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Safety Instructions

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

Safety Symbols

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

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

Safety Guidelines

General Guideline

- Make sure the BNC input voltage does not exceed 300Vpeak.

CAUTION

- Never connect a hazardous live voltage to the ground side of the BNC connectors. It might lead to fire and electrical shock.
- Do not place any heavy object on oscilloscope.
- Avoid severe impacts or rough handling that leads to damaging oscilloscope.
- Do not discharge static electricity to oscilloscope.
- Use only mating connectors, not bare wires, for the terminals.
- Do not block or obstruct cooling fan vent opening.
- Do not perform measurements at power source and building installation site (Note below).
- Do not disassemble oscilloscope unless you are qualified as service personnel.

(Note) EN 61010-1:2001 specifies the measurement categories and their requirements as follows. Oscilloscope falls under category II.
* Measurement category IV is for measurement performed at the source of low-voltage installation.
* Measurement category III is for measurement performed in the building installation.
* Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation.

Power Supply

- Input voltage: 100 ~ 240 V AC, 47 ~ 63Hz

WARNING

- The power supply voltage should not fluctuate more than 10%.

- Connect the protective grounding conductor of the power cord to earth ground, to avoid electrical shock.

Fuse

WARNING

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

Cleaning oscilloscope	• Disconnect the power cord before cleaning. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid into oscilloscope. • Do not use chemicals or cleaners containing harsh materials such as benzene, toluene, xylene, and acetone.
Operation Environment	Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (see below) Relative Humidity: < 80% Altitude: < 2000m Temperature: 0°C to 50°C
	(Note) EN 61010-1:2001 specifies the pollution degrees and their requirements as follows. oscilloscope falls under degree 2. Pollution refers to “addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity”. * Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. * Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected. * Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.
Storage Environment	Location: Indoor Relative Humidity: < 80% Temperature: −20°C to 70°C

Power cord for the United Kingdom

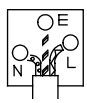
When using oscilloscope in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead / appliance must only be wired by competent persons

WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)



As the colours of the wires in main leads may not correspond with the colours marking identified in your plug/appliance, proceed as follows:

The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol or coloured Green or Green & Yellow.

The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.

The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of 0.75mm2 should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.

Any moulded mains connector that requires removal /replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if a engaged in live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

Getting Started

Follow these instructions to properly setup oscilloscope, especially if you are using it for the first time.

Oscilloscope characteristics

This oscilloscope is a generic purpose digital storage oscilloscope suitable for wide range of applications, such as production testing, research, and field verification.

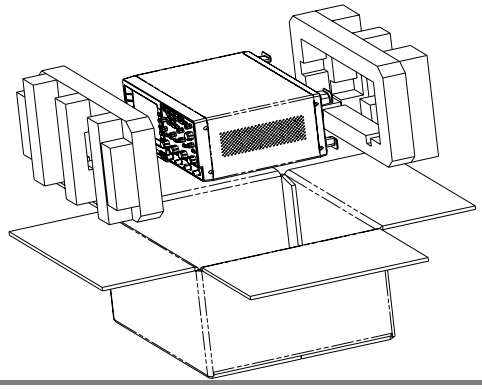
Main Features

- Wide selection range: 60MHz to 200MHz bandwidth, 2 or 4 channels
- High Sampling rate: up to 25GS/s equivalent-time
- Powerful display: 5.6 in. color TFT, wide viewing angle, 8 x 12 divisions waveform support
- USB connection: to printers and storage devices
- Optional Battery operation
- Deep memory: 25k points record length
- Automatic measurements: maximum 27 types
- Peak detection: up to 10ns
- FFT analysis
- Triggers: Video, Pulse width, Edge, Delay
- Program and play mode
- Go-No Go test
- Built-in help
- USB, RS-232, and optional GPIB interface

Package Contents

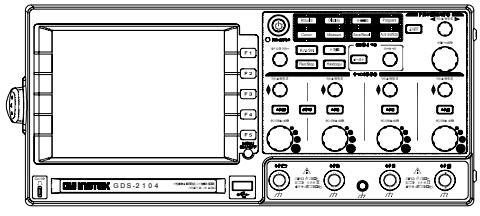
Check the contents before using oscilloscope. Contact your local dealer in case there is a missing item.

Opening the box

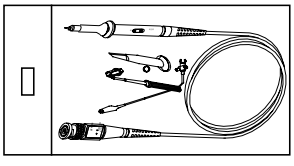


Contents

1. Main unit



2. Probe set



DSO-8062: GTP-060A x 2
DSO-8064: GTP-060A x 4
DSO-8104: GTP-100A x 4
DSO-8204: GTP-250A x 4

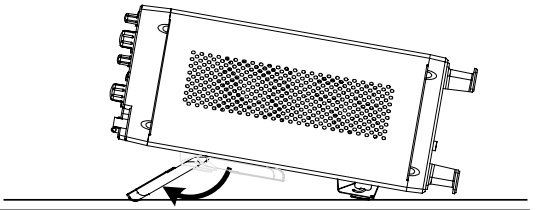
3. Power cord

4. User manual (this document)

Power Up

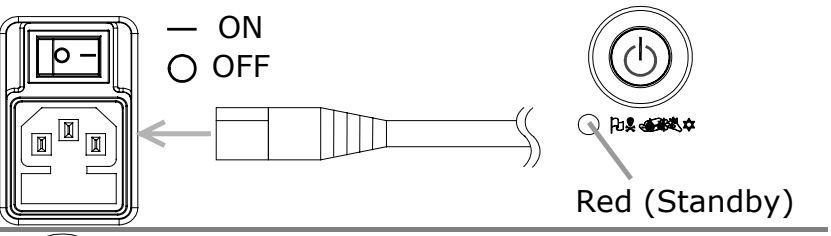
Place and power up oscilloscope as follows.

Tilt stand

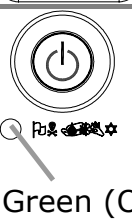


Turn On the Main Power

1. Connect the Power Cord to the rear panel.
2. Turn On the Main Power Switch.
3. The ON/STBY indicator on the front panel turns red.



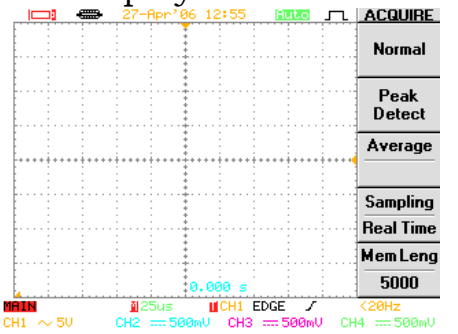
Press the ON/STBY key



The ON/STBY indicator on the front panel turns green.

Display view

The display becomes active in 6~8 seconds.



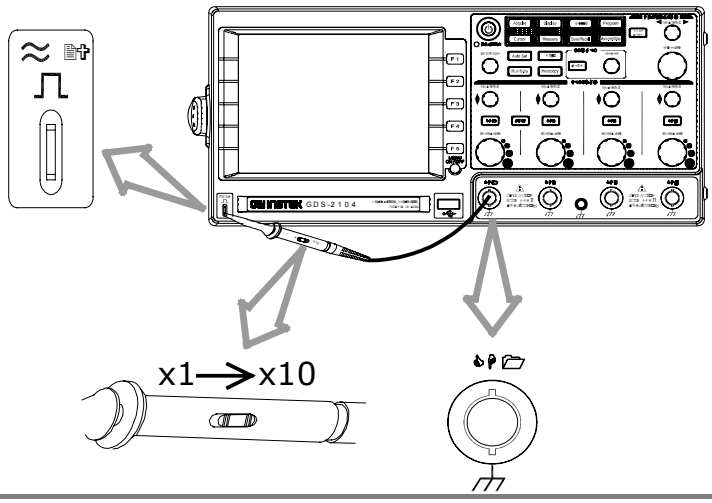
From the second time, the last display setting appears.

Functionality check

Before operating oscilloscope in a new environment, run these steps to make sure it is functionally stable.

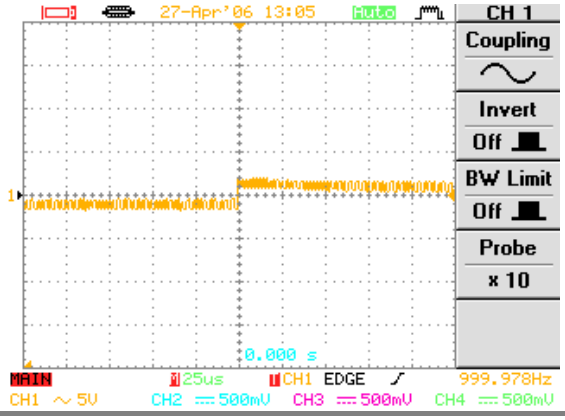
1. Connect the Probe

Connect the probe to Channel1 input terminal and to the probe calibration output (2Vpp ± 3%, 1kHz square wave).
Set the probe attenuation scale to x10.



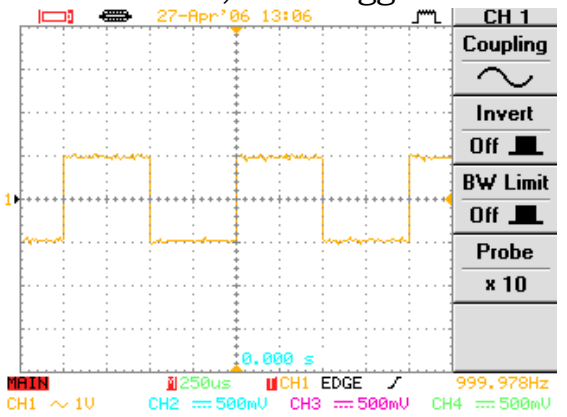
2. Capture the signal

Make sure the compensation signal appears. If CH1 is inactive (CH1 key LED is Off), press the CH1 key and activate it (LED On).



3. Set the scale

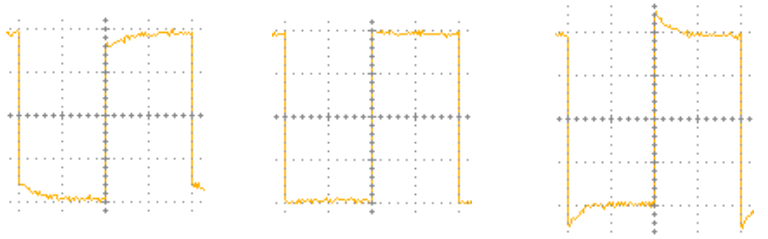
Press the Auto Set key Auto Set. The oscilloscope automatically adjusts the horizontal scale, vertical scale, and trigger level.



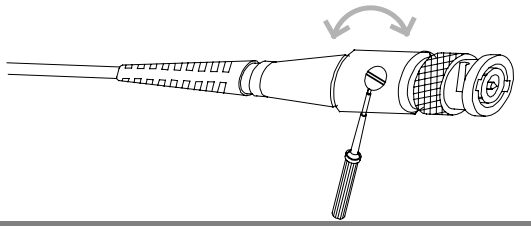
Probe compensation signal, 2Vpp, 1kHz

4. Compensate the probe

Watch the reference signal edge and compensate the probe accordingly.
To adjust the scale, use the Volts/Div knob (Vertical) and Time/Div knob (horizontal).
For more details, see page104.



Over Compensation | Normal | Under Compensation



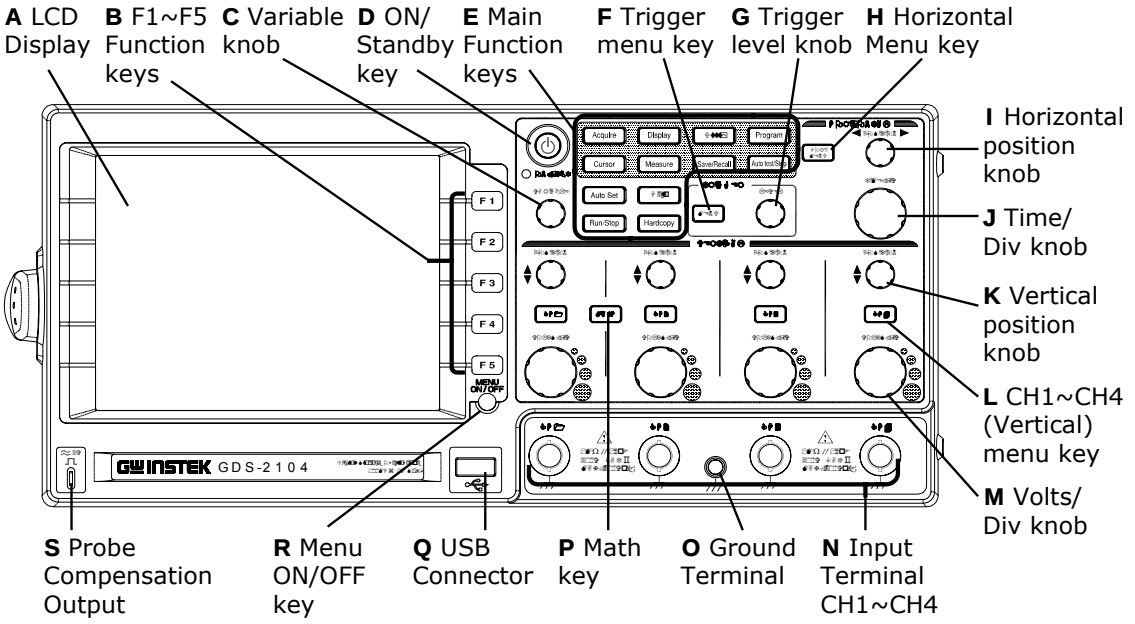
5. Start Measurements

Continue with the other measurements.
For shortcuts to major operations, see page24.
Detailed descriptions start from page36.

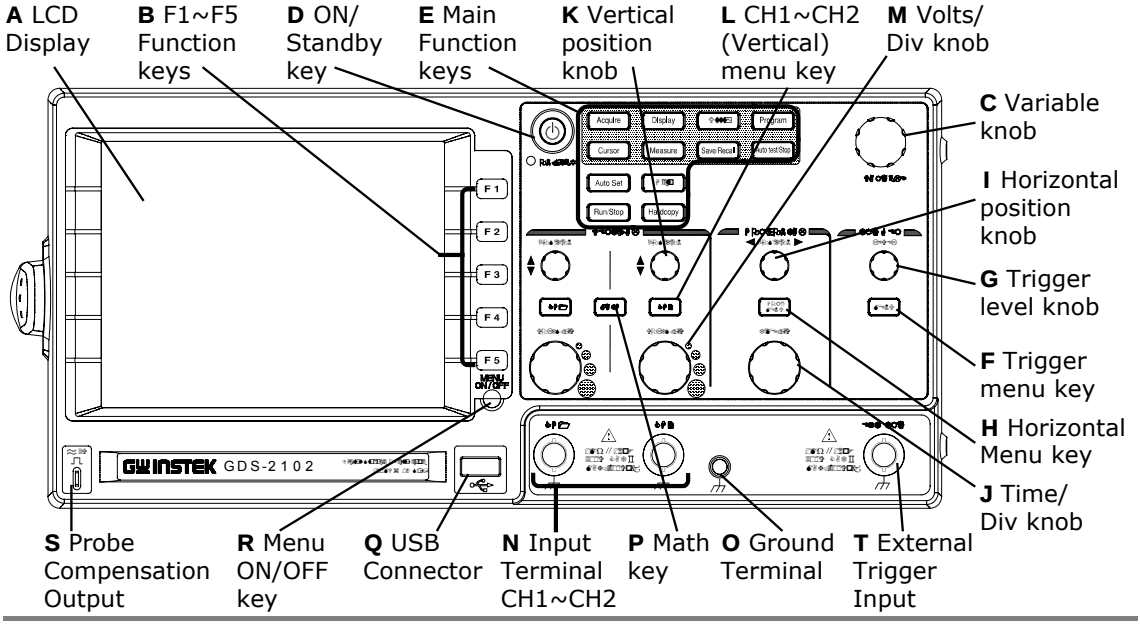
Panel Descriptions

Front Panel

The 4CH oscilloscope front panel



The 2CH oscilloscope front panel

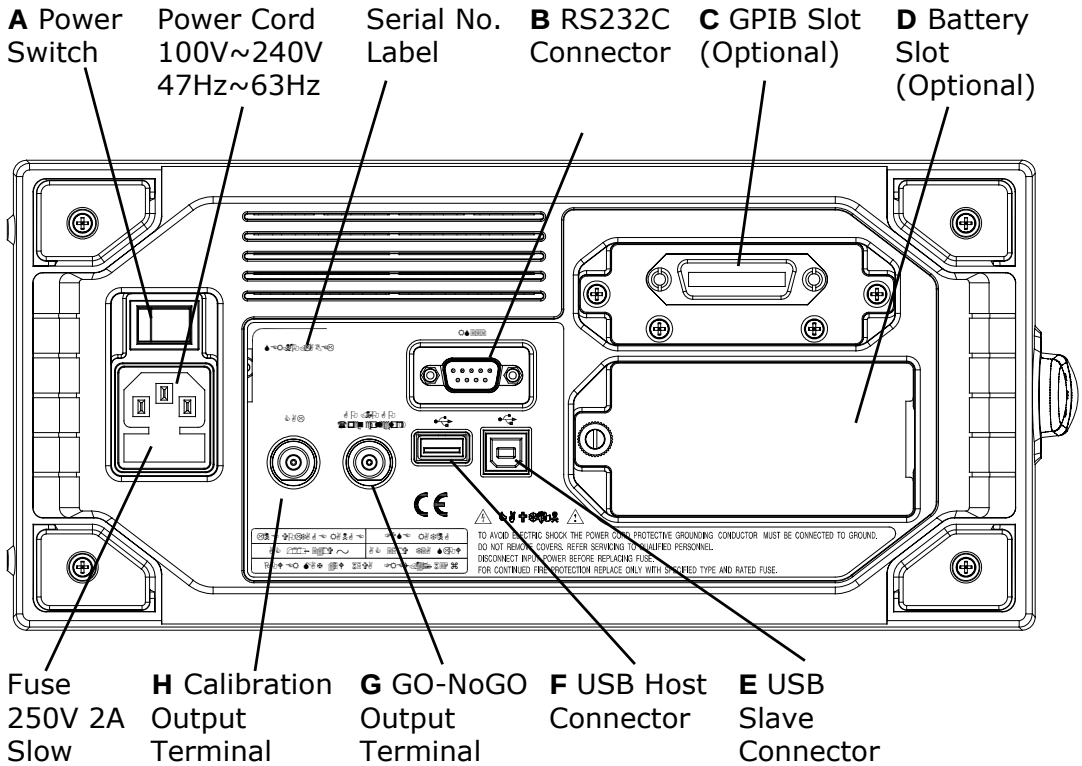


A	**LCD Display**	TFT Color, 320x234 resolution LCD display.
B	**F1~F5 Function Keys**	Soft keys linked to functions shown on the left side of the display.
C	**Variable knob**	Clockwise: increases the value or move to the next parameter. Counterclockwise: decreases the value or go back to the previous parameter.
D	**On/Standby key**	Press once: Power On (green indicator). Press again: Standby (red indicator).
E	**Main Function keys**	**Acquire key** is for configuring acquisition mode. See page38. **Display key** is for configuring display settings. See page45. **Utility key** is for configuring system settings (page62), running Go-No Go test (page75), printout and data transfer together with **Hardcopy key** (page92), and running calibration (page103). **Program key** and **Auto test/Stop key** are for Program and Play feature. See page83. **Cursor key** is for configuring horizontal and vertical cursors. See page41. **Measure key** is for configuring and running automatic measurements. See page71. **Help key** is for displaying built-in help. See page62. **Save/Recall key** is for saving and recalling image, waveform, and settings using USB storage or internal memory. See page95. **Auto Set key** is for finding signals and setting scales automatically. See page70. **Run/Stop key** is for freezing the signal view(Stop). See page47.
F	**Trigger menu key**	For configuring trigger settings. See page85.
G	**Trigger level knob**	Sets the trigger level: increase (clockwise) or decrease (counterclockwise).
H	**Horizontal**	For configuring the horizontal view. See

	menu key	page54.
I	**Horizontal position knob**	Moves the waveform right (clockwise) or left (counterclockwise).
J	**Time/Div knob**	For setting the horizontal scale: fine (clockwise) or coarse (counterclockwise).
K	**Vertical position knob**	Moves the waveform upward (clockwise) or downward (counterclockwise).
L	**Channel (Vertical) menu key**	For configuring the vertical view for each channel. See page58.
M	**Volts/Div knob**	For setting the vertical scale for each channel: fine (clockwise) or coarse (counterclockwise).
N	**Input Terminal**	BNC male connector for signal input.
O	**Ground Terminal**	Terminal for connecting the DUT (Device Under Test) ground lead.
P	**Math key**	For performing Math operations using Channel 1 and 2 input signals. See page79.
Q	**USB connector**	Type A host female, 1.1/ 2.0 compatible. For printing (page93) and data transfer (page95).
R	**Menu On/Off key**	Show (On) or hide (Off) the menu from the display. See page53.
S	**Probe compensation Output**	2Vpp signal output for probe compensation. See page104.
T	**External Trigger Input**	(2CH model only) For external trigger signal used in advanced delay triggering. See page90.

