TEXIO
Test and Measurement Solutions

INSTRUCTION MANUAL

DIGITAL STORAGE OSCILLOSCOPE
DCS-1000B SERIES

DCS-1052B **DCS-1054B**
DCS-1072B **DCS-1074B**
DCS-1102B **DCS-1104B**

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This manual is the contents as of April, 2021, Firmware:Ver1.29.

■ About export
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USING THE PRODUCT SAFELY

■ **Preface**
   To use the product safely, read this instruction manual to the end.
   Before using this product, understand how to correctly use it.
   If you read this manual but you do not understand how to use it, please
   ask us or your local dealer. After you read this manual, save it so that
   you can read it, anytime as requied.

■ **Pictorial indication**
   This instruction manual and product show the warning and caution items
   required to safely use the product. The following pictorial indication and
   warning character indication are provided.

<Pictorial indication>	
⚠	Some part of this product or the instruction manual may shows this pictorial indication. In this case, if the product is incorrectly used in that part, a serious danger may be brought about on the user's body or the product. To use the part with this pictorial indication, be sure to refer to this instruction manual.
⚠ **WARNING**	If you use the product, ignoring this indication, you may get killed or seriously injured. This indication shows that the warning item to avoid the danger is provided.
⚠ **CAUTION**	If you incorrectly use the product, ignoring this indication, you may get slightly injured or the product may be damaged. This indication shows that the caution item to avoid the danger is provided.

Please be informed that we are not responsible for any damages to the user
or to the third person, arising from malfunctions or other failures due to
wrong use of the product or incorrect operation, except such responsibility
for damages as required by law.

USING THE PRODUCT SAFELY

WARNING   **CAUTION**

- ■ **Do not remove the product's covers and panels**
  Never remove the product's covers and panels for any purpose.
  Otherwise, the user's electric shock or fire may be incurred.
- ■ **Warning on using the product**
  Warning items given below are to avoid danger to user's body and life and avoid the damage or deterioration of the product.
  Use the product, observing the following warning and caution items.
- ■ **Warning items on power supply**
  - Power supply voltage
    The rated power supply voltages of the product are 100, 120, 220 and 240VAC. The rated power supply voltage for each product should be confirmed by reading the label attached on the back of the product or by the "rated" column shown in this instruction manual. The specification of power cord attached to the products is rated to 125VAC for all products which are designed to be used in the areas where commercial power supply voltage is not higher than 125VAC. Accordingly, you must change the power cord if you want to use the product at the power supply voltage higher than 125VAC. If you use the product without changing power cord to 250VAC rated one, electric shock or fire may be caused.
    When you used the product equipped with power supply voltage switching system, please refer to the corresponding chapter in the instruction manuals of each product.

  - Power cord
    (Important)   The attached power cord set can be used for this device only.
    If the attached power cord is damaged, stop using the product and call us or your local dealer. If the power cord is used without the damage being removed, an electric shock or fire may be caused.

  - Protective fuse
    If an input protective fuse is blown, the product does not operate. For a product with external fuse holder, the fuse may be replaced. As for how to replace the fuse, refer to the corresponding chapter in this instruction manual.
    If no fuse replacement procedures are indicated, the user is not permitted to replace it. In such case, keep the case closed and consult us or your local dealer. If the fuse is incorrectly replaced, a fire may occur.

USING THE PRODUCT SAFELY

■ **Warning item on Grounding**
If the product has the GND terminal on the front or rear panel surface, be sure to ground the product to safely use it.

■ **Warnings on Installation environment**
● Operating temperature and humidity
Use the product within the operating temperature indicated in the "rating" temperature column. If the product is used with the vents of the product blocked or in high ambient temperatures, a fire may occur. Use the product within the operating humidity indicated in the "rating" humidity column. Watch out for condensation by a sharp humidity change such as transfer to a room with a different humidity. Also, do not operate the product with wet hands. Otherwise, an electric shock or fire may occur.
● Use in gas
Use in and around a place where an inflammable or explosive gas or steam is generated or stored may result in an explosion and fire. Do not operate the product in such an environment.
Also, use in and around a place where a corrosive gas is generated or spreading causes a serious damage to the product. Do not operate the product in such an environment.
● Installation place
Avoid installing the product on inclined places or on places subject to vibration. Otherwise, the product may slip or fall down to cause damages or injury accidents.

■ **Do not let foreign matter in**
Do not insert metal and inflammable materials into the product from its vent and spill water on it. Otherwise, electric shock or fire may occur.

■ **Warning item on abnormality while in use**
In abnormal situations, such as "smoke", "fire", "abnormal smell" or "irregular noise" occur from the product while in use, stop using the product, turn off the switch, and remove the power cord plug from the outlet. After confirming that no other devices catch fire, ask us or your local dealer.

USING THE PRODUCT SAFELY

■ Warning Item for the Measurement

- When you measure a part of a high voltage, be careful not to touch a hand to a measurement part directly. There is a risk of an electric shock.
- Be sure to connect the probe or the cable and the ground side of the input connector to the ground potential (ground) of the substance measured. Since the chassis of this instrument is connected to the ground of the input block, connecting the earth lead of the probe to the potential floating from the ground potential may result in the following:
  - ● Electric shock
  - ● A high current flows and damages the substance measured, this instrument, and other connected device.

  The following parts are connected to the chassis:
  - ● Probe for each channel and ground side of the input BNC connector
  - ● Grounding conductor of the accessory 3-core power cord
  - ● Ground pin for an interface signal

"Bad example"   `Prohibition`
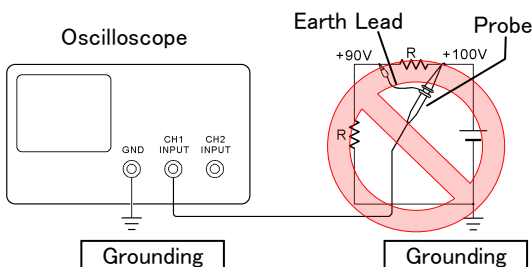
At connecting as Bad Example, +90V and chassis are shorted, and damages substance a measured. Therefore do not make such connection.
If the instrument is not grounded, a potential of the chassis is +90V.
Ground a chassis, in order to prevent an electric shock accident.

When measuring the floating potential, a differential method of measurement is recommended (refer to the figure below).

"Good example"
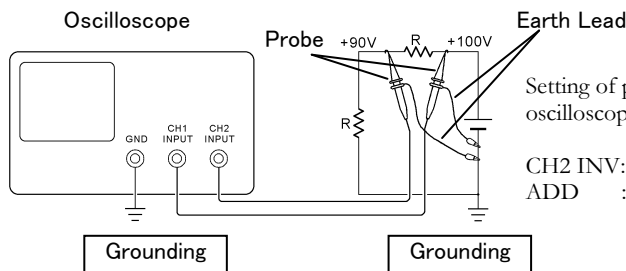
Setting of panel switches of an oscilloscope

CH2 INV: ON (CH2 inverted)
ADD   : ON (CH1+CH2)

USING THE PRODUCT SAFELY

■ **Input / Output terminals**
Maximum input to terminal is specified to prevent the product from being damaged. Do not supply input, exceeding the specifications that are indicated in the "Rating" column in the instruction manual of the product.
Also, do not supply power to the output terminals from the outside.
Otherwise, a product failure is caused.

■ **Calibration**
Although the performance and specifications of the product are checked under strict quality control during shipment from the factory, they may be deviated more or less by deterioration of parts due to their aging or others.
It is recommended to periodically calibrate the product so that it is used with its performance and specifications stable.
For consultation about the product calibration, ask us or your local dealer.

■ **Daily Maintenance**
When you clean off the dirt of the product covers, panels, and knobs, avoid solvents such as thinner and benzene. Otherwise, the paint may peel off or resin surface may be affected.
To wipe off the covers, panels, and knobs, use a soft cloth with neutral detergent in it. During cleaning, be careful that water, detergent, or other foreign matters do not get into the product.
If a liquid or metal gets into the product, an electric shock and fire are caused. During cleaning, remove the power cord plug from the outlet.

Use the product correctly and safely, observing the above warning and caution items. Because the instruction manual indicates caution items even in individual items, observe those caution items to correctly use the product.

If you have questions or comments about the instruction manual, ask us or E-Mail us.

1. GETTING STARTED

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

1-1. Main Features

Model name	Frequency bandwidth	Input channels	Real-time Sampling Rate
DCS-1052B	50MHz	2	1GSa/s
DCS-1054B	50MHz	4	1GSa/s
DCS-1074B	70MHz	4	1GSa/s
DCS-1104B	100MHz	4	1GSa/s
DCS-1072B	70MHz	2	1GSa/s
DCS-1102B	100MHz	2	1GSa/s

⚠️Note   This instruction manual has been described as the 4ch model. In 2ch model, Can't set the ch3 and ch4.

Features	• 7 inch, 800 x 480, WVGA TFT display. • Available from 70MHz to 100MHz. • Real-time sampling rate of 1GSa/s. • Deep memory: 10M points record length. • Waveform capture rate of 50,000 waveforms per second. • Vertical sensitivity: 1mV/div~10V/div. • On-screen Help. • 32 MB internal flash disk. • Go-NoGo application. • Remote Disk appl • Serial Bus Decode: Serial bus decoding of UART, I2C, SPI, CAN & LIN buses.ication.
Additional Feature	• Segmented Memory: Optimizes the acquisition memory to selectively capture only the important signal details. Up to 29000 successive waveform segments can be captured with a time-tag resolution of 4ns. • Waveform Search: Allows the scope to search for a number of different signal events.
Interface	• USB host port: front panel, for storage devices. • USB device port: rear panel, for remote control or printing. • Probe calibration output with selectable output frequency (1kHz ~ 200kHz). • Ethernet port (4ch Model Only) • Calibration output.

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1-2. Accessories

Standard Accessories	Part number	Description
Power cord		N/A region dependent
Passive probe		x4 or x2
for 50MHz /70MHz Model	GTP-070B-4	70 MHz probe
for 100MHz Model	GTP-100B-4	100MHz probe

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

Optional Apps	Name	Description
	Data Log	Waveform or image data logging app.
	DVM	Digital Volt Meter app.
	Digital Filter	High or low pass digital filter for analog inputs.

Optional Function	Part number	Description
	Segment	Segment memory Function
	Search	Search Function

Optional Accessories	Part number	Description
	GTL-110	test lead, BNC to BNC heads
	GTL-246	USB2.0 A - B type cable

Drivers		
	USB driver	

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

Panel Overview
1-2-1. Front Panel
4ch Model

Hardcopy key

Variable knob and Select key

Function keys

Autoset, Run/Stop, Single and Default settings

LCD

Side menu keys

Menu key

Option key

Horizontal controls

Trigger controls

Vertical controls

Bottom menu keys

Power button

CH1~CH4

USB Host port, Probe Compensation terminals

Math, Reference and Bus keys

2ch Model

Hardcopy key

Variable knob and Select key

Function keys

Autoset, Run/Stop, Single and Default settings

LCD

Side menu keys

Menu key

Option key

Horizontal controls

Trigger controls

Vertical controls

Bottom menu keys

Power button

CH1~CH2, EXT TRIG

USB Host port, Probe Compensation terminals

Math, Reference and Bus keys

LCD Display	7" WVGA TFT color LCD. 800 x 480 resolution, wide angle view display.
Menu Off Key	**MENU OFF** Use the Menu Off key to hide the onscreen menu system.
Option Key	**OPTION** The Option key is used to access future installed options.
Menu Keys	The side menu and bottom menu keys are used to make selections from the soft-menus on the LCD user interface. To choose menu items, use the 7 Bottom menu keys located on the bottom of the display panel. To select a variable or option from a menu, use the side menu keys on the side of the panel. See page 14 for details.

Side menu keys

Bottom menu keys
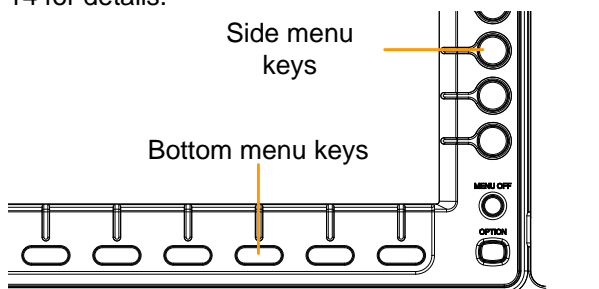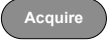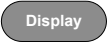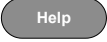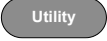
Hardcopy Key	**HARDCOPY** The Hardcopy key is a quick-save or quick-print key, depending on its configuration.
Variable Knob and Select Key	**VARIABLE** The Variable knob is used to increase/decrease values or to move between parameters. The Select key is used to make selections. Select
Function Keys	The Function keys are used to enter and configure different functions on the DCS-1000B.
Measure	**Measure** Configures and runs automatic measurements.
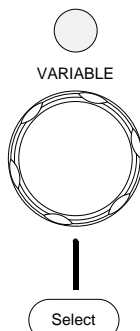
Cursor	**Cursor**	Configures and runs cursor measurements.
APP	**APP**	Configures and runs optional applications.
Acquire	**Acquire**	Configures the acquisition mode, including Segmented Memory acquisition.
Display	**Display**	Configures the display settings.
Help	**Help**	Shows the Help menu.
Save/Recall	**Save/Recall**	Used to save and recall waveforms, images, panel settings.
Utility	**Utility**	Configures the Hardcopy key, Interface, language, probe compensation and calibration. It also accesses the file utilities menu or the system menu.
Autoset	**Autoset**	Press the Autoset key to automatically set the trigger, horizontal scale and vertical scale.
Run/Stop Key	**Run/Stop**	Press to Freeze (Stop) or continue (Run) signal acquisition. The run stop key is also used to run or stop Segmented Memory acquisition .
Single	**Single**	Sets the acquisition mode to single triggering mode.
Default Setup	**Default**	Resets the oscilloscope to the default settings.
Horizontal Controls		The horizontal controls are used to change the position of the cursor, set the time base settings, zoom into the waveforms and search for events.
Horizontal Position	◁ POSITION ▷ PUSH TO ZERO	The Position knob is used to position the waveforms horizontally on the display screen. Pressing the knob will reset the position to zero.
SCALE	SCALE	The Scale knob is used to change the horizontal scale (TIME/DIV).

Zoom	Zoom	Press Zoom in combination with the horizontal Position knob.
Play/Pause	►/II	The Play/Pause key allows you to view each search event in succession – to effectively "play" through each search event. It is also used to play through a waveform in zoom mode.
Search	Search	The Search key accesses the search function menu to set the search type, source and threshold. (Optional function)
Search Arrows	← →	Use the arrow keys to navigate the search events. (Optional function)
Set/Clear	Set/Clear	Use the Set/Clear key to set or clear points of interest when using the search function. (Optional function)
Trigger Controls	The trigger controls are used to control the trigger level and options.	
Level Knob	LEVEL	Used to set the trigger level. Pressing the knob will reset the level to zero.
Trigger Menu Key	Menu	Used to bring up the trigger menu.
50% Key	50 %	Sets the trigger level to the half way point (50%).
Force - Trig	Force-Trig	Press to force an immediate trigger of the waveform.
Vertical POSITION	POSITION PUSH TO ZERO	Sets the vertical position of the waveform. Push the knob to reset the vertical position to zero.
Channel Menu Key	CH1	Press the CH1~4 key to set and configure the channel.
VOLTS/DIV Knob	VOLTS/DIV	Sets the vertical scale of the channel (VOLTS/DIV).

External Trigger Input	EXT TRIG	Accepts external trigger signals (page 89). Only on 2 channel models. Input impedance: 1MΩ Voltage input: ±15V(peak), EXT trigger capacitance:16pF.
Math Key	MATH M	Use the Math key to set and configure math functions.
Reference Key	REF R	Press the Reference key to set or remove reference waveforms.
BUS Key	BUS B	The Bus key is used for parallel and serial bus (UART, I^2C, SPI, CAN, LIN) configuration.
Channel Inputs	CH1	Accepts input signals. Input impedance: 1MΩ. Capacitance: 16pF CAT I 300V
USB Host Port		TypeA, 1.1/2.0 compatible. Used for USB memory.
Ground Terminal		Accepts the DUT ground lead for common ground.
Probe Compensation Outputs	2V	The probe compensation output is used for probe compensation. It also has an adjustable output frequency. By default this port outputs a 2Vpp, square wave signal at 1kHz for probe compensation.
Power Switch	POWER	Used to turn the power on/off. I: ON O: OFF
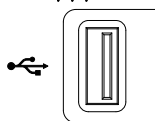
1-2-2. Rear Panel

USB Device port   LAN port

Calibration output

Go/No Go output

Fan   Key lock   Power input socket
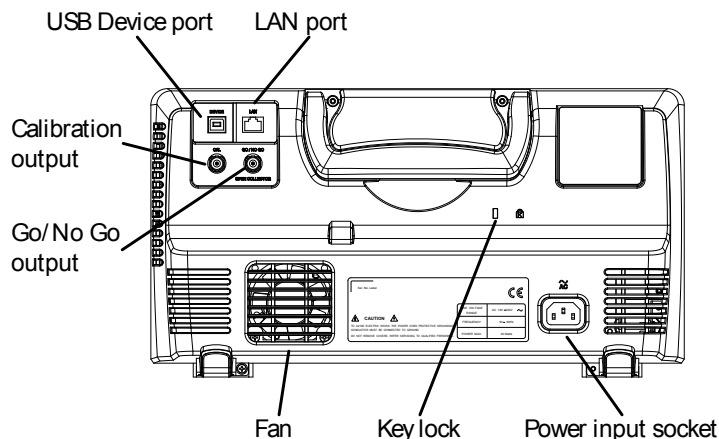
Calibration Output	CAL	Outputs the signal for vertical scale accuracy calibration.
USB Device Port	DEVICE	The USB Device port is used for remote control.
LAN (Ethernet) Port	LAN	The LAN port is used for remote control over a network or when combined with the Remote Disk app, allows the scope to be mounted to a share disk. The LAN port is only available for the 4 channel models
Power Input Socket	$\overset{\sim}{AC}$	Power cord socket accepts AC mains, 100 ~ 240V, 50/60Hz.
Security Slot		Kensington security slot compatible.
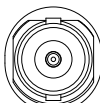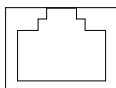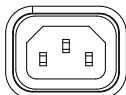
Go-No Go Output	GO / NO GO ⊚ OPEN COLLECTOR	Outputs Go-No Go test results as a 500us pulse signal.

1-2-3. Display

Memory length and sample rate   Memory bar   Acquistion mode

Analog Waveform   Trigger position   — Trigger level

Trigger status

Bus
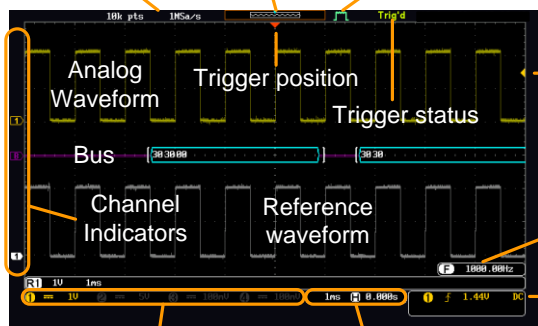
Channel Indicators   Reference waveform   Waveform frequency

Trigger configuration

Channel status   Horizontal status

Analog Waveforms	Shows the analog input signal waveforms. Channel 1: Yellow Channel 2: Blue Channel 3: Pink Channel 4: Green
Bus Waveforms	Shows the bus waveforms for serial buses. The values are displayed in hex or binary.
Channel Indicators	The channel indicators show the zero volt level of the signal waveform for each activated channel. Any active channel is shown with a solid color. 3 Analog channel indicator B Bus indicator(B) 1 Reference waveform indicator M Math indicator
Trigger Position	Shows the position of the trigger.
Horizontal Status	Shows the horizontal scale and position.
Trigger Level	◀ Shows the trigger level on the graticule.
Memory Bar	The ratio and the position of the displayed waveform compared to the internal memory

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Trigger Status	Trig'd	Triggered.
	PrTrig	Pre-trigger.
	Trig?	Not triggered, display not updated.
	Stop	Trigger stopped. Also appears in Run/Stop (page 21).
	Roll	Roll mode.
	Auto	Auto trigger mode.

For trigger details, see page 89.

Acquisition Mode	🔲 Normal mode
	🔲 Peak detect mode
	🔲 Average mode

For acquisition details, see page 46.

| Signal Frequency | F 1000.00Hz | Shows the trigger source frequency. |
| | F <2Hz | Indicates the frequency is less than 2Hz (lower frequency limit). |

| Trigger Configuration | ① ƒ 2.32V DC | Trigger source, slope, voltage, coupling. |

| Horizontal Status | 1ms 🅷 0.000s | Horizontal scale, horizontal position. |

For trigger details, see page 89.

| Channel Status | ① ═ 2V | Channel 1, DC coupling, 2V/Div. |

1-3. Set Up

1-3-1. Tilt Stand

Tilt   To tilt, pull the legs forward, as shown below.
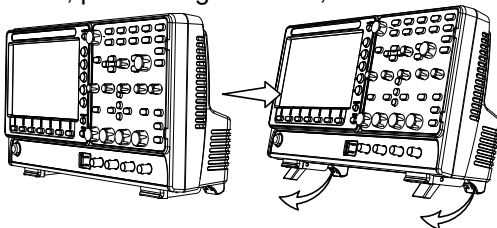
Stand	To stand the scope upright, push the legs back under the casing as shown below.
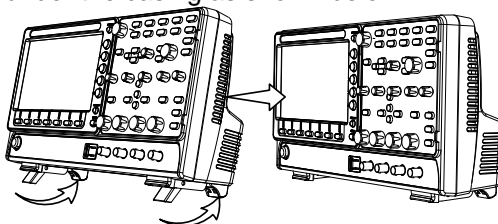
1-3-2. Power Up

Requirements	The DCS-1000B accepts line voltages of 100 ~ 240V at 50 or 60Hz.
Step	1. Connect the power cord to the rear panel socket.
	2. Press the POWER key. The display becomes active in ~ 30 seconds. ▬ I: ON ▬ O: OFF
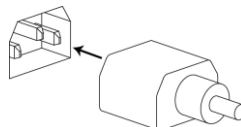
⚠️ Note	The DCS-1000B recovers the state right before the power is turned OFF. The default settings can be recovered by pressing the Default key on the front panel. For details, see page 141.

1-3-3. First Time Use

Background	This section describes how to connect a signal, adjust the scale, and compensate the probe. Before operating the DCS-1000B in a new environment, run these steps to make sure the instrument performs at its full potential.
1. Power On	Follow the procedures on the previous page.
2. Firmware	Update to the latest firmware. Page 168
3. Optional appliction	Add the Optional application, depending on the necessity. Page 118
4. Reset System	Reset the system by recalling the factory settings. Press the *Default* key on the front panel. For details, see page 141.

5. Connect Probe	Connect the probe to the Channel 1 input and to the CAL signal output. This output provides a 2Vp-p, 1kHz square wave for signal compensation by default.
	Set the probe attenuation to x10 if the probe has adjustable attenuation.

CH1

x1

x10
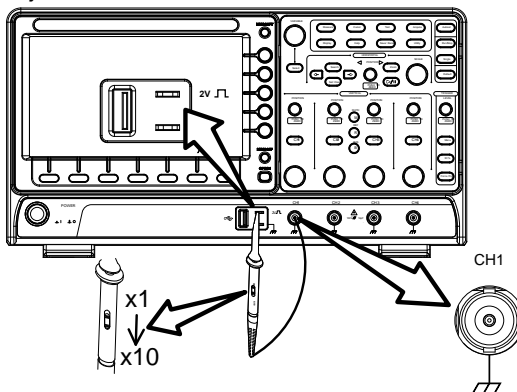
6. Capture Signal (Autoset)	Press the *Autoset* key. A square waveform appears on the center of the screen. For Autoset details, see page 20.

Autoset
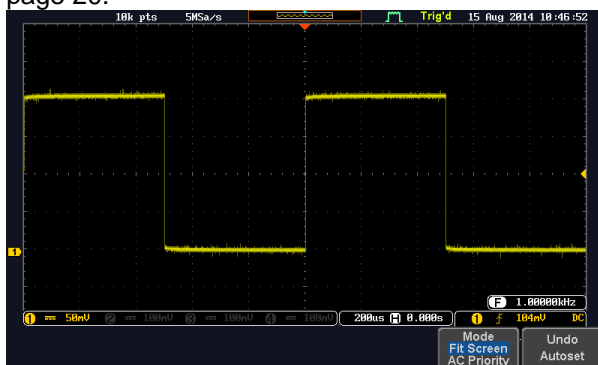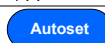
7. Select Vector Waveform	Press the *Display* key, and set the display to *Vector* on the bottom menu.

Display

Dot Vector
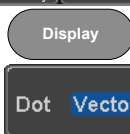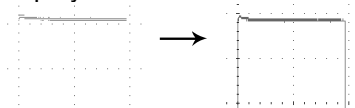
8. Compensate Probe	Turn the adjustment point on the probe to make the square waveform edge flat.

Under Compensation   Normal   Over Compensation
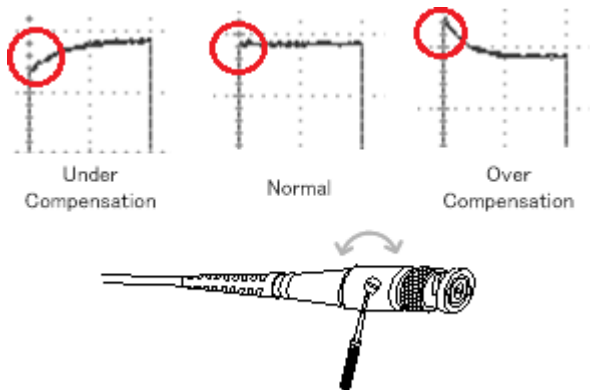
9. Start Operation	Continue with the other operations.	
	Measurement:	page 19
	Configuration:	page 46
	Save/Recall:	page 130
	File Utilities:	page 147
	Apps:	page 118
	Hardcopy key:	page 152
	Remote Control:	page 155
	Maintenance:	page 163

1-3-4. How to Use This Manual

Background	This section describes the conventions used in this manual to operate the DCS-1000B.
	Throughout the manual any reference to pressing a menu key refers to the keys directly below or beside any menu icons or parameters.
	When the user manual says to "toggle" a value or parameter, press the corresponding menu item. Pressing the item will toggle the value or parameter.
	Active parameters are highlighted for each menu item. For example in the example below, Coupling is currently set to DC.
	If a menu item can be toggled from one value or parameter to another, the available options will be visible, with the current option highlighted. In the example below the slope can be toggled from a rising slope to a falling slope or either slope.

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Menu item	Menu item
Coupling	**Slope**

Parameter

Active parameter — Optional parameters

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

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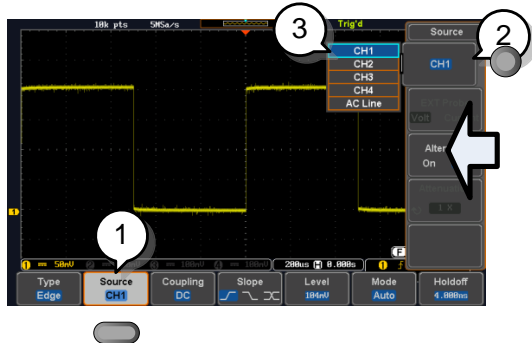
1. Press a bottom menu key to access the side menu.

   Source CH1

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

   CH1

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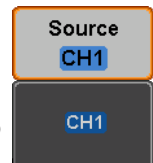
   VARIABLE
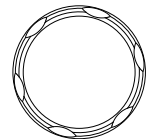
   Select

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

   Source CH1

Example 2   For some variables, a circular arrow icon indicates that the variable for that menu key can be edited with the Variable knob.

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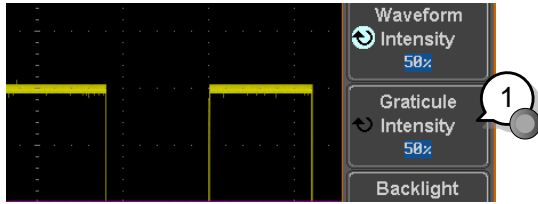
1. Press the desired menu key to select it. The circular arrow will become highlighted.

2. Use the Variable knob to edit the value.

Toggling a Menu Parameter
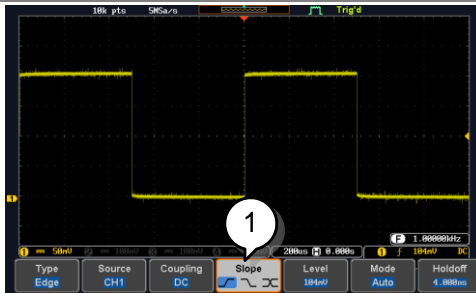
1. Press the bottom menu key to toggle the parameter.

