channel.

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

5. The FFT result appears. For FFT, the horizontal scale changes from time to frequency, and the vertical scale from voltage to dB.
6. To move the FFT waveform vertically, press F4 (Position) and use the Variable knob.

   Position: 0.00 Div
   Low \(\downarrow\) \(\rightarrow\) High

   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: 1 dB
   Range: 1, 2, 5, 10, 20 dB/Div
   RMS Voltage

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

---

**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**

<table>
<thead>
<tr>
<th>Item</th>
<th>Default setting</th>
<th>Setup details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buzzer sound when the test fails (NoGo)</td>
<td>Off</td>
<td>page69</td>
</tr>
<tr>
<td>NoGo criteria: in or out of the boundary</td>
<td>Out</td>
<td>page69</td>
</tr>
<tr>
<td>Test signal</td>
<td>Channel 1</td>
<td>page70</td>
</tr>
<tr>
<td>Test continue or stop when NoGo occurs</td>
<td>Stop</td>
<td>page70</td>
</tr>
<tr>
<td>Boundary (template)</td>
<td>Min/Max separately</td>
<td>page71</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Default setting**
To recall the default setting, press the Save/Recall key, then press F1 (Default Setup). See page44 for details.
Edit: Buzzer sound

Panel operation
1. Press the Utility key.
2. Press F3 repeatedly to select the buzzer for test fail (NoGo) notification.
   - High pitch
   - Middle pitch
   - Low pitch
   - Sound Off

Note
The buzzer setting also affects the vertical resolution calibration (page 157) – the buzzer notifies the completion of calibration.

Edit: NoGo when

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

Edit: Source signal

1. Press the Utility key.
3. Press F3 (Go-NoGo Menu).
4. Press F2 (Source) repeatedly to select the channel to be tested. (Note: the selected channel is automatically activated)

Edit: Continue or stop after NoGo

1. Press the Utility key.
3. Press F3 (Go-NoGo Menu).
4. Press F3 (Violating) repeatedly to select whether to continue or stop test after the NoGo condition is met.
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 (page 69), 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.


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 page 129.
Max
(marked as waveform “A” in the 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.

1. Make sure the source signal, on which the templates are based, appears on the display.

2. Press the Utility key.


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.

Run Go-NoGo test

This section assumes all Go-NoGo settings (page 68) are completed.

Panel operation

1. Press the Utility key.


3. Press F3 (Go-NoGo Menu).

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 (page 70). To stop the test manually, Press F4 again.

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).

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.
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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program set</td>
<td>1 set</td>
</tr>
<tr>
<td>Program step</td>
<td>Maximum 20 steps</td>
</tr>
<tr>
<td>Measurement item</td>
<td>Cursor or Automatic measurement</td>
</tr>
<tr>
<td>Time (duration)</td>
<td>1 ~ 99 seconds, or user activation per step</td>
</tr>
<tr>
<td>Program loop</td>
<td>1 ~ 99 loops, the first and last step settable</td>
</tr>
</tbody>
</table>

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 page128 for details.

3. Edit the program (page78) using the internally stored panel setup.

4. Run the program (page80).

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.
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.

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

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.

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.

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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.

<table>
<thead>
<tr>
<th>Range</th>
<th>Normal</th>
<th>Peak Detect</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="image1.png" alt="image" /></td>
<td><img src="image2.png" alt="image" /></td>
<td><img src="image3.png" alt="image" /></td>
</tr>
</tbody>
</table>

Normal ![image](image1.png) All of the acquired data is used to draw the waveform.

Peak Detect ![image](image2.png) 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 ![image](image3.png) 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.


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.

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.