Rear Panel

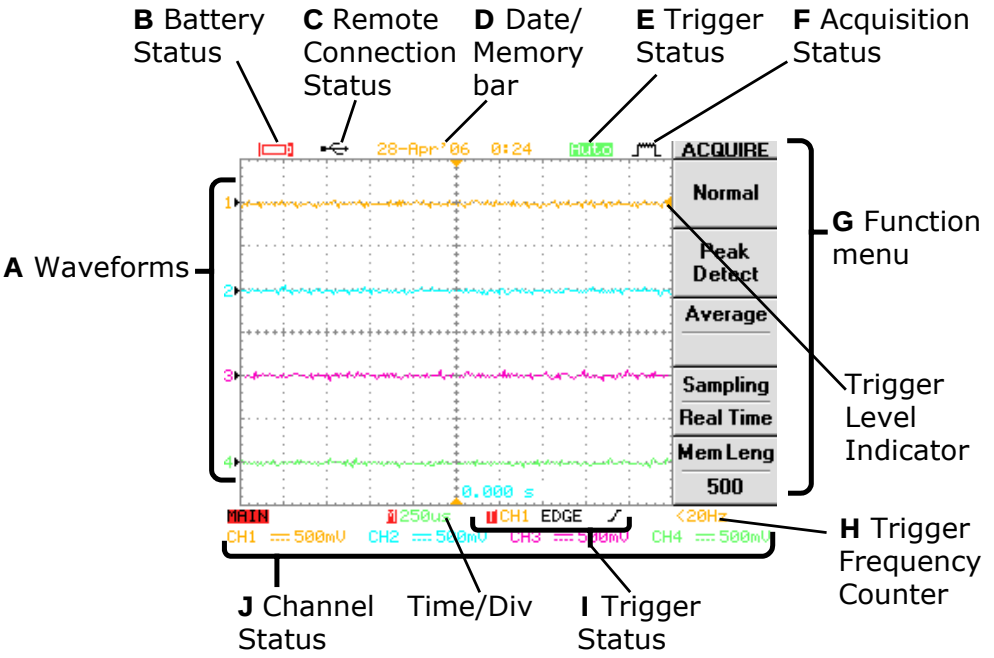
The oscilloscope rear panel



A	**Power Switch**	—: ON (front panel indicator turns green) ○: OFF (front panel indicator turns red) For power up sequence, see page12.
B	**RS232C Connector**	9 pin male connector for data communication. See page66.
C	**GPIB Slot (Optional)**	24 pin female connector for data communication. See page66.
D	**Battery Slot (Optional)**	11.1V Li-Ion battery pack, 8h charging time/ 3h operation time. See page68.
E	**USB Device Connector**	Type B slave female connector for data communication. See page66. Note: USB rear panel host and rear panel slave connection cannot be used at the same time.
F	**USB Host Connector**	Type A host female, 1.1/2.0 full speed compatible, with the same functionality as the front panel USB connector. Note: USB rear panel host and rear panel slave connection cannot be used at the same time.
G	**Go-NoGo Output Terminal**	Outputs Go-NoGo test result as a pulse signal. See page75.
H	**Calibration Output Terminal**	Outputs a calibration signal. See page103.

Display

The oscilloscope display



Description of display items

A Waveforms

Input signal waveforms, activated by pressing the Channel key.

Channel 1: Amber Channel 2: Blue
Channel 3: Pink Channel 4: Green

B Battery Status (Optional)

Indicates the remaining battery level, when the battery is installed.

C Remote Connection Status

Shows the active communication interface.
: RS232C
: USB
: GPIB (optional)

D Date/ Memory bar

28-Apr'06 0:24 : (Default) The current time and date, configurable in the Utility menu. See page64.

The memory bar temporarily appears when configuring the horizontal scale (page54) and memory length (page40), indicating the ratio and the position of

		display waveform compared with the internally stored information.
E	**Trigger Status**	Auto: Auto Trigger mode Trig?: Trigger condition is not found STOP: Triggering is halted For triggering details, see page85.
F	**Acquisition Status**	: Normal mode : Peak Detect mode : Average mode For acquisition details, see page38.
G	**Function key**	The active function key and menu corresponding to F1~F5 soft keys.
H	**Trigger Frequency Counter**	The signal frequency of the selected channel. <20Hz shows the frequency is less than 20Hz and it out of the oscilloscope triggering range.
I	**Trigger Status**	T CH1 EDGE (From left) Trigger source channel, trigger type, and slope For trigger details, see page85.
J	**Channel Status**	CH1 500mV (From left) Channel, Bandwidth limit On, Coupling mode, Time/Div scale For Channel (vertical scale) details, see page58.

Quick Reference

Operation Shortcuts

Here is the list of operations and their key shortcuts introduced in this manual.

Symbols description

Display→F1	=Press the Display key, then press F1
F1↵	=Press F1 repeatedly, if necessary
F1~F4	=Use all F1, F2, F3, and F4 to complete the operation

Configure the System

Acquisition	
Select the Acquisition mode	Acquire→F1~F4
Select the memory length	Acquire→F5
Cursor	
Select the horizontal cursor	Cursor→F1~F2
Select the vertical cursor	Cursor→F1, F3
Display	
Freeze the waveform	Run/Stop
Refresh the display view	Display→F3
Select the display grid	Display→F5
Switch the vectors/dots waveform	Display→F1
Set the display contrast	Display→F4
Turn Off the display menu	Menu ON/OFF
View accumulated waveform	Display→F2
Horizontal	
Zoom the horizontal view	HORIMENU→F2~F3
Roll the horizontal view	HORIMENU→F4
View in XY mode	HORIMENU→F5
Vertical	
Invert the waveform	CH1/2/3/4→F2
Limit the frequency bandwidth	CH1/2/3/4→F3
Select the coupling mode	CH1/2/3/4→F1
Select the probe attenuation	CH1/2/3/4→F4
Other Configurations	
Select the buzzer sound	Utility→F3
Select the language	Utility→F4
Set the date/time	Utility→F5→F5→F2→F1↵
Configure data interface	Utility→F2→F1↵
View the system information	Utility→F5→F2

Measure the Signal

Automatic Measurements

Automatic Delay measurements	Measure→F5→F3↵
Automatically set the scale	Auto Set
Automatic Time measurements	Measure→F3→F3↵
View all measurement results	Measure→Measure→F1~F4
Automatic Voltage measurements	Measure→F1→F3↵
Go-No Go Test	
Edit Go-No Go test template	Utility→F3→F2~F3 Utility→F3→F1→F1~F4 Utility→F5→F4
Run Go-No Go test	Utility→F5→F3→F4
Math Operation	
Add/ Subtract	MATH→F1↵→F2~F4
Run FFT operation	MATH→F1↵→F2~F5
Program and Play	
Edit the program steps	Program→F1↵→F2~F5
Play the program	Program→F1↵→F2~F5
Trigger	
Use the Delay trigger (2CH only)	Trigger→F1↵→F2~F4→F5→F1~F4
Use the Edge trigger	Trigger→F1↵→F2~F3→F5→F1~F4
Use the Pulse width trigger	Trigger→F1↵→F2~F4→F5→F1~F4
Use the Video trigger	Trigger→F1↵→F2~F5

Print and Data Transfer

Printout	
Printout display image/waveform	Utility→F1↵→F1 Hardcopy
Save and Recall	
Quick save to USB	Utility→F1→F1 Hardcopy
Save all (image/setup/waveform)	Save/Recall→F5→F2→F1~F4
Save image	Save/Recall→F5→F1→F1~F4
Save setup	Save/Recall→F3→F1~F4
Save waveform	Save/Recall→F4→F1~F4
Recall setup	Save/Recall→F5→F3→F1~F4
Recall waveform	Save/Recall→F5→F4→F1~F4
Configure folders in USB drive	Save/Recall→F3→F5→F1~F4

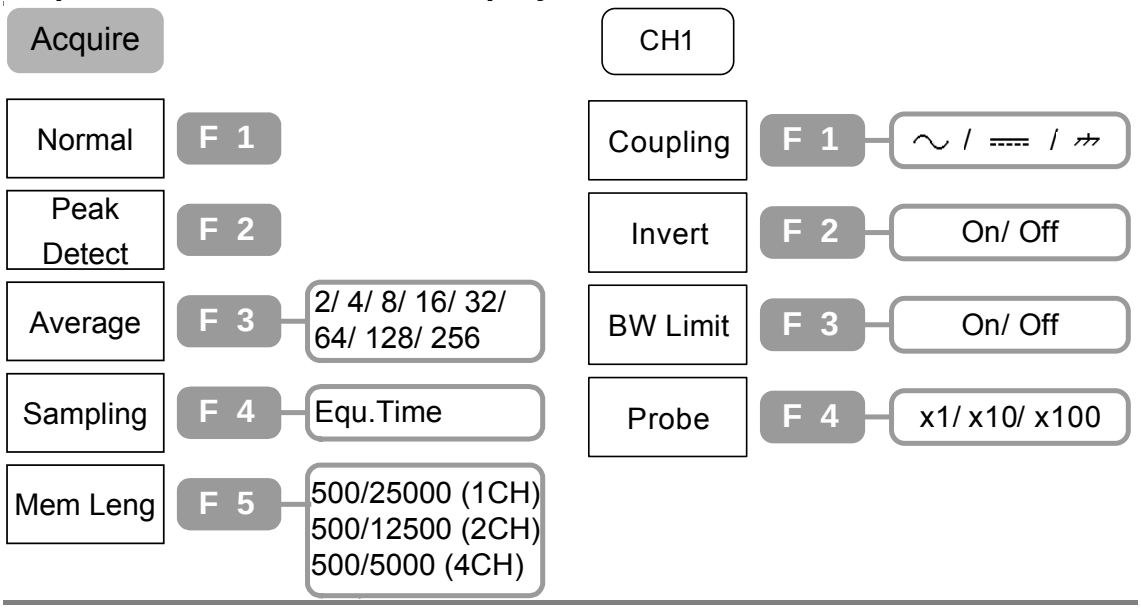
Calibration

Calibrate oscilloscope	Utility→F5→F1→F1~F3
Compensate the probe	Utility→F5→F5→F1→F1~F3

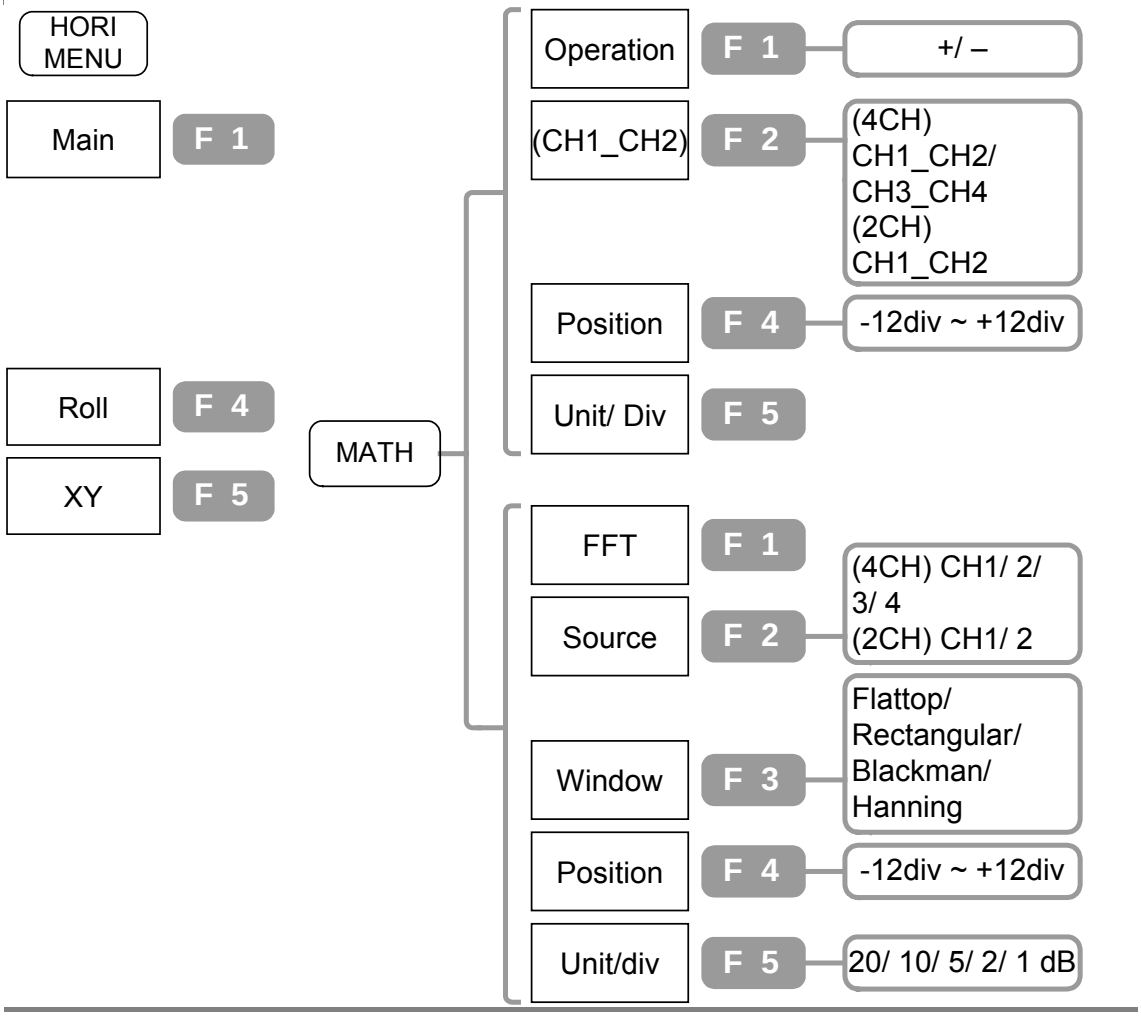
Menu Tree

No menu for the following keys: Auto Set, Run/Stop, Help, Auto test/Stop, Hardcopy.

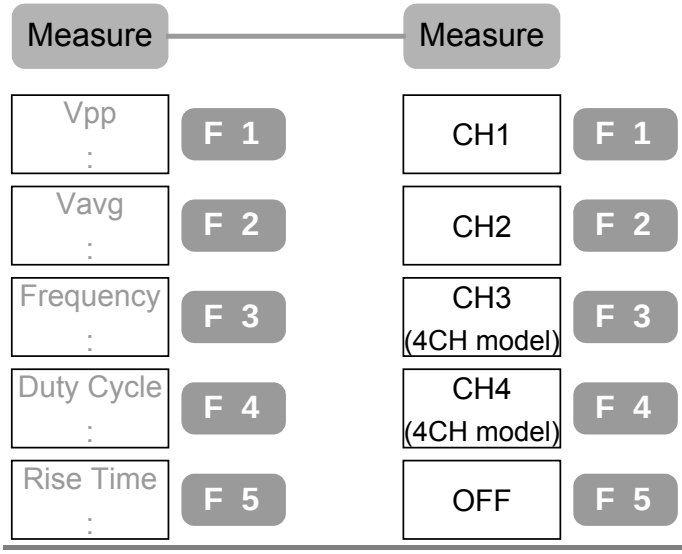
Acquire, Channel, Cursor, Display



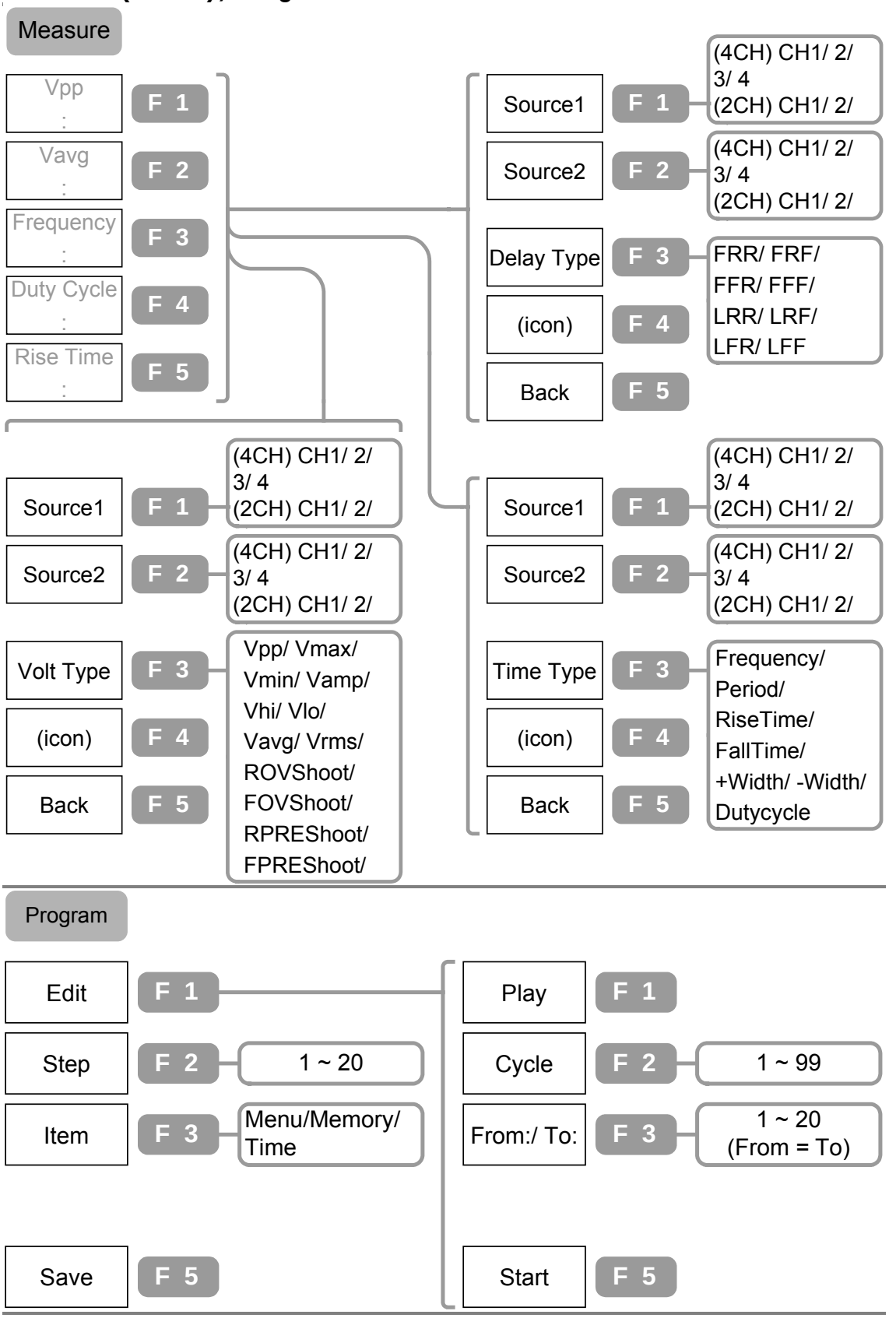
Horizontal, Math, Measure (1 of 2)