Reduce Side Menu
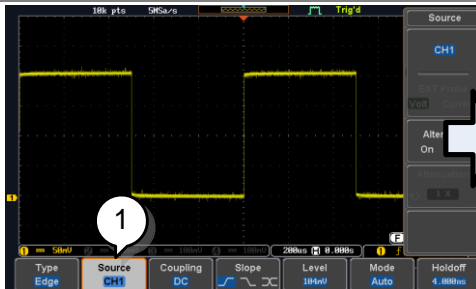
2. To reduce the side menu, press the corresponding bottom menu that brought up the side menu.

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

Reduce Lower
Menu
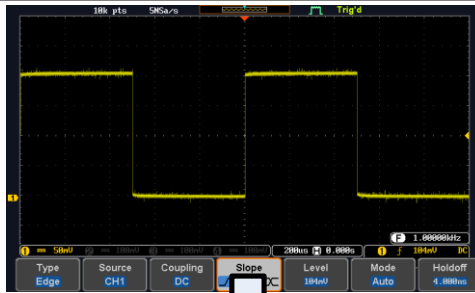
1. Press the relevant function key again to reduce the bottom menu. For example: press the Trigger Menu key to reduce the trigger menu.
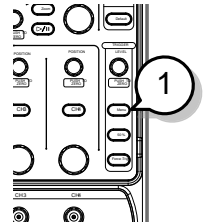
Remove All
Menus
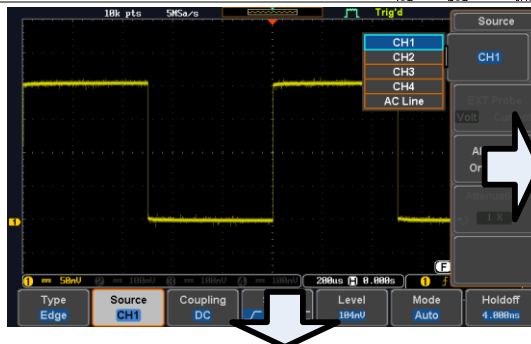
1. Press the *Menu Off* key to reduce the side menu, press again to reduce the bottom menu.
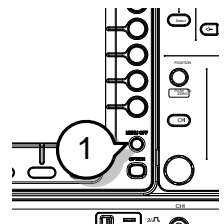
| Remove On-Screen Messages | 2. The *Menu Off* key can also be used to remove any on screen messages. | |
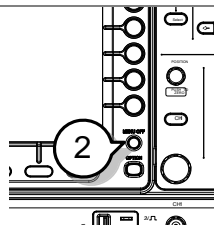
1-4. Built-in Help

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

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

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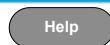
| Example: Help on the Display key | |

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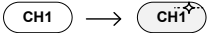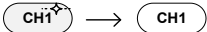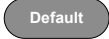
2. MEASUREMENT

2-1. Basic Measurement

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

- Cursor Measurement → from page 34
- Configuration → from page 46

Before operating the oscilloscope, please see the Getting Started chapter, page4.

2-1-1. Channel Activation

Activate Channel	To activate an input channel, press a *channel* key. When activated, the channel key will light up. The corresponding channel menu will also appear.	CH1 ⟶ CH1
	Each channel is associated with the color shown beside each channel's VOLT/DIV knob: CH1: yellow, CH2: blue, CH3: pink and CH4: green. When a channel is activated, it is shown above the bottom menu system.	
	CH1 CH2 CH3 CH4 ❶ ⎓ 1V ❷ ⎓ 100mV ❸ ⎓ 100mV ❹ ⎓ 100mV	
De-activate Channel	To de-activate a channel, press the corresponding *channel* key again. If the channel menu is not open, press the *channel* key twice (the first press shows the Channel menu).	CH1 ⟶ CH1
Default Setup	To activate the default state, press *Default*.	Default

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2-1-2. Autoset

Background	The Autoset function automatically configures the panel settings to position the input signal(s) to the best viewing condition. The DCS-1000B automatically configures the following parameters: • Horizontal scale • Vertical scale • Trigger source channel There are two operating modes for the Autoset function: Fit Screen Mode and AC Priority Mode. Fit Screen Mode will fit the waveform to the best scale, including any DC components (offset). AC priority mode will scale the waveform to the screen by removing any DC component.

Panel Operation 1. Connect the input signal to the DCS-1000B and press the *Autoset* key.

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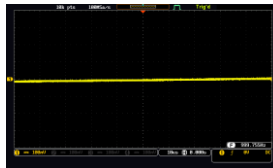
   Before   After

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

Change modes 4. Choose between *Fit Screen Mode* and *AC Priority Mode* from the bottom menu.

5. Press the *Autoset* key again to use Autoset in the new mode.
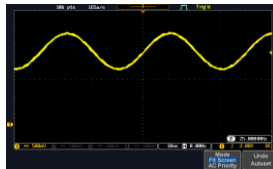
   Fit Screen Mode   AC Priority

Limitation	Autoset does not work in the following situations:
	• Input signal frequency is less than 20Hz
	• Input signal amplitude is less than 10mV
⚠ Note	The Autoset key does NOT automatically activate the channels to which input signals are connected.

2-1-3. Run/Stop

Background	By default, the waveform on the display is constantly updated (Run mode). Freezing the waveform by stopping signal acquisition (Stop mode) allows flexible observation and analysis. To enter Stop mode, two methods are available: pressing the Run/Stop key or using the Single Trigger mode.	
	Stop mode icon When in Stop mode, the Stop icon appears at the top of the display.	
	Stop	
	Triggered icon **Trig'd**	
Freeze Waveform using the Run/Stop Key	Press the *Run/Stop* key once. The Run/Stop key turns red. The waveform and signal acquisition freezes.	Stop: **Run/Stop** → **Run/Stop**
	To unfreeze, press the *Run/Stop* key again. The Run/Stop key turns green again.	Run: **Run/Stop** → **Run/Stop**
Freeze Waveform by Single Trigger Mode	Press the *Single* key to go into the Single Trigger mode. The Single key turns bright white. In the Single Trigger mode, the scope will be put into the pre-trigger mode until the scope encounters the next trigger point. After the scope has triggered, it will remain in Stop mode, until the *Single* key is pressed again or the *Run/Stop* key is pressed.	**Single** → **Single**
Waveform Operation	The waveform can be moved or scaled in both Run and Stop mode, but in different manners. For details, see page 63 (Horizontal position/scale) and page 69 (Vertical position/scale).	

2-1-4. Horizontal Position/Scale

Set Horizontal Position	The horizontal position knob moves the waveform left and right.	◁ POSITION ▷ **PUSH TO ZERO**
Set Horizontal Position to 0	Pressing the horizontal position knob will reset the horizontal position to 0.	◁ POSITION ▷ **H TO ZERO**

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

Acquire

Reset H Position to 0s

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

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

1ms 🔲 0.000s

Select Horizontal Scale	To select the timebase, turn the horizontal *SCALE* knob; left (slow) or right (fast).	**SCALE**
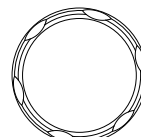
Range   5ns/div ~ 100s/div, 1-2-5 increments
The scale is displayed to the left of the H icon at the bottom of the screen.

1ms 🔲 0.000s

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	Display bar	The display bar indicates how much of the waveform is displayed on the screen at any given time. Changes to timebase will be reflected on the display bar.
		Fast
		Medium
		Slow
	Stop mode	In the Stop mode, the waveform size changes according to the scale.
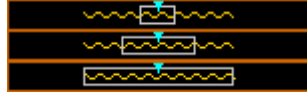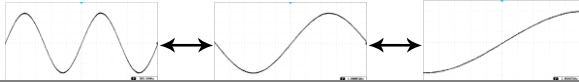
Note

The Sample rate changes according to the timebase and record length. See page 49.

2-1-5. Vertical Position/Scale
For more detailed configuration, see page 69.

Set Vertical Position	To move the waveform up or down, turn the *vertical position knob* for each channel.	POSITION
		PUSH TO ZERO
	Push the *vertical position knob* to reset the position to 0. As the waveform moves, the vertical position of the cursor appears on the display.	POSITION
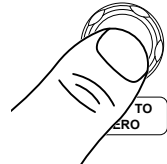
Position = 1.84mV

	Run/Stop mode	The waveform can be moved vertically in both Run and Stop mode.
Select Vertical Scale	To change the vertical scale, turn the vertical VOLTS/DIV knob; left (down) or right (up).	**VOLTS/DIV**
	Range	1mV/div ~ 10V/div 1-2-5 increments

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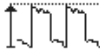
The vertical scale indicator for each channel on the bottom of the display changes accordingly.

❶ ▬ 10mV ❷
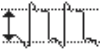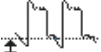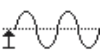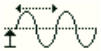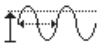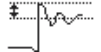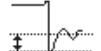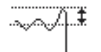
2-2. Automatic Measurement

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

2-2-1. Measurement Items

	V/I Measurements		Time Meas.		Delay Meas.	
Overview	Pk-Pk		Frequency		FRR	
	Max		Period		FRF	
	Min		RiseTime		FFR	
	Amplitude		FallTime		FFF	
	High		+Width		LRR	
	Low		-Width		LRF	
	Mean		Dutycycle		LFR	
	Cycle Mean		+Pulses		LFF	
	RMS		-Pulses		Phase	
	Cycle RMS		+Edges			
	Area		-Edges			
	Cycle Area					
	ROVShoot					
	FOVShoot					
	RPREShoot					
	FPREShoot					
Voltage/Current Measurement	Pk-Pk (peak to peak)		Difference between positive and negative peak. (=max − min)			
	Max		Positive peak.			
	Min		Negative peak.			

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Amplitude		Difference between the global high value and the global low value, measured over the entire waveform or gated region. (=high − low)
High		Global high voltage. See page 30 for details.
Low		Global low voltage. See page 30 for details.
Mean		The arithmetic mean value is calculated for all data samples as specified by the Gating option.
Cycle Mean		The arithmetic mean value is calculated for all data samples within the first cycle found in the gated region.
RMS		The root mean square of all data samples specified by the Gating option.
Cycle RMS		The root mean square value is calculated for all data samples within the first cycle found in the gated region.
Area		Measures the positive area of the waveform and subtracts it from the negative area. The ground level determines the division between positive and negative areas.
Cycle Area		The Summation based on all data samples within the first cycle found in the gated region.
ROVShoot		Rise overshoot
FOVShoot		Fall overshoot
RPRE-Shoot		Rise preshoot
FPRE-Shoot		Fall preshoot

Time Measurement	Frequency		Frequency of the waveform.
	Period		Waveform cycle time. (=1/Freq)
	RiseTime		The time required for the leading edge of the first pulse to rise from the low reference value to the high reference value.
	FallTime		The time required for the falling edge of the first pulse to fall from the high reference value to the low reference value.
	+Width		Positive pulse width.
	–Width		Negative pulse width.
	Duty Cycle		Ratio of signal pulse compared with whole cycle. =100x (Pulse Width/Cycle)
	+Pulses		Measures the number of positive pulses.
	-Pulses		Measures the number of negative pulses.
	+Edges		Measures the number of positive edges.
	-Edges		Measures the number of negative edges.
Delay Measurement	FRR		Time between: Source 1 first rising edge and Source 2 first rising edge.
	FRF		Time between: Source 1 first rising edge and Source 2 first falling edge.
	FFR		Time between: Source 1 first falling edge and Source 2 first rising edge.
	FFF		Time between: Source 1 first falling edge and Source 2 first falling edge.

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LRR		Time between: Source 1 first rising edge and Source 2 last rising edge.
LFR		Time between: Source 1 first rising edge and Source 2 last falling edge.
LRF		Time between: Source 1 first falling edge and Source 2 last rising edge.
LFF		Time between: Source 1 first falling edge and Source 2 last falling edge.
Phase		The phase difference of two signals, calculated in degrees. $$\frac{t1}{t2} \times 360°$$

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

2-2-2. Add Measurement

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

Add Measurement Item	1. Press the *Measure* key.	**Measure**
	2. Press *Add Measurement* from the bottom menu.	Add Measurement
	3. Choose either a *V/I*, *Time* or *Delay* measurement from the side menu and choose the type of measurement you wish to add.	V/I RMS Time Frequency Delay FRR

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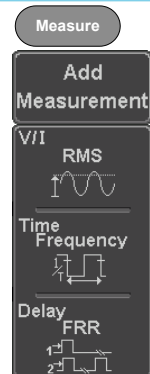
V/I (Voltage/ Current)	Pk-Pk, Max, Min, Amplitude, High, Low, Mean, Cycle Mean, RMS, Cycle RMS, Area, Cycle Area, ROVShoot, FOVShoot, RPREShoot, FPREShoot
Time	Frequency, Period, RiseTime, FallTime, +Width, –Width, Duty Cycle, +Pulses, -Pulses, +Edges, -Edges
Delay	FRR, FRF, FFR, FFF, LRR, LRF, LFR,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

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

Choose a Source	The channel source for measurement items can be set either before or when selecting a measurement item.
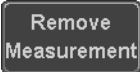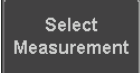
5. To set the source, press either the *Source1* or *Source2* key from the side menu and choose the source. Source 2 is only applicable for delay measurements.
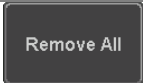
Range	CH1~ CH4, Math

2-2-3. Remove Measurement
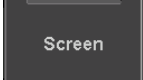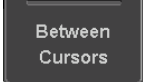
Individual measurements can be removed at any time using the Remove Measurement function.

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

| Remove All Items | Press *Remove All* to remove all the measurement items. | Remove All |
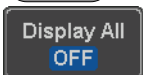
2-2-4. Gated mode

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

Set Gating Mode	1. Press the *Measure* key.	Measure
	2. Press *Gating* from the bottom menu.	Gating OFF
	3. Choose one of the gating modes from the side menu: *Off (full record)*, *Screen*, *Between Cursors*.	Off (Full Record)
		Screen
		Between Cursors

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

2-2-5. Display All mode

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

View Measurement Results	1. Press the *Measure* key.	Measure
	2. Press *Display All* from the bottom menu.	Display All OFF
	3. Press Source from the side menu and choose a measurement source. Range CH1~CH4, Math	Source CH1
	4. The results of Voltage and Time type measurements appear on the display.	

	10k pts	1GSa/s	
	① Measurement Summary		
① -25.0	Pk-Pk	1.04V	Frequency	24.98MHz
② 25.0n	Max	552mV	Period	40.02ns
△50.0n	Min	-488mV	RiseTime	12.00ns
dV/dt	Amplitude	1.04V	FallTime	12.16ns
	High	552mV	+Width	20.17ns
	Low	-488mV	-Width	19.85ns
	Mean	37.3mV	Dutycycle	50.39%
	CycleMean	72.3mV	+Pulses	249
	RMS	364mV	-Pulses	250
	CycleRMS	366mV	+Edges	249
	Area	373mVs	-Edges	250
	CycleArea	2.96mVs		
	ROVShoot	0.00%		
	FOVShoot	-7.69%		
	RPREShoot	?		
	FPREShoot	0.00%		

Add Measurement	Remove Measurement	Gating OFF	Display All CH1	High-Low Auto	Statistics	Reference Levels

Remove Measurements	To remove the measurement results, press *OFF*.	OFF

Delay Measurements	Delay type measurements are not available in this mode as only one channel is used as the source. Use the individual measurement mode (page 27) instead.

2-2-6. High Low Function

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

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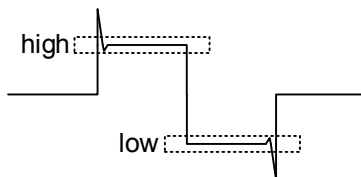
Min-max	Sets the high-low values as the minimum or maximum measured values.

high ⌷·····················⌷

⌷·················⌵·······⌷ low
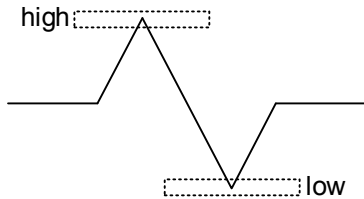
Set High-Low	1. Press the *Measure* key.	**Measure**
	2. Press *High-Low* from the bottom menu.	High-Low Auto
	3. Select the type of High-Low settings from the side menu. High-Low Settings: Histogram, Min-Max, Auto	
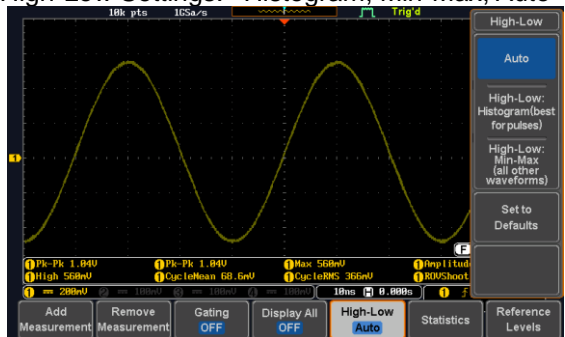
Restore Default High-Low Settings	To return to the default High-Low settings, press *Set to Defaults*.	Set to Defaults
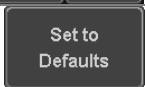
2-2-7. Statistics

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

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

Panel Operation

1. Press the *Measure* key.

Measure

2. Select at least one automatic measurement.

Page 27

3. Press *Statistics* from the bottom menu.

Statistics

4. Set the number of samples to be used in the mean and standard deviation calculations.
   Samples: 2~1000

Mean & Std Dev
Samples
2

5. Press *Statistics* and turn Statistics on.

Statistics
On   Off

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

	Value	Mean	Min	Max	Std Dev
Pk-Pk	1.04V	1.04	1.03	1.05	6.73n
Pk-Pk	1.04V	1.04	1.03	1.05	6.73n
Max	560mV	556m	552m	560m	3.97n
Amplitude	1.04V	1.04	1.03	1.05	6.73n
High	560mV	556m	552m	560m	3.97n
CycleMean	69.2nV	69.4n	37.8n	73.7n	710u
CycleRMS	365nV	365n	363n	367n	322u
ROVShoot	-6.11%	-6.73	-10.00	0.00	1.23

Reset Statistics	To reset the standard deviation calculations, press *Reset Statistics*.	Reset Statistics
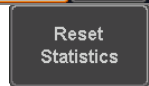
2-2-8. Reference Levels

Background	The reference level settings determine the measurement threshold levels for some measurements like the Rise Time measurement.	
High Ref 90.0%		High Ref: Sets the high reference level.
Mid Ref 50.0% 50.0%		Mid Ref: Sets the middle reference for the first and second waveforms.
Low Ref 10.0%		Low Ref: Sets the low reference level.
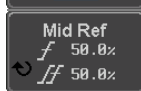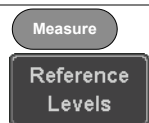
Panel Operation	1. Press the *Measure* key.	Measure
	2. Press *Reference Levels* from the bottom menu.	Reference Levels
	3. Set the reference levels from the side menu. Ensure the reference levels do not cross over. High Ref 0.0% ~ 100% Mid Ref(1) 0.0% ~ 100% Mid Ref(2) 0.0% ~ 100% Low Ref 0.0% ~ 100%	
Default Settings	4. Press *Set to Defaults* to set the reference levels back to the default settings.	Set to Defaults
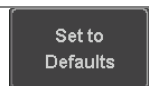
2-3. Cursor Measurement

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

2-3-1. Use Horizontal Cursors

Panel Operation   1. Press the *Cursor* key once.
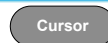
2. Press *H Cursor* from the bottom menu if it is not already selected.

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

OR

Range | Description
Left cursor (❶) movable, right cursor position fixed
Right cursor (❷) movable, left cursor position fixed
Left and right cursor (❶+❷) movable together

4. The cursor position information appears on the top left hand side of the screen
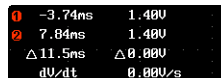
Cursor ❶   Hor. position, Voltage/Current
Cursor ❷   Hor. position, Voltage/Current
△   Delta (difference between cursors)
dV/dt or dI/dt

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

VARIABLE
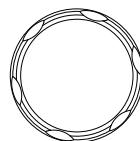
Select Units   6. To change the units of the horizontal position, press *H Unit.*
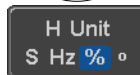
Units   S, Hz, % (ratio), ˚(phase)

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

Example

Horizontal cursors
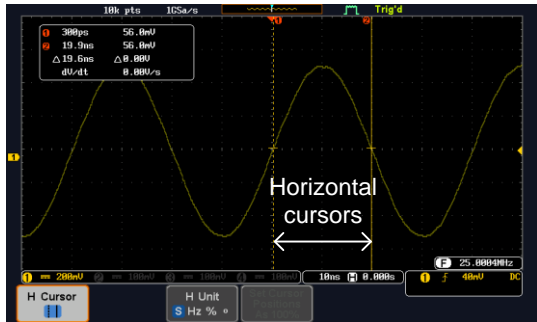
| FFT | FFT cursors can use different units. For FFT details, see page 41. | □ ❶ 1.0175GHz   21.2dB
○ ❷ 2.2700GHz   −51.4dB
△ 1.2525GHz △72.6dB
d/dt   −58.0ndB/Hz |
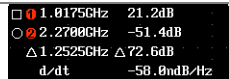
Cursor ❶	Hor. position, dB/Voltage
Cursor ❷	Hor. Position, dB/Voltage
△	Delta (difference between cursors)
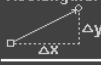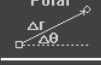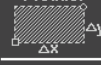
dV/dt or d/dt

Example

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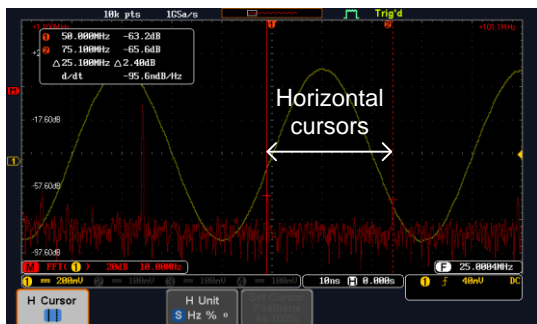
| XY Mode | XY mode cursors measure a number of X by Y measurements. |

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

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

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

△   Delta (difference between cursors)

Example   Horizontal cursors
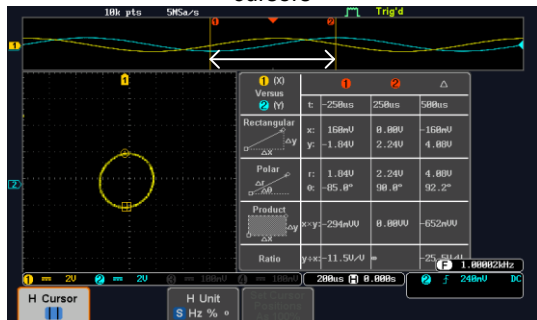
2-3-2. Use Vertical Cursors

Panel Operation/ Range

1. Press the *Cursor* key twice.

   Cursor x2

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

   V Cursor

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

   V Cursor

   OR

   Select
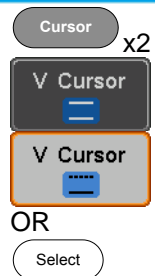
Range

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

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

	25.100MHz **❶** −7.20dB
○	50.100MHz **❷** −62.0dB
	△25.000MHz △54.8dB
	d/dt −2.19udB/Hz

☐,○   Time: cursor 1, cursor 2

❶,❷   Voltage/Current: cursor1, cursor2

△   Delta (difference between cursors)

dV/dt or dI/dt

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

VARIABLE

Select Units

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

V Unit
Base %
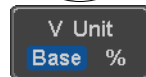
Units

Base (source wave units), % (ratio)

Base or Ratio Reference

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

Set Cursor
Positions
As 100%

Example

Horizontal cursors

Vertical cursors

H Cursor	V Cursor	H Unit		V Unit	
		S Hz % °		Base %	
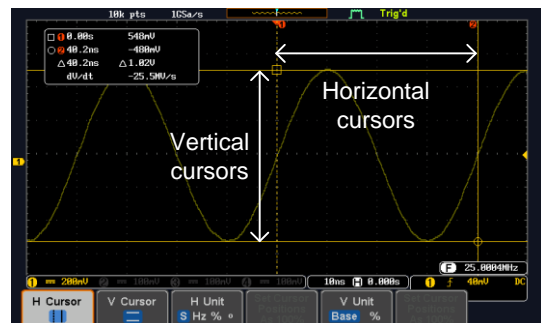
| FFT | FFT has different content. For FFT details, see page 41. | |

□, ○	Frequency/Time: cursor1, cursor2
❶, ❷	dB/V: cursor1, cursor2
△	Delta (difference between cursors)
d/dt	

Example

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

Cursor ❶	Rectangular, polar co-ordinates, product, ratio.
Cursor ❷	Rectangular, polar co-ordinates, product, ratio.
△	Delta (difference between cursors)

Example

Horizontal cursors

Vertical cursors

2-4. Math Operation

2-4-1. Basic Math Overview & Operators

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

2-4-1-1. Addition/Subtraction/Multiplication/Division

Panel Operation 1. Press the *Math* key.

MATH

M

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

Math

3. Select *Source 1* from the side menu

Source 1
CH1

Range   CH1~4, Ref1~4

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

Operator
+ − × ÷

Range   +, -, ×, ÷

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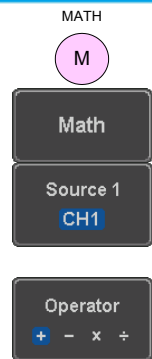
5. Select *Source 2* from the side menu.

Source 2
CH2

Range   CH1~4, Ref1~4

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

M **❶** + **❷**   5V   0.00Div

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

Example
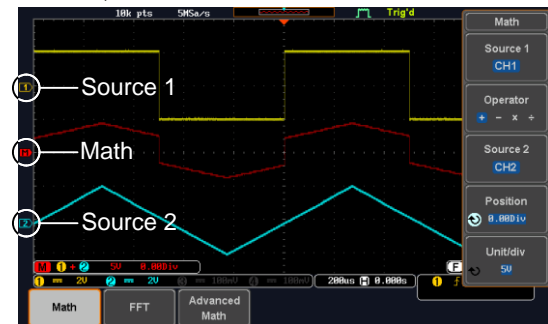
Position and Unit

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

Position
↻ 0.00Div

Range   –12.00 Div ~ +12.00 Div

To change the unit/div settings, press *Unit/div*, then use the *Variable* knob to change the unit/div.
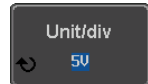
Unit/div
↻ 5V

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

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

Turn Off Math

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

MATH
Ⓜ

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2-4-2. FFT Overview & Window Functions

Background	The FFT Math function performs a Fast Fourier Transform on one of the input signals or the reference waveforms. The resultant spectrum will be shown on the screen in real-time. Four types of FFT windows are available: Hanning, Hamming, Rectangular, and Blackman, as described below.	
Hanning FFT Window	Frequency resolution	Good
	Amplitude resolution	Not good
	Suitable for....	Frequency measurement on periodic waveforms
Hamming FFT Window	Frequency resolution	Good
	Amplitude resolution	Not good
	Suitable for....	Frequency measurement on periodic waveforms
Rectangular FFT Window	Frequency resolution	Very good
	Amplitude resolution	Bad
	Suitable for....	Single-shot phenomenon (this mode is the same as having no window at all)
Blackman FFT Window	Frequency resolution	Bad
	Amplitude resolution	Very good
	Suitable for....	Amplitude measurement on periodic waveforms

2-4-2-1. FFT Operation

Panel Operation 1. Press the *Math* key.

MATH

M

2. Press *FFT* from the bottom menu.

FFT

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

Source 1
CH1

   Range   CH1~4, Ref~4

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

Vertical Units
dBV RMS

   Range   Linear RMS, dBV RMS

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

> Window
> Blackman
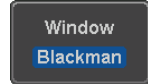
   Range   Hanning, Hamming, Rectangular, and Blackman.