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

1. Press the Acquire key.
2. Press F5 (Mem Leng) to select the memory length (points), short or long.

<table>
<thead>
<tr>
<th>Range (memory point)</th>
<th>Short memory length; useful for catching high frequency signal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td></td>
</tr>
<tr>
<td>5000</td>
<td>Long memory length when three or four channels are active.</td>
</tr>
<tr>
<td>12500</td>
<td>Long memory length when two channels are active.</td>
</tr>
<tr>
<td>25000</td>
<td>Long memory length when only one channel is active.</td>
</tr>
</tbody>
</table>

Example

- **FM signal**
  - Short memory (better)
  - Long memory

- **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 page 89.
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 page 49.

**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.

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

**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 page105 for trigger details.
- To view the signal peak clearly in Scan mode, turn on the Peak detection (page84).
Roll mode

Roll mode updates and moves the waveform gradually from the right side of the display to the left. Manually selected when the timebase (sampling rate) is slow.

Timebase \( \geq 250\text{ms/div} \) \((\leq 100\text{Sa/s})\)

Trigger all modes

Select Roll mode manually

1. Press the Horizontal menu key.

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

Note

The Roll mode locks the timebase to be at least 250ms/div \((100\text{Sa/s})\). If faster timebase or sampling rate is required, get out of the Roll mode by pressing F1 (Main).

Zoom waveform horizontally

Panel operation/ range

1. Press the Horizontal Menu key.

2. Press F2 (Window) key.

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.

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

Zoom range \(1\text{ns} \sim 1\text{ms}\)
4. Press F3 (Window Zoom). The specified range gets zoomed. The ZOOM indicator appears on the bottom left side of the display.

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

Show waveform in X-Y mode

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

Panel operation
1. Connect the signals to Channel 1 (X-axis) and Channel 2 (Y-axis).
2. Make sure both Channel 1 and 2 are activated (LED On). Press the Channel key if necessary.

3. Press the Horizontal menu key.

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

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

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

Move waveform position vertically

Panel operation

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

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

Run/Stop mode

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

Select vertical scale

Panel operation

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

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

Range

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

Stop mode

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

Select coupling mode

Panel operation

1. Press the Channel key.

2. Press F1 (Coupling) repeatedly to select the coupling mode.

Range

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

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

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

Example

Observing the AC portion of the waveform using AC coupling
Invert waveform vertically

Panel operation
1. Press the Channel key.
2. Press F2 (Invert) to invert the waveform.

Example
CH1

Limit bandwidth

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

Panel operation
1. Press the Channel key.
2. Press F3 (BW Limit) to turn Off the limitation.
3. The BW icon appears in the channel indicator at the bottom of the display.

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.

Range
x1, x10, x100

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

Trigger configures the condition GDS-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

<table>
<thead>
<tr>
<th>Trigger source</th>
<th>CH1 ~ 4</th>
<th>Channel 1 ~ 4 input signals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line</td>
<td>AC mains signal</td>
<td></td>
</tr>
<tr>
<td>Ext</td>
<td>(For 2CH models only) external trigger input signal</td>
<td></td>
</tr>
</tbody>
</table>

**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.

**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 (video trigger)**
- NTSC: National Television System Committee
- PAL: Phase Alternative by Line
- SECAM: SEquential Couleur A Memoire

**Sync polarity (video trigger)**
- Positive polarity
- Negative polarity

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

**Pulse condition (pulse trigger)**
Sets the pulse width (20ns ~ 200us) and the triggering condition.
- >: Longer than
- =: Equal to
- <: Shorter than
- ≠: Not equal to

**Trigger 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.

**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.
   - Short
   - Long
   - 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 (page96).

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.

   [CH1 EDGE]

   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.

   [CH1 DELAY]

   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)
   - **Range**: 2 ~ 65000 (by event)
4. Press F4 (Ext) repeatedly to select the threshold level for the external trigger input.