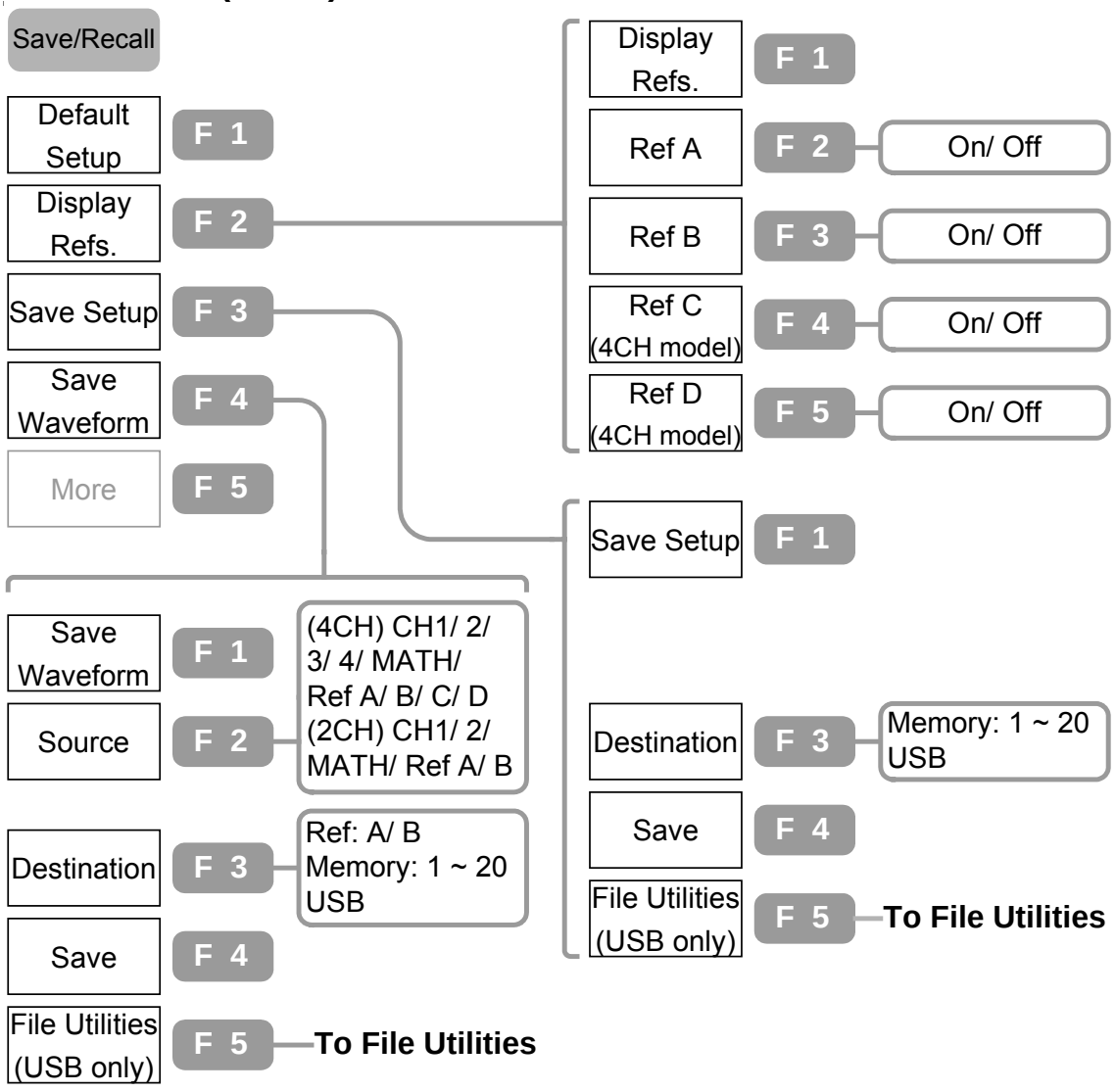
(Press once) (Press twice)

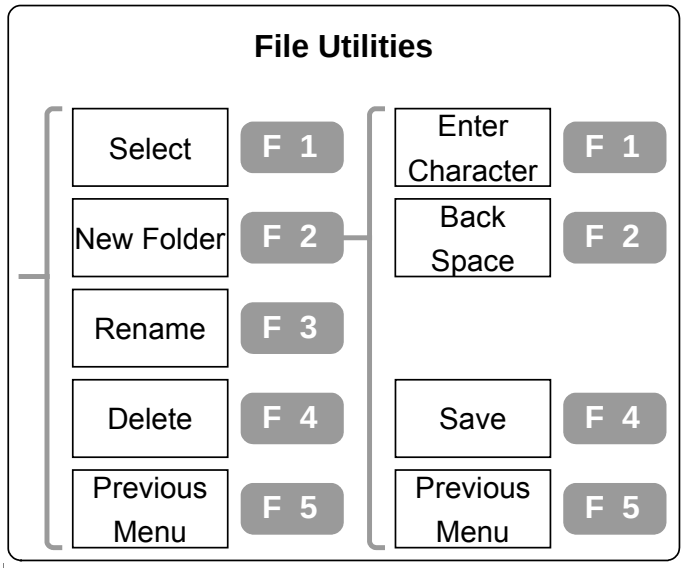


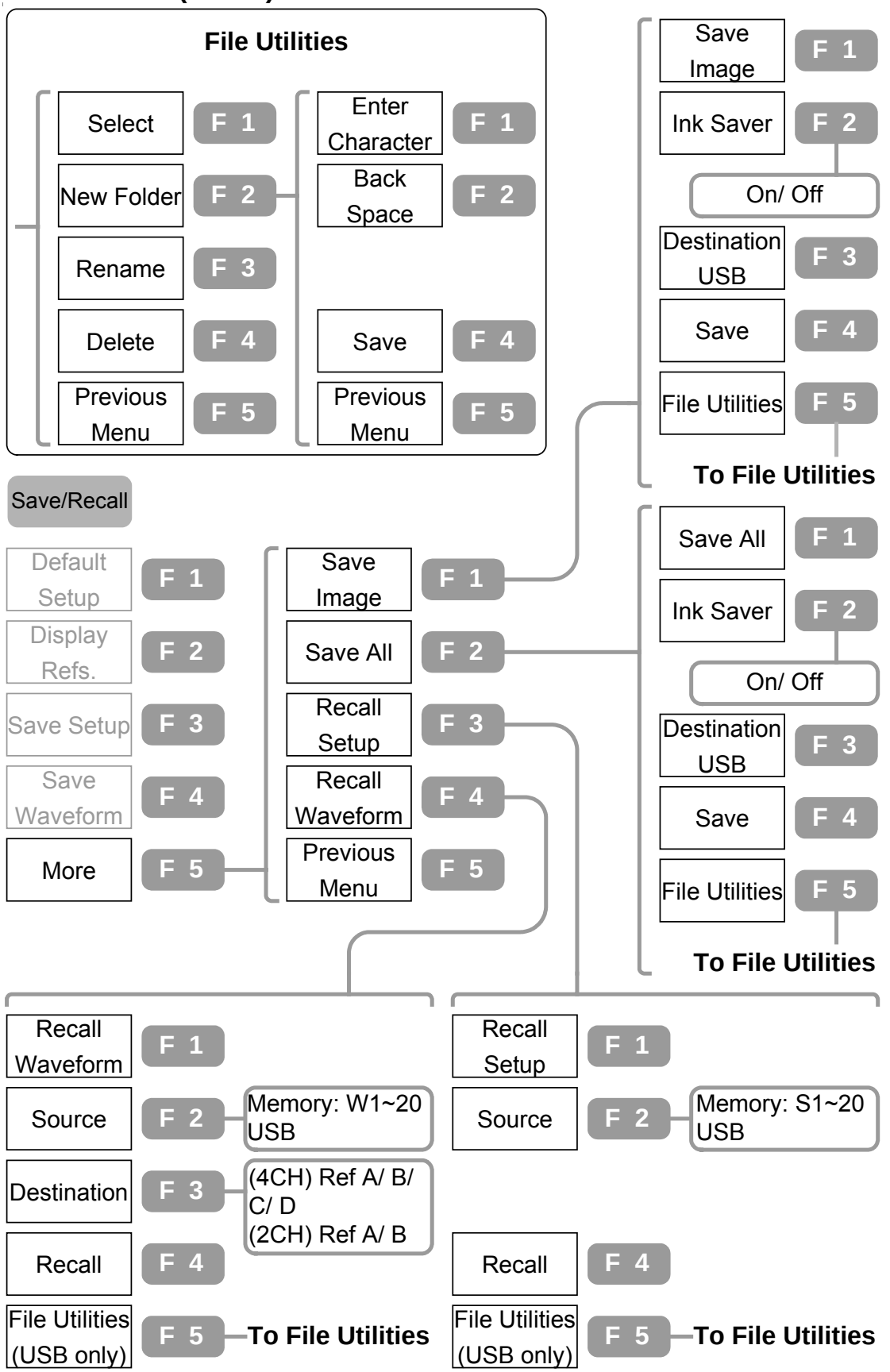
Measure (2 of 2), Program



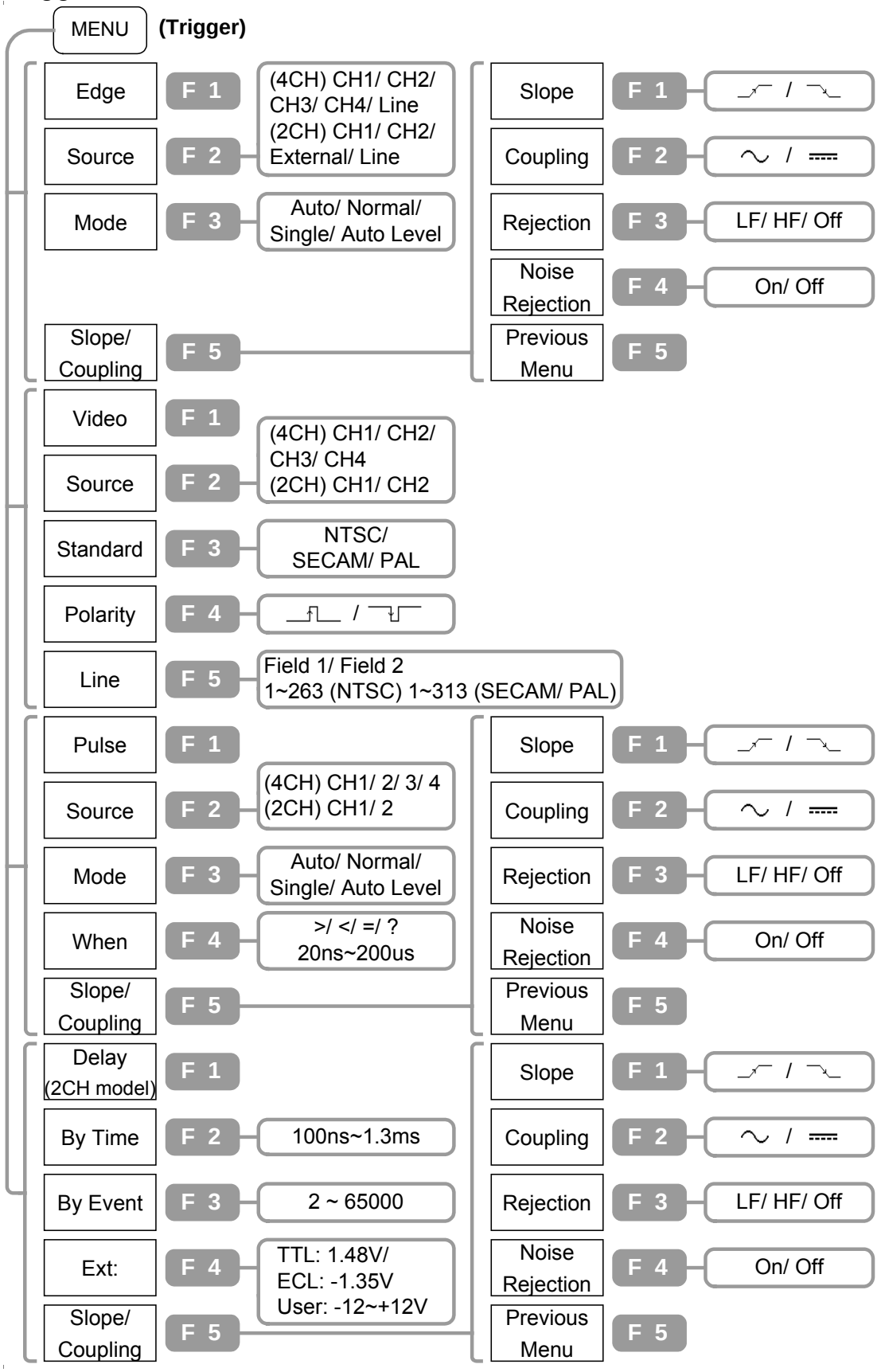
Save / Recall (1 of 2)