6. The FFT result appears. For FFT, the horizontal scale changes from time to frequency, and the vertical scale from voltage/current to dB/RMS.
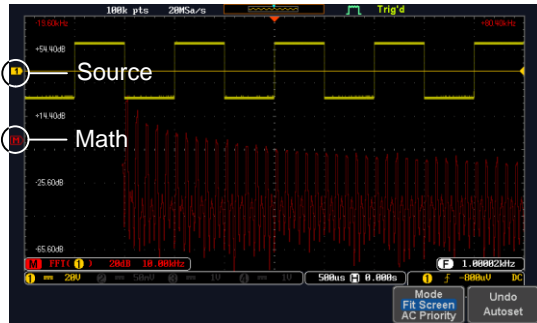
Position and Scale	To move the FFT waveform vertically, press *Vertical* until the *Div* parameter is highlighted and then use the Variable knob.	Vertical 20dB 1.88Div
	Range –12.00 Div ~ +12.00 Div	
	To select the vertical scale of the FFT waveform, press *Vertical* until the *dB* or *voltage* parameters are highlighted and then use the Variable knob.	Vertical 20dB 1.88Div
	Range 2mV~1kV RMS, 1~20 dB	
Horizontal Position and Scale	To move the FFT waveform horizontally, press *Horizontal* until the *Frequency* parameter is highlighted and then use the Variable knob.	Horizontal 50.0kHz/div 255.0kHz
	Range 0Hz ~ 2.5MHz	
	To select the horizontal scale of the FFT waveform, press *Horizontal* repeatedly until the *Hz/div* parameter is highlighted and then use the Variable knob.	Horizontal 50.0kHz/div 255.0kHz
	Range 10kHz/Div ~ 250kHz/Div	
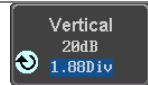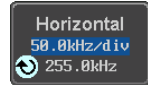
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2-4-3. Advanced Math Overview

Background	The advanced math function allows complex math expressions to be created based on the input sources, reference waveforms or even the automatic measurements available from the *Measure* menu (see page 24). An overview of each of the major parameters that can be used in the advanced math function are shown below:
Expression	Displays the function expression as it is created.
Source	Selects the source signal. Source CH1~4, Ref1~4
Function	Adds a mathematical function to the expression. Function Intg, Diff, log, Ln, Exp, Sqrt, Abs, Rad, Deg, Sin, Cos, Tan, Asin, Acos, Atan
Variable	Adds a user-specified variable to the expression. Source CH1~4, Ref1~4
Operator	Adds an operator or parenthesis to the function expression. Operator +, -, *, /, (,), !(, <, >, <=, >=, ==, !=, ||, &&
Figure	Adds a value to the expression. Figure Integers, floating point, or floating point with exponent values.
Measurement	Adds automatic measurements to the expression. Not all automatic measurements are supported. Measurement Pk-Pk, Max, Min, Amp, High, Low, Mean, CycleMean, RMS, CycleRMS, Area, CycleArea, ROVShoot, FOVShoot, Freq, Period, Rise, Fall, PosWidth, NegWidth, Dutycycle, FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF, Phase, RPRFShoot, FPREShoot, +Pulses, -Pulses, +Edges, -Edges

2-4-4. Advanced Math Operation

Panel Operation 1. Press the *Math* key.

MATH

M

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

Advanced Math
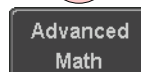
3. Press *Edit Expression*.
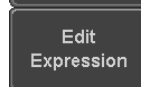
Edit Expression

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

Expression	CH1+CH2
Source	CH1 CH2 CH3 CH4 Ref1 Ref2 Ref3 Ref4
Function	Intg(Diff(log(ln(Exp(Sqrt(Abs(Rad(Deg(
	sin(cos(tan(asin(acos(atan(
Variable	VAR1 VAR2
Operator	+ - * / ( ) !(< > <= >= == != || &&
Figure	0 1 2 3 4 5 6 7 8 9 . E ,
	Pk-Pk(Max(Min(Amp(High(Low(Mean(CycleMean(RMS(
Measurement	CycleRMS(Area(CycleArea(ROVShoot(FOVShoot(Freq(
	Period(Rise(Fall(PosWidth(NegWidth(Dutycycle(FRR(
	FRF(FFR(FFF(LRR(LRF(LFR(LFF(Phase(

Press 'Select' when mathematics picked up by 'VARIABLE'.

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

Clear

6. Use the *Variable* knob and *Select* key to create an expression. Use the *Variable* knob to highlight a source, function, variable, operator, figure or measurement in orange. Press the *Select* key to make the selection. If a particular parameter is grayed out, it indicates that that particular parameter is not available at that time.
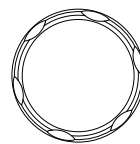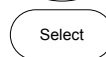
VARIABLE

Select

Back Space 1. To delete the last parameter press *Back Space*.

Back Space

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

OK Accept

Example: CH1 + CH2	

Source1

Advanced Math
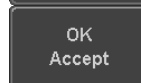
Source2
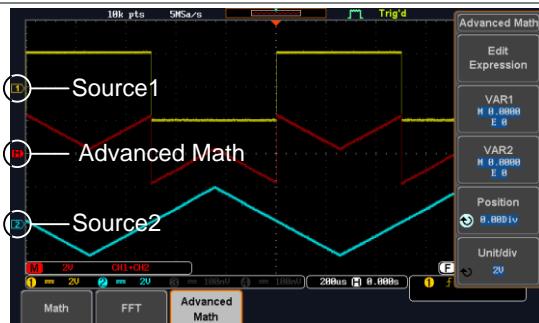
Set the VAR1 & VAR2	1. Press *VAR1* or *VAR2* to set VAR1/VAR2 if they were used in the expression created previously.	VAR1 M 0.0000 E 0
	2. Press *Mantissa*. Use the *Left* and *Right* arrow keys to select a digit and use the variable knob to set the value of the selected digit.	Variable 1
	3. Press *Exponent*. Use the Variable knob to set the exponent of the variable.	Mantissa ⟳ +00.0000
	4. Press *Go Back* to finish editing VAR1 or VAR2.	Exponent ⟳ 0
		Go Back
Vertical Position and Scale	1. Press *Unit/div* and use the Variable knob to set the vertical scale of the math waveform.	Unit/div ⟳ 2V
	2. Press *Position* and use the Variable knob to set the vertical position of the math waveform on the display.	Position ⟳ 0.00Div
Clear Advanced Math	To clear the advanced math result from the display, press the *Math* key again.	MATH (M)

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3. CONFIGURATION

3-1. Acquisition

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

3-1-1. Select Acquisition Mode

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

Panel Operation	1. Press the *Acquire* key.
	2. To set the Acquisition mode, press *Mode* on the bottom menu.
	3. Select an acquisition mode from the side menu.
	4. If *Average* was chosen, set the number of samples to be used for the average function.

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

Acquire

Mode
Sample

Sample

Peak Detect

Average
4

Example	Sample	Peak Detect

Average (256 times)
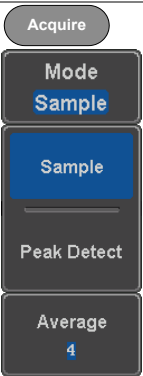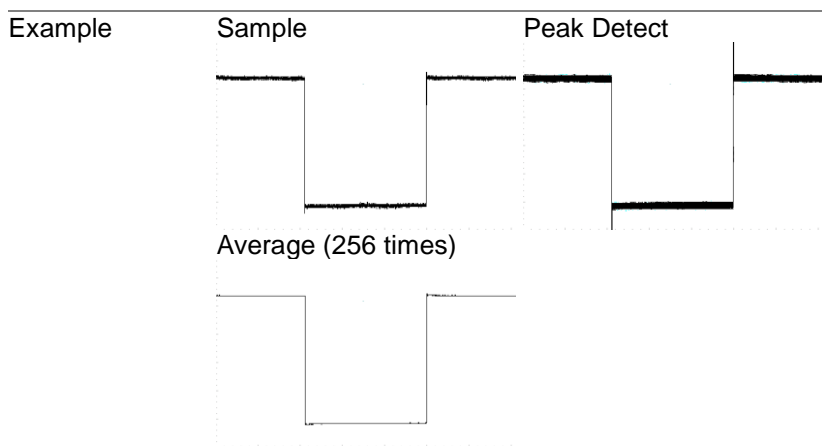
3-1-2. Show Waveform in XY Mode

Background	The XY mode maps the input of channel 1 to the input of channel 2. In 4 channel models, the input of channel 3 can be mapped to the input of channel 4. This mode is useful for observing the phase relationship between waveforms.
Connection	1. Connect the signals to Channel 1 (X-axis) and Channel 2 (Y-axis) or Channel 3 (X2-axis) and Channel 4 (Y2-axis). 2. Make sure a channel pair is active (CH1&CH2 or CH3&CH4). Press the Channel key if necessary. A channel is active if the channel key is lit.
Panel Operation	3. Press the *Acquire* menu key. 4. Press *XY* from the bottom menu. 5. Choose *Triggered XY* from the side menu.
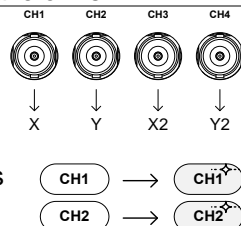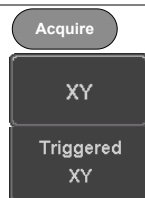
X-Y mode is split into two windows. The top window shows the signals over the full time range. The bottom window shows XY mode.
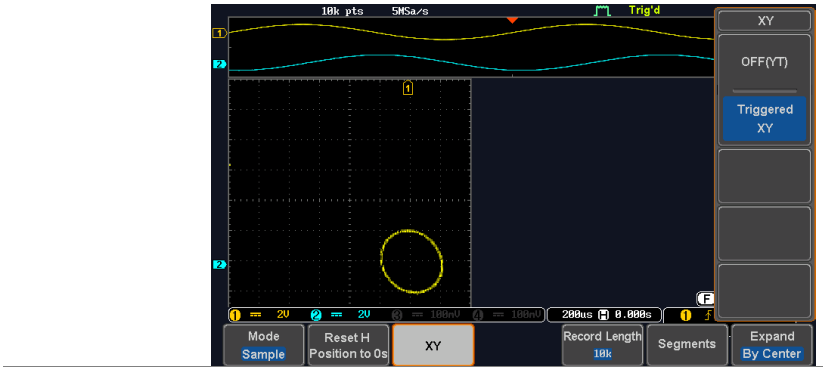
To move the X Y waveform position, use the vertical position knob: Channel 1 knob moves the X Y waveform horizontally, Channel 2 knob moves the X Y waveform vertically. Similarly, the X2 and Y2 axis can be positioned using the channel 3 and channel 4 vertical position knobs.
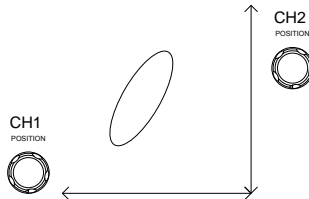
The horizontal position knob and horizontal Scale knob can still be used under the XY mode.

Turn Off XY Mode	To turn off XY mode, choose *OFF (YT)* mode.	
Cursors and XY Mode	Cursors can be used with XY mode. See the Cursor chapter for details.	Page 33

3-1-3. Set the Record Length

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

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

Limitations

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

Panel Operation   1. Press the *Acquire* key.

           2. Press the *Record Length* key on the bottom menu and choose the record length.
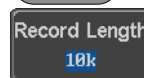
           Record length   1000, 10k, 100k, 1M, 10M points
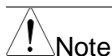
⚠ Note   The sampling rate may also be changed when the record length is changed.

3-2. Segmented Memory Acquisition (Option)

The advanced segmented memory utility allows the scope memory to be divided into different segments. Each time the scope is triggered, it only acquires data for one segment of memory at a time. This allows you to optimize the scope memory to only perform signal acquisition during important signal events.

For example, for a signal with a number of pulses, normally the oscilloscope will acquire the signal until the acquisition memory of the scope is filled up and then it will re-arm the trigger and then capture again. This could result in a number of events not being captured or captured at a less-than-desired resolution (depending on the horizontal scale and sampling rate). However, the segmented memory function would effectively allow you to capture more of the

signal than you would otherwise. The diagrams below illustrate this point.

Normal acquisition mode example:

Normal memory acquisition period   Rearm time   Next trigger
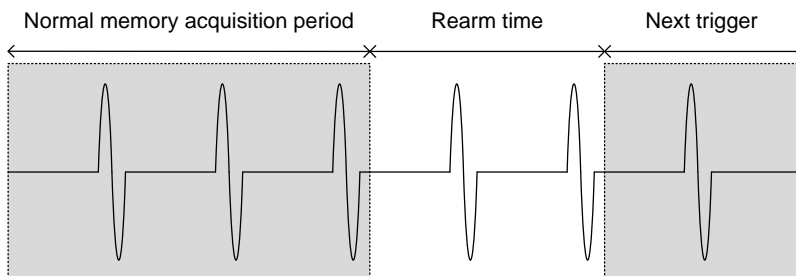
Segmented memory acquisition example:

Segment n   Segment n+1   Segment n+2   Segment n+3   Segment n+4   Segment n+5
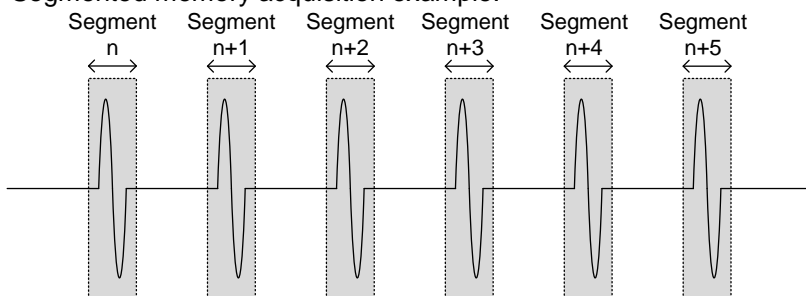
As shown above, the memory is divided into segments to increase the number of events that can be effectively captured with the same acquisition memory. Also notice that the scope doesn't need to rearm the trigger between each segment, this makes the segmented memory function especially useful for high speed signals. The time between each segment is also recorded so that accurate signal timing can also be measured.

The segmented memory function also supports automatic measurements for each segment or statistics for all the captured segments.

3-2-1. Segments Display

Progress Indicator
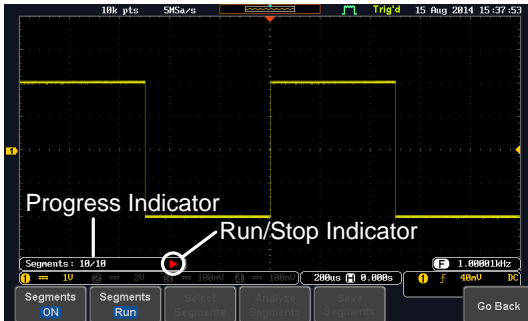
Run/Stop Indicator

Progress Indicator	**Segments: 10/10** ▶
	Indicates the number of segments that have to been captured relative to the set number of segments.
Run/Stop Indicator	☐ Stop: The segments have finished acquiring or have been stopped.
	▶ Run: The scope is ready to acquire segments.

3-2-2. Set the Number of Segments

Note	Before the Segment function can be used, set the trigger settings as appropriate for the signal you wish to use. The number of segments that can be used depends wholly on the record length. See page 49 to set the record length.

Record length	Number of segments
1000 pt.	1 ~ 29000
10k pt.	1 ~ 2900
100k pt.	1 ~ 290
1M pt.	1 ~ 20
10M pt.	1 ~ 2

Panel Operation   1. Press the *Acquire* key.   `Acquire`

2. Press *Segments* on the bottom menu.   `Segments`

3. Press *Select Segments* and set the number of segments from the side menu.   `Select Segments`

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	Num of Seg	1~29000 (record length dependant)
	Set to Maximum	Sets to the maximum number
	Set to Minimum	Sets to 1 segment

⚠️ Note
The Select Segments icon is only available when when Segments = OFF or when Segments is in the STOP mode (see the section below).

3-2-3. Run Segmented Memory

Background
Before the Segmented Memory function can be used, set the trigger settings as appropriate for the signal you wish to use. See page 89 for configuring the trigger settings.

Run Segments
1. Toggle *Segments On* from the bottom menu.

Segments
OFF
→
Segments
ON

2. Toggle *Segments* Run from the bottom menu.

Segments
Stop
→
Segments
Run

3. The scope will automatically start acquiring segments. The progress of the segmented memory capture is shown in the Progress Indicator.

4. The Run Indicator will be shown when in the Run mode and the Segments icon will also indicate that the function is in run mode.

Progress Indicator
Run Indicator
Segments: 10/10
1 = 1V   2 = 2V   3 = 100mV   4 = 100mV   200us ⊞ 0.000s
Segments   Segments   Select   Analyze   Save
ON   Run   Segments Segments Segments

Segment (Run)icon

5. When the scope has finished acquiring segments, press *Segments Run* to toggle the mode to the *Segments Stop* mode.

Segments
Run
→
Segments
Stop

Alternatively, the *Run/Stop* key can be pressed.

(**Run/Stop**)

6. The Stop Indicator will be shown when in the Stop mode.
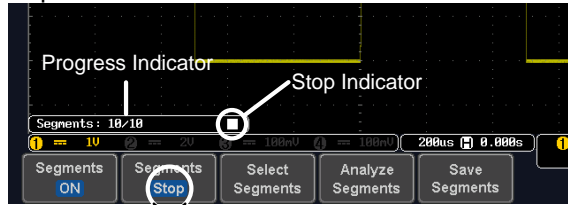
Segment (Stop)icon

The scope is now ready to navigate or analyze the acquired segments.

Rerun Segmented Acquisition	7. To rerun the segments, press the *Segments Stop* key to toggle the mode back to the *Segments Run* mode.

Alternatively, press the *Run/Stop* key again.　　　**Run/Stop**
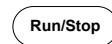
8. Repeat steps 3 and 4 in the section above when the segmented acquisition has completed.

3-2-4. Navigate Segmented Memory

Background	After the segmented memory acquisitions have been captured you can navigate through each segment one at a time.
Operation	1. Press *Select Segments* from the bottom menu. This key will be available in the Stop mode.　　**Select Segments**
	2. To navigate to the segment of interest, press *Current Seg* from the side menu and use the Variable knob to scroll to the segment of interest.　　**Current Seg 10**
	Alternatively, the *Set to Minimum* and *Set to Maximum* keys can be used to jump to the first and last segment respectively.
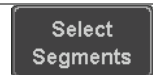
3. The position in time of the selected segment relative to the time of the first segment is shown in the *Segments Time* key.

Segments Time
27.00ns

3-2-5. Play Through Each Segment

Background	When all the segments have been acquired, the play/pause key can be used to play back through each segment.
Operation	1. Make sure the scope is in *Segments Stop* mode. See page 52 for details.
	2. Press the *Play/Pause* key to run through the acquired segments in numerical order.
	• Press the Play/Pause key again to pause the playback.
	• When the scope has played through to the last segment, pressing the Play/Pause key again will play through each segment again in reverse order.

▶/Ⅱ
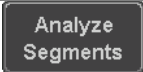
3-2-6. Segment Measurement

Background	The Segmented memory function can be used in conjunction with the automatic measurements in the Measurement menu.	
Modes	Segments Measure	This function will either perform statistics calculations on the segments or tabulate a list of the measurement results.
	Segments Info	Provides configuration information common for all the acquired memory segments.

3-2-7. Automatic Measurement

Background	The Segments Measure function allows you to view automatic measurements for the segments in statistical bins or as a list displaying the result of each automatic measurement.

	Statistics	This function will bin the measurement results of a single automatic measurement into a user-defined number of bins. This allows you to easily view statistics for a large number of segments. For example, the statistics function will display the number of results for each bin and the measurement range of each bin for the selected automatic measurement.
	Measurement List	Puts all the measurement results for a segment in a list. All the currently selected automatic measurement results are listed. A maximum of 8 automatic measurements can be used with this function.
Note	To use automatic measurements with the segmented memory, automatic measurements must first be selected from the Measure menu before the segmented memory function is run.	
Setup	Press the *Measure* key and select any *single* source measurement from the *Add Measurement* menu. See page 27 for details on how to add automatic measurements.	**Measure**
Operation	1. Press *Analyze Segments* from the Segments menu. Note: This key will only be available in the Stop mode.	**Analyze Segments**
	2. Press *Segments Measure*.	**Segments Measure**
	3. Select either the statistics or the measurement list from the side menu.	Statistics List

4. The statics table or measurement list appears on the display.
   Note that the more segments that you have, the longer it will take to calculate the statics or list the measurement results.

5. For statistic measurements, press *Plot Source* to choose which automatic measurement to use for the statistics calculations. The statistics for only one automatic measurement can be viewed at a time.

ⓘ FPREShoot ⓘ RPREShoot ⓘ Pk-Pk	Plot Source

6. For the measurement list, press *Source* and select the source channel for measurement.

   Range   CH1 ~ CH4

Source CH1

Statistics Results	This function will bin the measurement results of the selected automatic measurement into a user-defined number of bins.
Setup	1. To select the number of bins for the statistics, press *Divided by* and select the number of bins with the Variable knob.

Divided by ↻ 10

   Range   1~20 bins

2. Press *Select* and use the Variable knob to view the measurement results for each bin.
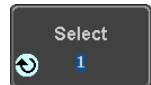
Select ↻ 1

Example: Statistics
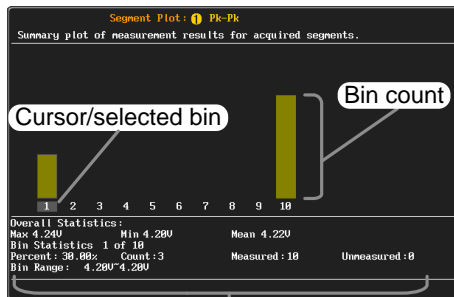
Statistics of currently selected bin

Measurement List	Puts all the measurement results for a segment in a list.

Setup	1. Press *Select* and use the variable knob to scroll through each segment.	Select ↻ 1

Example: Measurement List		

Select cursor

Measurement types

Measurement results

Save	1. Press *Save Meas. to File* to save all measurement data to CSV file.	Save Meas. to File

3-2-8. Segment Info

Operation	1. Press *Analyze Segments* from the bottom menu.	Analyze Segments
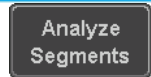
Note: This key will only be available in the Stop mode.

2. Press *Segments Info*.

Segments Info
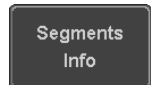
3. A table showing all general setting information for the segmented memory acquisitions is shown on the display.

Info: Sample rate, Record length, Horizontal, Vertical

```
DSO Segmented Info.

Samplerate: 1GSa/s
Record Length: 1000 points
Horizontal: 0.000s @ 200ns/div
Vertical:   ❶ 80.000mV @ 1V/div
```

3-2-9. Save Segment

Background   Segments waveform data can be saved in CSV format by specifying a section.

Operation   1. Press Save Segment from the bottm menu.
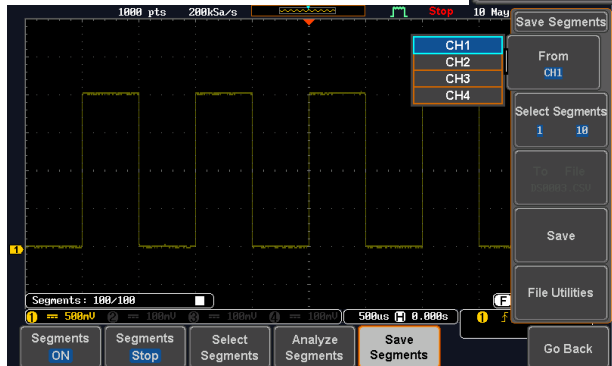
2. Press *From* key and Select channel.

3. Press *Select Segment*.
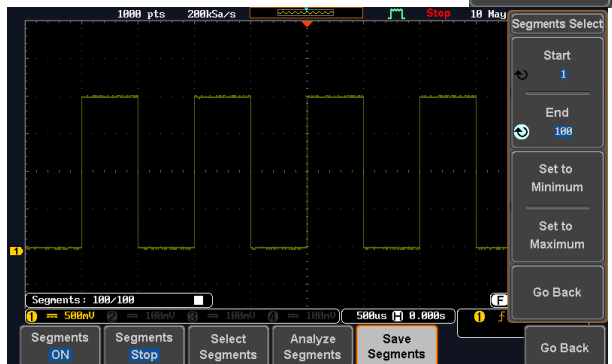
4. Press *Start* from the side menu and use the Variable knob to scroll to the segment of Start.

5. Press *End* from the side menu and use the Variable knob to scroll to the segment of End.

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

> Go Back

7. Press *Save* to save the file.

> Save

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

VARIABLE

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
.0123456789-_

Press *Enter Character* or the *Select* key to select a number or letter.
Press *Back Space* to delete a character.

> Enter Character

> Back Space

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

> Save Now

Waveform saved to USB:/DS0001.CSV.

10. There are two types of waveform data, Fast CSV format and Detail CSV format .
Please switch as necessary. (See 5-3-3.)
If LSF format is selected, it is saved with Detail CSV format.

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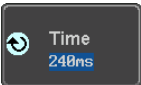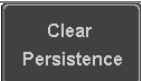
3-3. Display

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

3-3-1. Display Waveform as Dots or Vectors
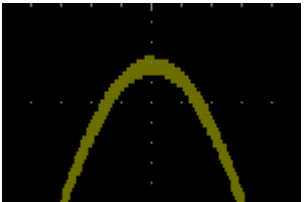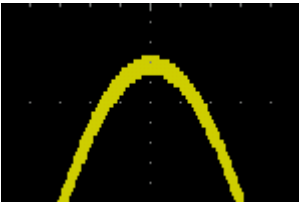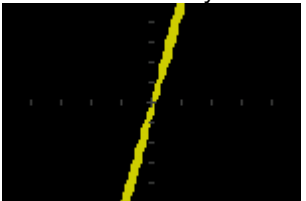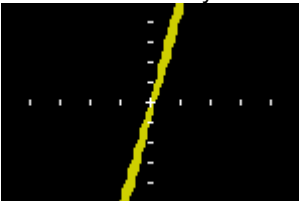
Background	When the waveform is displayed on the screen, it can be displayed as dots or vectors.

Panel Operation	1. Press the *Display* menu key.	**Display**
	2. Press *Dot / Vector* to toggle between Dot and Vector mode.	Dot **Vector**

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

Example:	Vectors	Dots
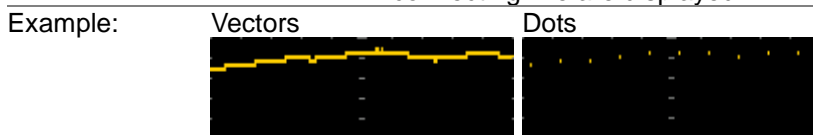
3-3-2. Set the Level of Persistence

Background	The persistence function allows the DCS-1000B to mimic the trace of a traditional analog oscilloscope. A waveform trace can be configured to "persist" for a designated amount of time.

Panel Operation	1. Press the *Display* menu key.	**Display**
	2. To set the persistence time, press the *Persistence* menu button on the bottom bezel.	**Persistence** 240ms
	3. Use the Variable knob to select a persistence time.	Time 240ms
	Time	16ms, 30ms, 60ms, 120ms, 240ms, 0.5s, 1s, 2s,~4s, Infinite, Off

Clear	To clear persistence, press *Clear Persistence*.	Clear Persistence

3-3-3. Set the Intensity Level

Background	The intensity level of a signal can also be set to mimic the intensity of an analog oscilloscope by setting the digital intensity level.
Panel Operation	1. Press the *Display* menu key. **Display**
	2. Press *Intensity* from the bottom menu. **Intensity**
Waveform Intensity	3. To set the waveform intensity, press *Waveform Intensity* and edit the intensity. Range 0~100%
Example	Waveform Intensity 50% Waveform Intensity 100%

Graticule Intensity	4. To set the graticule intensity, press *Graticule Intensity* from the side menu and edit the intensity value. Range 10~100%
Example	Graticule Intensity 10% Graticule Intensity 100%

Backlight Intensity	5. To set the LCD backlight intensity, press *Backlight Intensity* from the side menu and edit the intensity value. Range 2~100%

Backlight Auto-Dim	6. To automatically dim the backlight after a set duration, set *Backlight Auto-Dim* to On and then set *Time* to the appropriate time. After the set amount of time with no panel activity, the screen will dim until a panel key is pressed again. This function will prolong the life of the LCD display.
	Range 1~180 min

3-3-4. Select Display Graticule

Panel Operation 1. Press the *Display* menu key.

2. Press *Graticule* from the bottom menu.

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

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

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

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

Frame: Shows only the outer frame.

3-3-5. Freeze the Waveform (Run/Stop)
For more details about Run/Stop mode, see page 21.

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

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

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

Run/Stop → Run/Stop
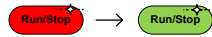
3-3-6. Turn Off Menu

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

MENU OFF

OPTION
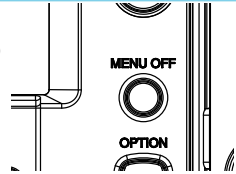
See page 14 for more information.

3-4. Horizontal View

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

3-4-1. Move Waveform Position Horizontally

Panel Operation	The horizontal position knob moves the waveform left/right. As the waveform moves, a position indicator on the on the top of the display indicates the horizontal position of the waveform in memory.

◀ POSITION ▶

PUSH TO ZERO
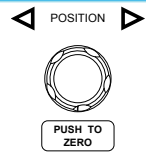
Reset Horizontal Position	1. To reset the horizontal position, press the Acquire key and then press *Reset H Position to 0s* from the bottom menu. Alternatively, pushing the horizontal position knob will also reset the position to zero.

Acquire

Reset H Position to 0s

◀ POSITION ▶

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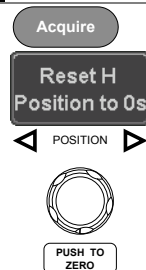
Run Mode	In Run mode, the memory bar keeps its relative position in the memory since the entire memory is continuously captured and updated.