   ![Ext: TTL](image1)

   **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).

   ![Slope / Coupling](image2)

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

   ![Ext: TTL](image1)

   **Range:** TTL (1.48V), ECL (1.35V), User (−12V ~ +12V)

**Use video trigger**

**Panel operation**

1. Press the Trigger menu key.

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

   ![Type Video](image3)

3. Press F2 repeatedly to select the trigger source channel.

   ![Source](image4)

4. Press F3 repeatedly to select the video standard.

   ![Standard](image5)

5. Press F4 repeatedly to select the video signal polarity.

   ![Polarity](image6)

6. Press F5 repeatedly to select the video field line. Use the Variable knob to select the video line.

   ![Line](image7)

   **Field:** 1, 2

   **Video line:**
   - NTSC: 1 ~ 262 (Even), 1 ~ 263 (Odd)
   - PAL/SECAM: 1 ~ 312 (Even), 1 ~ 313 (Odd)
Use pulse width trigger

Panel operation

1. Press the Trigger menu key.

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

3. Press F2 repeatedly to select the trigger source.

4. Press F3 repeatedly to select the trigger mode.

5. Press F4 repeatedly to select the pulse condition. Then use the Variable knob to set the pulse width.

6. Press F5 to set trigger slope and coupling.

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

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

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

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


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
- Russian
- German
- Polish
- Italian
- French

Set date and time

**Panel operation**
1. Press the Utility key.

2. Press F5 (More) twice.


4. Press F2 (Year/ Month/ Date) repeatedly. Use the Variable knob to change the value.
   - Year: 2000 ~ 2037
   - Month: 1 ~ 12
   - 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.

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**

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<thead>
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<td>Setup file format ............................. 121</td>
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<td>USB flash drive file utility .................. 122</td>
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<td></td>
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<thead>
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<td>Recall waveform .................................... 138</td>
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<td></td>
<td>Recall waveform .................................... 139</td>
</tr>
<tr>
<td></td>
<td>Recall waveform .................................... 141</td>
</tr>
</tbody>
</table>
File Format/Utility

Display image file format

<table>
<thead>
<tr>
<th>Format</th>
<th>DSxxxx.bmp or Axxxx.bmp (Windows bitmap format)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contents</td>
<td>The current display image in 234 x 320 pixels, color format. The background color can be inverted (Ink saver function).</td>
</tr>
</tbody>
</table>

Waveform file format

<table>
<thead>
<tr>
<th>Format</th>
<th>DSxxxx.csv or Axxxx.csv (Comma-separated values format, can be opened in spreadsheet applications such as Microsoft Excel)</th>
</tr>
</thead>
</table>
| Waveform type | CH1 ~ 4 Input channel signal  
Math Math operation result (page63) |
| 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. |

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)

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

<table>
<thead>
<tr>
<th>Acquire</th>
<th>• mode</th>
<th>• memory length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor</td>
<td>• source channel</td>
<td>• cursor on/off</td>
</tr>
<tr>
<td></td>
<td>• cursor location</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>• dots/vectors</td>
<td>• accumulation on/off</td>
</tr>
<tr>
<td></td>
<td>• grid type</td>
<td></td>
</tr>
<tr>
<td>Measure</td>
<td>• item</td>
<td>• source channel</td>
</tr>
<tr>
<td>Utility</td>
<td>• hardcopy type</td>
<td>• ink saver on/off</td>
</tr>
<tr>
<td></td>
<td>• interface type</td>
<td>• RS-232 config</td>
</tr>
<tr>
<td></td>
<td>• buzzer type</td>
<td>• GPIB address</td>
</tr>
<tr>
<td></td>
<td>• Go-NoGo cond.</td>
<td>• menu language</td>
</tr>
<tr>
<td>Program</td>
<td>• step contents</td>
<td>• loop count</td>
</tr>
<tr>
<td></td>
<td>• start/stop steps</td>
<td></td>
</tr>
<tr>
<td>Horizontal</td>
<td>• display mode</td>
<td>• scale</td>
</tr>
<tr>
<td></td>
<td>• position</td>
<td></td>
</tr>
<tr>
<td>Trigger</td>
<td>• trigger type</td>
<td>• source channel</td>
</tr>
<tr>
<td></td>
<td>• trigger mode</td>
<td>• video standard</td>
</tr>
<tr>
<td></td>
<td>• video polarity</td>
<td>• video line</td>
</tr>
<tr>
<td></td>
<td>• pulse timing</td>
<td>• slope/coupling</td>
</tr>
<tr>
<td>Channel (vertical)</td>
<td>• vertical scale</td>
<td>• vertical position</td>
</tr>
<tr>
<td></td>
<td>• coupling mode</td>
<td>• invert on/off</td>
</tr>
<tr>
<td></td>
<td>• bandwidth limit on/off</td>
<td>• probe attenuation</td>
</tr>
<tr>
<td>Math</td>
<td>• operation type</td>
<td>• source channel</td>
</tr>
<tr>
<td></td>
<td>• vertical position</td>
<td>• unit/div</td>
</tr>
<tr>
<td></td>
<td>• FFT window</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Variable knob movement</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Down</td>
<td>Go back to the root directory</td>
</tr>
<tr>
<td>Up</td>
<td>Go back to the previous (higher) directory</td>
</tr>
<tr>
<td>Left</td>
<td>Go into the folder</td>
</tr>
</tbody>
</table>