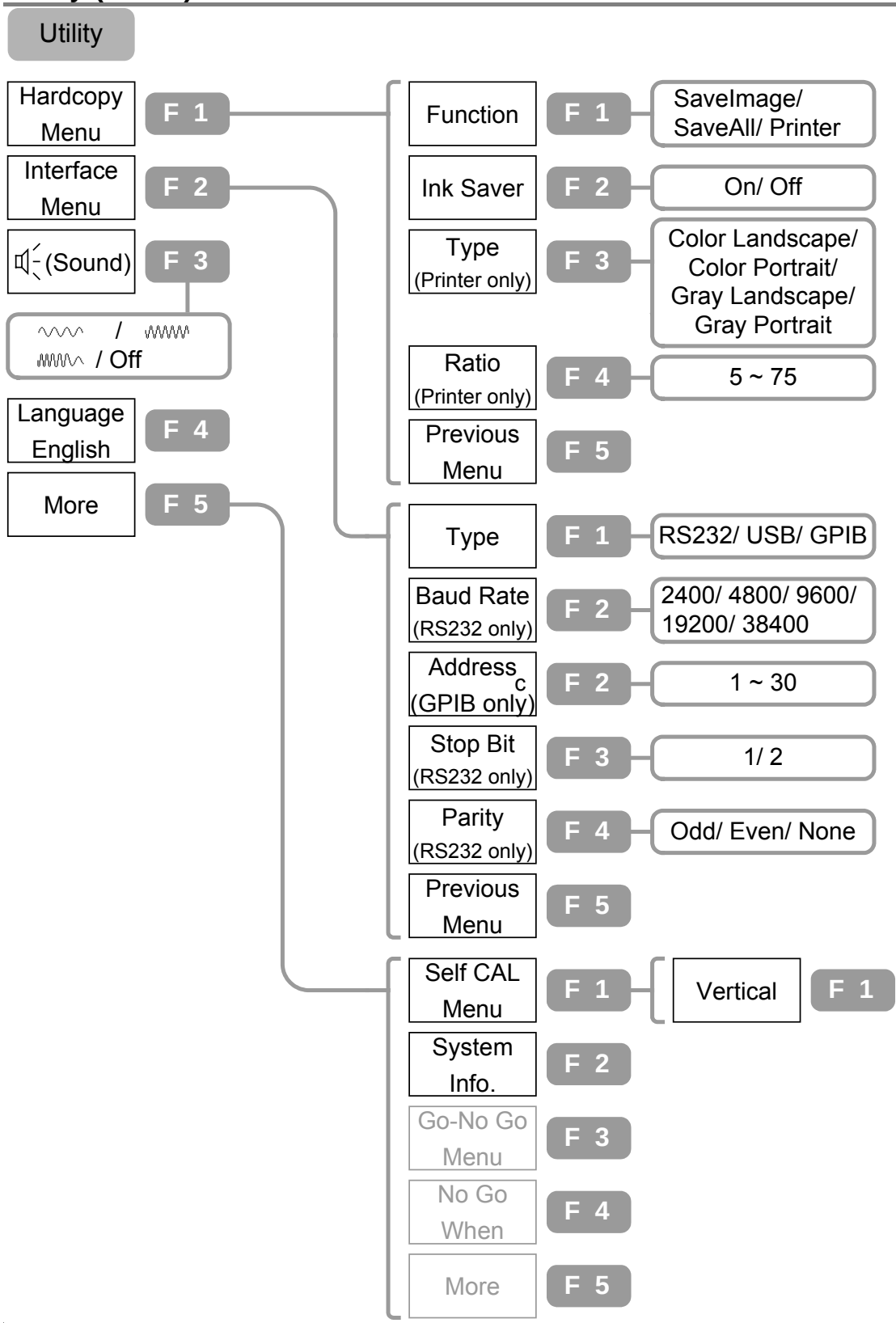


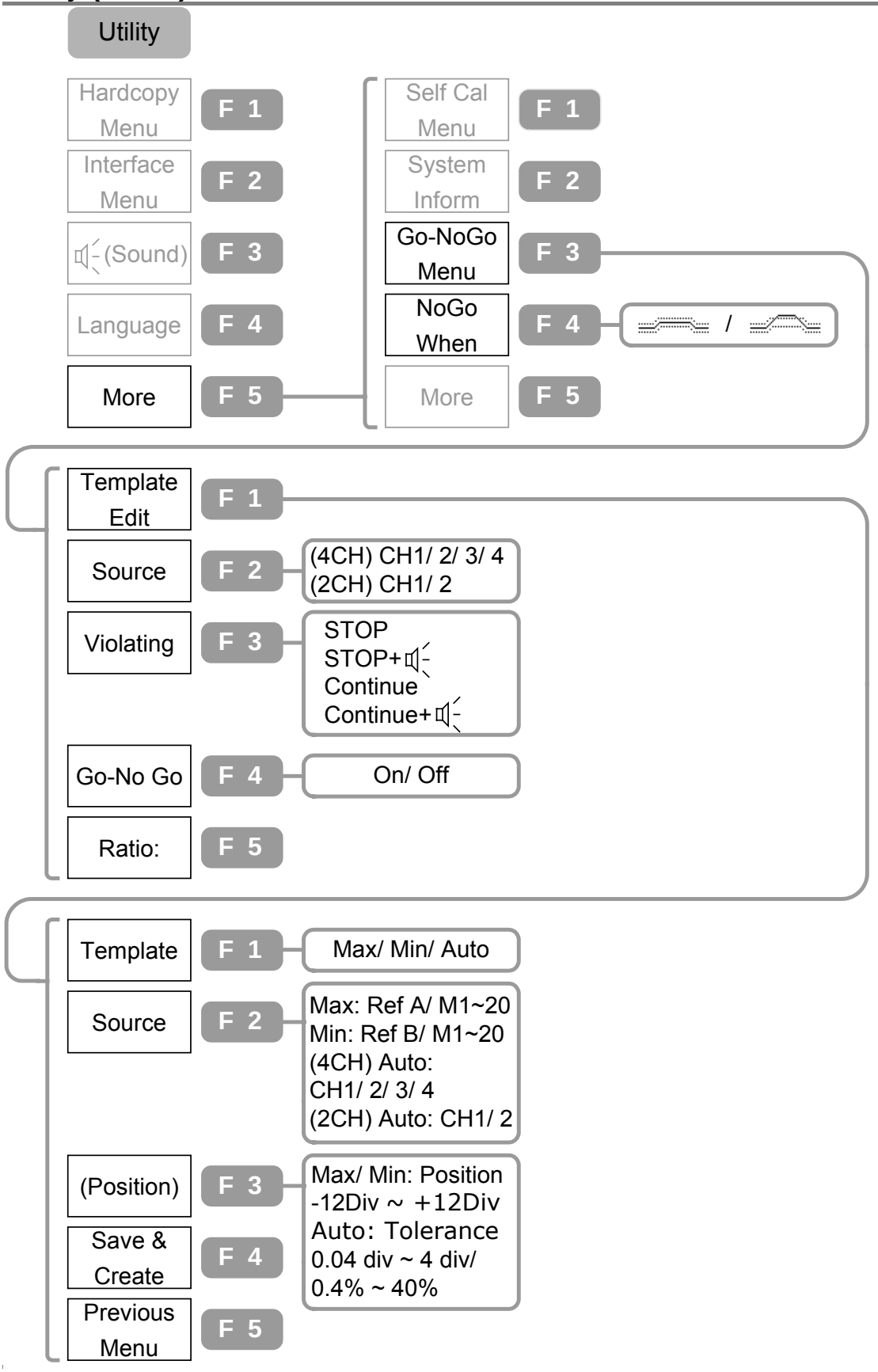


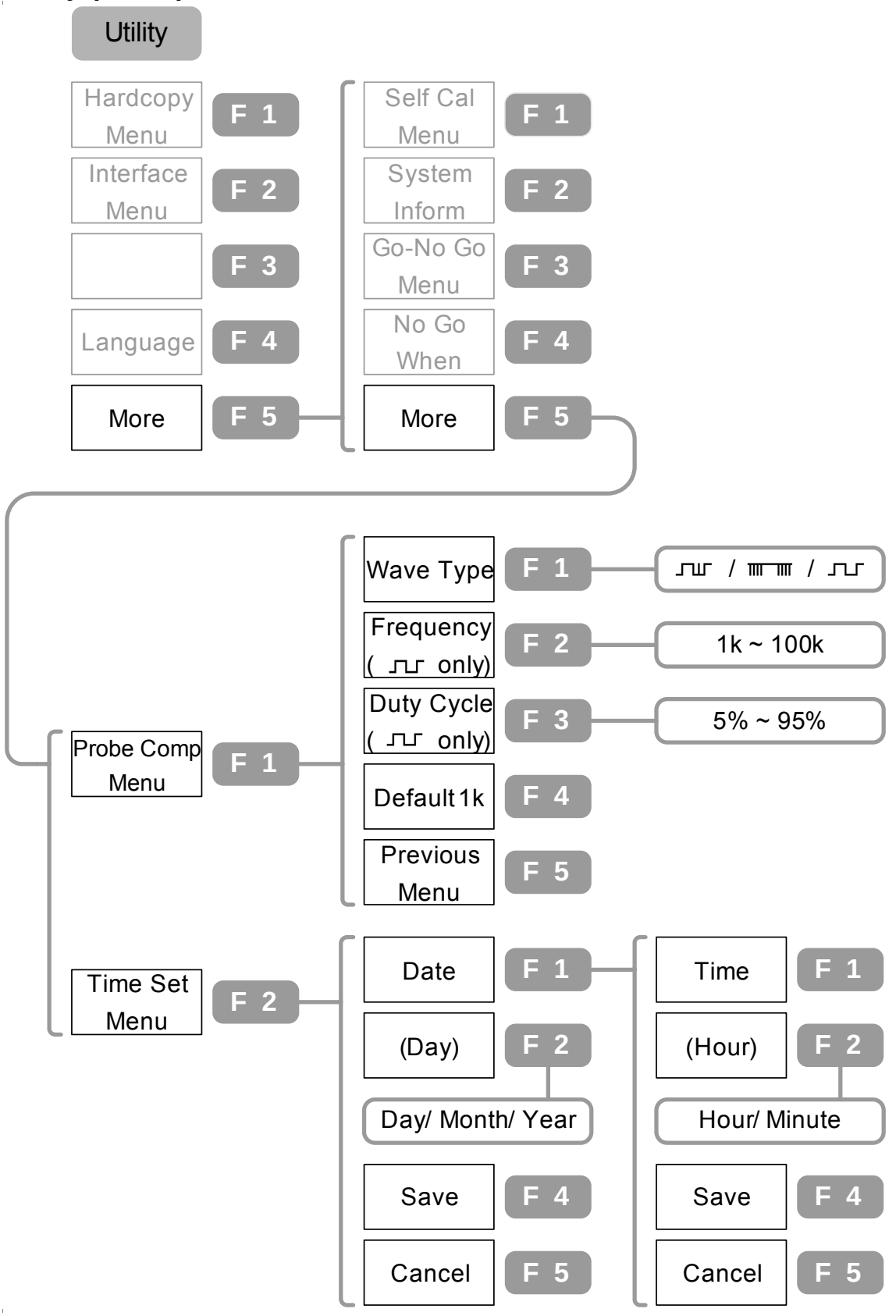

File Utilities
Select
F 1
New Folder
F 2
Rename
F 3
Delete
F 4
Previous Menu
F 5
Enter Character
F 1
Back Space
F 2
Save
F 4
Previous Menu
F 5
Save Image
F 1
Ink Saver
F 2
On/ Off
Destination USB
F 3
Save
F 4
File Utilities
F 5
To File Utilities
Save/Recall
Default Setup
F 1
Display Refs.
F 2
Save Setup
F 3
Save Waveform
F 4
More
F 5
Save Image
F 1
Save All
F 2
Recall Setup
F 3
Recall Waveform
F 4
Previous Menu
F 5
Save All
F 1
Ink Saver
F 2
On/ Off
Destination USB
F 3
Save
F 4
File Utilities
F 5
To File Utilities
Recall Waveform
F 1
Source
F 2
Memory: W1~20 USB
Destination
F 3
(4CH) Ref A/ B/ C/ D
(2CH) Ref A/ B
Recall
F 4
File Utilities (USB only)
F 5
To File Utilities
Recall Setup
F 1
Source
F 2
Memory: S1~20 USB
Recall
F 4
File Utilities (USB only)
F 5
To File Utilities

Trigger

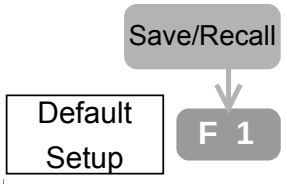

MENU
(Trigger)
Edge
F 1
(4CH) CH1/ CH2/ CH3/ CH4/ Line
(2CH) CH1/ CH2/ External/ Line
Source
F 2
Mode
F 3
Auto/ Normal/ Single/ Auto Level
Slope/ Coupling
F 5
Slope
F 1
/
Coupling
F 2
/
Rejection
F 3
LF/ HF/ Off
Noise Rejection
F 4
On/ Off
Previous Menu
F 5
Video
F 1
(4CH) CH1/ CH2/ CH3/ CH4
(2CH) CH1/ CH2
Source
F 2
Standard
F 3
NTSC/ SECAM/ PAL
Polarity
F 4
/
Line
F 5
Field 1/ Field 2
1~263 (NTSC) 1~313 (SECAM/ PAL)
Pulse
F 1
Source
F 2
(4CH) CH1/ 2/ 3/ 4
(2CH) CH1/ 2
Mode
F 3
Auto/ Normal/ Single/ Auto Level
When
F 4
>/ </ =/ ?
20ns~200us
Slope/ Coupling
F 5
Slope
F 1
/
Coupling
F 2
/
Rejection
F 3
LF/ HF/ Off
Noise Rejection
F 4
On/ Off
Previous Menu
F 5
Delay (2CH model)
F 1
By Time
F 2
100ns~1.3ms
By Event
F 3
2 ~ 65000
Ext:
F 4
TTL: 1.48V/
ECL: -1.35V
User: -12~+12V
Slope/ Coupling
F 5
Slope
F 1
/
Coupling
F 2
/
Rejection
F 3
LF/ HF/ Off
Noise Rejection
F 4
On/ Off
Previous Menu
F 5


Utility
Hardcopy Menu
F 1
Interface Menu
F 2
(Sound)
F 3
/
/ Off
Language English
F 4
More
F 5
Function
F 1
SaveImage/ SaveAll/ Printer
Ink Saver
F 2
On/ Off
Type (Printer only)
F 3
Color Landscape/ Color Portrait/ Gray Landscape/ Gray Portrait
Ratio (Printer only)
F 4
5 ~ 75
Previous Menu
F 5
Type
F 1
RS232/ USB/ GPIB
Baud Rate (RS232 only)
F 2
2400/ 4800/ 9600/ 19200/ 38400
Address (GPIB only)
F 2
1 ~ 30
Stop Bit (RS232 only)
F 3
1/ 2
Parity (RS232 only)
F 4
Odd/ Even/ None
Previous Menu
F 5
Self CAL Menu
F 1
Vertical
F 1
System Info.
F 2
Go-No Go Menu
F 3
No Go When
F 4
More
F 5


Utility
Hardcopy Menu
F 1
Interface Menu
F 2
(Sound)
F 3
Language
F 4
More
F 5
Self Cal Menu
F 1
System Inform
F 2
Go-NoGo Menu
F 3
NoGo When
F 4
/
More
F 5
Template Edit
F 1
Source
F 2
(4CH) CH1/ 2/ 3/ 4
(2CH) CH1/ 2
Violating
F 3
STOP
STOP+
Continue
Continue+
Go-No Go
F 4
On/ Off
Ratio:
F 5
Template
F 1
Max/ Min/ Auto
Source
F 2
Max: Ref A/ M1~20
Min: Ref B/ M1~20
(4CH) Auto:
CH1/ 2/ 3/ 4
(2CH) Auto: CH1/ 2
(Position)
F 3
Max/ Min: Position
-12Div ~ +12Div
Auto: Tolerance
0.04 div ~ 4 div/
0.4% ~ 40%
Save & Create
F 4
Previous Menu
F 5


Utility
Hardcopy Menu
F 1
Interface Menu
F 2
F 3
Language
F 4
More
F 5
Self Cal Menu
F 1
System Inform
F 2
Go-No Go Menu
F 3
No Go When
F 4
More
F 5
Probe Comp Menu
F 1
Wave Type
F 1
Frequency (only)
F 2
1k ~ 100k
Duty Cycle (only)
F 3
5% ~ 95%
Default 1k
F 4
Previous Menu
F 5
Time Set Menu
F 2
Date
F 1
(Day)
F 2
Day/ Month/ Year
Save
F 4
Cancel
F 5
Time
F 1
(Hour)
F 2
Hour/ Minute
Save
F 4
Cancel
F 5

Default Settings



These are the factory installed settings that appear when pressing Save/Recall key→F1 (Default Setup).

Acquisition	Mode: Normal	Memory Length: 500
Channel (Vertical)	Scale: 2V/Div Coupling: DC BW Limit: Off	Invert: Off Probe Attenuation: x1
Cursor	Source: CH1 Vertical: None	Horizontal: None
Display	Type: dots Graticule:	Accumulate: Off
Go-NoGo	Go-NoGo: Off NoGo when:	Source: CH1 Violating: Stop
Horizontal	Scale: 2.5us/Div	Mode: Main Timebase
Math	Type: + Position: 0.00 Div	Channel: CH1+CH2 Unit/Div: 2V
Measure	Source1: CH1 Volt type: VPP Delay type: FRR	Source2: CH2 Time Type: Frequency
Program	Mode: Edit Item: Memory	Step: 1
Trigger	Type: Edge Mode: Auto Coupling: DC Noise Rejection : Off	Source: Channel1 Slope: Rejection: Off
Utility	Hardcopy: SaveImage, Inksaver Off	Sound: Off

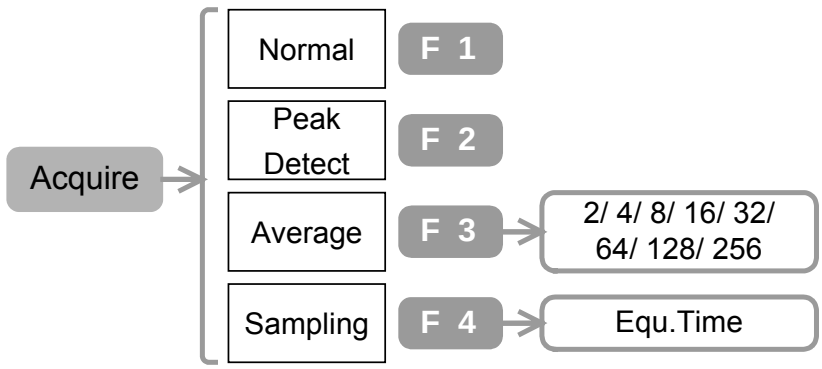
Configure the Settings

Acquisition

Acquisition process samples analog input signal and converts it into digital format, later to be reconstructed into a waveform.

Select the Acquisition mode

Panel operation



1. Press the Acquire key. Select the acquisition mode among F1~F3 and press it. The acquisition icon on the top right corner of the display changes accordingly.

2. (For Average mode) To select the number of samples, press F3 repeatedly.

Range

Acquisition mode

Normal — All the acquisition information is used to draw the waveform.

Peak Detect — The minimum and maximum value pairs for each acquisition interval (bucket) are stored. This mode is useful in catching abnormal glitches in the signal.

Average — Multiple acquisitions are averaged to draw a noise-free waveform.

Average number

2, 4, 8, 16, 32, 64, 128, 256

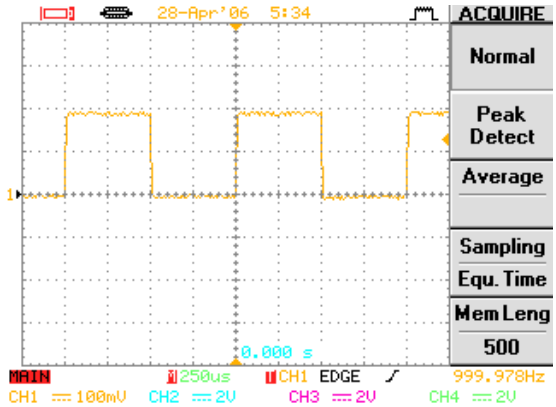
Sampling mode

The first sample during each acquisition interval is recorded.

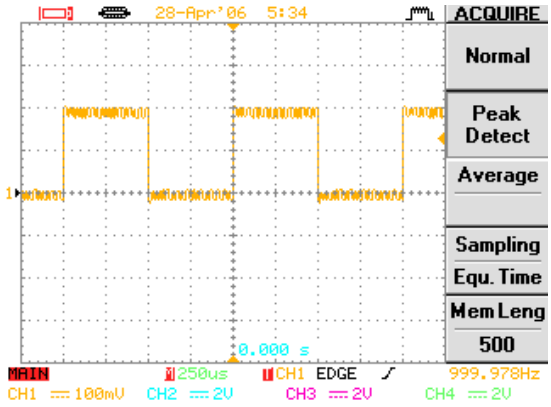
Equ. Time	Equivalent Time sampling. Oscilloscope draws the waveform by accumulating the sample records. Useful for repetitive signal.

Example

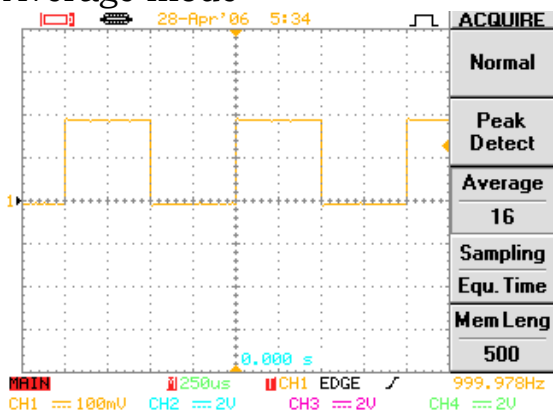
Normal mode



Peak Detect mode



Average mode



Select the waveform memory length

Panel operation

1. Press the Acquire key→F5.
2. To switch between short and long memory length, press F5 repeatedly.

Range

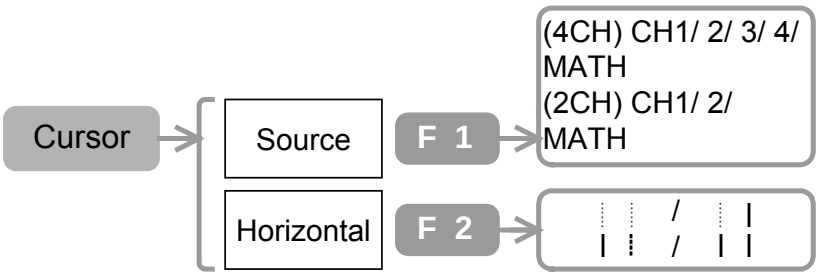
500	Short memory length common for all number of channels: useful when catching high frequency signal.
5000	Long memory length when three or four channels are active.
12500	Long memory length when two channels are active.
25000	Long memory length when only one channel is active.

Note that the display always shows 250 points (300 points when the menu is turned off).

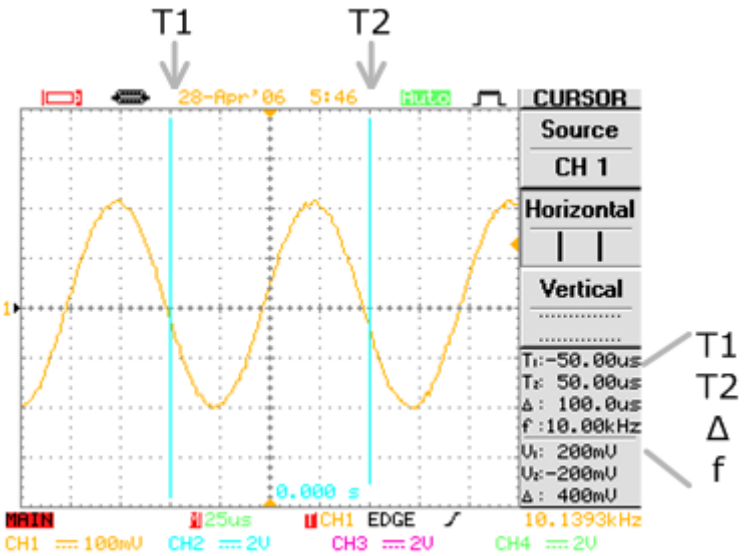
Cursor

Select the horizontal cursor type

Panel operation



1. Press the Cursor key→F1. To select the channel, press F1 repeatedly.
2. To select the cursor to be activated, press F2 repeatedly.
3. To move the cursor, use the Variable knob.
4. The bottom right corner of the display shows the positions of two cursors (T1 & T2), their time difference (Δ), and the frequency (f).