3-4-2. Select Horizontal Scale

Select Horizontal Scale	To select the timebase (time/div), turn the horizontal Scale knob; left (slow) or right (fast).	**SCALE**
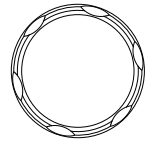
Range 5ns/div ~ 100s/div, 1-2-5 increment
The timebase indicator updates as the horizontal scale is adjusted.
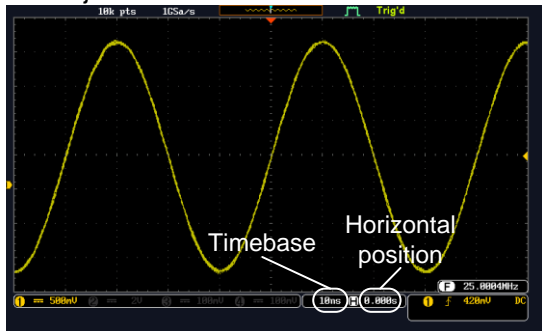
Run Mode	In Run mode, the memory bar and waveform size keep their proportion. When the timebase becomes slower, roll mode is activated (if the trigger is set to Auto).
Stop Mode	In Stop mode, the waveform size changes according to the scale.
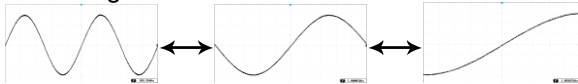
3-4-3. Select reference point of the horizontal expansion

Background	Tthe ability to change the center point of the horizontal expansion.
Panel Operation	1. press the Acquire key
	2. Press the Expand key and choose By Center or By Trigger Pos.

Acquire

Expand
By Trigger Pos

3-4-4. Select Waveform Update Mode

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

Roll mode

Select Roll Mode Manually	1. Press the Trigger *Menu* key.
	2. Press *Mode* from the bottom menu and select *Auto (Untriggered Roll)* from the side menu.

3-4-5. Zoom Waveform Horizontally

Background	When in Zoom mode, the screen is split into 2 sections. The top of the display shows the full record length, while the bottom of the screen shows the normal view.
Panel Operation	1. Press the *Zoom* key.
	2. The Zoom mode screen appears.

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Trigger position | Horizontal position

Zoom window

Zoom position

Zoom timebase
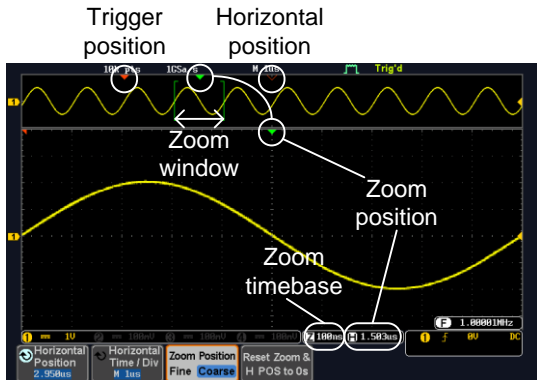
Horizontal Navigation	To scroll the waveform left or right, press *Horizontal Position* and use the *Variable Position* knob. The horizontal position will be shown on the *Horizontal Position* icon.	
Horizontal Scale	To change the horizontal scale, press *Horizontal Time/Div* and use the *Variable Position* knob. The scale will be shown on the *Horizontal Time/Div* icon.	
Zoom	To increase the zoom range, use the horizontal *Scale* knob. The zoom time base (Z) at the bottom of the screen will change accordingly.	
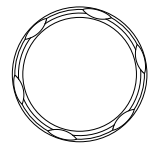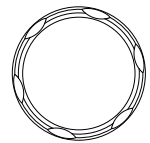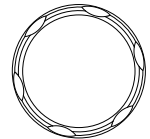
| Move the Zoom Window | Use the *Horizontal Position* knob to pan the zoom window horizontally. To reset the zoom position, press the *Horizontal Position* knob. | |

66
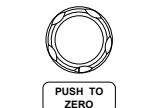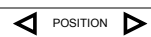
The position of the zoom window, relative to the horizontal position is shown at the bottom of the screen next to the Zoom timebase.
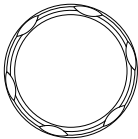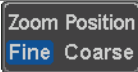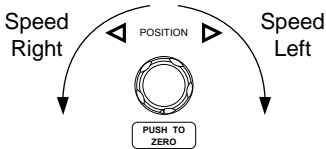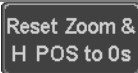
Scroll Sensitivity	To alter the scrolling sensitivity of the zoom window, press the *Zoom Position* key to toggle the scrolling sensitivity. Sensitivity Fine, Coarse	Zoom Position Fine Coarse
Reset the Zoom & Horizontal Position	To reset both the zoom and horizontal position, press *Reset Zoom & H POS to 0s.*	Reset Zoom & H POS to 0s
Exit	To go back to the original view, press the *Zoom* key again.	Zoom

3-4-6. Play/Pause

Background	The Play/Pause key can be used to play through signals in the Zoom mode.
Note	If the Segmented memory function is turned on, pressing the play pause key will play through memory segments. See page 54 for information.
Panel Operation	1. Press the *Play/Pause* menu key. ▶/Ⅱ

2. The scope will go into the Zoom Play mode and begin to scroll through the acquisition (from left to right).
The full-record length waveform will be shown at the top and the zoomed section will be shown at the bottom. The Play/Pause indicator shows the play status.

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Zoom	To increase the zoom range, use the horizontal *Scale* knob. The zoom time base (Z) at the bottom of the screen will change accordingly.	**SCALE**

Z 100ns **H** 0.000s

Scroll Speed	To alter the scrolling speed of the zoom window, press the *Zoom Position* key to toggle the scrolling speed. Sensitivity Fine, Coarse Alternatively, use the horizontal position knob to control the scroll speed. • Turning the Horizontal knob determines the speed and direction of the scrolling.	Zoom Position Fine Coarse

Speed Right ◁ POSITION ▷ Speed Left

PUSH TO ZERO

Reset the Zoom Position	To reset both the zoom position and horizontal position, press *Reset Zoom & H POS to 0s.*	Reset Zoom & H POS to 0s
Pause	Press the *Play/Pause* key to pause or resume playing the waveform.	►/❚❚
Reverse Direction	Press the *Play/Pause* key when at the end of the record length to play back through the waveform in reverse.	►/❚❚
Exit	To exit, press the Zoom key.	Zoom

3-5. Vertical View (Channel)

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

3-5-1. Move Waveform Position Vertically

Panel Operation	1. To move the waveform up or down, turn the *vertical position* knob for each channel.	POSITION PUSH TO ZERO
	2. As the waveform moves, the vertical position of the cursor appears at the bottom half of the display.	

Position = 0.00V

View or Set the Vertical Position	3. Press a channel key. The vertical position is shown in the ↺*Position / ↧Set to 0* soft key.	CH1
	4. To change the position, press ↺*Position /↧Set to 0* to reset the vertical position or turn the *vertical position* knob to the desired level.	↺ Position / ↧ Set to 0 1.000V POSITION PUSH TO ZERO
Run/Stop Mode	The waveform can be moved vertically in both Run and Stop mode.	

3-5-2. Select Vertical Scale

Panel Operation	To change the vertical scale, turn the VOLT/DIV knob; left (down) or right (up).	VOLTS/DIV
	The vertical scale indicator on the bottom left of the display changes accordingly for the specific channel.	1V Coupling DC AC GND
	Range 1mV/div ~ 10V/div. 1-2-5 increments	
Stop Mode	In Stop mode, the vertical scale setting can be changed.	
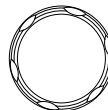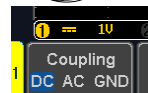
3-5-3. Select Coupling Mode

Panel Operation	1. Press a *channel* key.	**CH1**
	2. Press *Coupling* repeatedly to toggle the coupling mode for the chosen channel.	Coupling DC AC GND
Range	① ▬ 1U Coupling DC AC GND	DC coupling mode. The whole portion (AC and DC) of the signal appears on the display.
	① ∿ 2U Coupling DC AC GND	AC coupling mode. Only the AC portion of the signal appears on the display. This mode is useful for observing AC waveforms mixed with DC signals.
	① ⊓⊔ 1U Coupling DC AC GND	Ground coupling mode. The display shows only the zero voltage level as a horizontal line.
Example	Observing the AC portion of the waveform using AC coupling
	DC coupling AC coupling
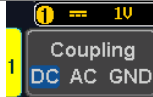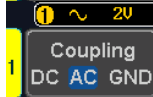
3-5-4. Input Impedance

Background	The input impedance of the DCS-1000B is fixed at 1MΩ. The impedance is displayed in the channel menu.

View Impedance	1. Press the *Channel* key.	**CH1**
	2. The impedance is displayed in the bottom menu.	Impedance 1MΩ

3-5-5. Invert Waveform Vertically

Panel Operation	1. Press the *Channel* key.	**CH1**
	2. Press *Invert* to toggle Invert On or Off.	Invert On Off
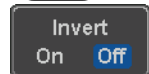
3-5-6. Limit Bandwidth

Background	Bandwidth limitation puts the input signal into a selected bandwidth filter. This function is useful for cutting out high frequency noise to see a clear waveform shape. The bandwidth filters available are dependent on the bandwidth of the oscilloscope model.
Panel Operation	1. Press the *Channel* key.

CH1

2. Press *Bandwidth* from the bottom menu.

> Bandwidth
> Full

3. Choose a bandwidth* from the side menu.
   *Depending on the bandwidth of the oscilloscope.
   > Range 70MHz models: Full, 20MHz
   >   100MHz models: Full, 20MHz
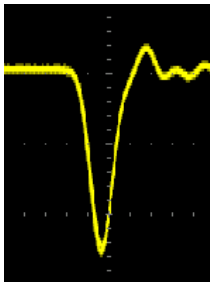
Example	BW Full	BW Limit 20MHz
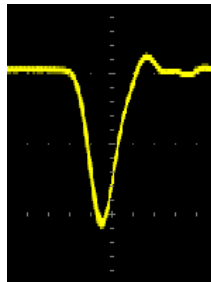
3-5-7. Expand by Ground/Center

Background	When the voltage scale is changed, the Expand function designates whether the signal expands from the center of the screen or from the signal ground level. Expand by center can be used to easily see if a signal has a voltage bias. Expand by ground is the default setting.
Panel Operation	1. Press a *channel* key.

CH1

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

> Expand
> By Ground

Example	If the vertical scale is changed when the Expand function is set to ground, the signal will expand from the ground level*. The ground level does not change when the vertical scale is changed. If the vertical scale is changed when the Expand function is set to center, the signal will expand from the center of the screen. The ground level will suit to match the signal position. *Or from the upper or lower edge of the screen if the ground level is off-screen.
Expand by Ground	Expand by Ground
Expand by Center	Expand by Center
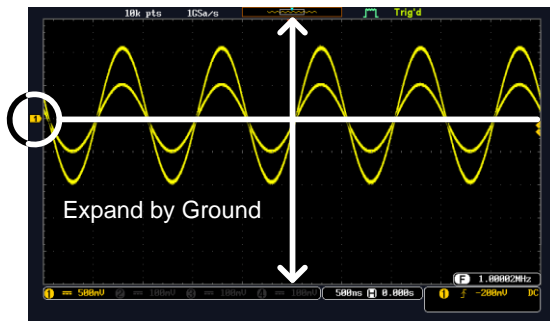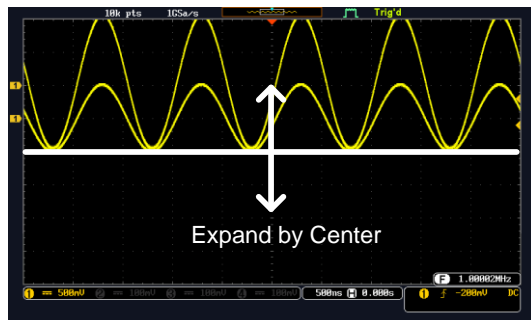
3-5-8. Select Probe Type

Background	A signal probe can be set to voltage or current.	
Panel Operation	1. Press the *Channel* key.	**CH1**
	2. Press *Probe* from the bottom menu.	Probe Voltage 1 X
	3. Press the *Voltage/Current* soft-key to toggle between voltage and current.	Voltage Current

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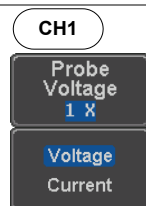
3-5-9. Select Probe Attenuation Level

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

Panel Operation	1. Press the *Channel* key.	**CH1**
	2. Press *Probe* from the bottom menu.	Probe Voltage 1 X
	3. Press *Attenuation* on the side menu and use the Variable knob to set the attenuation. Alternatively, press *Set to 10X*.	Attenuation 1 X Set to 10X
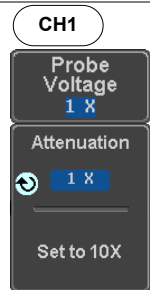
Range   1mX ~1kX (1-2-5 step)

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

3-5-10. Set the Deskew

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

Panel Operation	1. Press one of the *Channel* keys.	**CH1**
	2. Press *Probe* from the bottom menu.	Probe Voltage 1 X
	3. Press *Deskew* on the side menu and use the Variable knob to set the deskew time. Alternatively, press *Set to 0s* to reset the deskew time.	Deskew 0 s Set to 0s
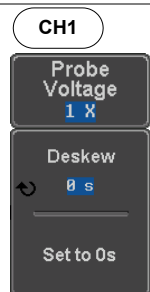
Range   -50ns~50ns, 10ps increments

4. Repeat the procedure for another channel if necessary.

3-6. Bus Key Configuration

The Bus key is used to configure the Serial bus inputs. The Bus menu also features event tables to track and save your bus data. The Bus key is used in conjunction with the Bus trigger (page 102) to decode serial bus signals.

3-6-1. Bus Display
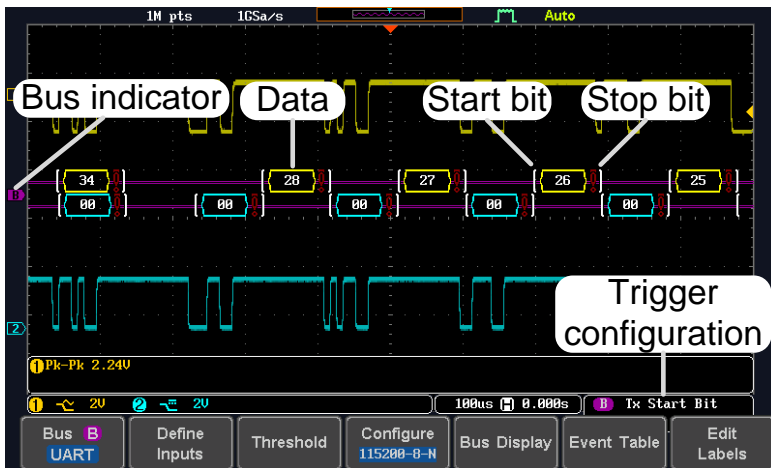
Start Bit/Start of Frame	[	The Start bit is shown as an open bracket.
Stop Bit/End of Frame	]	The Stop bit is shown as a closed bracket.
Data	F9	Data packets/frames can be shown in Hex or Binary. The color of the bus data indicates the type of data or the channel the data is coming from, depending on the bus type.

UART: Color of packet = Color of source channel.

I^2C: Color packet = SDA source channel.

SPI: Color of packet = MOSI or MISO source channel.

CAN: Purple = Error frame, Data length control (DLC), Overload.

             Yellow = Identifier.

             Cyan = Data.

             Orange = CRC.

             Red = Bit stuffing error

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	LIN:	Purple = Break, Sync and Checksum errors, Wakeup Yellow = Identifier, Parity Cyan = Data Red = Error type
Error Indicator/ Missing Ack		If there is an error/missing acknowledge in decoding the serial data, a red error indicator will be shown.
Bus Indicator		The Bus indicator shows the bus position. The active bus is shown with a solid color. The Variable knob can be used to horizontally position the Bus indicator when it is active.
		B Active bus **B** Activated bus (solid indicator) (transparent indicator)
Trigger Configuration		Shows the bus trigger (B) and the *Trigger On* settings.
		B Tx Start Bit

3-6-2. Serial Bus

The Serial Bus includes support for 5 common serial interfaces, SPI, UART, I^2C, CAN and LIN. Each interface is fully configurable to accommodate variations in the basic protocols.

Each input can be displayed as binary, hexadecimal or ASCII. An event table can also be created to aid in debugging.

3-6-2-1. Serial Bus Overview

UART		Universal Asynchronous Receiver Transmitter. The UART bus is able to accommodate a wide range of various common UART serial communications. The UART serial bus software is suitable for a number of RS-232 protocol variants.
	Inputs	Tx, Rx
	Threshold	Tx, Rx
	Configuration	Baud rate, Parity, Packets, End of packets, Input polarity
	Trigger On	Tx Start Bit, Rx Start Bit, Tx End of Packet, Rx End of Packet, Tx Data, Rx Data, Tx Parity Error, Rx Parity Error
I^2C		Inter Integrated Circuit is a two line serial data interface with a serial data line (SDA) and serial clock line (SCLK). The R/W bit can be configured.
	Inputs	SCLK, SDA

	Threshold	SCLK, SDA
	Configuration	Addressing mode, Read/Write in address
	Trigger On	Start, Repeat Start, Stop, Missing Ack, Address, Data, Address/Data
SPI	The SPI (Serial Interface Peripheral) bus is fully configurable to accommodate the wide variety of SPI interfaces. This bus is only available on 4 channel models.	
	Inputs	SCLK, SS, MOSI, MISO
	Threshold	SCLK, SS, MOSI, MISO
	Configuration	SCLK edge, SS logic level, Word size, Bit order
	Trigger On	SS Active, MOSI, MISO, MOSI&MISO
CAN	The CAN (Controller Area Network) bus is a 2-wire, message-based protocol.	
	Inputs	CAN Input
	Threshold	CAN Input
	Configuration	Signal Type, Bit Rate
	Trigger On	Start of Frame, Type of Frame, Identifier, Data, Id & Data, End of Frame, Missing Ack, Bit Stuffing Err.
LIN	The LIN (Local Interconnect Network) bus is used to decode a wide range of common LIN configurations.	
	Inputs	LIN Input
	Threshold	LIN Input
	Configuration	Bit Rate, LIN Standard, Include Parity Bits with Id
	Trigger On	Sync, Identifier, Data, Id & Data, Wakeup Frame, Sleep Frame, Error

3-6-2-2. UART Serial Bus Configuration

The UART bus menu is designed to decode RS-232 and other common RS-232 variants such as RS-422, RS-485. The software configuration is also flexible enough to decode the many proprietary protocols based on RS-232.

Background	Basic RS-232 protocol uses single-ended data transmissions. The signal voltage levels can be high (±15V) and employ active low signaling. High speed variants of RS-232, such as RS-422 and RS-485 use differential signaling and commonly employ low voltage differential signals with active high signaling. Universal Asynchronous Receiver/Transmitter (UART) or RS-232 driver/receiver ICs commonly used for embedded applications typically use active high signaling with standard IC signal levels.
Operation	1. Connect each of the bus signals (*Tx*, *Rx*) to one of the oscilloscope channels. Connect the ground potential of the bus to one of the probes' ground clip.

GND

Rx

Tx

BUS

2. Press the *BUS* key.

B
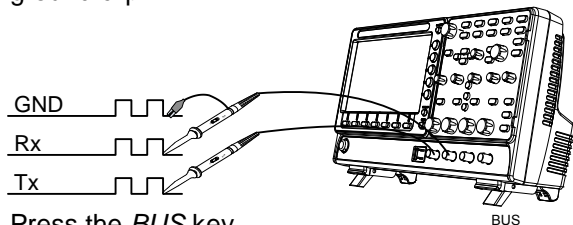
3. Press *Bus* from the bottom menu and choose the *UART* serial bus on the side menu.

Bus **B**
UART
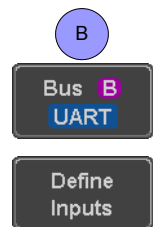
Define Inputs	1. Press *Define Inputs* from the bottom menu.

Define
Inputs

2. From the side menu choose the *Tx Input* and the *Rx Input* source and the signal polarity.

Tx	OFF, CH1 ~ CH4
Rx	OFF, CH1 ~ CH4

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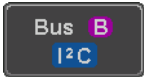
	Polarity	Normal (High = 0), Inverted (High = 1)

Configuration	The Configure key sets the baud rate, number of data bits and parity.

1. Press *Configure* from the bottom menu.

Configure
9600-8-N

2. From the side menu select the *Baud rate*, *Data bits*, *Parity*, *Packets* and *End of Packet bits*.

Baud Rate	50, 75, 110, 134, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 14400, 15200, 19200, 28800, 31250, 38400, 56000, 57600, 76800, 115200, 128000, 230400, 460800, 921600, 1382400, 1843200, 2764800
Data Bits	8 (fixed)
Parity	Odd, Even, None
Packets	On, Off
End of Packet (Hex)	00(NUL), 0A(LF), 0D(CR), 20(SP), FF

3-6-2-3. I^2C Serial Bus Interface

The I^2C bus is a 2 wire interface with a serial data line (SDA) and serial clock line (SCLK). The I^2C protocol supports 7 or 10 bit addressing and multiple masters. The scope will trigger on any of the following conditions: a start/stop condition, a restart, a missing acknowledge message, Address, Data or Address&Data frames. The I^2C trigger can be configured for 7 or 10 bit addressing with the option to ignore the R/W bit as well as triggering on a data value or a specific address and direction (read or write or both).

Panel operation	1. Connect each of the bus signals (*SCLK*, *SDA*) to one of the oscilloscope channels. Connect the ground potential to one of the probes' ground clip.

GND

SCLK

SDA

	2. Press the *Bus* key.	BUS **B**
	3. Press *Bus* from the bottom menu and choose I^2C from the side menu.	**Bus B** **I²C**
Define Inputs	1. Press *Define Inputs* from the bottom menu.	**Define Inputs**
	2. From the side menu choose the *SCLK* input and the *SDA* Input. SCLK CH1 ~ CH4 SDA CH1 ~ CH4	
Include R/W in address	To configure whether you want the R/W bit to be included in the address, press *Include R/W in address* and set to Yes or No in the side menu. R/W Bit Yes, No	**Include R/W in address Yes**

3-6-2-4. SPI Serial Bus Interface

The serial peripheral interface (SPI) is a full duplex 4 wire synchronous serial interface. The 4 signals lines: Serial clock line (SCLK), slave select (SS), Master output/slave input (MOSI, or SIMO) and the Master input/slave output (MISO, or SOMI). The word size is configurable from 4 to 32 bits. The SPI triggers on the data pattern at the start of each framing period. Note: The SPI bus is only available for 4 channel models.

Panel operation 1. Connect each of the bus signals (*SCLK*, *SS*, *MOSI*, *MISO*) to one of the channel inputs. Connect the ground potential of the bus to one of the probes' ground clip.

               2. Press the *Bus* key.

BUS

B

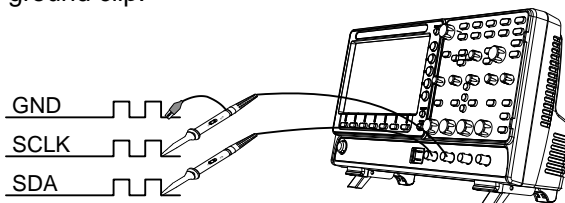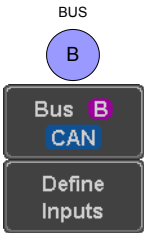|	3. Press *Bus* from the bottom menu and choose the *SPI* serial bus.	Bus B SPI
Define Inputs	1. Press *Define Inputs* from the lower menu.	Define Inputs
	2. From the side menu choose the *SCLK, SS, MOSI* and *MISO* inputs. SCLK CH1 ~ CH4 SS CH1 ~ CH4 MOSI OFF, CH1 ~ CH4 MISO OFF, CH1 ~ CH4	
Configuration	The *Configure* menu sets the data line logic level, SCLK edge polarity, word size and bit order.	
	1. Press *Configure* from the bottom menu.	Configure
	2. From the side menu select SCLK edge, SS logic level, word Size and Bit order.	

SCLK	rising edge ⌐, falling edge ⌐
SS	Active High, Active Low
Word Size	4 ~ 32 bits
Bit Order	MS First, LS First
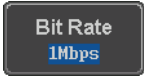
3-6-2-5. CAN Serial Bus Interface

The controller area network (CAN) bus is a half duplex 2 wire synchronous serial interface. The CAN bus is a multi-master communication system that relies on arbitration to solve contention issues. The DCS-1000B supports both CAN 2.0A and 2.0B. The CAN bus uses two wires, CAN-High and CAN-Low. These wires are voltage inverted, and as such, the DCS-1000B only needs one wire, CAN-High or CAN-Low for decoding.

Panel operation 1. Connect the bus signal (*CAN Input)* to one of the channel inputs. Connect the ground potential of the bus to the probe's ground clip.

	2. Press the *Bus* key.	BUS B
	3. Press *Bus* from the bottom menu and choose the *CAN* serial bus.	Bus B CAN
Define Inputs	1. Press *Define Inputs* from the lower menu.	Define Inputs
	2. From the side menu choose the *CAN Input* inputs and the signal type. CAN Input CH1 ~ CH4 Signal Type CAN_H, CAN_L, Tx, Rx.	
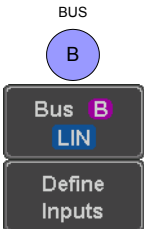
⚠ Note	The *Sample Point* soft-key indicates the sampling position of each bit. This parameter is fixed.	
Bit Rate	The *Bit Rate* menu sets the bit rate of the bus. The bit rate is usually tied to the bus length. 3. Press *Bit Rate* from the bottom menu and set the bit rate.	Bit Rate 1Mbps
	Bit Rate 10kbps, 20kbps, 50kbps, 125kbps, 250kbps, 500kbps, 800kbps, 1Mbps	

3-6-2-6. LIN Serial Bus Interface

The local interconnect network (LIN) bus is a single wire interface.
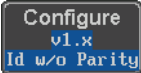
Panel operation 1. Connect the bus signal (*LIN Input)* to one of the channel inputs. Connect the ground potential of the bus to the probe's ground clip.

LIN
CAN Input
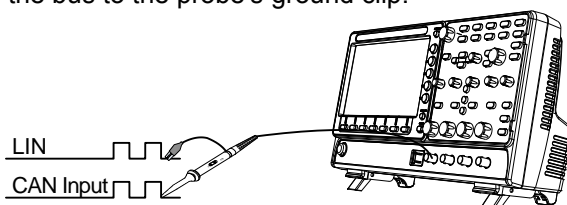
	2. Press the *Bus* key.	BUS B
	3. Press *Bus* from the bottom menu and choose the *LIN* serial bus.	Bus B LIN
Define Inputs	1. Press *Define Inputs* from the lower menu.	Define Inputs

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	2. From the side menu choose the LIN input and the polarity of the bus.	
	LIN Input CH1 ~ CH4	
	Polarity Normal (High = 1), Inverted(High = 0)	
⚠ Note	The *Sample Point* soft-key indicates the sampling position of each bit. This parameter is fixed.	
Configuration	The *Configure* menu sets the bit rate, the LIN standard and the parity options for the Id frame.	
	1. Press *Configure* from the bottom menu.	Configure v1.x Id w/o Parity
	2. From the side menu select configuration items.	
	Bit Rate 1.2kbps, 2.4kbps, 4.8kbps, 9.6kbps, 10.417kbps, 19.2kbps	
	LIN Standard V1.x, V2.x, Both	
	Include Parity On, Off Bits with Id	

3-6-2-7. Bus Encoding

Background	The bus that is displayed on the screen or in the event tables can be set to either hex or binary formats.	
Operation	Press *Bus Display* from the Bus menu and choose either Hex or Binary from the side menu.	Bus Display

3-6-3. Threshold Configuration

Background	The threshold levels for the Serial buses can be set to either a user-defined threshold level or to pre-set threshold.	
Set the Threshold	1. Press *Threshold* from the bottom menu.	Threshold
	2. Press *Select* from the side menu and choose a one of the serial bus lines.	Select ↻ Tx
	UART Tx, Rx	
	I^2C SCLK, SDA	
	SPI SCLK, SS, MOSI, MOSI	
	CAN CAN_H, CAN_L, Tx, Rx	

LIN	LIN Input

3. Press *Choose Preset* to select a pre-set logic threshold.

> Choose Preset
> ↻ User
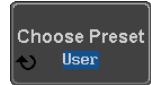
Logic Type	Threshold
TTL	1.4V
5.0V CMOS	2.5V
3.3V CMOS	1.65V
2.5V CMOS	1.25V
ECL	-1.3V
PECL	3.7V
0V	0V

4. Press *Threshold* to set a user defined threshold for the currently selected group. The threshold level depends on vertical scale.

> Threshold
> ↻ -720mV
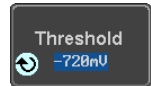
Scale	Range	Scale	Range
10V/Div	±290V	50mV/Div	±5.2V
5V/Div	±270V	20mV/Div	±580mV
2V/Div	±33V	10mV/Div	±540mV
1V/Div	±29V	5mV/Div	±520mV
500mV/Div	±27V	2mV/Div	±508mV
200mV/Div	±5.8V	1mV/Div	±504mV
100mV/Div	±5.4V		

3-6-3-1. Serial Bus Event Tables

Background	The serial bus event tables list when each data event on the bus occurred. The data is displayed as either hex or binary, depending on the bus display settings. Event tables can be saved to disk in a CSV format. The files will be named "Event_TableXXXX.CSV", where XXXX is a number from 0000 to 9999. See page 86 for details.
Operation	1. Press *Event Table* from the bottom menu.