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.

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

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. 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.

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

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

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

The printing operation is described in page 145.

Using the Save/Recall key can also save files but with more configurations. For details, see page 127.

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 page 145.

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.

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**

<table>
<thead>
<tr>
<th>Item</th>
<th>Source</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel setup</td>
<td>Front panel settings</td>
<td>Internal memory: S1 ~ S20</td>
</tr>
<tr>
<td>(DSxxxx.set)</td>
<td></td>
<td>External memory: USB</td>
</tr>
<tr>
<td>Waveform data</td>
<td>Channel 1 ~ 4</td>
<td>Internal memory: Reference waveform A ~ D, W1 ~ W20</td>
</tr>
<tr>
<td>(DSxxxx.csv)</td>
<td>Math operation result</td>
<td>External memory: USB</td>
</tr>
<tr>
<td></td>
<td>Reference waveform A ~ D</td>
<td></td>
</tr>
<tr>
<td>Display image</td>
<td>Display image</td>
<td>External memory: USB</td>
</tr>
<tr>
<td>(DSxxxx.bmp)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Save All</td>
<td>Display image (Axxxx.bmp)</td>
<td>External memory: USB</td>
</tr>
<tr>
<td></td>
<td>Waveform data (Axxxx.csv)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Front panel settings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Axxxx.set)</td>
<td></td>
</tr>
</tbody>
</table>

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

4. 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
SAVE/RECALL

USB

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

5. 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 page 122.

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)
   - CH1~CH4 (4CH model)
   - Math
   - RefA~D

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

   - USB
   - 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.

Waveform save to RefA completed.

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 page 122.

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.


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).

6. Press F3 (Destination). Use the Variable knob to select the file name.
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 page 122.

---

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.


---

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

   ![Variable knob](image)

   **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.

   ![](image)

   **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 page122.

---

### Recall

#### File type/source/destination

<table>
<thead>
<tr>
<th>Item</th>
<th>Source</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default panel setup</td>
<td>• Factory installed setting</td>
<td>• Current front panel setting</td>
</tr>
<tr>
<td>Reference waveform</td>
<td>• Internal memory: A ~D</td>
<td>• Current front panel</td>
</tr>
<tr>
<td>Panel setup (DSxxxx.set)</td>
<td>• Internal memory: S1 ~ S20</td>
<td>• Current front panel</td>
</tr>
<tr>
<td>Waveform data (DSxxxx.csv)</td>
<td>• Internal memory: W1 ~ W20</td>
<td>• Reference waveform A ~ D</td>
</tr>
<tr>
<td>Display image (DSxxxx.bmp)</td>
<td>• External memory: USB</td>
<td>• Display</td>
</tr>
</tbody>
</table>

### Recall default panel setting

**Panel operation**

1. Press the Save/Recall key. 

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

**Setting contents**

The following is the default setting contents.
Recall reference waveform on the display

Panel operation

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

2. Press the Save/Recall key.


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.