Range

Source

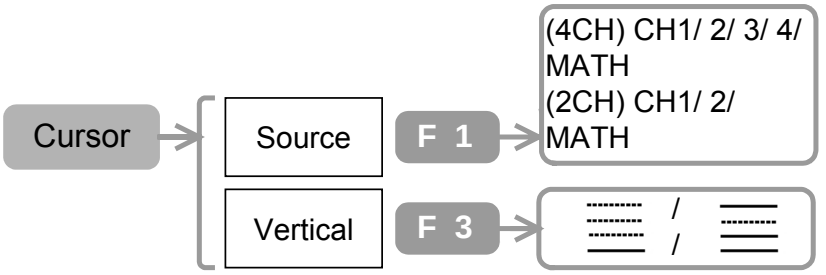
CH1~CH4 (4CH model)	Channel1~Channel2 waveform
CH1~CH2 (2CH model)	Channel1~Channel2 waveform
MATH	The waveform as a result of the math operation

Horizontal (cursor type)

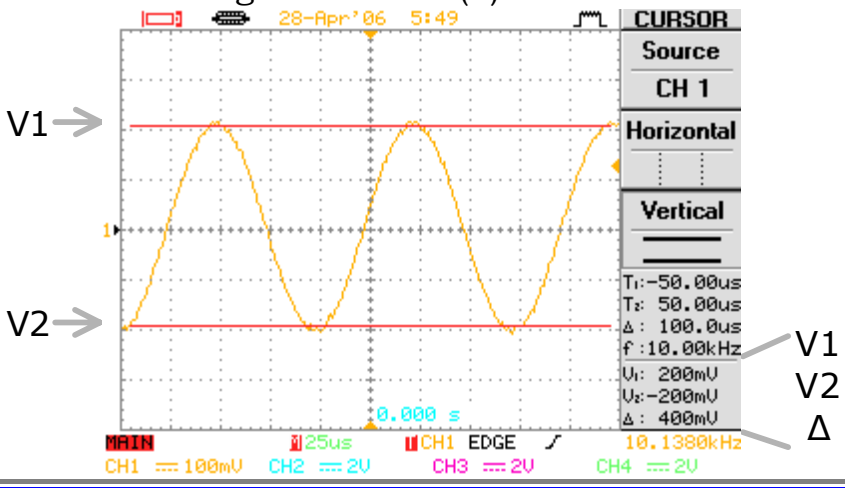
⋮ ⋮	Both T1 and T2 are invisible.
⋮ |	T2 is active, T1 is fixed. Variable knob moves only T2.
| ⋮	T1 is active, T2 is fixed. Variable knob moves only T1.
| |	Both T1 and T2 are active. Variable knob moves T1 and T2 together.

Select the vertical cursor type

Panel operation



1. Press the Cursor key→F1. To select the channel, press F1 repeatedly.
2. To select the cursor to be activated, press F3 repeatedly.
3. To move the cursor, use the Variable knob.
4. The bottom right corner of the display shows the positions of two cursors (V1 & V2) and their voltage difference (Δ).



Range

Source

CH1~CH4 (4CH model)	Channel1~Channel4 waveform
CH1~CH2 (2CH model)	Channel1~Channel2 waveform
MATH	The waveform as a result of the Math operation.

Vertical (cursor type)

	Both V1 and V2 are invisible.
	V2 is active, V1 is fixed. Variable knob moves only V2.
	V1 is active, V2 is fixed. Variable knob moves only V1.
	Both V1 and V2 are active. Variable knob moves V1 and V2 together.

Display

Select the vector / dot waveform

Panel operation

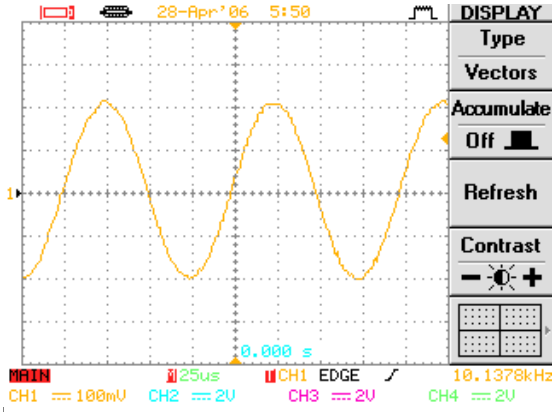
Display → Type → F 1 → Vectors/ Dots

1. Press the Display key→F1.
2. To select the line format, press F1 repeatedly.

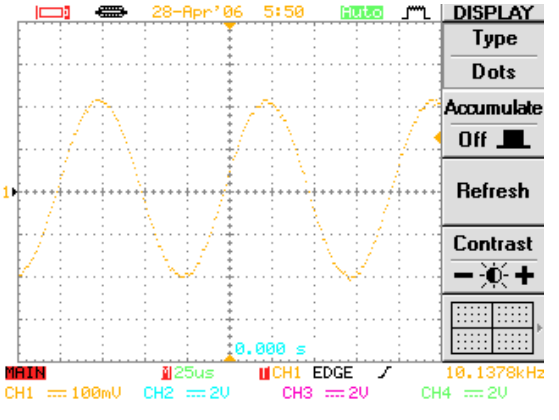
Range	Vectors	The sampled dots are connected to form a waveform line.
	Dots	Only the dots are shown on the display.

Example

Vectors

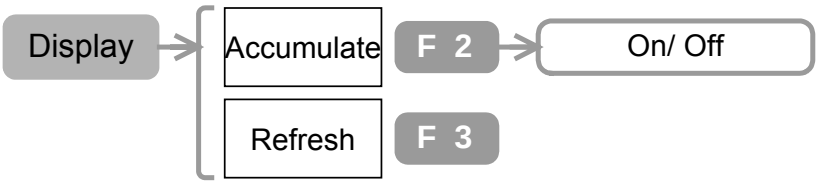


Dots



View accumulated waveform

Panel operation

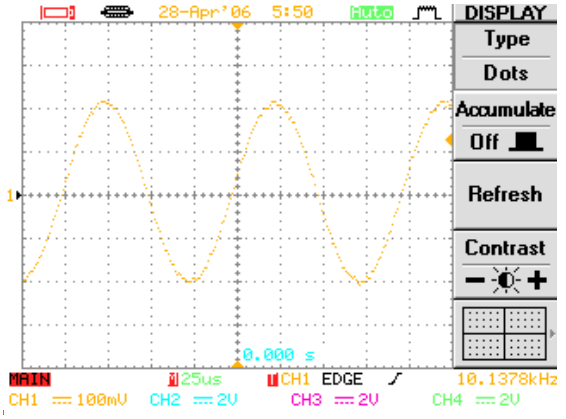


1. Press the Display key→F2.
2. To turn Off accumulation, press F2 again.
3. To clear the accumulated waveform, press F3.

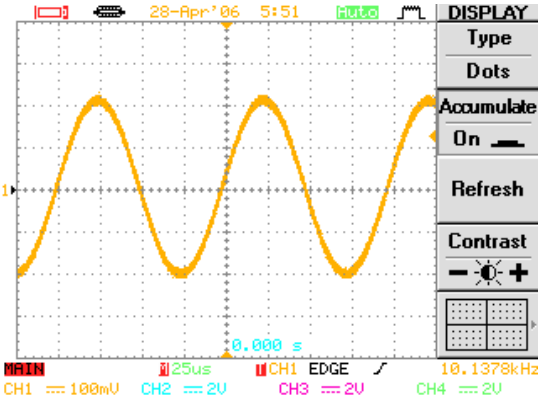
Range	On	The waveform is accumulated to show signal variation.
	Off	The waveform is refreshed each time.

Example

Accumulation Off



Accumulation On



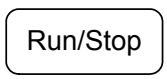
Set the display contrast

Panel operation

1. Press the Display key→F4.
2. To change the contrast, use the Variable knob.

Freeze the waveform

Panel operation



1. To freeze the waveform (and the trigger), press the Run/Stop key.
2. To unfreeze the waveform, press the Run/Stop key again.

The acquisition controls for RUN/STOP

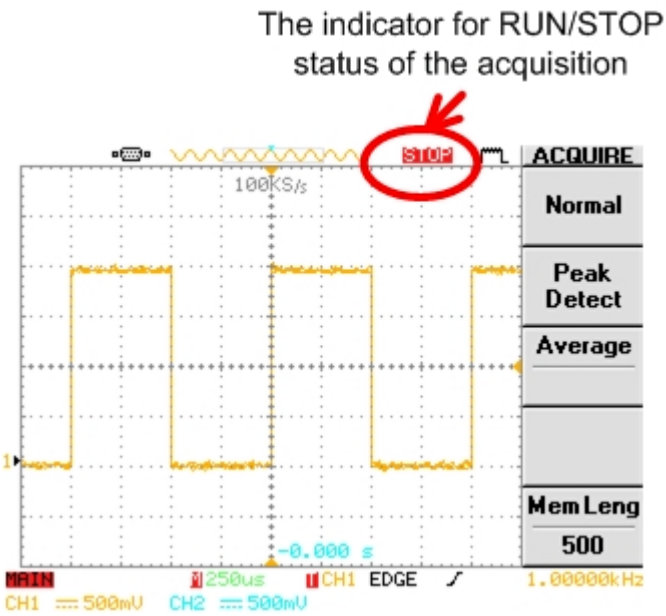
Panel operation

Run/Stop

Continuously acquires waveforms or stops the acquisition. Press the **RUN/STOP** button in order to start and stop the waveforms acquisition.

And also press the **RUN/STOP** button when you want to resume continuous acquisition after a "single shot" acquisition.

The status of the acquisition is shown on the top right corner.



Stopping the acquisition

Panel operation

Run/Stop

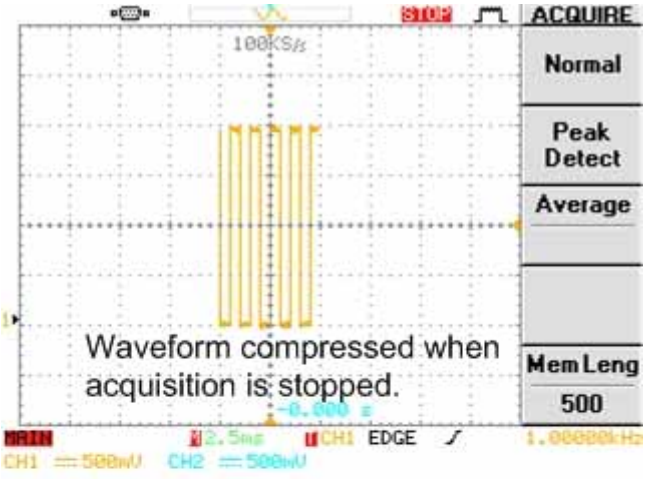
While the acquisition is running, the waveform display is live. Stopping the acquisition (when push the **RUN/STOP** button) freezes the display. In either mode, the waveform display can be scaled with the horizontal controls.

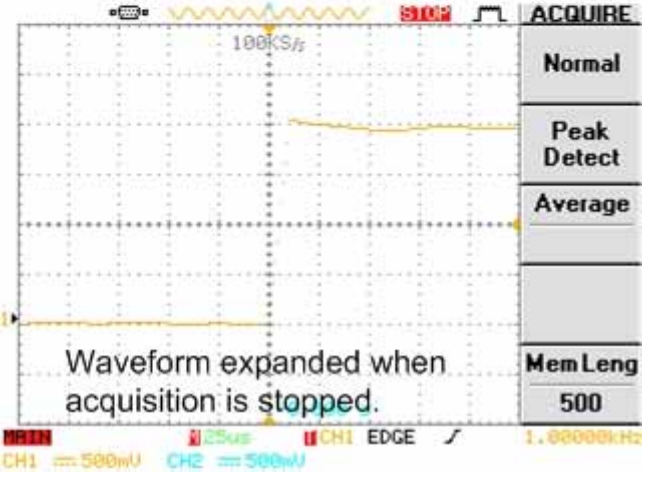
Time/DIV knob for RUN/STOP acquisition

Panel operation

Run/Stop

If waveform acquisition is stopped (using the **RUN/STOP** button), the **TIME/DIV** knob control expands or compresses the waveform.



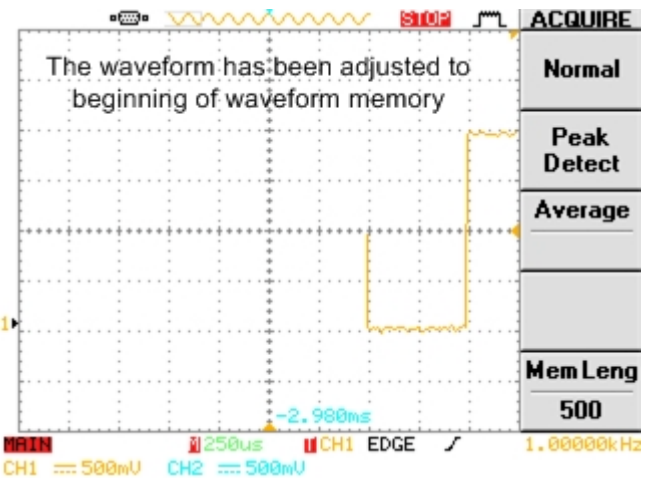


HORIZONTAL POSITION knob for RUN/STOP acquisition

Panel operation

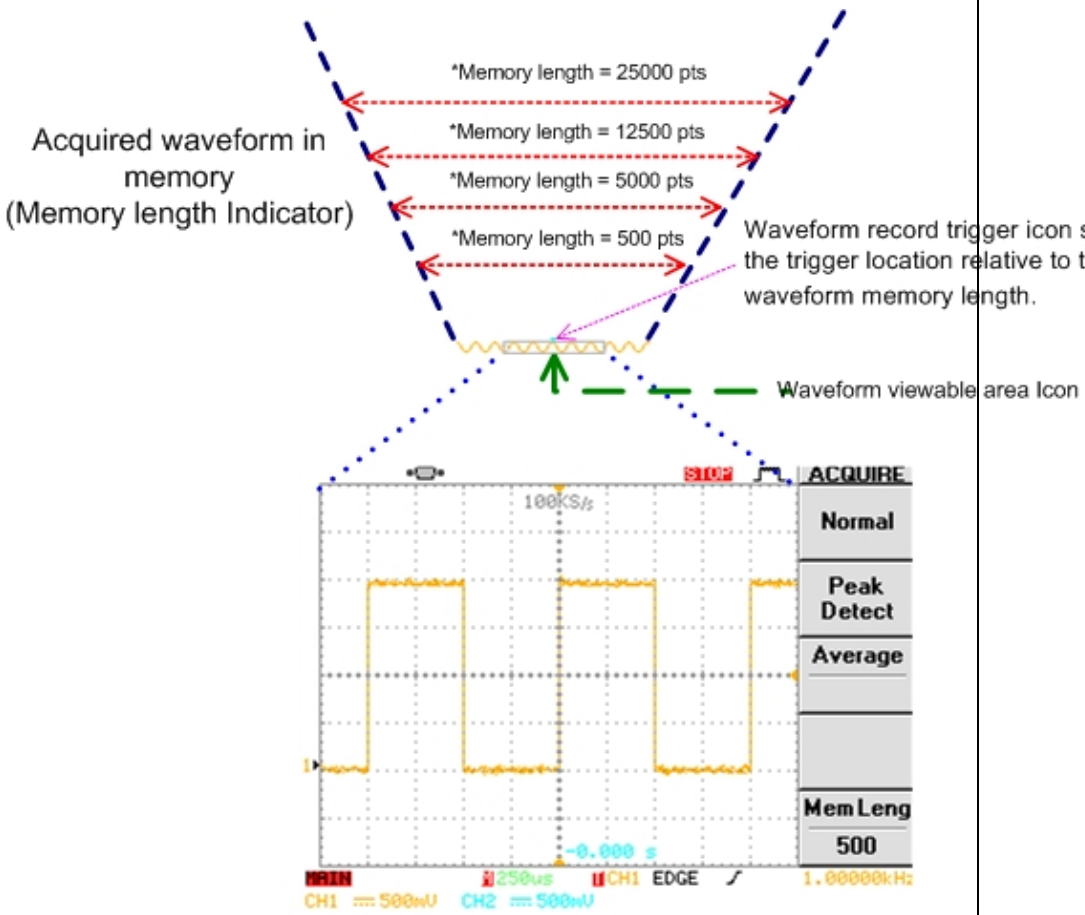
Run/Stop

If waveform acquisition is stopped (using the **RUN/STOP** button), the **TIME/DIV** knob control expands or compresses the waveform.



When the waveform been expanded or compressed, the waveform viewable area icon can also show the area

that the horizontal scale expands and compresses around the entire memory length of waveform.



*Note: The memory length Is switching to proper settings automatically by system which depends on the scale of time base and number of Input channel turned on

Select the display grid type

Panel operation

Display → (icon) → F 5 → ⊞ / ▦ / ▭

1. Press the Display key→F5.
2. To select the grid type, press F5 repeatedly.

Range

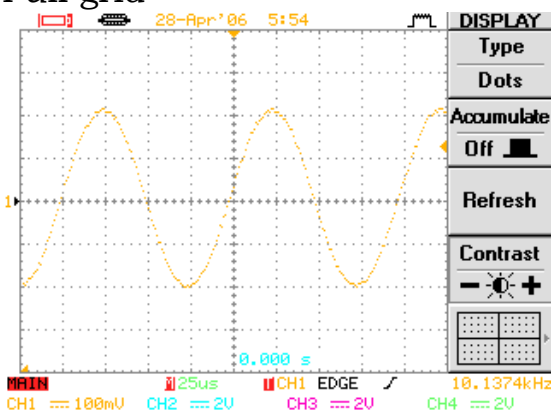
⊞ Only displays X and Y axis

▦ Displays full grid

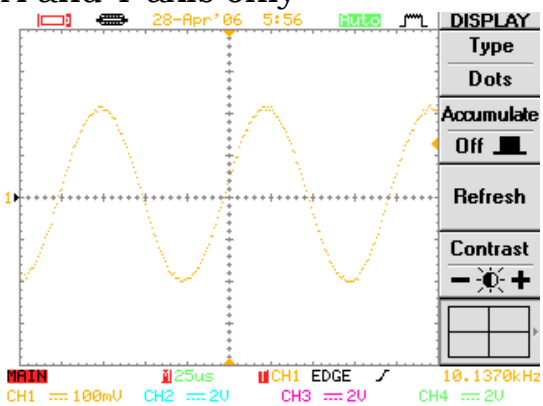
▭ Only displays outer frame

Example

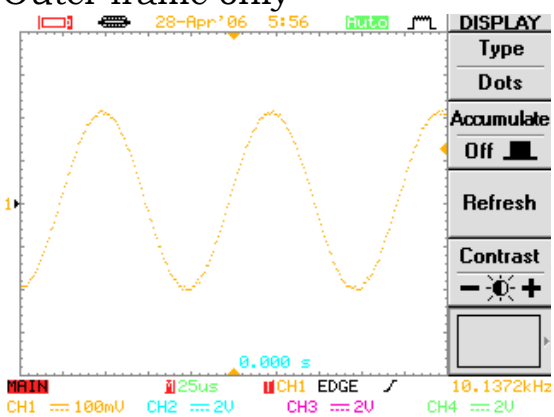
Full grid



X and Y axis only

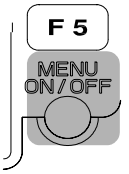


Outer frame only



Turn Off the display menu

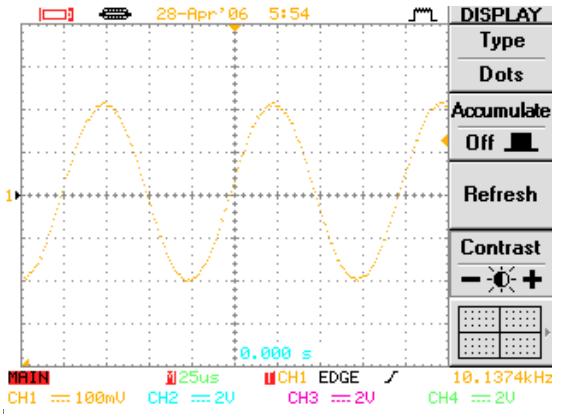
Panel operation



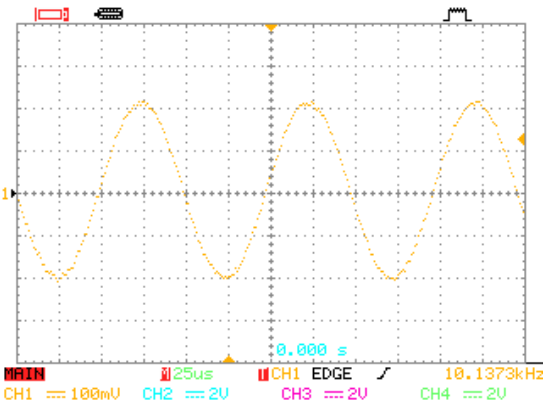
1. Press the MENU ON/OFF key.
2. To turn the menu On, press again.