> Event Table

2. Press *Event Table* from the side menu to turn the event table on or off.
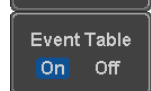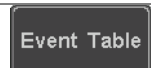
> Event Table
> On   Off

Event   On, Off

Use the Variable knob to scroll through the event table.

Data Detail (I^2C only)	1. To view the data at a particular address in more detail, turn *Data Detail* On. This is only available for the I^2C bus.	Data Detail On Off
	Detail On, Off	
	Use the Variable knob to scroll through the Data Detail event table.	
Save Event Table	1. To save the event table, press *Save Event Table*. The Event table will be saved to the current file path in a CSV format. See page 86 for details.	Save Event Table
	Use the variable knob to scroll through the event table.	
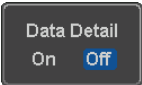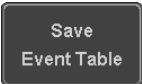
| Example: UART Event table | |

| Example: I^2C Event table | |
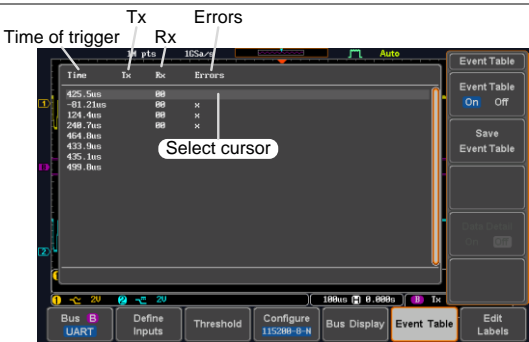
Example:
I²C Data Detail

Time of trigger Address

Select cursor

Data at cursor position
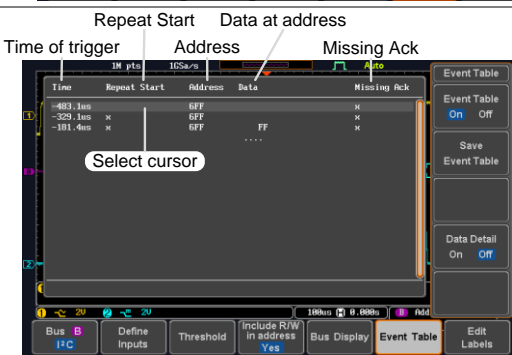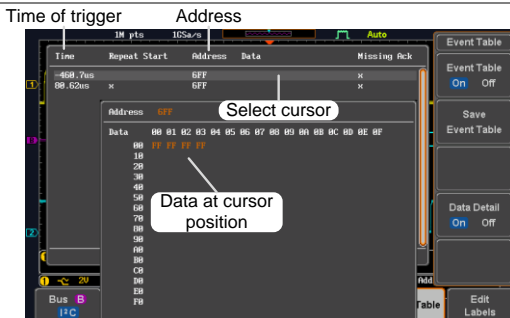
Note   Data Detail is only available with the 1²C bus.

Example:
SPI Event table

MOSI   MISO

Time of trigger

Select cursor

Example:
CAN Event table

Identifier DLC   CRC Missing ACK
Time of trigger   Data

Select cursor
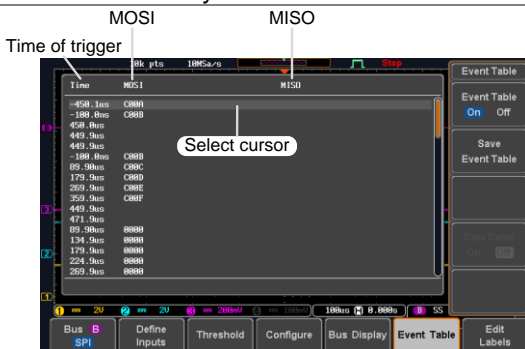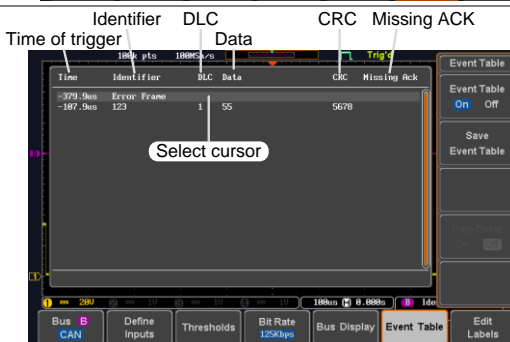
Example:
LIN Event table
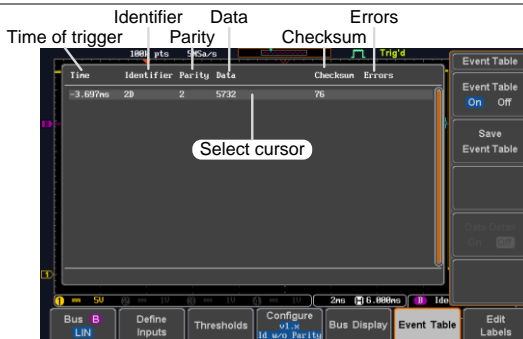
3-6-3-2. Event Tables Format

Each bus type (UART, I^{2}C, SPI, CAN, LIN) can have an event table saved containing each bus event as a .CSV file. For serial buses, an event is defined as the data on the bus when a Stop or End of Packet (UART) is encountered. The data associated with each event and the time of each event is recorded.

File Type	Each event table is saved as Event_TableXXXX.CSV into the designated file path. Each event table is numbered sequentially from 0000 to 9999. For example the first event table will be saved as Event_Table0000.CSV, the second as Event_Table0001.CSV, and so on.
Event Table Data	Each event table saves a timestamp of each event relative to the trigger as well as the data in each frame/packet at the time of an event. The frame/packet data is saved in HEX format. The table below lists in order the data saved for each event table.

	UART	Time, Tx frame data, Rx frame data, Errors.
	I^{2}C	Time, Repeat Start, Address, Data, Missing Ack.
	SPI	Time, MISO frame data, MOSI frame data.
	CAN	Time, Identifier, DLC, Data, CRC, Missing Ack.
	LIN	Time, Identifier, Parity, Data, Checksum, Errors.

Example	Below shows the data associated with an SPI event table in a spreadsheet.

Time	MOSI	MISO
-11.60us	0D87	0D87
-10.16us	06C0	06C0
-8.720us	8343	343
-7.282us	243	243
-5.840us	0C88	0C88

3-6-3-3. Adding a Label to the Serial Bus

Background	A Label can be added to the serial buses. This label will appear next to the bus indicator on the left hand-side of the display.
Panel Operation	1. To add a label to the bus, press *Edit Labels* from the Bus menu.

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

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

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

2. The Edit Label window appears.

3. Use the Variable knob to highlight a character.

VARIABLE

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
.0123456789-_
```
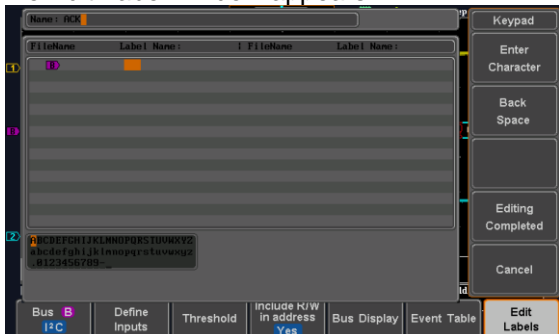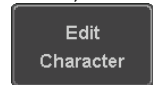
Press *Enter Character* to select a number or letter.

Enter Character

Press *Back Space* to delete a character.

Back Space

Press *Editing Completed* to create the new label and return to the previous menu.

Editing Completed

Note: this key must be pressed to save the label, even for the preset labels.

Press *Cancel* to cancel the editing and return to the Edit Label menu.

Cancel

4. The label will appear next to the bus indicator. Below, the label "ACK" was created for the bus.
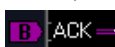
B [ACK━   The bus is labeled as ACK

| Remove Label | Press *Label Display* to toggle the label on or off. | Label Display On **Off** |

3-6-3-4. Using Cursors with the Serial Bus

Background	The cursors can be used to read bus values at any position.
⚠ Note	Ensure that one of the serial buses has been selected and is activated.
Panel Operation	1. Press the *Cursor* key. Horizontal cursors appear on the display.	Cursor
	2. Press the *H Cursor* soft-key and select which cursor(s) you wish to position.	H Cursor ▐▐

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Range	Description
| |	Left cursor (❶) movable, right cursor position fixed
| |	Right cursor (❷) movable, left cursor position fixed
| |	Left and right cursor (❶+❷) movable together

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