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).

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 page122.
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.


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).

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

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 page 122.
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.


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.
**PRINT OUT**

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

**Overview**

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

**1 Connect printer**

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

  **Front panel**
  ![Front panel image]

  **Rear panel**
  ![Rear panel image]

**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).

**2 Configure interface**

**Panel operation**

1. Press the Utility key.
2. Press F2 (Interface menu).
3. Press F1 (Type) repeatedly to select USB.
4. Press F5 (Previous menu).
5. Press F1 (Hardcopy menu).
6. Press F1 (Function) repeatedly to select Printer.

**3 Configure content**

**Panel operation**

1. Press the Utility key.
2. Press F1 (Hardcopy Menu).
3. Press F1 (Function) repeatedly to select Printer if it is not selected yet.
4. To invert the color for the saved or printed display image, press F2 (Ink Saver) and turn On the Ink Saver.

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

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

   Range  10% ~ 100%

4 Printout

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

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.

Configuration

- Configure USB interface.........................149
- Configure RS-232C interface ......................150
- Configure GPIB interface (optional) ..............152
- USB/RS-232C remote control software............154
**Interface Configuration**

**Configure USB interface**

<table>
<thead>
<tr>
<th>USB configuration</th>
<th>PC side connector</th>
<th>Type A, host</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDS-2000 side connector</td>
<td>Type B, slave</td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>1.1/2.0 (full speed)</td>
<td></td>
</tr>
</tbody>
</table>

**Panel operation**

1. Press the Utility key.
2. Press F2 (Interface Menu).
3. Press F1 (Type) repeatedly to select USB.
4. The interface icon at the top of the display changes into USB type.
5. Connect the USB cable to the rear panel slave port.

**Configure RS-232C interface**

<table>
<thead>
<tr>
<th>Connector</th>
<th>DB-9, Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud rate</td>
<td>2400, 4800, 9600, 19200, 38400</td>
</tr>
<tr>
<td>Parity</td>
<td>None, Odd, Even</td>
</tr>
<tr>
<td>Data bit</td>
<td>8 (fixed)</td>
</tr>
<tr>
<td>Stop bit</td>
<td>1, 2</td>
</tr>
</tbody>
</table>

**Panel operation**

1. Press the Utility key.
2. Press F2 (Interface Menu).
3. Press F1 (Type) repeatedly to select RS-232C.
4. The interface icon at the top of the display changes into RS-232C type.
5. To change the baud rate, press F2 (Baud Rate) repeatedly.
6. To change the stop bit, press F3 (Stop Bit) repeatedly.
7. Data bit is fixed at 8.
8. To change the parity, press F4 (Parity) repeatedly.
9. Connect the RS-232C cable to the rear panel port: DB-9 male connector. For functionality check see page 154.

**Pin assignment**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2: RxD (Receive data)</td>
<td>3: TxD (Transmit data)</td>
<td>5: GND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4, 6 ~ 9: No connection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.
2. Take off two screws and remove the rear panel GPIB module cover.
3. Insert the GPIB module and put the screws back.
4. Turn On the GDS-2000 power switch.

**Configure GPIB**

1. Press the Utility key.
2. Press F2 (Interface Menu).
3. Press F1 (Type) repeatedly to select GPIB.
4. The interface icon at display top changes to GPIB.

5. Press F2 (Address). Use the Variable knob to change the GPIB address.
   - Range: 1 ~ 30

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

USB/RS-232C remote control software

Terminal application
Invoke the terminal application such as MTTY (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, 00000001, V1.00

PC Software
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.
2. Open the rear panel battery pack cover.
3. Insert the battery packs and close the cover.
4. 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.
3. Press F2 (System Info).
4. The battery status (output voltage and charging rate) appears on the lower half of the display.