Example

Menu On



Menu Off



Horizontal View

Window

Panel operation

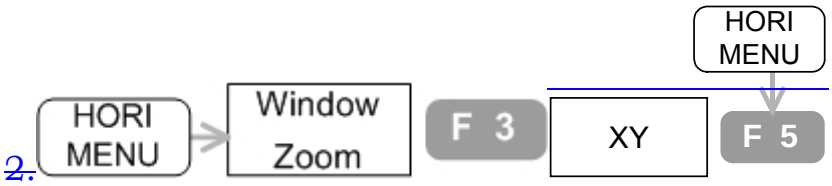
2.

To switch between the normal and zoomed display, Press **F2** softkey to display the timebase of windows zoom, in the meantime, the waveform display area will change to gray color except the zoomed area.

Use the **TIME/DIV** knob to change the length (windows frame time range: from 2ns to one more step faster than the desired timebase.

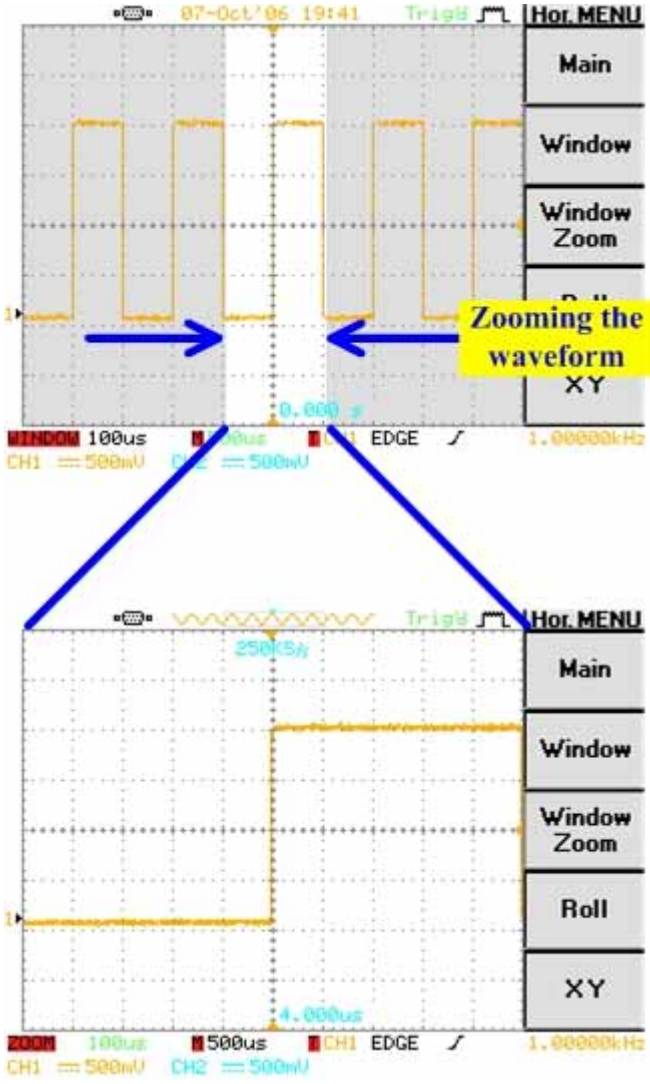
For example, if the 1ms timebase is selected, the maximum window frame timebase will be 500μs) of the zone and rotates the horizontal's **POSITION** knob to change the position.

Panel operation



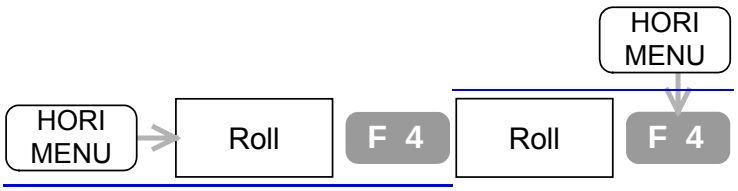
2.

Press **F3** softkey to display the zoomed waveform.



Roll the horizontal view

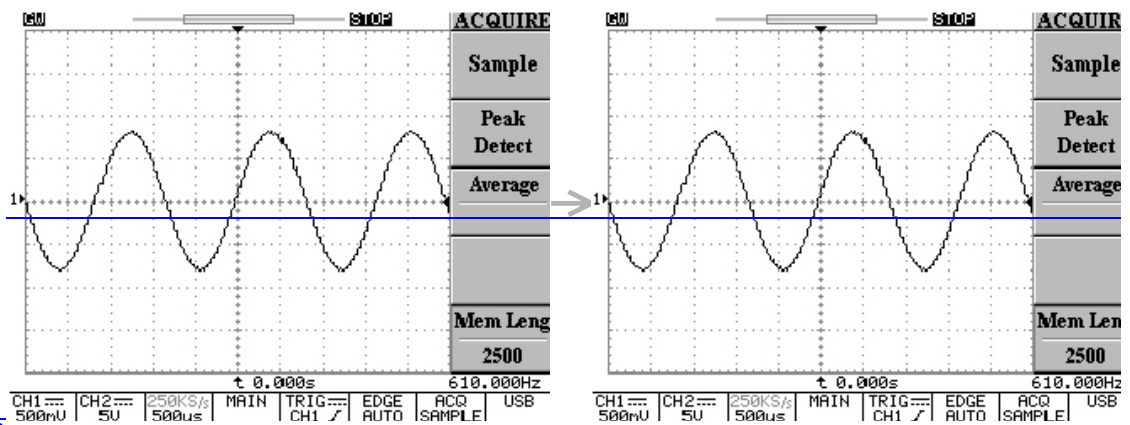
Panel operation



~~1.Press the Horizontal key →F4.~~

~~2.Press F4 again to cancel the effect.~~

1. Press the Horizontal key→F4.
2. To go back to the default (main) view, press F1.

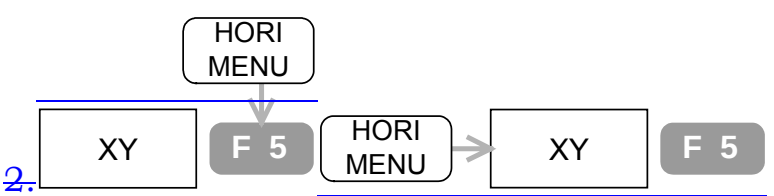


~~2.~~

View in XY mode

~~**XY mode compares Channel1 and 2 Voltage levels.**~~**Not available for Channel 3 and Channel 4**

Panel operation



~~2.~~

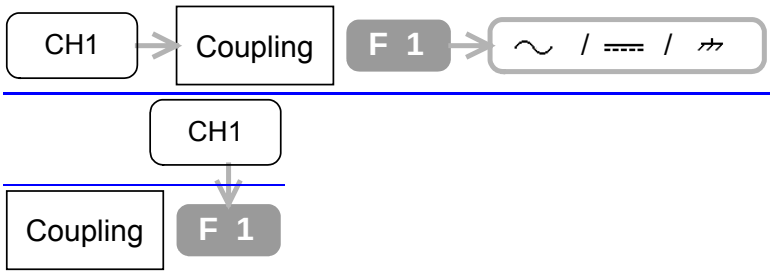
1. Feed Channel1 (horizontal) and Channel2 (vertical) signal.
2. Press the Horizontal key→F5.
3. To set the horizontal scale and position, use Channel1 Volts/Div knob and Position knob.

4. To set the vertical scale and position, use Channel2 Volts/Div knob and Position knob.

Vertical View

Select the coupling method

Panel operation



~~1.Press Channel key →F1.~~

~~2.Press F1 again to select the coupling.~~

1. Press the Channel key→F1.

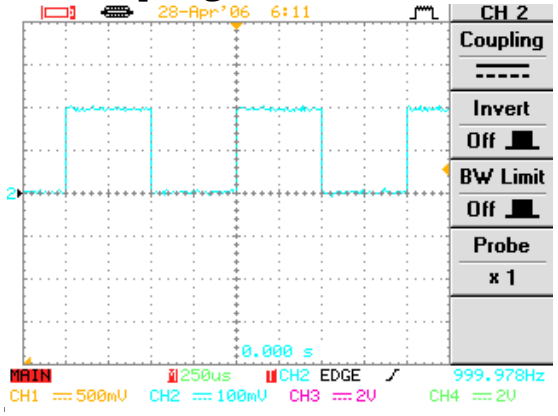
2. To select the coupling, press F1 repeatedly.

Range

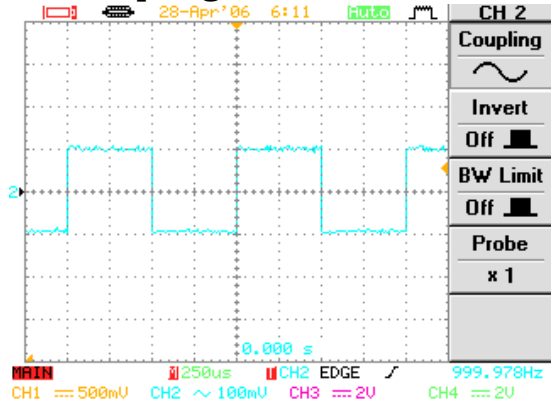
~	AC coupling
⎓	DC coupling
⏚	Ground coupling

Example Observe the AC portion of a signal using AC coupling

DC Coupling

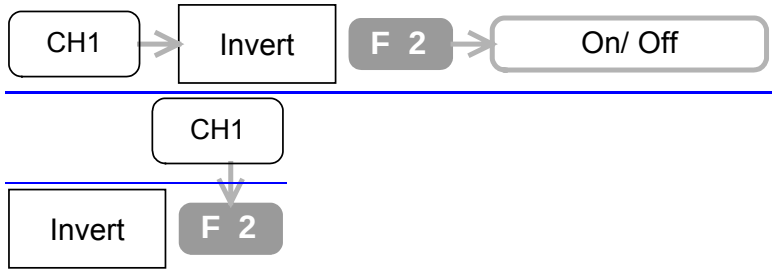


AC Coupling



Invert the waveform

Panel operation



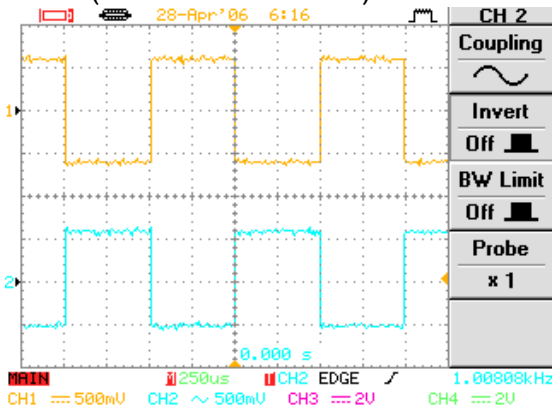
~~Press Channel key →F2.~~

~~Press F2 again to cancel the effect.~~

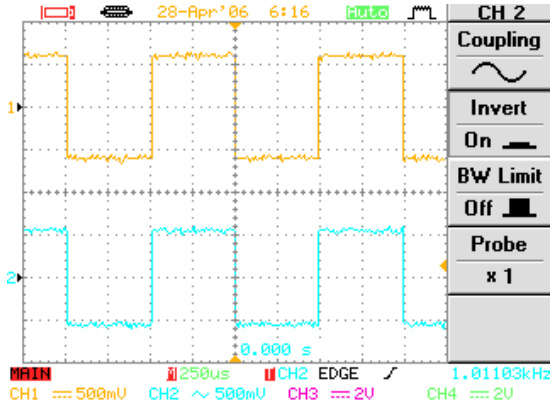
1. Press the Channel key→F2.
2. To cancel the effect, press F2 again.

Example

CH2 (lower waveform) Invert Off



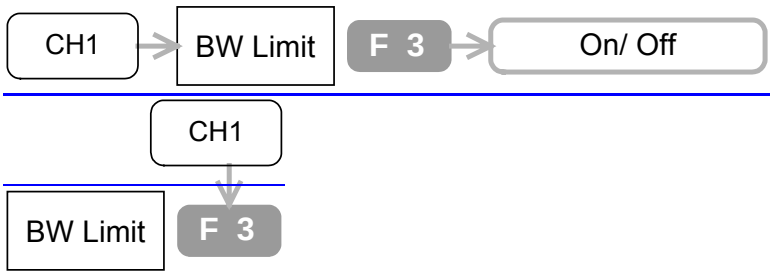
CH2 Invert On



~~2.~~The trigger is also inverted.

Limit the frequency bandwidth

Panel operation



~~1.Press the Channel key→F3.~~

~~2.Press F3 again to cancel the effect.~~

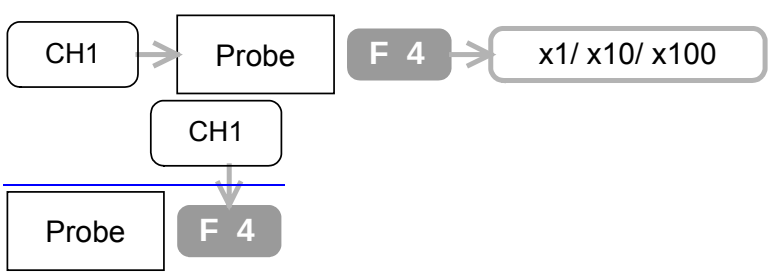
1. Press the Channel key→F3.
2. To cancel the effect, press F3 again.

Range

BW Limit On	Frequency bandwidth is limited to 20MHz (−3dB).
BW Limit Off	The full rating frequency bandwidth is used.

Select the probe attenuation

Panel operation



~~1.Press the Channel key→F4.~~

~~2.Press F4 again to select the attenuation level.~~

1. Press the Channel key→F4.
2. To select the attenuation level, press F4 repeatedly.
3. Vertical scale is adjusted accordingly.

Range

x1	No attenuation
x10	Attenuation factor 10

x100 Attenuation factor 100

Other Settings

Select the buzzer sound

Panel operation

1. Press the Utility key→F3.
2. To select the buzzer setting, press F3 repeatedly.

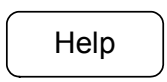
Range

∿∿∿	Low pitch
∿∿∿∿∿	High pitch
∿∿∿∿∿	Mixed pitch
Off	No sound

View the Help information

The Oscilloscope has built-in help accessible from the front panel.

Panel operation



1. Press the Help key. The waveform freezes and the display switches to “Help” mode.
2. To view the built-in help, select a key from the following and press it. The display shows the relevant functionalities.
   Acquire, Cursor, Display, Measure, Program, Utility
3. To go back to normal operation, press the Help key again.

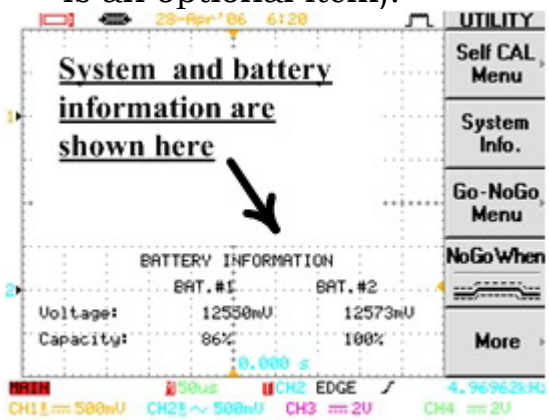
View the system information

Panel operation

Utility → More → F 5 → System Info. → F 2

1. Press the Utility key→F5→F2.

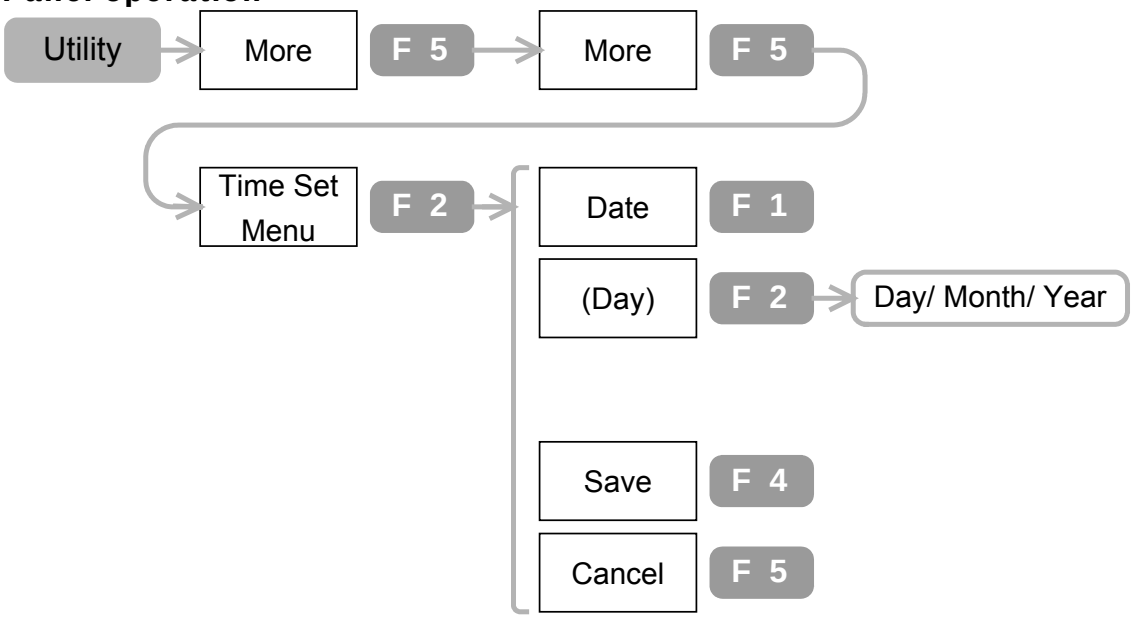
2. The display shows the following information. Model name, Serial No, Firmware version, battery level and the remaining level (Battery is an optional item).