```
❶  -268us    Addr :0x6FF
❷  232us     Data :0xFF
  △500us
```
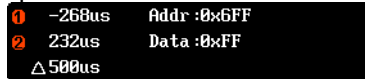
Example: I^{2}C cursors.

Cursor ❶　Hor. position, Bus value(s)

Cursor ❷　Hor. position, Bus value(s)

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

VARIABLE

3-7. Trigger
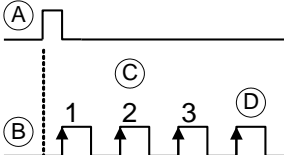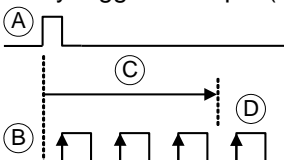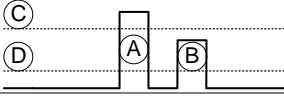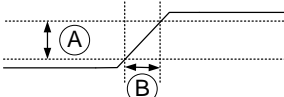
The trigger configures the conditions for when the DCS-1000B captures a waveform.

3-7-1. Trigger Type Overview

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

Rising edge trigger

Falling edge trigger

Delay	The Delay trigger works in tandem with the edge trigger, by waiting for a specified time (duration) or number of events before the delay trigger starts. This method allows pinpointing a location in a long series of trigger events.
	Note: when using the delay trigger, the edge trigger source can be any one of the channel inputs, the EXT* input or the AC line. *EXT only available on 2 channel models.
	Delay trigger example (by event)

A Edge trigger
B Delay Source
C Delay event count (3)
D First triggering point

Delay trigger example (by time)

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

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

Pulse width

Video	Extracts a sync pulse from a video format signal, and triggers on a specific line or field.
Pulse and Runt	Triggers on a "runt". A runt is a pulse that passes a specified threshold but fails to pass a second threshold. Both positive and negative runts can be detected.

A Pulse
B Runt
C High threshold
D Low threshold

Rise and Fall (Slope)	Trigger on rising and or falling edges, below or over a specified rate. The threshold can also be specified.

A Thresholds
B Rate (time)

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

	A	Trigger level threshold
	B	Timer
	C	Triggering point

Bus(Option)	Triggers on SPI, UART, I2C, CAN or LIN bus.

3-7-2. Trigger Parameter Overview

	All the following parameters are common for all the trigger types unless stated otherwise.	
Trigger Source	CH1 ~ 4	Channel 1 ~ 4 input signals
	EXT	External trigger input signal

EXT TRIG

	AC Line	AC mains signal
	Alternate	Alternate between channel sources for the trigger source.
	EXT Probe	Probe trigger source. Set the probe as either current or voltage.
Source Bus	UART	UART bus
	I^2C	Inter-Integrated Circuit
	SPI	Serial Peripheral Bus
	CAN	Controller Area Network bus
	LIN	Local Interconnect Network
Trigger Mode	Auto (un-triggered roll)	The DCS-1000B generates an internal trigger if there is no trigger event, to make sure waveforms are constantly updated regardless of trigger events. Select this mode especially when viewing rolling waveforms at slower timebases.
	Normal	The DCS-1000B acquires a waveform only when a trigger event occurs.

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	Single	The DCS-1000B acquires a waveform once when a trigger event occurs, then stops acquiring. Press the Single key to acquire a waveform again.	**Single**
Coupling (Edge, Delay, Timeout)	DC	DC coupling.	
	AC	AC coupling. Blocks DC components from the trigger circuits.	
	HF reject	High frequency filter above 70kHz	
	LF reject	Low frequency filter below 70kHz	
	Reject noise	DC coupling with low sensitivity to reject noise.	
Slope (Edge, Delay, Rise & Fall)	⌐	Trigger on a rising edge.	
	⌐	Trigger on a falling edge.	
	⌐	Either. (either rising or falling edge) (Edge, Delay, Rise & Fall trigger type only)	
Trigger Level (Edge, Delay)	Level	Adjusts the trigger manually using the Trigger LEVEL knob.	**LEVEL** **PUSH TO ZERO**
	Set to TTL 1.4V	Sets the trigger level to 1.4V, suitable for triggering on TTL signals.	
	Set to ECL -1.3V	Sets the trigger to -1.3V. This is suitable for ECL circuits.	
	Set to 50%	Sets the trigger level to 50% of the waveform amplitude.	**50 %**
Holdoff	Holdoff	Sets the holdoff time.	
	Set to Minimum	Set the holdoff time to the minimum.	
Delay (Delay)	Time	Sets the delay time (4ns ~ 10s) between the trigger event and the real trigger timing.	
	Event	Sets the number of events (1 ~ 65535) passed after the trigger event, until the real trigger timing.	
	Set to Minimum	Sets the source trigger to the minimum time.	

When (Pulse Width)	Sets the pulse width (4ns ~ 10s) and the triggering condition.	
	>	Longer than	=	Equal to
	<	Shorter than	≠	Not equal to

Threshold (Pulse Width)	Sets the amplitude threshold level for the pulse widths.	
	Threshold	–XXV ~ +XXV, user-set level
	Set to TTL	1.4V
	Set to ECL	-1.3V
	Set to 50%	Sets the threshold to 50%

Standard (Video)	NTSC	National Television System Committee
	PAL	Phase Alternate by Line
	SECAM	SEquential Couleur A Memoire
	EDTV	Enhanced Definition Television
	HDTV	high-definition television

Polarity (Pulse Width, Video)	⊓	Positive polarity (triggered on the high to low transition)
	⊔	Negative polarity (triggered on the low to high transition)

Polarity (Pulse Runt)	⊓	Positive polarity (positive runt)
	⊔	Negative polarity (negative runt)
	⊓⊔	Either (either negative or positive runt)

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

Trigger On (Bus)	Selects the conditions for the bus triggers.	
	UART Bus	Tx Start Bit, Rx Start Bit, Tx End of Packet, Rx End of Packet, Tx Data, Rx Data, Tx Parity Error, Rx Parity Error
	I^2C	Start, Repeat Start, Stop, Missing Ack, Address, Data, Address/Data
	SPI	SS Active, MOSI, MISO, MOSI&MISO

	CAN	Start of Frame, Type of Frame, Identifier, Data, Id & Data, End of Frame, Missing Ack, Bit Stuffing Err
	LIN	Sync, Identifier, Data, Id & Data, Wakeup Frame, Sleep Frame, Error
Threshold (Pulse Runt)		Sets the upper threshold limit. Sets the lower threshold limit.
Threshold (Rise & Fall)	High Low	Sets the High threshold. Sets the Low threshold.
Trigger When (Timeout)	Stays High	Triggers when the input signal stays high for a designated amount of time.
	Stays Low	Triggers when the input signal stays low for a designated amount of time.
	Either	Triggers when the input signal stays high or low for a designated amount of time.
Timer (Timeout)	4nS~10.0S	Sets the amount of time that a signal must stay high or low for the timeout trigger.

3-7-3. Setup Holdoff Level

Background   The holdoff function defines the waiting period before the DCS-1000B starts triggering again after a trigger point. The holdoff function ensures a stable display if there are a number of points in a periodic waveform that can be triggered. Holdoff applies to all the triggering types.
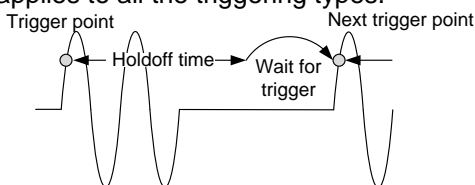
Panel Operation 1. Press the trigger *Menu* key.

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

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

Range   4ns~10s

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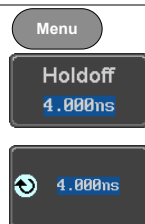
Pressing *Set to Minimum* sets the
Holdoff time to the minimum, 4ns.

`Set to Minimum`

⚠️ Note

Note: The holdoff function is automatically
disabled when the waveform update mode is in
roll mode (page65).

3-7-4. Setup Trigger Mode

Background	The trigger mode can be set to Normal or Auto (untriggered roll). The triggering mode applies to all the trigger types. See page 65.

Panel Operation 1. Press the Trigger menu key.

`Menu`

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

`Mode Auto`

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

3-7-5. Using the Edge Trigger

Panel Operation 1. Press the trigger *Menu* key.

`Menu`

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

`Type Edge`

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

`Edge`

❶ ƒ -4.12U   DC

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

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

`Source CH1`

5. Use the side menu to select the trigger source
type.
Range   Channel 1 ~ 4 (Alternate On/Off),
               EXT (Ext Probe: Volt/Current,
               Attenuation: 1mX~1kX, CH2 models
               only), AC Line

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

`Coupling DC`

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Choose the coupling from the side menu.
Range   DC, AC, HF Reject, LF Reject

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

Noise Reject
On   Off
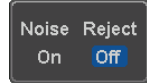
Range   On, Off

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

Slope

Range   Rising edge, falling edge, either

9. To set the external trigger level, select *Level* from the bottom bezel menu (Not applicable for AC line source).
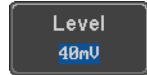
Level
40mV

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

40mV
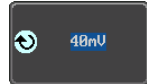
Range   00.0V~ 5 screen divisions
             Set to TTL 1.4V
             Set to ECL -1.3V
             Set to 50%

3-7-6. Using Advanced Delay Trigger

Panel Operation 1. Set the edge trigger source. This will set the initializing trigger for the delay source.   Page 95

2. Press the trigger *Menu* key.

Menu

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

Type
Edge

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

Delay

D A ƒ 1.36V   DC
   B ƒ 1.36V   DC
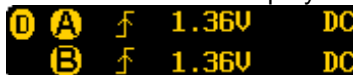
From left: Delay trigger indicator (D), edge trigger (A), edge slope, edge level, edge coupling, delay trigger (B), delay slope, delay trigger level, delay coupling.

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

Source
CH1

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

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

   | Coupling |
   | DC |

   Choose the coupling from the side menu.
   Range   DC, AC, HF Reject, LF Reject

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

   | Delay |
   | 1 |

8. To Delay by Time (Duration), press
   Time from the side menu and set
   the delay time.
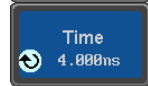
   | Time |
   | 4.000ns |

   Range   4ns ~ 10s (by time)
               Set to minimum

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

   | Event |
   | 1 |

   Range   1 ~ 65535 events
               Set to Minimum

3-7-7. Using Pulse Width Trigger

Panel Operation 1. Press the trigger *Menu* key.

   | Menu |

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

   | Type |
   | Edge |

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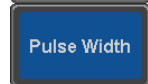
   | Pulse Width |

   ❶ ⌐Ŀ › 80.0ns   DC

   From left: source, polarity, when, coupling

4. Press *Source* from the lower bezel.

   | Source |
   | CH1 |

5. Use the side menu to select the pulse width
   trigger source.
   Range   Channel 1 ~ 4 (Alternate On/Off),
               EXT (Ext Probe: Volt/Current,
               Attenuation: 1mX~1kX), AC Line

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

   | Polarity |
   | ⌐Ŀ ⌐Ŀ |

97
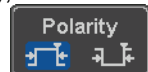
Range   Positive (high to low transition)
         Negative (low to high transition)

7. Press *When* from the lower bezel.

When
> 4.000ns
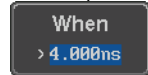
   Then use the side menu to select the pulse
   width condition and width.
   Condition > , < , = , ≠
   Width   4ns ~ 10s

8. Press *Threshold* from the lower
   bezel to edit the pulse width
   threshold.
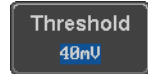
Threshold
40mV

   Use the side menu to set the threshold.
   Range   -XXV~XXV
            Set to TTL 1.4V
            Set to ECL -1.3V
            Set to 50%

3-7-8. Using Video Trigger

Panel Operation 1. Press the trigger *Menu* key.

Menu

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

Type
Edge

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

Video

   1 NTSC F1   1   AC

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

4. Press *Source* from the lower bezel.

Source
CH1

5. Use the side menu to select the
   video trigger source.
   Range   Channel 1 ~ 4

6. Press *Standard* on the bottom
   bezel.
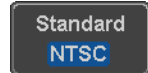
Standard
NTSC

   Use the side menu to select the video standard.
   Range   NTSC, PAL, SECAM, EDTV(480P,
            576P), HDTV(720P, 1080i, 1080P)

7. Press *Trigger On* to edit the video
   field and line.
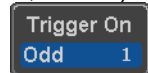
Trigger On
Odd   1

   Use the side menu to select the field and line.

98

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

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

Polarity

Range   positive, negative

3-7-9. Pulse Runt trigger

Panel Operation   1. Press the trigger *Menu* key.

Menu

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

Type
Edge

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

Pulse Runt
Rise & Fall
Timeout
Bus

Others
Pulse Runt

🖳 ❶ H   40mV   DC
        L -100mV
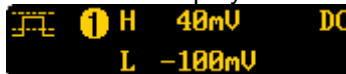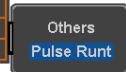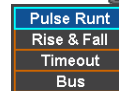
From left: polarity, source, high/low threshold, threshold level, coupling

4. Press *Source* from the lower menu.
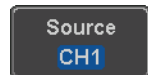
Source
CH1

Use the side menu to select a source.
Range   Channel 1 ~ 4(Alternate On/Off)

5. Press *Polarity* to toggle the polarity.
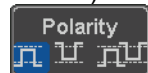
Polarity

Range   Rising edge, falling edge, either.

6. Press *When* from the lower menu.

When
> 4.000ns
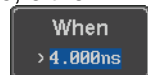
Then use the side menu to select the condition and width.
Condition > , < , = , ≠

99

Width   4ns ~ 10s

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

Threshold
40mV
-100mV

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

Range   -XXV~XXV

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

Range   -XXV~XXV

3-7-10. Using Rise and Fall Trigger

Panel Operation 1. Press the trigger *Menu* key.

Menu

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

Type
Edge

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

Pulse Runt
Rise & Fall
Timeout
Bus

Others
Rise & Fall
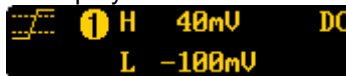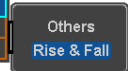
From left: slope, source, high/low threshold, threshold level, coupling

4. Press *Source* from the lower menu.

Source
CH1

Use the side menu to select a source.
Range   Channel 1 ~ 4(Alternate On/Off)

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

Slope

Range   Rising edge, falling edge, either

6. Press *When* from the lower menu.

When
> 4.000ns
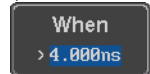
Then use the side menu to select the logic conditions and true or false status.
Condition > , < , = , ≠
Width   4ns ~ 10s

100

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

> Threshold
> 40mV
> -100mV

Range   High: -XXV~XXV
Low: -XXV~XXV

3-7-11. Using the Timeout Trigger

Panel Operation   1. Press the trigger *Menu* key.

> Menu

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

> Type
> Edge

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

> Pulse Runt
> Rise & Fall
> Timeout
> Bus

> Others
> Timeout
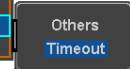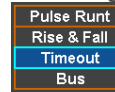
> ① Timeout 1.40V   DC

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

4. Press *Source* from the lower menu.

> Source
> CH1

Use the side menu to select a source.
Range   Channel 1 ~ 4, EXT (Ext Probe: Volt/Current, Attenuation: 1mX~1kX), AC Line

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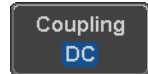
> Coupling
> DC

Choose the coupling from the side menu.
Range   DC, AC, HF Reject, LF Reject

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

> Noise Reject
> On   Off
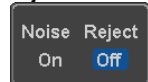
Range   On, Off

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

> Trigger
> When
> Stays High

Then use the side menu to select trigger conditions.

Condition   Stays High, Stays Low, Either

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

Level
40mV
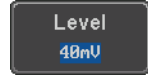
Range -XXV~XXV
Set to TTL 1.4V
Set to ECL -1.3V
Set to 50%

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

Timer
4.000ns
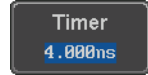
Range 4ns~10.0S

3-7-12. Using the Bus Trigger

The Bus trigger is used to trigger and decode UART, I2C, SPI, CAN and LIN serial bus signals.

3-7-12-1. UART BUS Trigger Settings

The UART bus trigger conditions can be set at any time after the bus settings have been set to *UART*.

Panel Operation	1. Set the Bus to UART in the bus menu.	Page 77

2. Press the *Trigger Menu* key.

Menu

3. Press *Type* from the bottom menu.

Type
Edge

4. Press *Others* from the side menu and select *Bus*.

Pulse Runt
Rise & Fall
Timeout
Bus

Others
Bus

The Trigger on settings will be reflected on the Trigger Configuration icon.
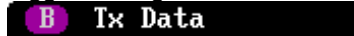
B Tx Data

From left: Bus trigger, Trigger source

5. Press *Trigger On* and select the triggering condition for the UART bus.

Trigger On
Tx Start Bit

Trigger On	Tx Start Bit, Rx Start Bit, Tx End of Packet, Rx End of Packet, Tx Data, Rx Data, Tx Parity Error, Rx Parity Error

Trigger On – Tx Data, Rx Data	If Tx Data or Rx Data was configured for the Trigger On setting, then the number of bytes and data can also be configured.

1. Press *Data* from the bottom menu.

    Data

2. Press *Number of Bytes* from the side menu and choose the number of bytes for the data.

    UART   1~10 Bytes
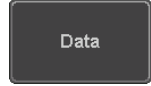
    Number of Bytes
    🔄 1

3. Press *Data* from the side menu to edit the triggering data.
    To edit the data, use the *Variable* knob to highlight a binary or hex digit and press *Select*. Use the *Variable* knob to choose a value for the digit and press *Select* to confirm.

    Data

    VARIABLE

    ← ↻ →
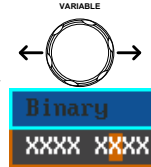
    Binary
    XXXX XXXX

    Binary   0,1,X (don't care)
    Hex   0~F, X (don't care)
    ASCII   ASCII characters for the equivalent Hex characters 00 to FF

3-7-12-2. I^2C Bus Trigger Settings
The I^2C bus trigger conditions can be set at any time after the bus settings has been set to 1^2C.

Panel Operation 1. Set the Bus to I^2C in the bus menu. Page 78
                 2. Press the *Trigger Menu* key.

                    Menu

                 3. Press *Type* from the bottom menu.

                    Type
                    Edge

                 4. Press *Others* from the side menu and select *Bus*.

                    Pulse Runt
                    Rise & Fall
                    Timeout
                    Bus

                    Others
                    Bus

                    The Trigger on settings will be reflected on the Trigger Configuration icon.

                    B **Data**

                    From left: Bus trigger, Trigger source

                 5. Press *Trigger On* and select the triggering condition for the selected bus.

                    Trigger On
                    Start

                    Trigger   Start, Repeat Start, Stop, Missing
                    On   Ack, Address, Data, Address/Data

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Trigger On – Data	If Data or Address/Data was configured for the Trigger On setting, then the number of bytes, data and addressing mode (I^2C) can be configured.

1. Press *Data* from the bottom menu.

   Data

2. Press *Number of Bytes* from the side menu and choose the number of bytes for the data.
   I^2C 1~5 Bytes

   Number of Bytes 1

3. Press *Addressing Mode* to toggle between 7 and 10 bit addressing modes.

   Addressing Mode 7 bit 10 bit

4. Press *Data* from the side menu to edit the triggering data.
   To edit the data, use the *Variable* knob to highlight a binary or hex digit and press *Select*. Use the *Variable* knob to choose a value for the digit and press *Select* to confirm.
   Binary   0,1,X (don't care)
   Hex   0~F, X (don't care)

   Data

   VARIABLE

   ← ○ →

   Binary
   XXXX XXXX

Trigger On - Address	If Address or Address/Data was configured for the Trigger On setting, then the triggering address must be configured.

1. Press *Address* on the bottom menu.

   Address

2. Press *Addressing Mode* to toggle between 7 and 10 bit addressing modes.

   Addressing Mode 7 bit 10 bit

3. To choose a preset address as the default address, press *Choose Preset* and select a preset address.

   Choose Preset General Call

Address	Description
0000 000 0	General Call
0000 000 1	START Byte
0000 1XX X	Hs-mode
1010 XXX X	EEPROM
0000 001 X	CBUS

	Press *Apply Preset* to set the default address to the preset.	Apply Preset
Note	• Presets are not available for *Trigger On Address/Data*.	

4. Press *Address* from the side menu to manually edit the triggering address.

VARIABLE

To edit the address, use the *Variable* knob to highlight a binary or hex digit and press *Select*. Use the *Variable* knob to choose a value for the digit and press *Select* to confirm.

Binary

XXXX XXXX

Binary   0,1, X (don't care)
Hex   0~F, X (don't care)

Direction	1. Press *Direction* on the bottom menu and choose the direction from the side menu.	Direction Write
	Direction Write, Read, Read or Write	
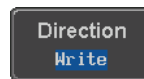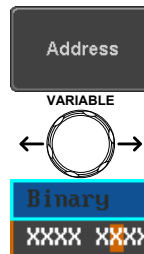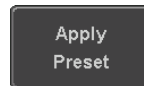
3-7-12-3. SPI Bus Trigger Settings
The SPI bus trigger conditions can be set at any time after the bus setting has been set to SPI.

Panel Operation	1. Set the Bus to SPI in the bus menu.	Page 79
	2. Press the *Trigger Menu* key.	Menu
	3. Press *Type* from the bottom menu.	Type Edge

4. Press *Others* from the side menu and select *Bus*.

Pulse Runt
Rise & Fall
Timeout
Bus

Others
Bus

The Trigger on settings will be reflected on the Trigger Configuration icon.

B   MOSI

From left: Bus trigger, Trigger source

5. Press *Trigger On* and select the triggering condition for the SPI bus.

Trigger On
SS Active

SPI   SS Active, MOSI, MISO, MOSI&MISO
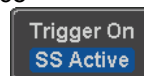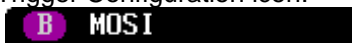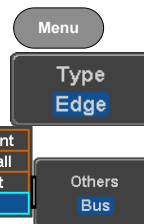
|	
Trigger On – Data	If MOSI, MISO or MISO/MOSI was configured for the Trigger On setting, then the number of words and the data can be configured.

1. Press *Data* from the bottom menu.

<div align="right">

Data

</div>

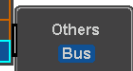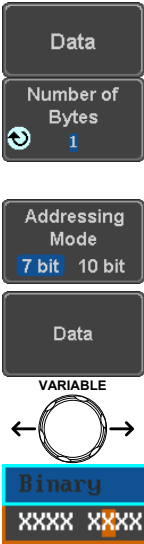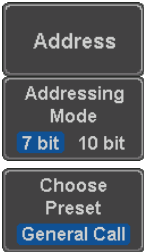2. Press *Number of Words* from the side menu and choose the number of words for the data.
   SPI   1~32 Words

<div align="right">

Number of Words
1

</div>

3. Press *MOSI or MISO* from the side menu to edit the triggering data.
   To edit the data, use the *Variable* knob to highlight a binary or hex digit and press *Select*. Use the *Variable* knob to choose a value for the digit and press *Select* to confirm.
   Binary   0,1,X (don't care)
   Hex   0~F, X (don't care)

<div align="right">

MOSI

VARIABLE

Binary
XXXX XXXX

</div>

3-7-12-4. CAN Bus Trigger

The CAN bus trigger conditions can be set at any time after the bus setting has been set to CAN.

Panel Operation	1. Set the Bus to CAN in the bus menu.	Page 80

2. Press the *Trigger Menu* key.
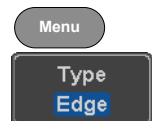
<div align="right">

Menu

</div>

3. Press *Type* from the bottom menu.

<div align="right">

Type
Edge

</div>

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

Pulse Runt
Rise & Fall
Timeout
Bus

Others
Bus
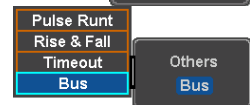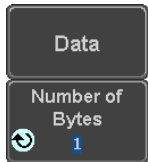
The Trigger on settings will be reflected on the Trigger Configuration icon.

B Id & Data

From left: Bus trigger, Trigger source

5. Press *Trigger On* and select the triggering condition for the selected bus.

<div align="right">

Trigger On
Id & Data

</div>

	Trigger On	Start of Frame, Type of Frame, Identifier, Data, Id & Data, End of Frame, Missing Ack, Bit Stuffing Err
Trigger On – Type of Frame	1.	If *Type of Frame* was configured for the Trigger On setting, then the type of frame can be configured from the side menu.
	Type	Data Frame, Remote Frame, Error Frame, Overload Frame
Trigger On – Identifier	1.	If *Identifier/Id & Data* was configured for the Trigger On setting, select the format from the side menu.
	Format	Standard, Extended

Trigger On – Identifier

1. If *Identifier/Id & Data* was configured for the Trigger On setting, select the format from the side menu.

   Format   Standard, Extended

2. Press *Identifier* from the side menu to set the identifier data.

   To edit the identifier, use the *Variable* knob to highlight a binary or hex digit and press *Select*. Use the *Variable* knob to choose a value for the digit and press *Select* to confirm.

   Binary   0,1,X (don't care)
   Hex   0~F, X (don't care)

3. Press Direction on the bottom menu and select the CAN Direction from the side menu.

   CAN Direction   Write, Read, Read or Write

Trigger On - Data

If *Data/Id and Data* was configured for the Trigger On setting, then the triggering data must be configured.
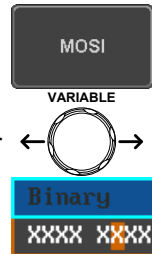
1. Press *Data* on the bottom menu.

2. Press *Number of Bytes* from the side menu and choose the number of bytes for the data.

   Bytes   1~8 Bytes

3. Press *Data* from the side menu to edit the triggering data.
   To edit the data, use the *Variable* knob to highlight a binary or hex digit and press *Select*. Use the *Variable* knob to choose a value for the digit and press *Select* to confirm.

   Data

   VARIABLE

   ← →

   Binary
   XXXX XXXX

   Binary   0,1,X (don't care)
   Hex   0~F, X (don't care)

4. Press *Trigger When* from the side menu to choose the triggering condition for the data.
   When   =, ≠, <, >, ≤, ≥

   Trigger When
   = ≠ < > ≤ ≥

5. The bus will now trigger when the specified data matches the *Trigger When* conditions.

3-7-12-5. LIN Bus Trigger

The LIN bus trigger conditions can be set at any time after the bus setting has been set to LIN.

Panel Operation
1. Set the Bus to LIN in the bus menu.
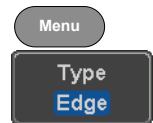
2. Press the *Trigger Menu* key.

   Menu

3. Press *Type* from the bottom menu.

   Type
   Edge

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

   Pulse Runt
   Rise & Fall
   Timeout
   Bus

   Others
   Bus
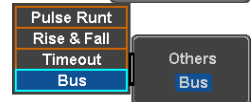
   B Sync

   From left: Bus trigger, Trigger source

5. Press *Trigger On* and select the triggering condition for the selected bus.

   Trigger On
   Id & Data

   Trigger   Sync, Identifier, Data, Id and Data,
   On   Wakeup Frame, Sleep Frame, Error.

Trigger On –
Identifier
1. If *Identifier* or *Id & Data* was configured for the Trigger On setting, press *Identifier* from the bottom menu.

   Identifier

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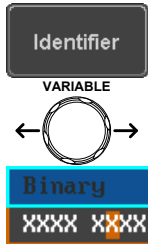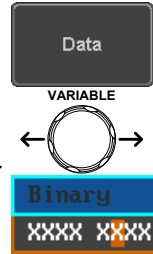|	
2. Press *Identifier* from the side menu to set the identifier data. To edit the identifier, use the *Variable* knob to highlight a binary or hex digit and press *Select*. Use the *Variable* knob to choose a value for the digit and press *Select* to confirm.	Identifier **VARIABLE** ← → Binary XXXX XXXX

Binary   0,1,X (don't care)
Hex   0~F, X (don't care)

Trigger On - Data		If *Data/Id and Data* was configured for the Trigger On setting, then the triggering data must be configured.

1. Press *Data* on the bottom menu.

<div align="right">Data</div>

2. Press *Number of Bytes* from the side menu and choose the number of bytes for the data.
   Bytes   1~8 Bytes

<div align="right">Number of Bytes
🔄 1</div>

3. Press *Data* from the side menu to edit the triggering data. To edit the data, use the *Variable* knob to highlight a binary or hex digit and press *Select*. Use the *Variable* knob to choose a value for the digit and press *Select* to confirm.

<div align="right">Data
VARIABLE
← →
Binary
XXXX XXXX</div>

Binary   0,1,X (don't care)
Hex   0~F, X (don't care)

4. Press *Trigger When* from the side menu to choose the triggering condition for the data.
   When   =, ≠, <, >, ≤, ≥

<div align="right">Trigger When
= ≠ < > ≤ ≥</div>

5. The bus will now trigger when the specified data matches the *Trigger When* conditions.

3-7-13. Bus Trigger Mode

|	
Trigger Mode	1. Like the other trigger configurations, the Bus Trigger mode can be set to Auto (Untriggered Roll) and Normal.

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

Mode
Auto

3. Use the side panel to select *Auto* or *Normal* triggering modes.
   Range   Auto, Normal
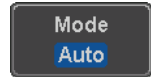
3-8. Search (Option)

The search feature can be used to search for events on the analog input channels. The events that can be searched for are similar to the events that are used for the trigger system. The only difference is that the search feature uses the measurement threshold levels rather than the trigger level to determine events.

3-8-1. Configuring Search Events

Background	Similar to configuring the trigger system, the Search events must first be configured before they can be found.
	Luckily the trigger system configuration settings can also be used for the search events. The types of searches are listed below. Please note that a full description of the events can be found in the Trigger section on page 89.

Display   Number of   Trigger point
                 search events

Search event markers
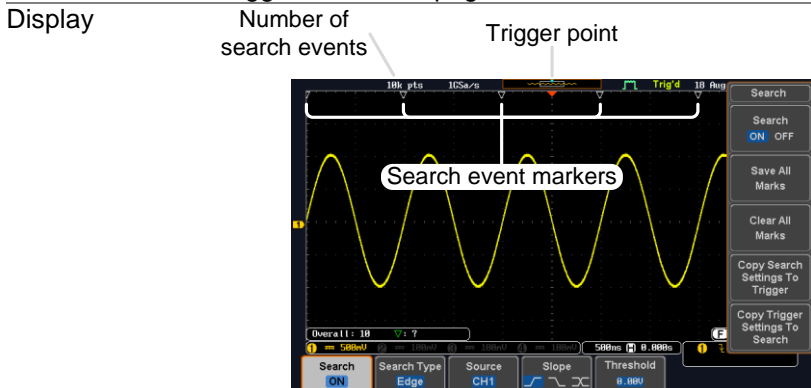
Search Event Types	Edge, Pulse Width, Pulse Runt, Rise and Fall Times, FFT Peak*, Bus
	*The FFT Peak search event doesn't have a trigger equivalent.
Panel Operation	1. Press the *Search* menu key.

Search

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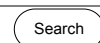
2. Press *Search* from the bottom menu and turn the Search function on.

`Search ON`

3. Press *Search Type* from the bottom menu and select the type of search. The search events are configured in the same fashion as the trigger events.

`Search Type Edge`

Please see the trigger configuration settings for details:

Event Types:	Edge, Pulse Width, Pulse Runt, Rise/Fall Time, FFT Peak*, Bus

*No trigger equivalent.

4. To set the threshold levels for the search events (instead of the trigger level that is used for trigger events), use the threshold soft-key from the bottom menu.

`Threshold 0.00V`

⚠️ Note	The search function can support up to 10,000 events, however only 1,000 events can be displayed on screen at once.

3-8-2. Copying Search Event To/From Trigger Events

Background	As the trigger system and search feature have similar settings, their settings can be used interchangeably by using the Copy functions.
Interchangeable Settings	Edge, Pulse Width, Pulse Runt, Rise and Fall Times, Bus (FFT Peak has no trigger equivalent)
Panel Operation	1. Press *Search* from the lower bezel menu. `Search ON`
	2. To copy the settings of the selected search type to the trigger settings, select *Copy Search Settings to Trigger.* `Copy Search Settings To Trigger`
	3. To copy over the current trigger settings to the search settings, press *Copy Trigger Settings To Search.* `Copy Trigger Settings To Search`
⚠️ Note	If the settings cannot be copied or if the there are no trigger settings configured (so that you cannot copy from the trigger settings), then those particular options will not be available.

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3-8-3. Search Event Navigation

Background	When using the search feature, each event can be searched for according to the event settings.
Operation	1. Turn Search on and set the appropriate search type. Page110
	2. Search events are marked by hollow white triangles at the top of the graticule.
	3. Use the search arrow keys to move between each search event. Search events can be navigated in both stop and run mode.
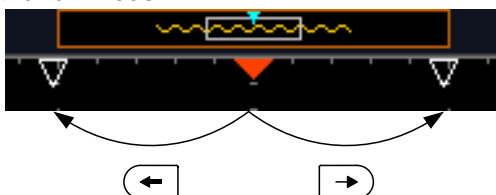
When using the arrow keys to navigate to each event, the "current event" will always be centered on the display.

3-8-4. Save Search Marks

Background	The search events can be saved to the graticule display, allowing you to superimpose new search events. Search events are saved over the entire record length, with a maximum of 1000 marks.
Save Marks	1. Press *Search* from the lower bezel menu. `Search ON`
	2. Press the *Save All Marks* soft-key. `Save All Marks`
	3. The search event markers will become solid white triangles to indicate that they have been saved.
Clear All Marks	To clear all the saved marks, press Clear All Marks from the side menu. `Clear All Marks`
⚠ Note	Each time the Save All Marks function is used, the previously saved marks will also be retained, unless cleared.
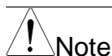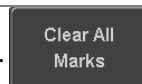
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3-8-5. Setting/Clearing Single Search Events

Background	In addition to searching for search events based on Search Type settings, custom search marks can be created with the Set/Clear key.
Set Search Event	4. Navigate to a point of interest using ◄ POSITION ► the horizontal position knob or some other method.
	PUSH TO ZERO
	1. Press the *Set/Clear* key. ⟨ Set/Clear ⟩
	2. A marker will be saved at the center of the display. • This marker can be navigated to/from in the same way that a normally saved search marker can.
Clear Search Event	To clear a set search event, use the ⟨ Set/Clear ⟩ search arrows to navigate to the event of interest and press the Set/Clear key. The marker will be deleted from the display.

3-8-6. FFT Peak

Background	The FFT Peak search type can be used to mark all FFT peaks that are above a certain threshold.
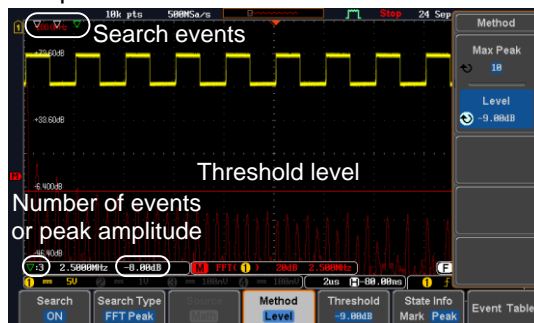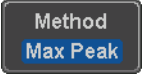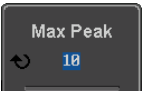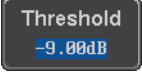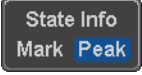
⚠ Note	The search function can support up to 10,000 events, however only 1,000 events can be displayed on screen at once.
Panel Operation	1. Turn the FFT math function on. Page 41

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2. Press the *Search* menu key.

> Search

3. Press *Search* from the bottom menu and turn the Search function on.

> Search
> ON

4. Press *Search Type* from the bottom menu and select *FFT Peak* from the side menu.

> Search Type
> FFT Peak

5. Note that the Math source is automatically selected.

> Source
> Math

6. Next, select the event search method by pressing *Method* from the bottom menu.
   Select *Max Peak* to search by a selected number of "max" peaks. Select *Level* to set the threshold level for the search events. Any peaks above the threshold level will be seen as a search event. The threshold level will be mirrored in the Threshold key.

> Method
> Max Peak

> Max Peak
> ↻ 10
>
> Level
> ↻ −9.00dB

> Threshold
> −9.00dB

Max Peak   1 ~ 10
Level   -100db ~ 100dB

| View Number of Peak Events | To view the number of peak events, set *State Info* to Mark. The number of search events will be shown at the bottom of the screen. | State Info
Mark Peak |

Overall: 10   ▽:9

| View Amplitude of Peak Search Event | To view the position and amplitude of a selected event, set *State Info* to Peak. This information will be shown at the bottom of the display. | State Info
Mark Peak |

▽:3   2.5000MHz   −8.00dB

| Peak Event Table | The Event Table function tabulates the amplitude and frequency of each peak event in real time. The event table can also be saved to a USB disk drive. File names are saved as a PeakEventTbXXXX.csv, where XXXX is a number starting from 0001 and is incremented each time the event table is saved. |

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1. Press *Event Table* from the bottom menu and turn the Event Table function on.

Event Table

The event table will appear on the screen.

No.	Frequency	Value
1	1.0000MHz	-30.4dB
2	2.0000MHz	-31.2dB
3	3.0000MHz	-32.8dB
4	4.0000MHz	-35.2dB
5	5.0000MHz	-38.4dB
6	6.0000MHz	-44.0dB
7	7.0000MHz	-54.4dB
8	9.0000MHz	-52.0dB
9	10.000MHz	-51.2dB
10	11.000MHz	-52.8dB
11	12.000MHz	-58.4dB
12	497.00MHz	-58.4dB
13	498.00MHz	-56.0dB
14	499.00MHz	-54.4dB

Amplitude — Peak frequency — Peak number

Save Event Table	1. To save the event table, insert a USB memory drive into the front panel USB-A port. 2. Press *Save Event Table*. The event table will be saved as PeakEventTbXXXX.csv.
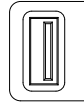
Save Event Table

Event Table CSV Format	The format for the CSV file is the same as the event table displayed on the DCS-1000B screen; No., Frequency, and Value. For example:

No.	Frequency	Value
1	1.0000MHz	-29.6dB
2	2.0000MHz	-30.4dB
3	3.0000MHz	-32.0dB

Center Peak Results on Screen	To shift the peak events to the center of the screen, press *Selected Peak To Center* from the event table side menu.

Selected Peak To Center

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3-9. System Settings and Miscellaneous Settings

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

3-9-1. Select Menu Language

Description	The DCS-1000B has a number of different languages to choose from.

Panel Operation 1. Press the *Utility* key.

> **Utility**

2. Press *Language* on the lower menu.

> **Language**
> **English**

3. Select the language* from the side menu.
   *Language selection may differ based on region, and as such are not listed here.

3-9-2. View System Information

Panel Operation 1. Press the *Utility* key.

> **Utility**

2. Press *System* from the lower menu.

> **System**

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

> **System Info**

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

3-9-3. Erase Memory

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

Panel Operation 1. Press the *Utility* key.

 Utility

2. Press *System* from the lower menu.

 System

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

 Erase Memory

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

4. Press *Erase Memory* again.

 Erase Memory

3-9-4. Probe Compensation Frequency

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

Compensation output

2V ⊓

Panel Operation/ Parameter

1. Press the *Utility* key.

 Utility

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

 Probe Comp. 1KHz

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

 Frequency 1KHz

Default Frequency

4. Press Default to set the frequency of the probe compensation signal to 1kHz default.

 Default 1KHz

4. Applications

4-1. Overview

Background	The APP function allows different software applications to be run. The DCS-1000B comes pre-installed with a number of apps.	
Included Applications	Go/No-Go	The Go/No-Go application can be used to set threshold boundaries for input signals. Go/No-Go tests to see if a waveform will fit inside a user-specified maximum and minimum amplitude boundary (template).
	Mount Remote Disk	This app allows the scope to mount a network share drive.
Optional Apps	DVM	The DVM application displays a digital voltage meter readout that floats on the top left-hand side of the screen.
	Data Log	The Data Log app will log waveform data and/or screenshots at set intervals for set duration of time.
	Digital Filter	Adds a digital low or high filter to any of the input channels. Each filter can have a user-defined cutoff frequency set.

Optional app must be installed, Please See Page 151.

4-2. Running Applications

Background	The APP function can host a number of different applications that can be downloaded from the GW Instek website.
Panel Operation	1. Press the *APP* key.

APP

2. Press *APP* from the bottom menu.

APP

3. Scroll through each application using the *Variable* knob.

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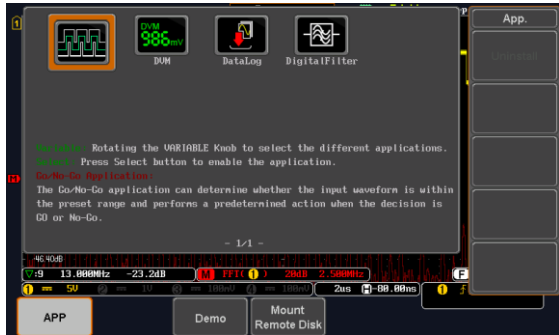
4. Select an application by pressing the *Select* key *twice*.

(Select) ×2

4-3. Using Go-NoGo

Background   The Go-NoGo test checks if a waveform fits inside
                    a user-specified maximum and minimum boundary.
                    Boundary templates are automatically created from
                    a source channel. Boundary tolerances and
                    violation conditions can be set.
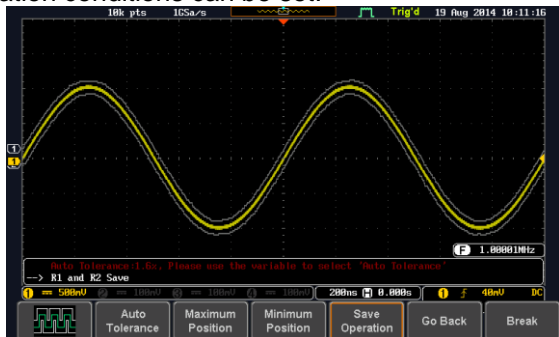
Choose the Go_NoGo application
from the APP menu. See page 118.
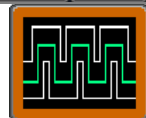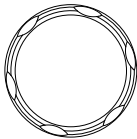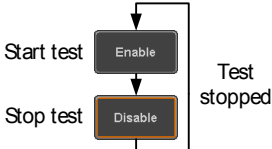
Set Go-NoGo   Select the Go-NoGo conditions (NG When) and
Conditions   actions when a Go-NoGo condition has been met
                    (Violating).

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

NG
When
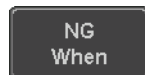
| | Enter | Enter: Sets the NoGo condition to when the input signal stays within the limit boundary. |
| | Exit | Exit: Sets the NoGo condition to when the input signal exceeds the limit boundary. |

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

| Set Go-NoGo Actions | 3. Press *Violating* to set what action to perform when a signal violates the Go-NoGo conditions. | Violating |

| | Stop | The waveform stops when the conditions are violated. |
| | Continue | Ignore violations and continue to monitor the signal. Each violation is counted. |

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

| Set Go-NoGo Source | 5. Press *Compare Source* from the bottom menu to set the Go-NoGo boundary source. | Compare Source |

	CH1	Sets CH1 as the source.
	CH2	Sets CH2 as the source.
	CH3	Sets CH3 as the source.
	CH4	Sets CH4 as the source.

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

| Set Boundary Tolerance | 7. To set the Go-NoGo boundary tolerance, press *Reference Mode*. | Reference Mode |

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Auto Tolerance	8. To set the boundary tolerance as a percentage offset from the source waveform, press *Auto Tolerance* and use the Variable knob.	Auto Tolerance
		VARIABLE

	Offset	0.4% ~ 40% (.4% steps)
Maximum and Minimum Position	9. To manually set the template tolerance, press *Minimum Position* or *Maximum Position* and use the Variable knob to set the absolute minimum or maximum position.	Minimum Position
		or
		Maximum Position

	Range	Voltage division range
Save Boundary Template	10. Press *Save Operation* to save the tolerance boundaries.	Save Operation
	11. The Maximum Position tolerance will be saved to reference waveform R1, and the Minimum Position tolerance to R2.	
	12. Press *Go Back* to return to the previous menu.	Go Back

Start Go-NoGo	Press *Enable* to start the Go-NoGo test. The Enable button will change to Disable. Pressing *Disable* will stop the Go-NoGo test and toggle the button back to Enable. If the Violating setting was set to Stop, press *Enable* to restart the test after it has stopped.

Start test   Enable

Test stopped

Stop test   Disable

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

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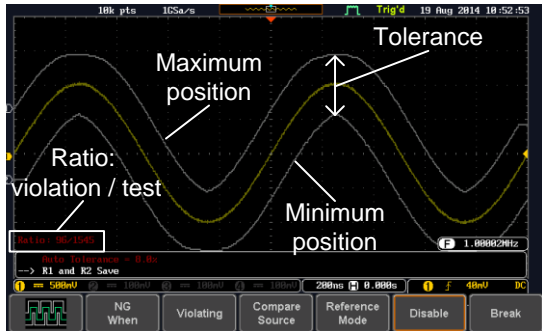
| Exit the Application | To exit the application, press *Break*. | |

| ⚠ Note | After you exit the Go/NoGo app, the boundary templates that were saved to R1 & R2 reference waveforms will still be turned on. See page 145 to turn the reference waveforms off. |

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

Timing Diagram
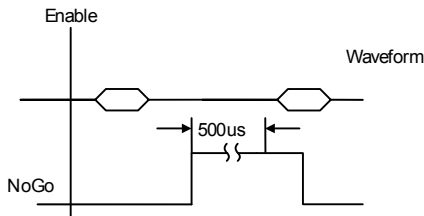
Circuit Diagram
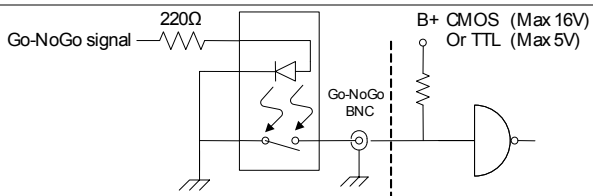
4-4. Using the DVM (Option)

Background   The DVM app is a digital voltage meter or digital current meter readout that floats on the top left-hand side of the screen. However, please note that if the cursors (refer to page 34) are turned on, the DVM readout will be replaced by the cursor readout.

The DVM app allows you to measure the AC RMS, DC, DC RMS, Duty and frequency of an input signal. This software is especially useful for those measurement applications that require both a DSO and a basic DVM to be used at the same time.

Basic Features:
- 3 digit resolution for voltage measurements
- 5 digit resolution for frequency
- Input channel selection

Example   DVM function indicator
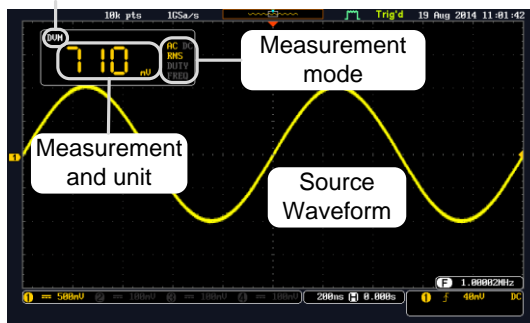
Panel Operation   Choose the DVM application from the APP menu. See page 118.

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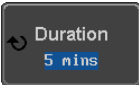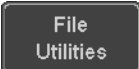
Set Source	1. Press *Source* and select the source channel for the DVM. The probe type setting (voltage or current) determines whether the function acts as a digital volt meter or as a digital current meter for the selected source. See page 72 to set the probe type.	Source CH1
	Source CH1 ~ CH4	
Mode	The Mode setting determines the measurement mode for the meter.	
	2. Press Mode and select the mode.	Mode DC
	Mode AC RMS, DC, DC RMS, Duty, Frequency	
Turn On/Off	3. Press *DVM* and toggle DVM on. The DVM app will remain running in the background even if other functions are turned on.	DVM ON

4-5. Using the Data Logger (Option)

Background	The Data Log app will log the current waveform data or screenshot at set intervals for a set duration of time.
	Basic Features:
	• Log up to 100 hours of images or waveform data.
	• Interval times of up to 2 seconds (waveform) or 5 seconds (images).
Example	

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Panel Operation	Choose the Data Log application from the APP menu. See page 118.	
	1. Press *Setup.*	Setup
	2. Press *Log to* from the side menu and select what type of data to log, waveform data or screenshots. Log to Image, Waveform	Log to Image
	3. Press *Source* from the side menu and select a source channel to log if waveforms are to be logged. Source CH1 ~ CH4, All Displayed	Source CH1
	4. Press *Interval* and set the logging interval time. Interval Data: 2secs ~ 2mins Image: 5secs ~ 2mins	Interval 2 secs
	5. Press *Duration* and select the logging duration time. Duration 5mins ~ 100hrs.	Duration 5 mins
	6. From the bottom menu, press *File Utilities* and set the save file path. See the File Utilities chapter r details.	File Utilities Page 147
Turn On/Off	7. Press *Data Logging* from the bottom menu and toggle Data Logging on. The data/images will be saved to the designated file path when Data Logging is turned on. The Data Logging app will remain running in the background even if other functions are turned on.	Data Logging ON
Set File Path	8. Press *File Utilities* to set the file path.	Page 147
NOTE:	The DCS-1000B does not have a built-in clock, so the date and time are not recorded.	

4-6. Using the Digital Filter (Option)

Background | The Digital Filter app is a digital high or low pass filter with a selectable cutoff frequency. The digital filter and be applied to each channel individually or together using the tracking functionality.

Basic Features:

- High pass or low pass filtering of analog channels.
- Selectable cutoff frequencies.
- Tracking function

Example
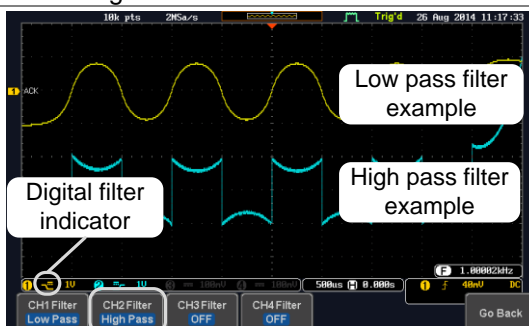
Digital filter type or status

CH1 input: 2Vpp 1kHz square wave, low pass filter with 1kHz cutoff frequency.
CH2 input: 2Vpp 1kHz square wave, high pass filter with 1kHz cutoff frequency.

Panel Operation | Choose the Digital filter application from the APP menu. See page 118.

Set Source

1. Select a source channel by pressing *CH1Filter, CH2 Filter, CH3 Filter or CH4 Filter*.
2. From the side menu press *Filtering* and turn on.
3. Press *Filter Type* and select low or high pass filter.
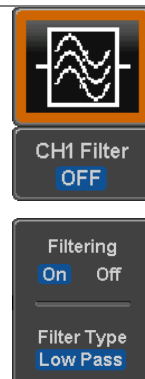
Type　　Low Pass, High Pass

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	4. If Low Pass was selected, press *Upper Limit* to set the low pass cutoff frequency. Likewise if High Pass was selected, press *Lower Limit* to set the high pass cutoff frequency. Only one option will be available at a time. Upper Limit 1Hz ~ 500MHz Lower Limit 1Hz ~ 500MHz	Upper Limit 1.000kHz Lower Limit 136.570Hz
Tracking	5. Press *Tracking* if you want the settings of the digital filter on each channel to be the same. When a setting is changed on one channel, it is reflected on the other channels.	Tracking On Off
⚠Note	The digital filter settings will still apply to the relevant input signals after leaving the app, unless turned off.	
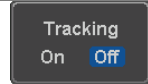
4-7. Remote Disk

Background	The Remote Disk app allows the scope to mount a network share drive. Basic Features: • Save and load files from the network share drive. • Ability to automatically mount the network share drive at startup.
Example	
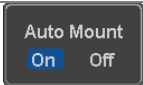
Panel Operation 1. Press the *APP* key.

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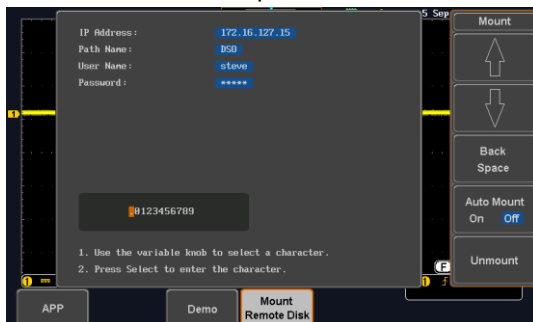
2. Press *Mount Remote Disk* from the bottom menu.

Mount Remote Disk

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	3. A form will appear (above) prompting you to enter the IP Address, Path Name, User Name and Password.	
	• IP Address refers to the IP address of the network share drive.	
	• Path Name refers to name of the shared directory of the network drive. This path must be in the root directory of the boot drive of the network disk. No sub-directories are allowed in the path name. For example a path name of "DSO" would be equivalent to C:/DSO.	
	• User Name refers to a username with permission to access the share drive.	
	• Password refers to the password for the username above.	
	• Use the Up and Down soft-keys navigate to each item in the form.	
	• Use the Variable knob and Back Space soft-key to enter characters for each item in the form.	
Mount/Unmount	4. To mount the network share driver, press *Mount* from the side menu. Press again to unmount. When the drive is successfully mounted, "Complete!" will be shown on the display.	Mount
Auto Mount	5. Press *Auto Mount* to automatically mount the network share drive at startup.	Auto Mount On Off
Set File Path	6. When accessing the file utilities, the network share drive is shown as "Z" drive. Files can be saved to or recalled from the network share drive in the same manner as the internal memory or a USB flash disk. See the File Utilities chapter for usage details.	Page 147

Example

Remote disk
drive (Z drive)
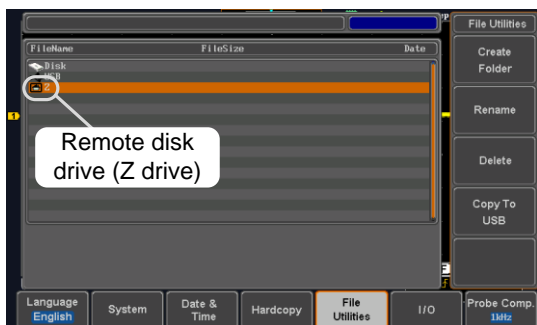
5. SAVE/RECALL

5-1. File Format/Utility

5-1-1. Image File Format

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

5-1-2. Waveform File Format

Format	DSxxxx.lsf, CH1~CH4.lsf	
	The LSF file format efficiently stores waveforms. This is the file format used for storing and recalling all waveforms that are used with the DCS-1000B series.	
Filename	DSxxxx.lsf, CH1 ~ CH4.lsf	
Waveform Type	CH1 ~ 4	Input channel signal
	REF	Reference waveform
	Math	Math operation result (page 39)
Storage Location	Wave1 ~ Wave20	Waveform files stored to the internal memory. Stored waveforms can be transferred to Ref. 1 ~ 4 to be viewed on the display. (W1 ~ W20 waveforms cannot be directly recalled on the display).
	Ref 1~4	Reference waveforms stored in the internal memory, separate from W1 ~ W20. Reference waveforms (Ref 1 ~ 4) can be displayed directly onto the display with amplitude and frequency information. Ref 1~4 are useful for reference purposes. Other waveforms (LSF and W1~20) must be recalled to R1~4 before being displayed.
Contents: Waveform Data	The waveform data can be used for detailed analysis. It consists of the horizontal and vertical data used by the waveform.	

5-1-3. Spreadsheet File Format

Format	*.csv (Comma-separated values format, can be opened in spreadsheet applications such as Microsoft Excel).
	CSV-formatted files can be stored in either a short-memory format or a long-memory format: Detail CSV, Fast CSV. The number of points that are saved depends on the record length settings.
	Detail CSV will record both the horizontal and vertical sample points of the waveform. All the points are recorded in scientific notation for analog data.
	Fast CSV will only record the vertical amplitude of the sample points. Fast CSV also contains data that enables the horizontal data points to be reconstructed, such as trigger position, etc. Data is recorded as integers.
	Note, however, that only fast CSV can be recalled to the internal memory. Detailed CSV cannot be recalled.
Filename	DSxxxx.csv
Waveform Type	CH1 ~ 4 Input channel signal Ref1~4 Reference waveform Math Math operation result (page 39) All All the waveforms on the display. Displayed
Contents: Detail CSV	Detail CSV waveform data contains channel information such as vertical and horizontal position of a signal for all the recorded points. The following information is included in Detail CSV, where applicable: - Format (scope type) - Trigger Level - Label - Vertical units - Vertical position - Horizontal scale - Memory length - Source - Probe ratio - Vertical scale - Horizontal units - Horizontal position

	• Horizontal mode	• Sampling period
	• Firmware	• Mode
	• Vertical data	• Horizontal data

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

	• Format (scope type)	• Memory length
	• IntpDistance (input trigger distance)	• Trigger address
	• Trigger level	• Source
	• Vertical units	• Vertical units div
	• Vertical units extend div	• Label
	• Probe type	• Probe ratio
	• Vertical scale	• Vertical position
	• Horizontal units	• Horizontal scale
	• Horizontal position	• Horizontal mode
	• SincET mode (sampling mode)	• Sampling period
	• Horizontal old scale	• Horizontal old position
	• Firmware	• Mode
	• Raw vertical waveform data	

5-1-4. Setup File Format

Format	DSxxxx.set (proprietary format) The setup file saves or recalls the following settings.

Contents	Acquire	• Mode	• Sample mode
		• Sample rate	
		• XY	• Record Length
	Display	• Mode	• Backlight intensity
		• Persistence	
		• Waveform intensity	• Graticule
			• Backlight
		• Graticule intensity	• Auto-dim

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

5-2. Create/Edit Labels

Overview	Reference files, Setup files and the analog input channels can have individual file labels set. For the analog channels and reference waveforms, the file label can be displayed next to the channel/reference indicator. The file labels are also used to easily identify reference files, setup files or channels when saving or recalling waveforms and setups.
Example	
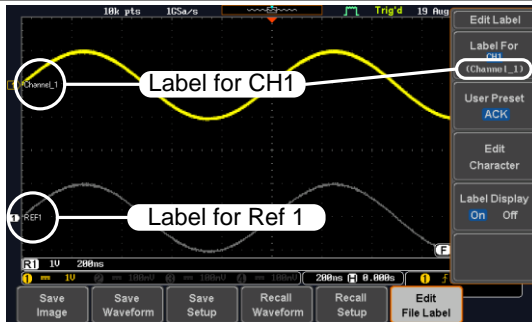
In the example above, the file label for channel 1 is displayed next to the channel indicator and is also displayed in the *Edit Label* menu. The Ref_1 file label is shown next to the reference indicator.

Panel Operation	1. Press the *Save/Recall* key from the front panel. **Save/Recall**
	2. Press *Edit File Label* from the bottom menu. **Edit File Label**
	3. Press *Label For* and select the item that you want to create the label for. **Label For Ref1 (ACK)** Label For CH1~CH4, Ref1~4, Set1~20, Math
	4. To choose a preset label, Press *User Preset* from the side menu and choose a label. **User Preset ACK** Labels ACK, AD0, ANALOG, BIT, CAS, CLK, CLOCK, CLR, COUNT, DATA, DTACK, ENABLE, HALT, INT, IN, IRQ, LATCH, LOAD, NMI

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

2. The Edit Label window appears.
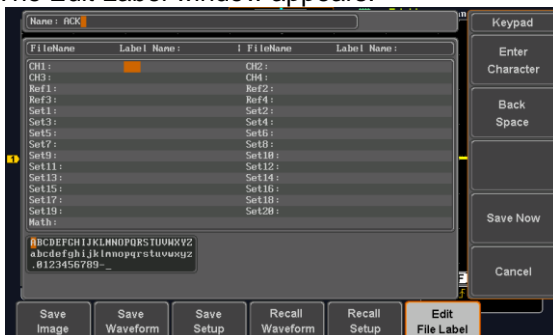
3. Use the Variable knob to highlight a character.

Press *Enter Character* to select a number or letter.	Enter Character
Press *Back Space* to delete a character.	Back Space
Press *Save Now* to save the label and return to the previous menu.	Save Now
To cancel the editing the label and return to the previous menu, press *Cancel*.	Cancel

Display Label	To display the currently selected file label on the screen next to its respective indicator, toggle *Label Display* to On. Conversely, if you want to remove the currently selected file label from the display, toggle *Label Display* to Off.	Label Display On Off

5-3. Save

5-3-1. File Type/Source/Destination

Item	Source	Destination
Panel Setup (DSxxxx.set)	• Front panel settings	• Internal memory: Set1 ~ 20 • File system: Disk, USB
Waveform Data (DSxxxx.csv) (DSxxxx.lsf) (CH1~CH4.lsf, Ref1~Ref4.lsf, Math.lsf)* ALLxxxx.csv	• Channel 1 ~ 4 • Math operation result • Reference waveform Ref1~4 • All displayed waveforms	• Internal memory: Reference waveform Ref1~4, Wave1 ~ 20 • File system: Disk, USB
Display Image (DSxxxx.bmp/png) (Axxx1.bmp/png)**	• Display image	• File system: Disk, USB

*Stored in ALLXXXX directories when All Displayed waveforms are saved.

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

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

The DCS-1000B does not have a built-in clock, so the date and time are not recorded.

5-3-2. Save Image

Images can be saved either using the Save/Recall key or by using the Hardcopy key. To save images using the Hardcopy key, see the hardcopy section on page152.

Panel Operation	1. To save to USB, connect a USB drive to the front panel USB port. If a USB drive is not connected, images can still be saved to the internal memory.	Front Panel
	2. Press the *Save/Recall* key from the front panel.	Save/Recall
	3. Press *Save Image* from the bottom menu.	Save Image
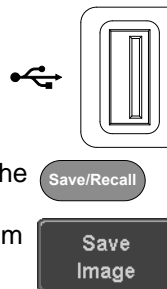
4. Press *File Format* to choose PNG or BMP file types.

File Format
Bmp

Range DSxxxx.bmp, DSxxxx.png
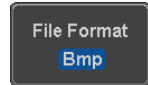
5. Press *Ink Saver* to toggle Ink Saver On or Off.
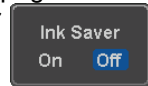
Ink Saver
On **Off**
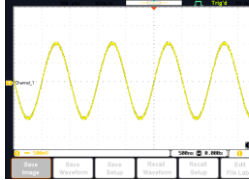
Ink Saver On   Ink Saver Off
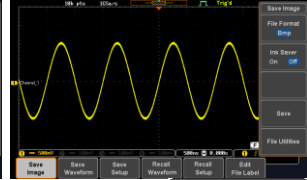
6. Press *Save* from the side menu to save the display as an image file.

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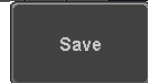
7. You will automatically be taken to a file utility where you will be able to edit the name of the file.

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

VARIABLE

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
.0123456789-_

Press *Enter Character* or the *Select* key to select a number or letter.
Press *Back Space* to delete a character.

Enter
Character
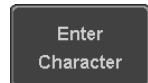
Back
Space

9. Press *Save Now* to save the file. The file name need not have been edited to save the file.
Note: Pressing *Cancel* will cancel the save operation and return you to the Save/Recall menu.

Save Now

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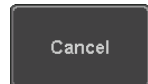
After *Save Now* has been pressed the file will be saved.

Image saved to USB:/DS0197.BMP.

⚠️ Note	The file will not be saved if the power is turned off or the USB drive is taken out before the message ends.	
File Utility	To edit the internal memory or the USB flash drive contents (create/ delete/rename files and folders) or to edit the default file path, press *File Utilities* from the side menu. See page 147 for details.	**File Utilities**

5-3-3. Save Waveform

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

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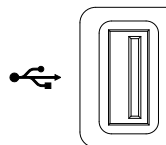
2. Press the *Save/Recall* key from the front panel.

Save/Recall

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

Save Waveform

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

From CH1

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

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

To Ref1 (ACK)

To File DS0001.LSF
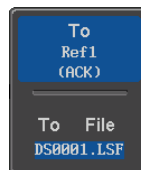
    To   Ref1~4, Wave1~20
    To File   Format: LSF, Detail CSV, Fast CSV

6. Press *Save* to save the file.

Save

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

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

VARIABLE

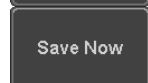```
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
.0123456789-_
```