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**

1. Press the Utility key.
3. Press F1 (Self Cal Menu).
4. Press F1 (Vertical).
5. The buzzer sounds and the message “Set CAL to CH1, then press F5” appears at the bottom of the display.
6. Connect the calibration signal from the rear panel CAL out to Channel1 input.
7. Press F5.
8. The calibration for Channel1 starts and ends automatically, in less than 5 minutes.
9. When finished, connect the calibration signal to Channel2 and press F5. Channel2 calibration starts.
10. (for 4 Channel model only) Repeat the above step for Channel 3 and 4.
11. When the calibration for all channels is completed, the display goes back the default state.

**Probe Compensation**

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

4. Press F1 (ProbeComp Menu).

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

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

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

8. 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 page 22.

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 page54 for details.
To clear FFT result, press the Math key twice. See page63 for details.
To clear Help result, press the Help key again. See page45 for details.

The waveform does not update (frozen).

Press the Run/Stop key to unfreeze the waveform. See page49 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 page105 for trigger setting details.

The probe waveform is distorted.

You might need to compensate the probe. For details, see page158.
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 page48 for Auto Set details.

I want to clean up the cluttered panel settings.

Recall the default settings by pressing Save/Recall key ō F1. For default setting contents, see page44.

The display image printout is too dark on the background.

Use the Inksaver function which reverses the background color. For details, see page145.

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 page155.

The date and time setting are not correct.

For date and time setting details, please see page116. 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.

Step 2. Replace the fuse in the holder.

Rating T2A, 250V

GPIB Module Installation

For GPIB interface and remote control details, see page148.

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

Step 1. Turn Off the GDS-2000 power switch.

Step 2. Take off two screws and remove the rear panel GPIB module cover.

Step 3. Insert the GPIB module and put the screws back.

Step 4. 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

<table>
<thead>
<tr>
<th>Model</th>
<th>Channels</th>
<th>Bandwidth</th>
<th>Rise time</th>
</tr>
</thead>
</table>
| GDS-2062 | 2        | DC ~ 60MHz (-3dB) | 5.8ns approx.
| GDS-2064 | 4        | DC ~ 60MHz (-3dB) | 5.8ns approx.
| GDS-2102 | 2        | DC ~ 100MHz (-3dB) | 3.5ns approx.
| GDS-2104 | 4        | DC ~ 100MHz (-3dB) | 3.5ns approx.
| GDS-2202 | 2        | DC ~ 200MHz (-3dB) | 1.75ns approx.
| GDS-2204 | 4        | DC ~ 200MHz (-3dB) | 1.75ns approx.

Common

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>2mV/div~5V/Div (1-2-5 increments)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>± (3% x [Readout] +0.05div + 0.8mV)</td>
</tr>
<tr>
<td>Input Coupling</td>
<td>AC, DC, Ground</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>1MΩ±2%, ~16pF</td>
</tr>
<tr>
<td>Polarities</td>
<td>Normal &amp; Invert</td>
</tr>
<tr>
<td>Maximum Input</td>
<td>300V (DC+AC peak), CAT II</td>
</tr>
<tr>
<td>Math Operation</td>
<td>+, –, FFT</td>
</tr>
<tr>
<td>Offset Range</td>
<td>2mV/div<del>20mV/div: 0.5V 50mV/div</del>200mV/div: 5V 500mV/div~2V/div: 50V 5V/div: 300V</td>
</tr>
<tr>
<td>Bandwidth Limit</td>
<td>DC ~ 200MHz (-3dB)</td>
</tr>
</tbody>
</table>

Trigger Sources

| CH1, CH2, Line, EXII(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)

| +/-15V |

Range

| 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

| 1000div |

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 Modes

| 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, Rise Preshoot/ Overshoot, Fall Preshoot/ Overshoot |