3. To go back to the signal view, press the other key.

Set the Date

Panel operation



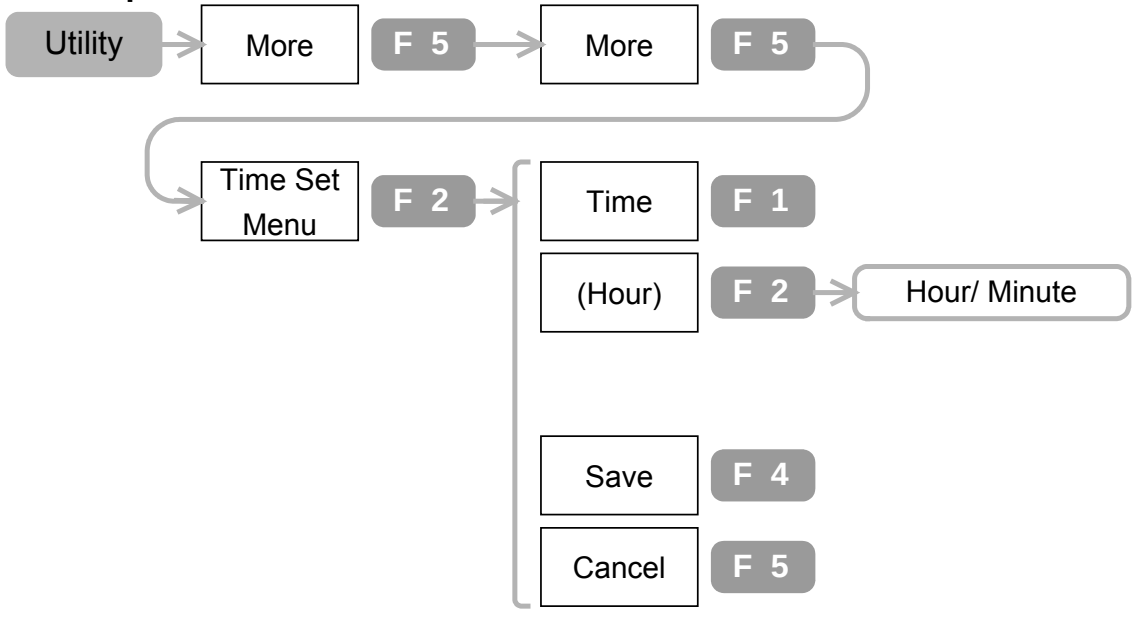
1. Press the Utility key→F5→F5→F2. Press F1 again if "Date" does not appear.
2. To select the item, press F2 repeatedly.
3. To set the parameter, use the Variable knob.
4. To save the change, press F4 twice.
5. To go back to the previous menu, press F5.

Range

Day	1~31
Month	1~12
Year	2000~2037

Set the Time

Panel operation



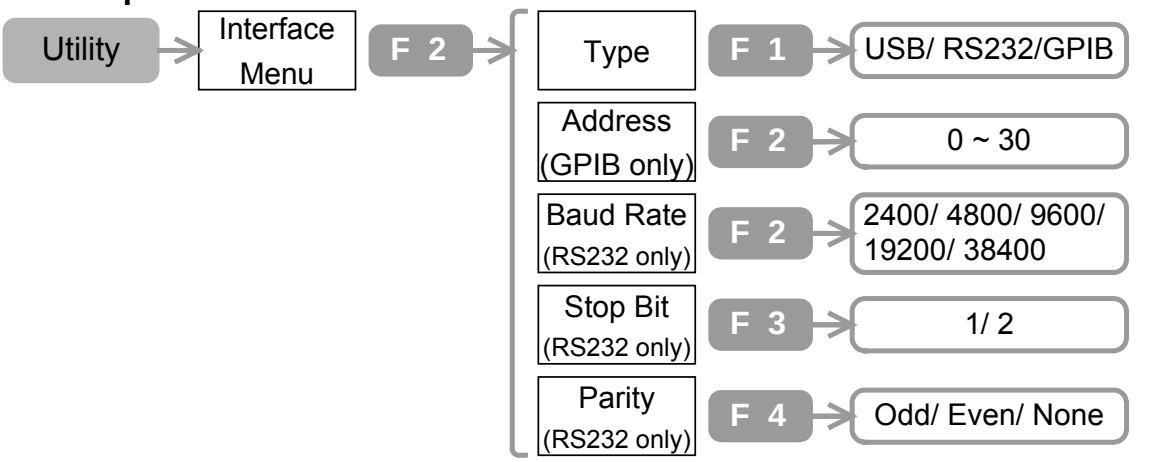
1. Press the Utility key→F5→F5→F2→F1. Press F1 again if "Time" does not appear.
2. To select the item, press F2.
3. To set the parameter, use the Variable knob.
4. To save the change, press F4 twice.
5. To go back to the previous menu, press F5.

Range

Hour	0~23
Minute	0~59

Set the Communication Interface

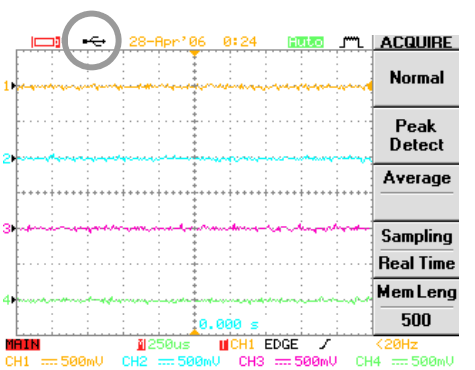
Panel operation



1. Press the Utility key→F2. To select the interface, press F1 repeatedly.

2. The interface icon appears on the top left side of the display.
   USB:
   RS232C:
   GPIB (Optional):

Interface Icon

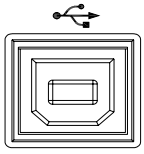


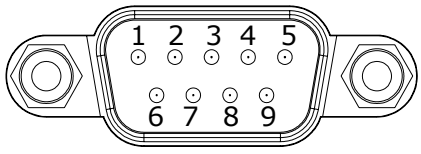
3. (For RS232C only) To configure RS232, press F2 (Baud rate), F3 (Stop Bit), and F4 (Parity) repeatedly.

4. (For GPIB only) To select the address, press F2 repeatedly.

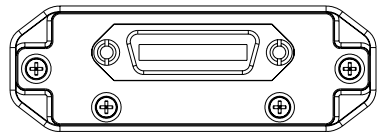
5. Connect the USB/RS232C/GPIB cable to the rear panel.

USB RS-232C GPIB (Optional)





2: RxD, 3: TxD, 5: GND
1, 4, 6~9: No connection



To install, turn Off Oscilloscope power and plug the GPIB card into the slot.

Range

Baud Rate (RS232C)
2400, 4800, 9600, 19200, 38400

Stop Bit (RS232C)
1, 2

Parity (RS232C)
Odd/ Even/ None

Address (GPIB)
1~30

Battery Maintenance (Optional)

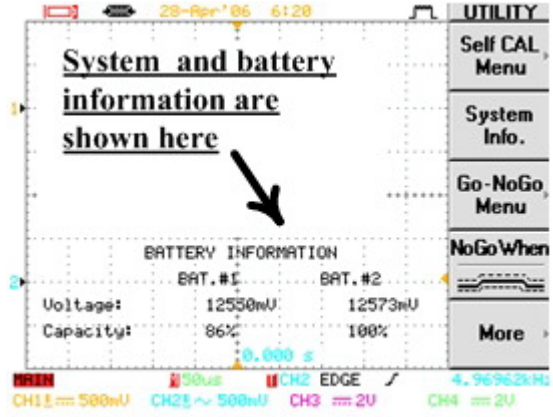
The battery is a factory-installed optional item. Contact your local dealer for purchase and installation.

Specification

Li-Ion, 11.1V 1600mAh per pack (two packs for one Oscilloscope)
Charging time: Eight hours approx.
Operation time: Three hours approx.

Battery information

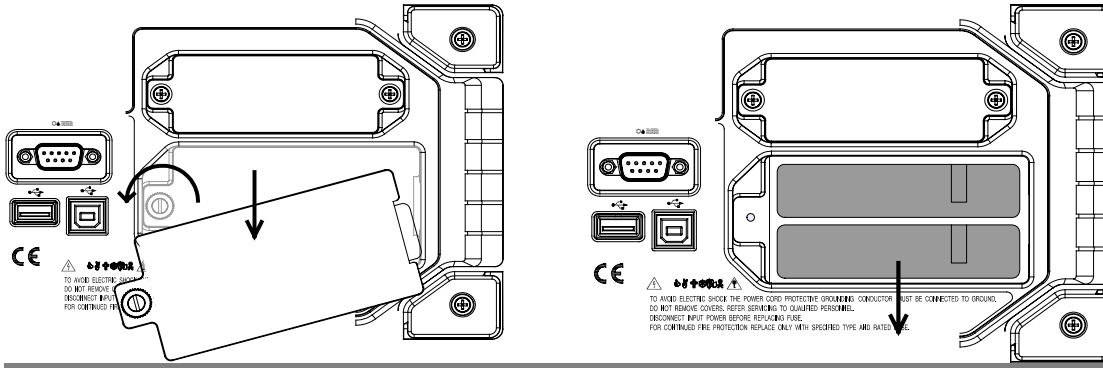
To view battery status, press Utility key→F5→F2.



The display shows battery voltage and charge information on the lower pane.

When not in use

Take the batteries out of the unit to prolong the battery life.



Measurements

Automatic Measurements

Auto Set

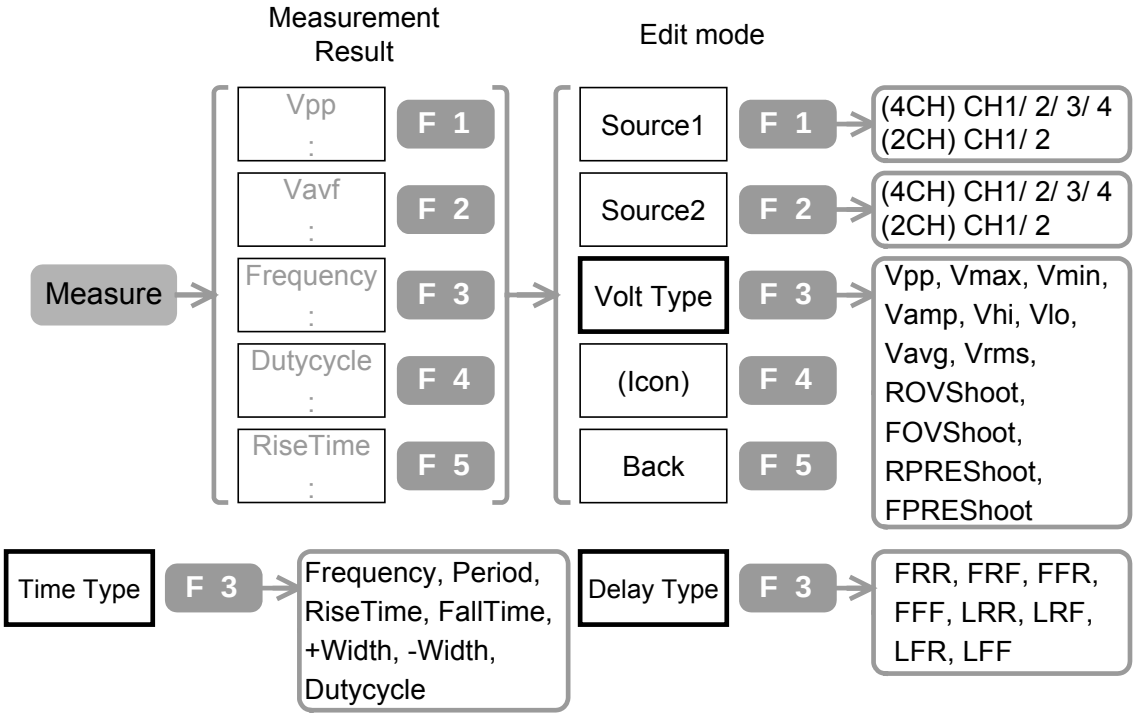
Auto Set automatically finds the appropriate settings (vertical, horizontal, trigger) for the input signals.
Limitation: Signals under 30mV or 30Hz would not be recognized.

Panel Operation Auto Set

The following is the Auto Set configuration.

Acquisition	Mode:	Sample
	Stop after:	RUN/STOP button only
Display	Style:	Vectors
	Format:	YT
Horizontal	Scale:	Signal frequency dependent
	Position:	Centered in the display
Trigger	Coupling:	DC
	Position:	Center
	Slope:	Positive
	Type:	Edge
	Source:	Highest frequency
	Level:	Midpoint of the trigger source
Vertical	Bandwidth:	Full
	Offset:	0
	Coupling:	Signal dependent
	Scale:	Signal dependent

Panel operation



1. Press the Measure key. F1 to F5 shows the result from the previous measurement.
2. Press any of F1~F5. The menu switches to edit mode.
3. To select the first channel to be measured, press F1 repeatedly.
4. To select the second channel to be measured, press F2 repeatedly (essential for Delay measurement).
5. To select the measurement type (Voltage, Time, and Delay), press F3 repeatedly.
6. To select the measurement item, use the Variable knob. The corresponding icon is shown on F4.
7. To go back to the measurement result view, press F5.

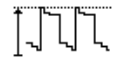
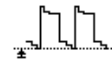
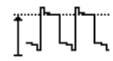
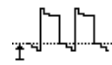
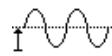
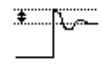
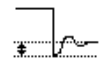
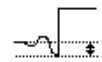
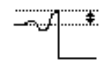
Range

Source1, 2

(4CH) CH1~CH4 (4CH model) Channel1~Channel2

(2CH) CH1,CH2 (2CH model) Channel1,Channel2

Volt type

Vpp		Difference between positive and negative peak voltage. (=Vmax−Vmin)
Vmax		Positive peak voltage.
Vmin		Negative peak voltage.
Vamp		Difference between global high and global low voltage. (=Vhi – Vlo).
Vhi		Global high voltage.
Vlo		Global low voltage.
Vavg		Averaged voltage of the first cycle.
Vrms		Root Mean Square voltage.
ROVShoot		Rise Overshoot voltage.
FOVShoot		Fall Overshoot voltage.
RPREShoot		Rise Preshoot voltage.
FPREShoot		Fall Preshoot voltage.

Time Type

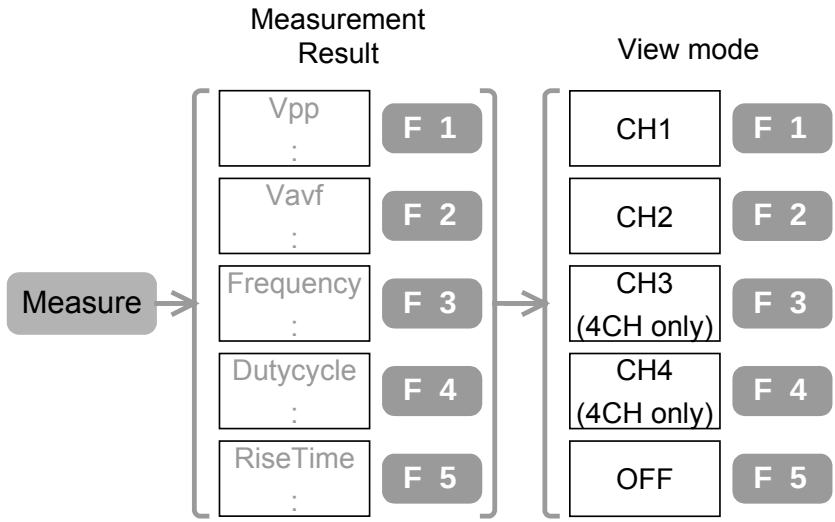
Freq		Frequency of the waveform.
Period		Waveform cycle time. (=1/Freq)
Risetime		Rising time of the pulse (~90%)

Falltime		Falling time of the pulse (90%~)
+Width		Positive pulse width.
-Width		Negative pulse width.
Duty Cycle		The ratio of the signal pulse compared with the whole cycle. (=100 x Pulse Width/Cycle)

Delay Type

FRR		Time between Source1 signal **first rising** edge and Source2 signal **first rising** edge.
FRF		Time between Source1 signal **first rising** edge and Source2 signal **first falling** edge.
FFR		Time between Source1 signal **first falling** edge and Source2 signal **first rising** edge.
FFF		Time between Source1 signal **first falling** edge and Source2 signal **first falling** edge.
LRR		Time between Source1 signal **first rising** edge and Source2 signal **last rising** edge.
LRF		Time between Source1 signal **first rising** edge and Source2 signal **last falling** edge.
LFR		Time between Source1 signal **first falling** edge and Source2 signal **last rising** edge.
LFF		Time between Source1 signal **first falling** edge and Source2 signal **last falling** edge.

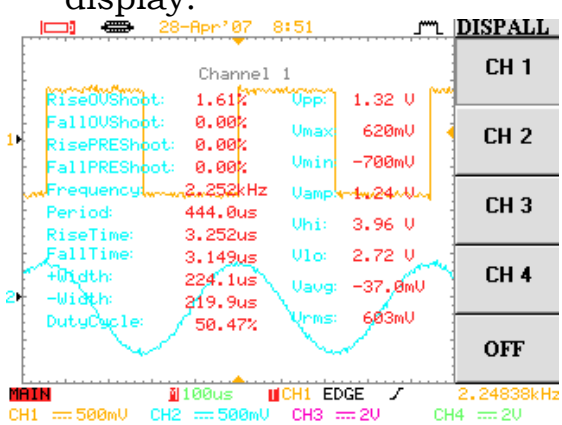
Panel operation



1. Two viewing modes are available: selected results on the menu and full results on the main display.

2. To view the selected result, press the Measure key repeatedly until the Result mode appears.

3. To view the full measurement result, press the Measure key again. Select the channel from F1~F4 and press it. Oscilloscope runs all the applicable Voltage and Time type measurements. The results are shown on the display.