Press *Enter Character* or the *Select* key to select a number or letter.
Press *Back Space* to delete a character.

Enter Character

Back Space

9. Press *Save Now* to save the file. The filename need not have been edited to save the file.
Note: Pressing *Cancel* will cancel the save operation and return you to the Save/Recall menu.

Save Now

Cancel

After *Save Now* has been pressed the file will be saved.
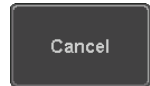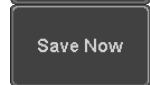
Waveform saved to USB:/DS0001.CSV.

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

| File Utility | To edit the internal memory or the USB flash drive contents (create/ delete/rename files and folders), press *File Utilities.* For details, see page147. | File Utilities |
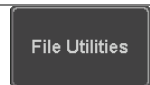
### 5-3-4. Save Setup

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

Front Panel

🔌

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

Save/Recall

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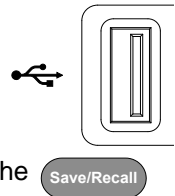
3. Press *Save Setup* from the bottom menu.

| Save Setup |

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

| To Set1 |
| To File DS0001.SET |

To          Set1~Set20
To File     DSxxxx.set

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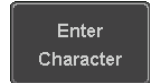
| Save |

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

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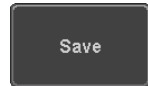
VARIABLE

←——————○——————→

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
.0123456789-_

Press *Enter Character* or the *Select* key to select a number or letter.
Press *Back Space* to delete a character.

| Enter Character |

| Back Space |
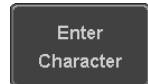
8. Press *Save Now* to save the file. The filename need not have been edited to save the file.
Note: Pressing *Cancel* will cancel the save operation and return you to the Save/Recall menu.
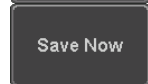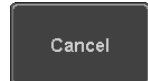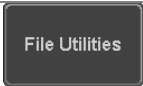
| Save Now |

| Cancel |

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

Setup saved to USB:/DS0001.SET.

|  | Note | The file will not be saved if the power is turned off or the USB drive is taken out before the message ends. |
| --- | --- | --- |
| File Utility | To edit the internal memory or the USB flash drive contents (create/ delete/ rename files and folders) or to set the file path, press *File Utilities*. For details, see 147. | File Utilities |
| Edit Label | To edit labels for Setup files, press *Edit Label*. For more details on editing labels, see page 134. | Edit Label |

## 5-4. Recall

### 5-4-1. File Type/Source/Destination

| Item | Source | Destination |
| --- | --- | --- |
| Default Panel Setup | • Factory installed setting | • Current front panel |
| Reference Waveform | • Internal memory: Ref1~4 | • Current front panel |
| Panel Setup (DSxxxx.set) | • Internal memory: S1 ~ 20<br>• File system: Disk, USB | • Current front panel |
| Waveform Data (DSxxxx.lsf, DSxxxx.csv\*\*) (CH1~CH4.lsf, Ref1~Ref4.lsf, Math.lsf)\* | • Internal memory: Wave 1 ~ 20<br>• File system: Disk, USB | • Reference waveform Ref1 ~ 4 |

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

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

### 5-4-2. Recall Default Panel Setting
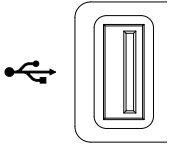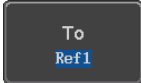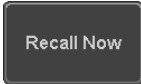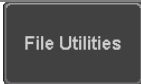
| Panel Operation | 1. Press the *Default* key. | Default |
| --- | --- | --- |
|  | 2. The screen will update with the default panel settings. | |
| Setting Contents | The following is the default (factory) setting contents. | |
| Acquire | Mode: Sample<br>Record Length: 10k | XY: OFF<br>Expand: By Center |
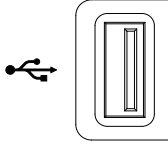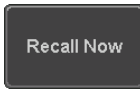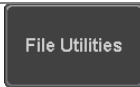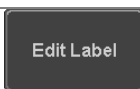
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| | | |
|---|---|---|
| Display | Mode: Vector | Persistence: 240ms |
| | Waveform intensity: 50% | Graticule intensity: 50% |
| | Backlight Intensity: 80% | Backlight Auto-dim: On |
| | Time: 10min | Graticule: full |
| Channel | Scale: 100mV/Div | CH1: On |
| | Coupling: DC | Impedance: 1MΩ |
| | Invert: Off | Bandwidth: full |
| | Expand: By Ground | Position: 0.00V |
| | Probe: Voltage | Probe attenuation: 1x |
| | Deskew: 0s | |
| Cursor | Horizontal cursor: Off | Vertical Cursor: Off |
| Measure | Source: CH1 | Gating: Screen |
| | Display All: Off | High-Low: Auto |
| | Statistics: Off | Mean & Std Dev |
| | | Samples: 2 |
| | High Ref: 90.0% | Mid Ref: 50.0% |
| | Low Ref: 10.0% | |
| Horizontal | Scale: 10us/Div | Position: 0.000s |
| Math | Source1: CH1 | Operator: + |
| | Source2: CH2 | Position: 0.00 Div |
| | Unit/Div: 200mV | Math Off |
| FFT | Source: CH1 | Vertical Units: dBV RMS |
| | Window: Hanning | Vertical: 20dB |
| | Horizontal:5MHz/div | |
| Advanced Math | Expression: CH1+CH2 | VAR1: 0 |
| | VAR2: 1 | Position: 0.00Div |
| | Unit/div: 500mV | |
| APP | App: Go-NoGo, DVM, Datalog, Mount Remote Disk | |
| Trigger | Type: Edge | Source: CH1 |
| | Coupling: DC | Alternate: Off |
| | Noise Rejection: Off | Slope: Positive |
| | Level: 0.00V | Mode: Auto |
| | Holdoff: 10.0ns | |
| Utility | Hardcopy: Save | Ink Saver: Off |
| | Assign Save To: Image | File Format: Bmp |
| | Probe Comp.: 1kHz | |

### 5-4-3. Recall Waveform

| | | |
|---|---|---|
| Panel Operation | 1. For recalling from an external USB flash drive, connect the drive to the front or rear panel USB port. | Front Panel |

2. The waveform must be stored in advance. See page 138 for waveform store details.
3. Press the *Save/Recall* key.

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

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

> From       Wave1~20
> From File*   File format: Lsf, Fast Csv
> *Only files in the current file path will be available, this includes files saved in the ALLxxxx directories.
> Allxxxx.csv files cannot be recalled to the oscilloscope.
> Only the "Fast CSV", "LSF" files can be recalled to the oscilloscope.

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

> To         Ref1~4

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

| | |
|---|---|
| File Utility | To edit USB flash drive contents (create/ delete/ rename files and folders) or to set the file path, press *File Utilities*. For details, see page 147. |

### 5-4-4. Recall Setup

| | | |
|---|---|---|
| Panel Operation | 1. (For recalling from an external USB flash drive) Connect the drive to the front or rear panel USB port. | Front Panel |
| | 2. Press the *Save/Recall* key. | **Save/Recall** |
| | 3. Press *Recall Setup* from the bottom menu. | **Recall Setup** |
| | 4. Press *From* (internal memory) or *From File* and choose a source to recall from. | **From Set1** / **From File** |

From        Set1~20
From File  DSxxxx.set (USB, Disk)\*
\* Only files in the current file path will be available.

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

> Setup recalled from Set1.

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

| | | |
|---|---|---|
| File Utility | To edit the internal memory or the USB flash drive contents (create/ delete/ rename files and folders) or to set the file path, press *File Utilities*. For details, see page 147. | **File Utilities** |
| Edit Label | To edit labels for Setup files, press *Edit label*. For more details on editing labels, see page 134. | **Edit Label** |

## 5-5. Reference Waveforms
### 5-5-1. Recall and Display Reference Waveforms

Panel Operation    A reference waveform must be stored in advance.
                   See page 138 to store waveforms as reference
                   waveforms.

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

   REF

   ( R )

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

   R1 OFF
   19-Aug-14
   11:54:14

   ⇕

   R1 ON
   19-Aug-14
   11:54:14

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

   R1 ON
   19-Aug-14
   11:54:14

   ↓

   R1 ON
   19-Aug-14
   11:54:14
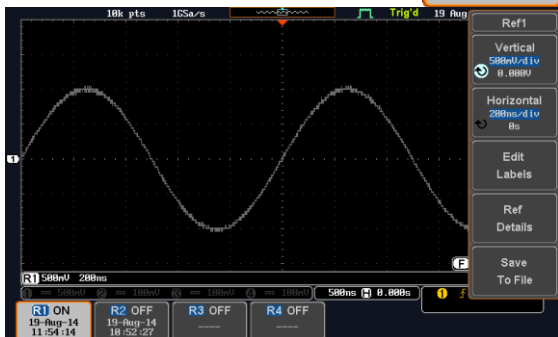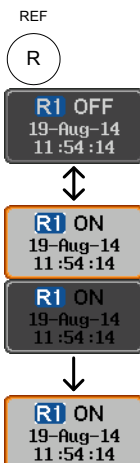
| Vertical | Press *Vertical* repeatedly from the side menu to choose to edit the vertical position or Unit/Div. Use the Variable knob to edit the values. | Vertical 500mV/div 0.000V |
|---|---|---|
| Navigation | | |
| Horizontal | Press *Horizontal* repeatedly from the side menu to choose to edit the Time/Div or the horizontal position. Use the Variable knob to edit the value. | Horizontal 200ns/div 0s |
| Navigation | | |
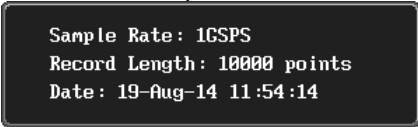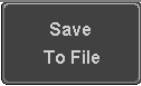
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| View Reference Waveform Details | Pressing *Ref Details* will display the reference waveform details. | Ref Details |
|---|---|---|
| | Details: Sample Rate, Record Length, Date | |
| | Sample Rate: 1GSPS<br>Record Length: 10000 points<br>Date: 19-Aug-14 11:54:14 | |
| Edit Labels | To edit labels for Setup files, press *Edit Labels*. For more details on editing labels, see page 134. | Edit Labels |
| Save Reference Waveforms | To save reference waveforms, press *Save to File*. For more details on saving waveforms, see page 138. | Save To File |

# 6. FILE UTILITIES

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

6-1-1. File Navigation

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

File System          File path                    Drive space
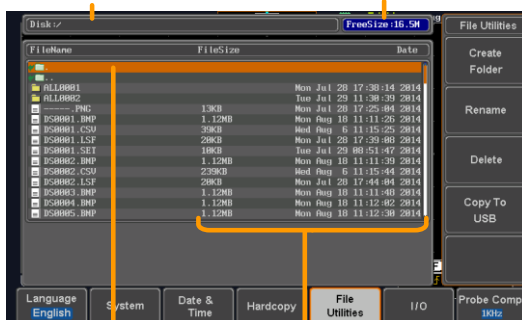


File cursor        File attributes

Panel Operation  1. Press the *Utility* key.

**Utility**

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

**File Utilities**
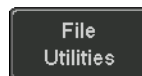
3. The file system appears.

4. Use the *Variable* knob to move the file cursor up and down.
Use the *Select* key to choose a file or directory or to set the file path.

**VARIABLE**

Select
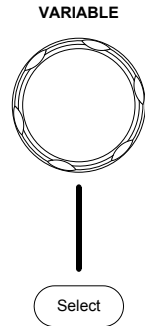
⚠️ Note

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

### 6-1-2. Create Folder

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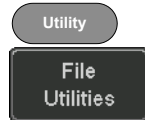
Utility

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

File Utilities

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

| Disk:/ | | FreeSize:16.5M | File Utilities |
|--------|---|---------------|----------------|
| FileName | FileSize | Date | |
| ◼ | | | Create Folder |
| 📁 .. | | | |
| 📁 ALL0001 | | Mon Jul 28 17:38:14 2014 | |
| 📁 ALL0002 | | Tue Jul 29 11:30:39 2014 | |
| ◼ ------.PNG | 13KB | Mon Jul 28 17:25:04 2014 | Rename |
| ◼ DS0001.BMP | 1.12MB | Mon Aug 18 11:11:26 2014 | |
| ◼ DS0001.CSV | 39KB | Wed Aug  6 11:15:25 2014 | |
| ◼ DS0001.LSF | 20KB | Mon Jul 28 17:39:08 2014 | |
| ◼ DS0001.SET | 10KB | Tue Jul 29 08:51:47 2014 | Delete |
| ◼ DS0002.BMP | 1.12MB | Mon Aug 18 11:11:39 2014 | |
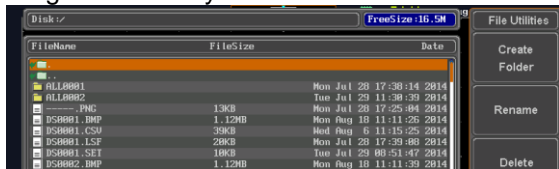
Create Folder 4. Press *Create Folder* to make a new directory at the selected location.
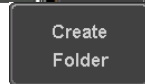
Create Folder

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

VARIABLE

⟵ ⟶

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
.0123456789-_

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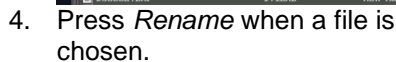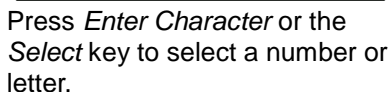
| | Press *Enter Character* or the *Select* key to select a number or letter. | Enter Character |
| | Press *Back Space* to delete a character. | Back Space |
| | 6. Press *Save Now* to create the folder. | Save Now |
| Cancel | Press *Cancel* to cancel the operation. | Cancel |

### 6-1-3. Rename File

Panel Operation 1. Press the Utility key.

Utility

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

File Utilities

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



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

Rename

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



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

Enter Character

Press *Back Space* to delete a character.

Back Space

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

Save Now

### 6-1-4. Delete File or Folder

Panel Operation 1. Press the *Utility* key.