Time

| Freq, Period, Rise Time, Fall Time, Positive Width, Negative Width, Duty Cycle |

Delay

| FRR, FRF, FFR, FFT, LRR, LRF, LFR, LFF |

Cursor Voltage difference (∆V) and Time difference (∆T) between cursors
### Apparatus

<table>
<thead>
<tr>
<th>Control Panel Function</th>
<th>Auto Set</th>
<th>Automatically adjust Vertical Volt/div, Horizontal Time/div, and Trigger level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Save Setup</td>
<td>Internal memory: 20 sets, USB Flash drive unlimited</td>
</tr>
<tr>
<td></td>
<td>Save Waveform</td>
<td>Internal memory: 20 sets, USB Flash drive unlimited</td>
</tr>
<tr>
<td></td>
<td>Save display image</td>
<td>USB Flash drive unlimited</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display</th>
<th>LCD</th>
<th>5.6 inch, TFT, brightness adjustable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resolution (dots)</td>
<td>234 (Vertical) x 320 (Horizontal)</td>
</tr>
<tr>
<td></td>
<td>Graticule</td>
<td>8 x 10 divisions (menu On), 8 x 12 divisions (menu Off)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interface</th>
<th>Go-No Go</th>
<th>Output 5V max/ 10mA TTL open collector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RS-232C</td>
<td>DTE DB 9-pin male</td>
</tr>
<tr>
<td></td>
<td>GPIB (Optional)</td>
<td>IEEE488.2 24-pin female</td>
</tr>
<tr>
<td></td>
<td>USB</td>
<td>Host: Flash drive, Printer, Device: Remote control, 2.0 full speed supported</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power Source</th>
<th>Line Voltage</th>
<th>100V<del>240V AC, 47Hz</del>63Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Battery (Optional)</td>
<td>Li-Ion pack, 11.1V average, 8 hours charge time (Power On), 3 hours operating time (depend on conditions)</td>
</tr>
</tbody>
</table>

### Miscellaneous

<table>
<thead>
<tr>
<th>Miscellaneous</th>
<th>Language Selection</th>
<th>English, Traditional Chinese, Simplified Chinese, others (depend on the region)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On-Line Help</td>
<td>Available for most keys</td>
</tr>
<tr>
<td></td>
<td>Real-Time Clock</td>
<td>Display: yy/mm/dd hh:mm:ss (time stamp for saved data)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation Environment</th>
<th>Ambient temperature</th>
<th>0 ~ 50°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relative humidity</td>
<td>≤ 80% @ 35°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storage Environment</th>
<th>Ambient temperature</th>
<th>-20 ~ 70°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relative humidity</td>
<td>90% @ 35°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>254 (D) x 142 (H) x 310 (W) mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>Approx. 4.3kg</td>
</tr>
</tbody>
</table>

### Probe Specifications

#### Model-specific

<table>
<thead>
<tr>
<th>GTP-060A-2</th>
<th>Applicable to</th>
<th>GDS-2062, GDS-2064</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>DC ~ 60MHz @ Position x 10</td>
<td></td>
</tr>
<tr>
<td>Rise time</td>
<td>5.8ns</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GTP-100A-2</th>
<th>Applicable to</th>
<th>GDS-2102, GDS-2104</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>DC ~ 100MHz @ Position x 10</td>
<td></td>
</tr>
<tr>
<td>Rise time</td>
<td>2.3ns</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GTP-250A-2</th>
<th>Applicable to</th>
<th>GDS-2202, GDS-2204</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>DC ~ 250MHz @ Position x 10</td>
<td></td>
</tr>
<tr>
<td>Rise time</td>
<td>1.4ns</td>
<td></td>
</tr>
</tbody>
</table>

#### Common

<table>
<thead>
<tr>
<th>Position x 10</th>
<th>Attenuation Ratio</th>
<th>10:1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Input Resistance</td>
<td>10MΩ when used with 1MΩ input oscilloscope</td>
</tr>
<tr>
<td></td>
<td>Input Capacitance</td>
<td>23pF approx for GTP-060A-2, 15pF approx for GTP-100A-2, 17pF approx for GTP-250A-2</td>
</tr>
<tr>
<td></td>
<td>Compensation Range</td>
<td>10 ~ 35pF</td>
</tr>
<tr>
<td></td>
<td>Maximum Input Voltage</td>
<td>500V CAT I, 300V CAT II (DC+Peak AC) Derating with frequency</td>
</tr>
<tr>
<td></td>
<td>Attenuation Ratio</td>
<td>1:1</td>
</tr>
<tr>
<td></td>
<td>Bandwidth</td>
<td>DC ~ 6MHz</td>
</tr>
<tr>
<td></td>
<td>Rise Time</td>
<td>58ns</td>
</tr>
<tr>
<td></td>
<td>Input Resistance</td>
<td>1MΩ when used with 1MΩ input oscilloscope</td>
</tr>
<tr>
<td></td>
<td>Input Capacitance</td>
<td>128pF for GTP-060A-2, 47pF for GTP-100A-2, 47pF for GTP-250A-2 (+oscilloscope capacitance)</td>
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<tr>
<td></td>
<td>Compensation Range</td>
<td>10 ~ 35pF</td>
</tr>
<tr>
<td></td>
<td>Maximum Input Voltage</td>
<td>300V CAT I, 150V CAT II (DC+Peak AC) Derating with frequency</td>
</tr>
<tr>
<td></td>
<td>Operating Condition</td>
<td>Temperature: -10°C ~ 55°C, Relative Humidity: ≤85% @ 35°C</td>
</tr>
</tbody>
</table>

| Safety Standard | EN61010-031 CAT III |

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**GW INSTEK GDS-2000 Series User Manual**

---

**Probe Specifications**

**Model-specific**

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<td></td>
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<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>Attenuation Ratio</td>
<td>1:1</td>
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<td>Rise Time</td>
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<td></td>
<td>Input Resistance</td>
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<td>Input Capacitance</td>
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<td>300V CAT I, 150V CAT II (DC+Peak AC) Derating with frequency</td>
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<tr>
<td></td>
<td>Operating Condition</td>
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</tr>
</tbody>
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| Safety Standard | EN61010-031 CAT III |
Declaration of Conformity

We
GOOD WILL INSTRUMENT CO., LTD.
(1) No.7-1, Jhongsing Rd., Tucheng City, Taipei County, Taiwan
(2) No. 69, Lu San Road, Suzhou City (Xin Qu), Jiangsu Sheng, China
declare, that the below mentioned product
Type of Product: Power Supply
Model Number: GDS-2062, GDS-2064, GDS-2102, GDS-2104, GDS-2202, GDS-2204
For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Directive, the following standards were applied:

**EMC**
- Conducted Emission
- Radiated Emission
  - EN 61000-3-2: 2000 + A2:2005
- Current Harmonics
- Voltage Fluctuations
- Electrostatic Discharge
- Radiated Immunity

**Safety**
- EN 61010-1: 2001
| Key Overview | Menu Tree | Shortcut | Vector Waveform | Vertical | Waveform | Accumulation | File Contents | How to Recall | How to Save | Invert Waveform | Recall Menu Tree | Roll Mode | Scan Mode | X-Y Mode | X-Y Mode | Zoom Mode | Zoom Waveform |
|-------------|-----------|----------|----------------|----------|----------|--------------|---------------|---------------|-------------|---------------|---------------|-------------|------------|-----------|----------|----------|------------|-------------|
| 14          | 39        | 39       | 90             | 101      |          | 91           | 120           | 141           | 129         | 103           | 34, 35        | 97          | 96        | 99        | 19       | 98         |