**Utility**

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

File Utilities

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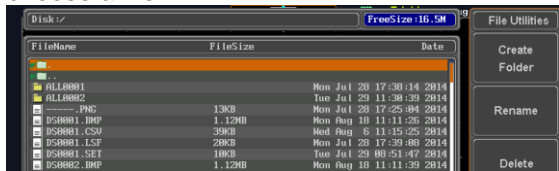


4. Press *Delete* to delete the selected file.

Delete

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

Delete

### 6-1-5. Copy File to USB

Panel Operation 1. Connect a USB drive to the front panel USB port.
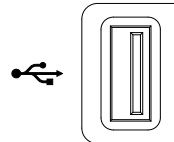
Front Panel

2. Press the *Utility* key.

**Utility**

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

File Utilities

4. Use the *Variable* knob and *Select* key to navigate the file system to choose a file from internal memory.
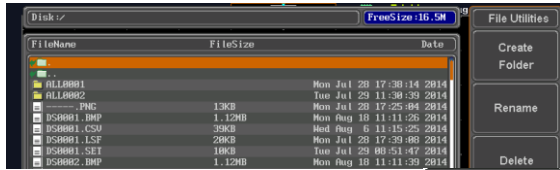
5. Press *Copy to USB* to copy the selected file to the USB drive.

Copy To USB

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

6-1-6. Installing Optional Apps and Functions

Overview  The DCS-1000B Series has the optional apps or the optional functions

Panel Operation 1. After copy the option's file to the Front Panel USB drive, Connect the USB drive to the front panel USB port.
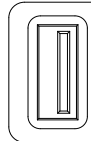
2. Press the *Utility* key.

  **Utility**

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

  File Utilities

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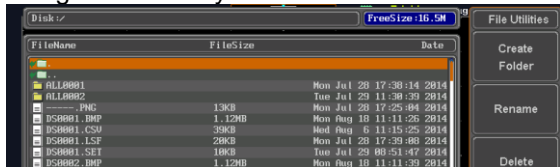


5. Press *Copy to USB* to copy the selected file to the USB drive.

  Select

6. When the installation has completed you will be prompted to restart the oscilloscope.

| Option Name | File Nmae |
|---|---|
| Data log function | :DataLog_1KB.gz |
| Digital Filter function | :DigitalFilter_1KB.gz |
| DVM function | :DVM_1KB.gz |

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# 7. HARDCOPY

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

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

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

## 7-1-1. Printer I/O Configuration

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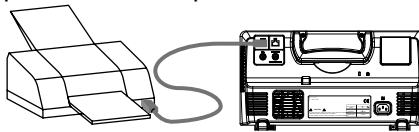


            2. Press the *Utility* key.

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

            4. Press USB *Device Port* from the side menu and select *Printer*.
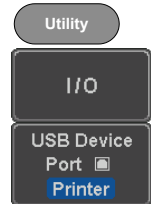
## 7-1-2. Print Output

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

Panel Operation    1. Press the *Utility* key.

            2. Press *Hardcopy* from the bottom menu.

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

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

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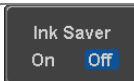
Ink Saver On                          Ink Saver Off
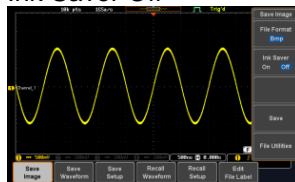


### 7-1-3. Save - Hardcopy Key

| Background | When the Hardcopy key is assigned to "Save", pressing the Hardcopy key can be used to save a screen shot, a waveform, or the current setup, depending on the configuration. | |
|---|---|---|
| Panel Operation | 1. If you wish to save to USB, connect a USB drive to the front panel USB port, otherwise the file will save to internal memory. | Front |
| | 2. Press the *Utility* key. | Utility |
| | 3. Press *Hardcopy* from the bottom menu. | Hardcopy |
| | 4. On the side menu, press *Function* to select Save. | Function  Print  Save |
| | 5. Press *Assign Save To* and select which type of file will be saved when the Hardcopy key is pressed.  File Type:  Image, Waveform, Setup, All | Assign Save To  Image |
| | 6. Press the *Hardcopy* key to save the file*.  A message will appear when the save is successful. | HARDCOPY |
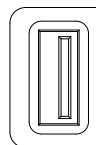
Image saved to USB:/DS0197.BMP.

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

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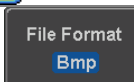
Format: BMP, PNG

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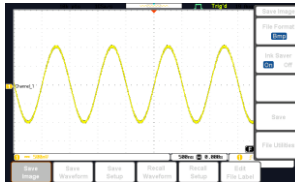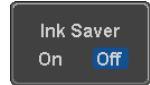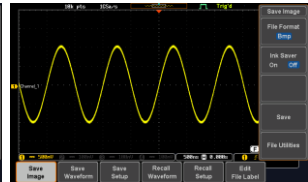


| Ink Saver On | Ink Saver Off |

⚠️ Note

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

# 8. REMOTE CONTROL

This chapter describes basic configuration for remote control. For a command list, refer to the programming manual.

8-1-1.  Configure USB Interface

| USB Configuration | PC side connector | Type A, host |
|---|---|---|
| | DCS-1000B side connector | Type B, device |
| | Speed | 1.1/2.0 |
| | USB Class | USB-CDC |
| | OS | Windows7 or higher (32bit/64bit) |
| | USB Driver | TEXIO_CDC*.inf |

| Panel Operation | 1. Press the Utility key. | **Utility** |
|---|---|---|
| | 2. Press *I/O* from the bottom menu. | **I/O** |
| | 3. Press *USB Device Port* from the side menu and select *Computer*. | **USB Device Port ▣ Computer** |
| | 4. Connect the USB cable to the rear panel device port. | **DEVICE** |
| | 5. When the PC asks for the USB driver or 'Unknown device' listed in Device Manager, install TEXIO-CDC*.inf attached CD. | |
| | 6. If the computer can not recognize the new hardware due to the security, please go to update the driver from the "Other devices" in the Device Manager. | |
| ⚠ Note | You must have administrator account to install driver. | |

8-1-2.  Configure the Ethernet Interface

| Ethernet Configuration | MAC Address | Domain Name |
|---|---|---|
| | Instrument Name | DNS IP Address |
| | User Password | Gateway IP Address |
| | Instrument IP Address | Subnet Mask |
| | | HTTP Port 80 (fixed,stopped) |
| Background | The Ethernet interface is used for remote control using a socket server connection. For details, please see the Socket Server section on page 157. | |

Panel Operation 1. Connect the Ethernet cable to the LAN port on the rear panel.
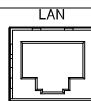
2. Press the *Utility* key.

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

4. Press *Ethernet* from the side menu.
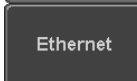
5. Set *DHCP/BOOTP* to *On* or *Off* from the side menu.
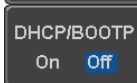
⚠️ Note    IP addresses will automatically be assigned with DHCP/BOOTP set to on. For Static IP Addresses, DHCP/BOOTP should be set to off.

| | |
|---|---|
| MAC Address: | 00:08:21:21:72:73 |
| Instrument Name: | Steve |
| User Password: | dso |
| Instrument IP Address: | 172.16.5.56 |
| Domain Name: | |
| DNS IP Address: | |
| Gateway IP Address: | 172.16.0.254 |
| Subnet Mask: | 255.255.0.0 |
| HTTP Port: | 80 |

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
.0123456789-_

1. Use the variable knob to select a character.
2. Press Select to enter the character.

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

Items    MAC Address, Instrument Name, User Password, Instrument IP Address, Domain Name, DNS IP Address, Gateway IP Address, Subnet Mask
Note: HTTP Port is fixed at 80.

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

**VARIABLE**

Select
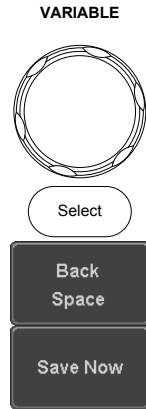
Press *Backspace* to delete a character.

Back Space

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

Save Now

### 8-1-3. Configure Socket Server

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

| Configure Socket Server | 1. Configure the IP address for the DCS-1000B. | Page 155 |
|---|---|---|
| | 2. Press the *Utility* key. | Utility |
| | 3. Press *I/O* from the bottom menu. | I/O |
| | 4. Press *Socket Server* from the side menu. | Socket Server |
| | 5. Press *Select Port* and choose the port number with the Variable knob.<br>Range    1024~65535 | Select Port<br>3001 |
| | 6. Press *Set Port* to confirm the port number. | Set Port |
| | 7. The Current Port icon will update to the new port number. | Current Port<br>3000 |
| | 8. Press *Server* and turn the socket server On. | Server<br>On   Off |
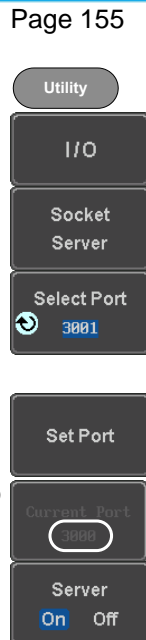
## 8-1-4. USB Functionality Check

| | |
|---|---|
| Terminal Application | Invoke a terminal application such as RealTerm. Set the COM port, baud rate, stop bit, data bit, and parity accordingly. Set the delimiter and the local echo as necessary. To check the COM port number and associated port settings, see the Device Manager in the PC. For Windows 7: *Control panel → Hardware and Sound→ Device Manager* Example: Configuring RealTerm: |



| | |
|---|---|
| Functionality Check | Key in this query command via the terminal application. \*idn? This should return the Manufacturer, Model number, Serial number, and Firmware version in the following format. *TEXIO,DCS-1102B,PXXXXXX,V1.00* |
| ⚠️ Note | For further details about remote control and remote commands, please see the DCS-1000B programming manual. |
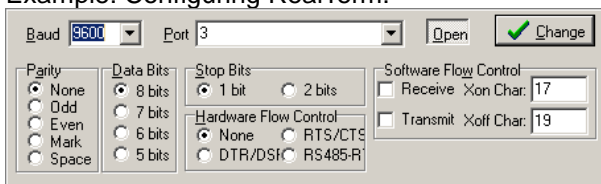
## 8-1-5. Socket Server Functionality Check

| | |
|---|---|
| NI Measurement and Automation Explorer | To test the socket server functionality, National Instruments MAX (Measurement and Automation Explorer) can be used. This program is available on the NI website, www.ni.com. The following display and operation will differ depending on the version of MAX, Please use in accordance with the display for your MAX. |
| Operation | 1. Configure the IP address for the DCS-1000B.     Page 155 |
| | 2. Configure the socket port.     Page 157 |
| | 3. Start the NI Measurement and Automation Explorer (MAX) program. Using Windows, press: |

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



4. From the Configuration panel access; *My System>Devices and Interfaces>Network Devices*
5. Right click *Network Devices* and select *Create New Visa TCP/IP Resource…*
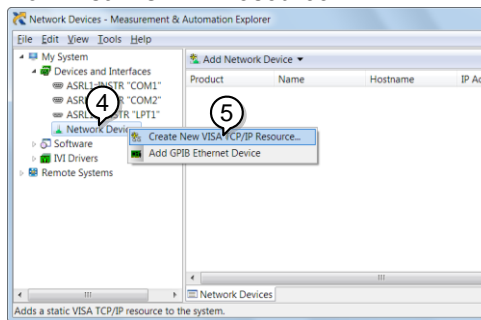


6. Select *Manual Entry of Raw Socket* from the popup window.
7. Click *Next*.
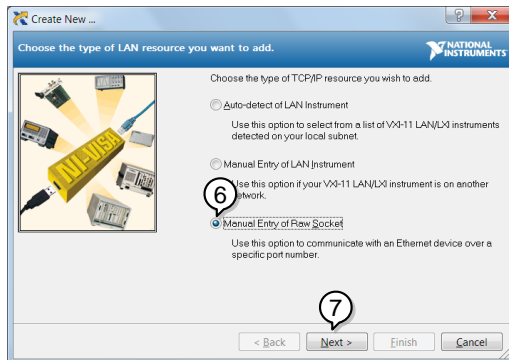
8. Enter the DCS-1000B's IP address and socket port number.
9. Click *Validate*.
10. A popup will appear to tell you if a VISA socket session was successfully created.
11. Click *Next*.
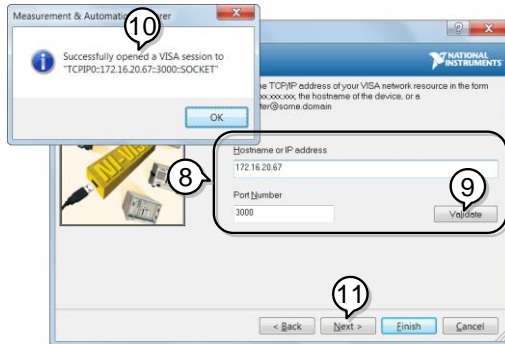


12. Choose an alias for the socket connection if you like.
13. Click *Finish* to finish the configuration.



14. The DCS-1000B will now appear under Network Devices in the Configuration Panel.

Functionality
Check

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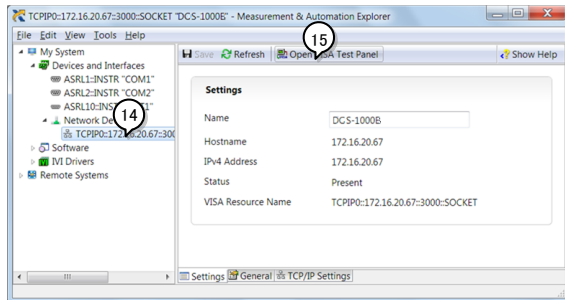


16. Click on the *Configuration* icon.
17. Select the *I/O Settings* tab.
18. Mark the *Enable Termination Character*
    checkbox. Make sure the termination character
    is a line feed (/n, value: xA).
19. Click *Apply Changes*.
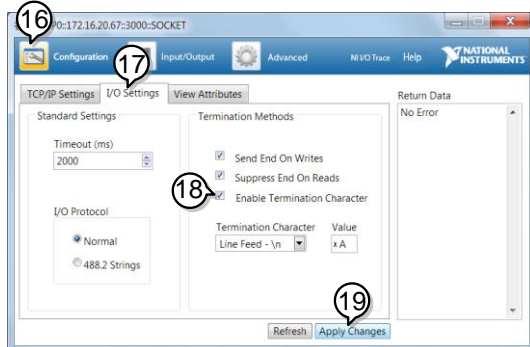
20. Click the *Input/Output* icon.
21. Make sure the \*IDN? query is selected in the *Select or Enter Command* drop box.
22. Click on *Query*.
23. The manufacturer, model number, serial number and firmware version will be displayed in the buffer. For example:
    TEXIO,DCS-1202E,PXXXXXX,V1.00
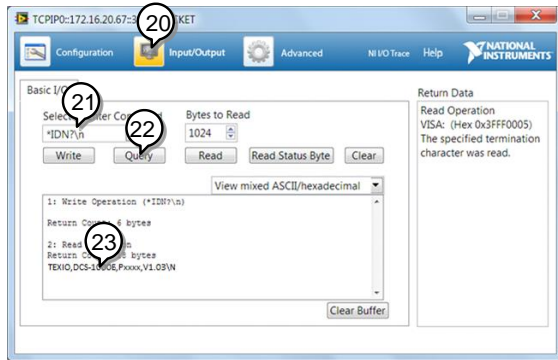


| ⚠ Note | For further details about remote control and remote commands, please see the DCS-1000B programming manual. |

# 9. MAINTENANCE

Three types of maintenance operations are available:
    Signal Path Compensation (SPC)
    calibrate vertical accuracy
    compensate the probe.
Run these operations when using the DCS-1000B in a new environment.

9-1-1.  How to use SPC function

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

Panel Operation  1. Press the *Utility* key.

2. Press *System* from the bottom menu.

3. Press *SPC* from the side menu. A message showing a brief introduction to SPC appears on the screen.
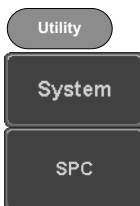
⚠ Note  Disconnect all probes and cables from all channels before calibrating.
The DSO needs to be warmed up for at least 30 minutes before using the SPC function.

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

5. The SPC Calibration will proceed one channel at a time, from channel 1 to channel 4.
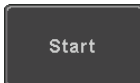
9-1-2.  Vertical Accuracy Calibration

Panel Operation  1. Press the *Utility* key.

2. Press *System* from the bottom menu.

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

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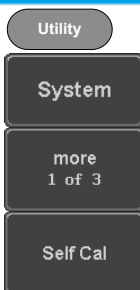
5. Press *Vertical* on the side menu.
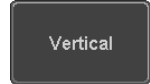
Vertical

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

7. Connect the calibration signal from the rear panel to the Channel 1 input with a BNC cable. It will use very low level signal, please use the cable with the high shield effect and short.

CAL            CH1
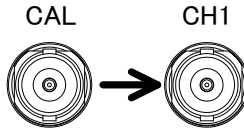
8. Press *Vertical* again after connecting CAL to the channel 1 input.

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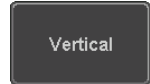
The calibration for Channel 1 starts and ends automatically, in less than 5 minutes.
A message is displayed when the calibration procedure has ended.

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

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

### 9-1-3. Probe Compensation

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

2. Alternatively, the probe compensation frequency can be changed. See page 117 for details.
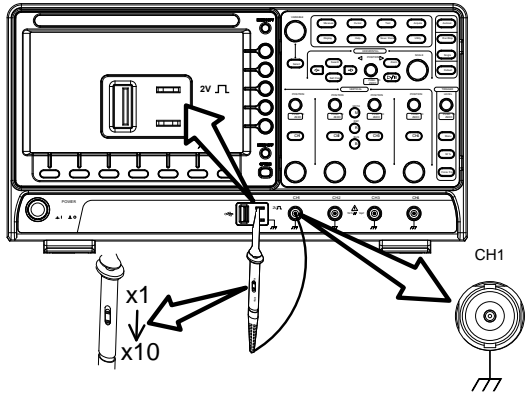
3. Press the *CH1* key to activate CH1.

**CH1**

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

Coupling
DC AC GND

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

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

Autoset

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

Display →

Dot Vector
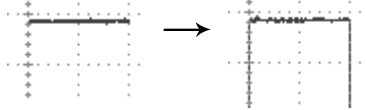


8. Turn the adjustment point on the probe to make the waveform as square as possible.



Under Compensation          Normal          Over Compensation



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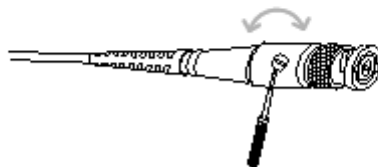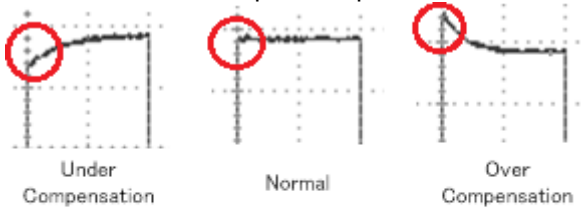
# 10. APPENDIX

## 10-1. FAQ

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

- **I connected the signal but it does not appear on the display.**
  Make sure you have activated the channel by pressing the Channel key (the channel key lights up).

- **I want to remove the (Measurement result / FFT result / Help contents) from the display.**
  To clear automatic measurement results, press the Measure key, select Remove Measurement and choose Remove All. See page 28.
  To clear individual measurements from the screen, press the Measure key, select Display All and choose Off. See page 29.
  To clear the FFT result, press the Math key twice. See page 39 for details.
  To clear Help result, press the Help key again. See page 18 for details.

- **The waveform does not update (frozen).**
  Press the Run/Stop key to unfreeze the waveform. See page 21 for details.
  If this does not help, the trigger mode might be set to Single. Press the Single key to exit Single mode. See page 21 for Single trigger details.

- **The probe waveform is distorted.**
  You might need to compensate the probe.

- **Autoset does not catch the signal well.**
  The Autoset function cannot catch signals under 30mV or 20Hz.
  Please use the manual operation. See page 20 for Autoset
  details.

- **The display image printout is too dark on the background.**
  Use the Ink Saver function which reverses the background color.
  For details, see page 152.

- **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 TEXIO
TECHNOLOGY at https://www.texio.co.jp / or mail to
info@texio.co.jp.

## 10-2. Updating the Firmware

| | |
|---|---|
| Background | New firmware can be downloaded from the TEXIO website in the DSO products section. Place a copy of the firmware onto the root directory of a USB memory stick. |
| Panel Operation | 1. Put the USB drive that contains the firmware into the front panel USB port. Front panel |
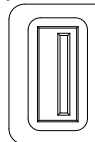
1. Press the *Utility* key.

   Utility

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

   File Utilities

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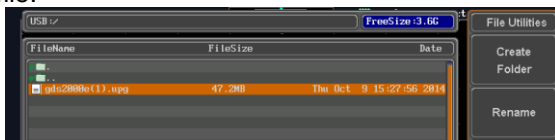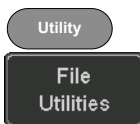


4. Press the *Select* key to begin the installation of the upgrade file.

   Select

5. A message will appear asking you to confirm this process.
   Press the *Select* key again to confirm the installation of the firmware.

   Select

   Alternatively, press any other key to cancel the installation.

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

## 10-3.  SPECIFICATIONS
### 10-3-1.  Model Specifications

| | | |
|---|---|---|
| DCS-1052B | Channels | 2 + Ext |
| | Bandwidth | DC ~ 50MHz (–3dB) |
| | Rise Time | 7ns |
| | Bandwidth Limit | 20MHz |
| DCS-1054B | Channels | 4 |
| | Bandwidth | DC ~ 50MHz (–3dB) |
| | Rise Time | 7ns |
| | Bandwidth Limit | 20MHz |
| DCS-1072B | Channels | 2 + Ext |
| | Bandwidth | DC ~ 70MHz (–3dB) |
| | Rise Time | 5ns |
| | Bandwidth Limit | 20MHz |
| DCS-1074B | Channels | 4 |
| | Bandwidth | DC ~ 70MHz (–3dB) |
| | Rise Time | 5ns |
| | Bandwidth Limit | 20MHz |
| DCS-1102B | Channels | 2 + Ext |
| | Bandwidth | DC ~ 100MHz (–3dB) |
| | Rise Time | 3.5ns |
| | Bandwidth Limit | 20MHz |
| DCS-1104B | Channels | 4 |
| | Bandwidth | DC ~ 100MHz (–3dB) |
| | Rise Time | 3.5ns |
| | Bandwidth Limit | 20MHz |

### 10-3-2.  Common Specifications

| | | |
|---|---|---|
| Vertical Sensitivity | Resolution | 8 bit: 1mV~10V/div |
| | Input Coupling | AC, DC, GND |
| | Input Impedance | 1MΩ// 16pF approx. |
| | DC Gain Accuracy | 1mV: ±4% full scale<br>>2mV: ±3% full  scale |
| | Polarity | Normal & Invert |
| | Maximum Input Voltage | 300Vrms, CAT I |
| | Offset Position Range | 1mV/div : ±1.25V<br>2mV/div ~ 100mV/div : ±2.5V<br>200mV/div ~ 10V/div : ±125V |
| | Waveform Signal Process | +, -, ×, ÷, FFT, FFTrms, User Defined Expression<br>FFT: Spectral magnitude. Set FFT Vertical Scale to Linear RMS or dBV RMS, and FFT Window to Rectangular, Hamming, Hanning, or Blackman-Harris |

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| | | |
|---|---|---|
| Trigger | Source | CH1, CH2, CH3*, CH4*, Line, EXT**<br>*four channel models only.<br>**two channel models only. |
| | Trigger Mode | Auto (supports Roll Mode for 100 ms/div and slower), Normal, Single Sequence |
| | Trigger Type | Edge, Pulse Width(Glitch), Video, Pulse Runt, Rise & Fall(Slope), Timeout, Alternate, Event-Delay(1~65535 events), Time-Delay(Duration, 4nS~10S), Bus |
| | Holdoff range | 4ns to 10s |
| | Coupling | AC, DC, LF rej., Hf rej., Noise rej. |
| | Sensitivity | 1div |
| External Trigger | Range | ±15V |
| | Sensitivity | DC ~ 100MHz Approx. 100mV |
| | Input Impedance | 1MΩ±3%~16pF |
| Horizontal | Timebase Range | 5ns/div ~ 100s/div (1-2-5 increments)<br>ROLL: 100ms/div ~ 100s/div |
| | Pre-trigger | 10 div maximum |
| | Post-trigger | 2,000,000 div maximum |
| | Timebase Accuracy | ±50 ppm over any ≥ 1 ms time interval |
| | Real Time Sample Rate | 1GSa/s max. |
| | Record Length | Max. 10Mpts |
| | Acquisition Mode | Normal, Average, Peak Detect, Single |
| | Peak Detection | 2nS (typical) |
| | Average | selectable from 2 to 256 |
| X-Y Mode | X-Axis Input | Channel 1; Channel 3*<br>*four channel models only |
| | Y-Axis Input | Channel 2; Channel 4*<br>*four channel models only |
| | Phase Shift | ±3° at 100kHz |
| Cursors and Measurement | Cursors | Amplitude, Time, Gating available; Unit: Seconds(s), Hz(1/s), Phase(degree), Ration(%) |
| | Automatic Measurement | 36 sets: Pk-Pk, Max, Min, Amplitude, High, Low, Mean, Cycle Mean, RMS, Cycle RMS, Area, Cycle Area, ROVShoot, FOVShoot, RPREShoot, FPREShoot, Frequency, Period, RiseTime, FallTime, +Width, -Width, Duty Cycle, +Pulses, -Pulses, +Edges, -Edges, FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF, Phase |

| | Cursors measurement | Voltage difference between cursors ( $\Delta V$)<br>Time difference between cursors ( $\Delta T$) |
|---|---|---|
| | Auto counter | 6 digits, range from 2Hz minimum to the rated bandwidth |
| Control Panel Function | Autoset | Single-button, automatic setup of all channels for vertical, horizontal and trigger systems, with undo Autoset |
| | Save Setup | 20set |
| | Save Waveform | 24set |
| Display | TFT LCD Type | 7" TFT WVGA color display |
| | Display Resolution | 800 horizontal × 480 vertical pixels (WVGA) |
| | Interpolation | Sin(x)/x |
| | Waveform Display | Dots, vectors, variable persistence (16ms~4s), infinite persistence |
| | Waveform Update Rate | 50,000 waveforms per second, maximum |
| | Display Graticule | 8 x 10 divisions |
| | Display Mode | YT, XY |
| Interface | USB Port | USB 2.0 High-speed host port X1, USB High-speed 2.0 device port X1 |
| | Ethernet Port (LAN) | RJ-45 connector, 10/100Mbps with HP Auto-MDIX  (4ch Model Only) |
| | Go-NoGo BNC | 5V Max/10mA TTL open collector output |
| | Kensington Style Lock | Rear-panel security slot connects to standard Kensington-style lock |
| Power Source | Line Voltage | 100V~240V AC, 50Hz~60Hz |
| | Power Consumption | 30W, 45VA maximum |
| Miscellaneous | Menu | Multi-language manu Available |
| | Operation Environment | Temperature: 0°C to 50°C. Relative Humidity ≤ 80% at 40°C or below;<br>≤ 45% at 41°C ~ 50°C |
| | On-line help | Available |
| | Dimensions | 384mmX208mmX127.3mm |
| | Weight | 2.8kg |

### 10-3-3.  Probe Specifications
### 10-3-3-1. For DCS-1052B/1054B/1072B/1074B

| Model | | GTP-070B-4 |
|---|---|---|
| Position x10 | Attenuation Ratio | 10:1 |
| | Bandwidth | DC ～ 70MHz |
| | Input Resistance | 10MΩ when used with oscilloscopes with 1MΩ input. |
| | Input Capacitance | 14.5pF~17.5pF |
| | Compensation Range | 10pF ～ 35pF |
| | Max. Input Voltage | ≤600V DC + ACpk |
| Position x1 | Attenuation Ratio | 1:1 |
| | Bandwidth | DC ～ 10MHz |
| | Input Resistance | 1MΩ when used with 1MΩ input |
| | Input Capacitance | 85pF~115pF |
| | Max. Input Voltage | ≤200V DC + ACpk |
| Operating Cond. | Temperature | −10°C ~ 50°C |
| | Relative Humidity | ≤85% |

### 10-3-3-2. For DCS-1102B/1104B

| Model | | GTP-100B-4 |
|---|---|---|
| Position X10 | Attenuation Ratio | 10:1 |
| | Bandwidth | DC ～ 100MHz |
| | Input Resistance | 10MΩ when used with oscilloscopes with 1MΩ input. |
| | Input Capacitance | 14.5pF~17.5pF |
| | Compensation Range | 5 ～ 30pF |
| | Max. Input Voltage | ≤600V DC + ACpk |
| Position X1 | Attenuation Ratio | 1:1 |
| | Bandwidth | DC ～ 10MHz |
| | Input Resistance | 1MΩ (Oscilloscope Input) |
| | Input Capacitance | 85pF~115pF |
| | Max. Input Voltage | ≤200V DC + ACpk |
| Operating Cond. | Temperature | −10°C ~ 50°C |
| | Relative Humidity | ≤85% |

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

## 10-4. DIMENSIONS