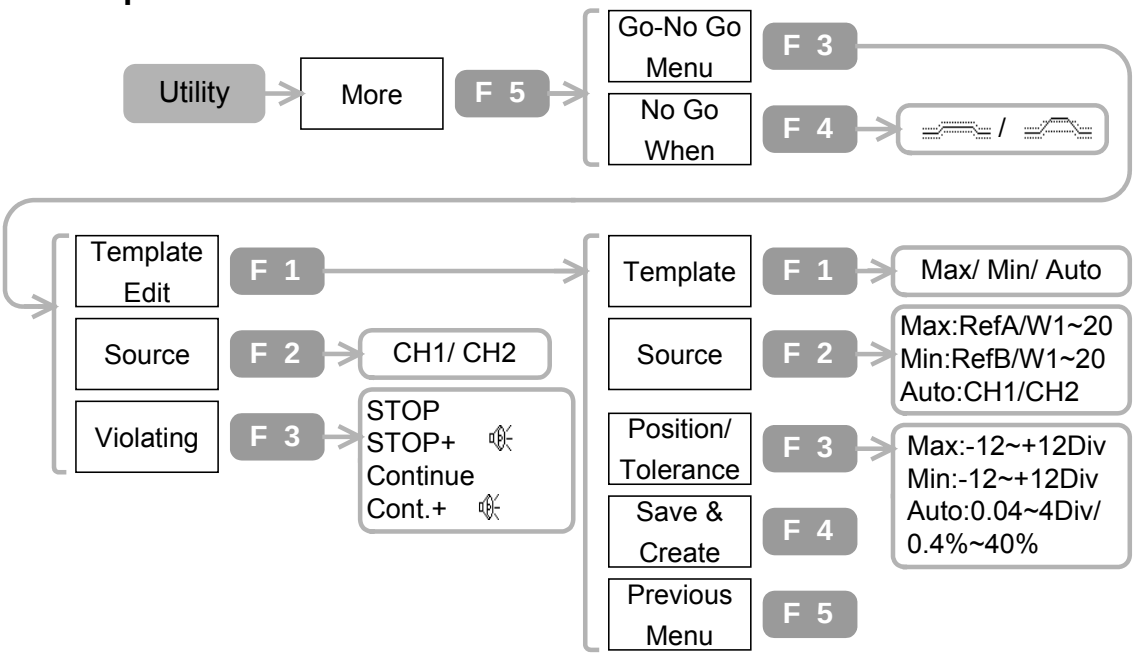


4. To go back to the normal view, press F5.

Go-No Go Test

Edit Go-No Go test condition

Panel operation



1. Press the Utility key→F5. To select No Go When (violation condition), press F4 repeatedly.
2. Press F3 and go into Go-No Go menu.
3. To select the test subject signal, press F2 repeatedly.
4. To select the violation event, press F3 repeatedly.
5. Press F1 and go into template edit menu.
6. To select the template, press F1 repeatedly.
7. To select the template source, press F2 repeatedly.
8. To select the template position (Maximum/Minimum) or tolerance (Auto), use Variable knob.
9. To save the edited template, press F4.
10. To go back to the previous menu, press F5.

Range **Go-No Go When (violation condition)**

No Go = the subject signal is within the template.

No Go = the subject signal is violating the template.

Template

Max

Sets the maximum level of the template.

Template source
RefA: One of the four reference waveforms.
M1~20: One of the twenty internally stored waveforms.
To store a waveform (template), see page96.

Template position
±12/Div

Min

Sets the minimum level of the template.

Template source
RefB: One of the four reference waveforms.
W1~W20: One of the twenty internally stored waveforms.
To store a waveform (template), see page96.

Template position
±12/Div

Auto — Automatically creates the maximum and minimum template from an input signal, specifying the margin (tolerance) around the waveform.

Template source

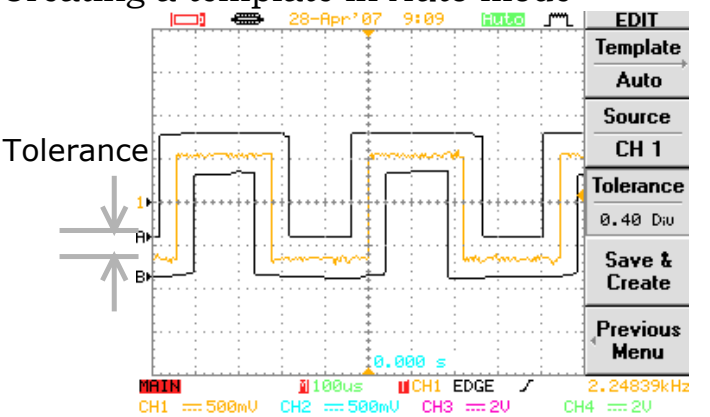
CH1: Use Channel1 signal

CH2: Use Channel2 signal

Template tolerance

0.4%~40%

Creating a template in Auto mode



Source signal

CH1 — Channel1 as the subject of test

CH2 — Channel2 as the subject of test

Violation Condition

Stop — The test stops in case of violation.

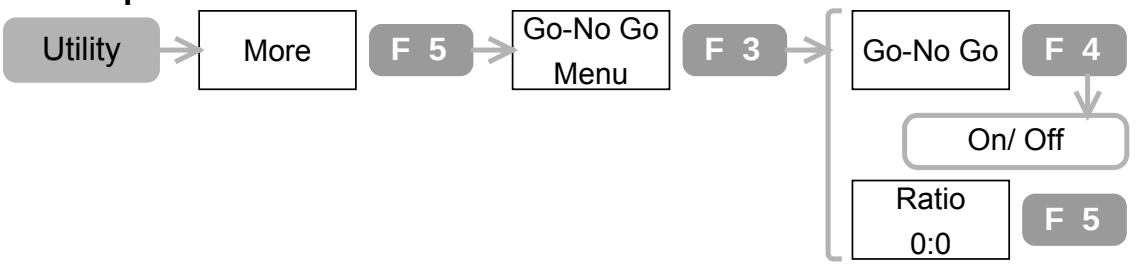
Stop+ — The test stops with a buzzer sound in case of violation.

Continue — The test continues even in case of violation.

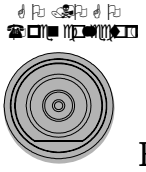
Cont.+ — The test continues but with a buzzer sound in case of violation.

Run Go-No Go test

Panel operation



1. Edit the test condition.
2. Press the Utility key→F5→F3.
3. To run Go-No Go test, press F4.
4. To stop Go-No Go test, press F4 again.
5. The test result is shown on F5 as (Number of test: Number of violation).
6. Oscilloscope outputs the test result as a 10us pulse signal from the rear panel.

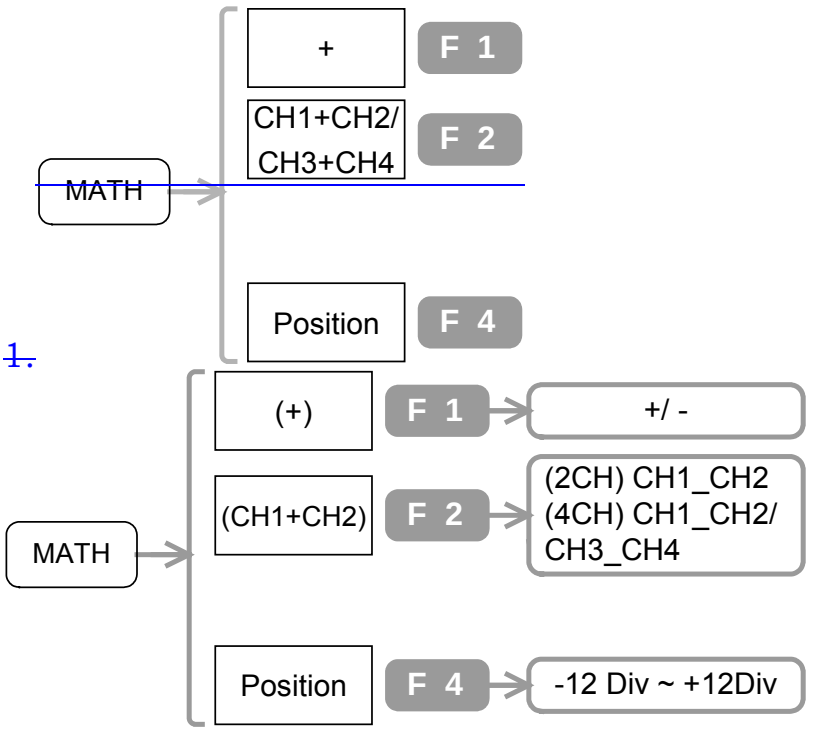


Rear panel output terminal (Open Collector)

Math Operation

Add / Subtract signals

Panel operation



1. Press the Math key.
2. To select the operation (add or subtract), press F1 repeatedly.
3. (For 4CH model) To select the channel pairs, press F2 repeatedly.
4. To set the position of the resulted waveform, press F4. Then use the Variable knob.

Range

Math Operation type

+	Addition
–	Subtraction

Channel Pair

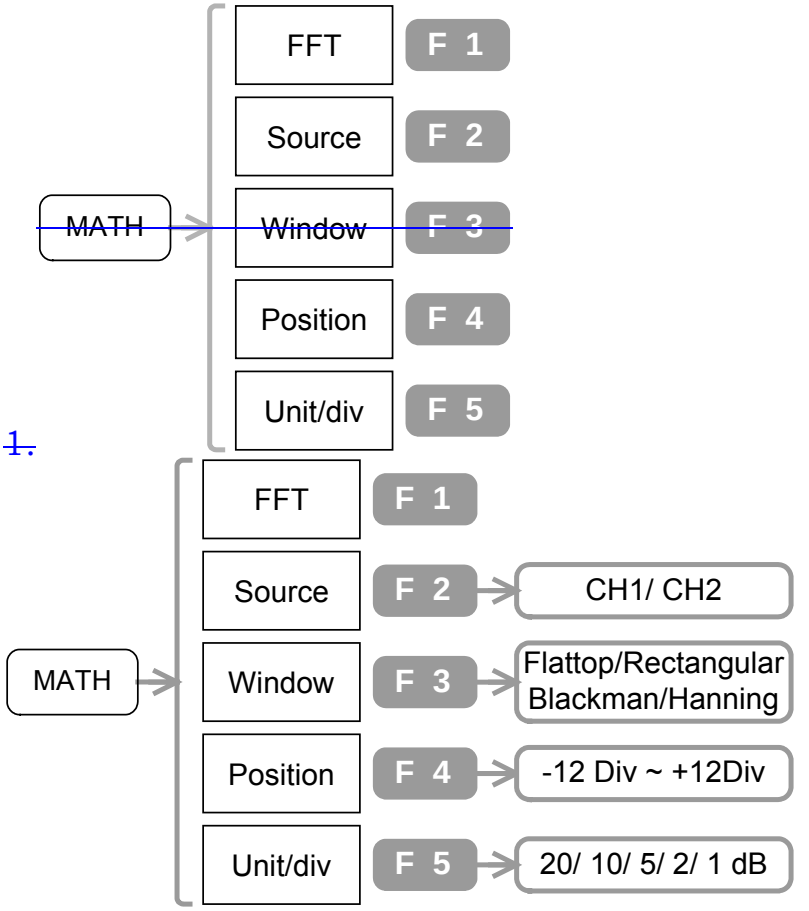
CH1_CH2	Math operation between Channel1 and Channel2
CH3_CH4	Math operation between Channel3 and Channel4 (only for 4CH model)

Position
-12Div~+12Div

Run FFT operation

Not available for Channel3 and Channel4.

Panel operation



1. Press the Math key→F1. Press F1 repeatedly until “FFT” comes up.
2. To select the subject channel, press F2 repeatedly.
3. To select the FFT window type, press F3 repeatedly.
4. To set the position of the resulted waveform, press F4. Then use the Variable knob.
5. To select the amplitude scale, press F5 repeatedly.

~~Range~~

~~Channel: 1 or 2~~

~~FFT window type: Rectangular, Blackman, Hanning, Flattop~~

~~Position: ±12div~~

~~Amplitude scale: 20/ 10/ 5/ 2/ 1 dB/div~~

Range

FFT Window

Rectangular	Suitable for transient analysis.
Blackman	Frequency resolution is not as good as Hanning, but comes with better sidelobe rejection.
Hanning	Higher frequency resolution.
Flattop	Higher magnitude accuracy.

Position

-12Div~+12Div

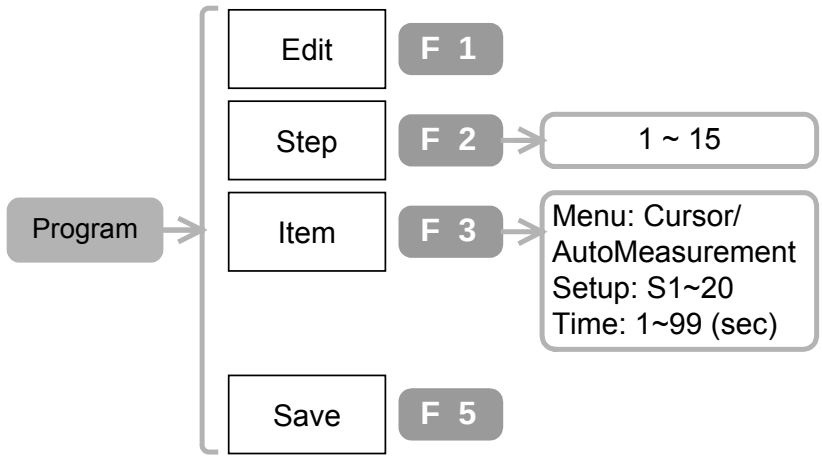
Amplitude scale

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

Program and Play

Edit the program steps

Panel operation



1. Press the Program key→F1. In case the “Edit” menu does not appear, press F1 again.
2. To select the step to be edited, press F2. Then use Variable knob. The cursor in the display also moves accordingly.
3. To select the program item, press F3. Then use Variable knob and select the parameter.
4. To save the edited step, press F5.
5. Repeat the above for the other steps.

Range

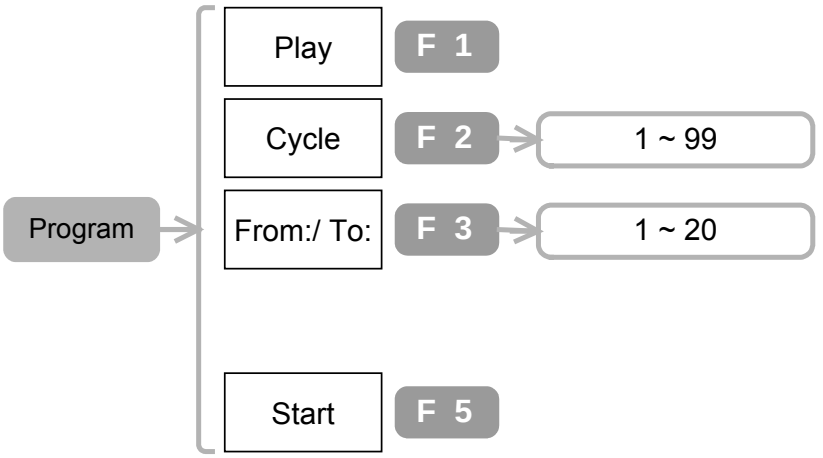
Step (number)
1~20

Item

Menu	“AutoMeasure” or “Cursor”.
Setup	S1~S20 internal setups. To store setups, see page96.
Time	1~99 seconds for each step.

Play the program

Panel operation



1. Edit the program. See page83.
2. Press Program key→F1. In case “Play” menu does not appear, press F1 again.
3. To set the number of repetition (cycle), press F2.Then use the Variable knob.
4. To select “From:” step (beginning of the program), press F3. In case “From:” menu does not appear, press F3 again. Then use the Variable knob.
5. To select “To:” step (end of the program), press F3. In case “To:” menu does not appear, press F3 again. Then use the Variable knob.
6. To start the program, press F5 or press Auto test/Stop key Auto test/Stop.
7. To stop the program, press Auto test/Stop key Auto test/Stop again.

Range

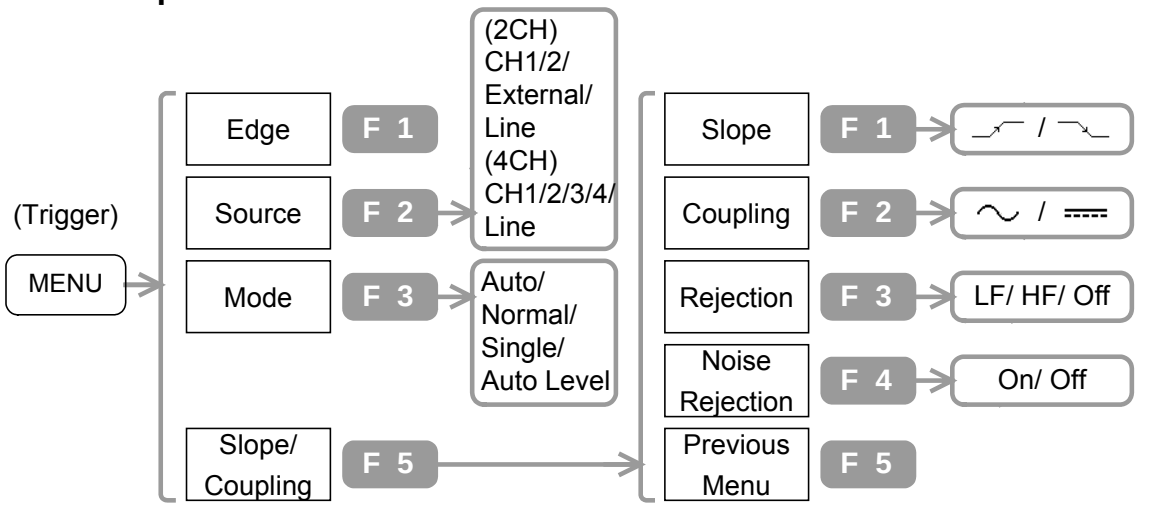
Cycle (number of repetition)
1~99

From: / To: (beginning and end step)
1~20 From: ≤ To:

Trigger

Use the Edge trigger

~~1.~~Panel operation



1. Press the Trigger menu key. Press F1 repeatedly until “Edge” appears.
2. To select the trigger source signal, press F2 repeatedly.
3. To select the trigger mode, press F3 repeatedly.
4. To go into Slope/Coupling menu, press F5.
5. To select the trigger slope, press F1 repeatedly.
6. To select the trigger coupling, press F2 repeatedly.
7. To select the frequency rejection mode, press F3 repeatedly.
8. To turn On noise rejection, press F4. To turn Off, press again.
9. To go back to the previous menu, press F5.

Range

Trigger source

CH1~CH2	Channel 1~Channel 2 (2CH model)
CH1~CH4	Channel 1~Channel 4 (4CH model)
External	Signal from the External trigger input (only for 2CH model)
Line	AC Power supply signal

Trigger mode

Auto	The oscilloscope generates an internal trigger if there is no trigger event. Select this mode when viewing rolling waveform at slower timebase, maximum 10s/div.
Normal	The oscilloscope acquires waveform in a trigger event.
Single	The oscilloscope acquire waveform only once in a trigger event. Press Run/Stop key to acquire again.
Auto Level	The oscilloscope automatically adjusts the trigger level indicator to the center part of the waveform.

Slope

	Rising edge
	Falling edge

Coupling

	AC coupling
	DC coupling

(Frequency) Rejection

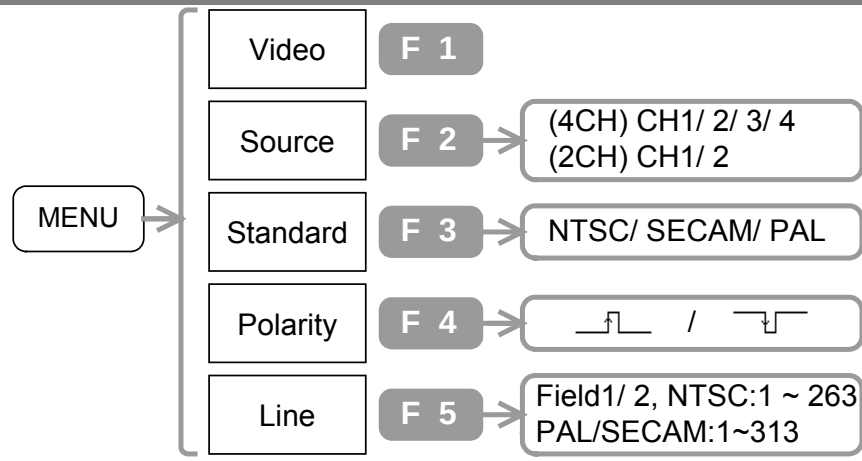
LF	Low Frequency rejection. Rejects frequency below 50kHz.
HF	High Frequency rejection. Rejects frequency above 50kHz.
Off	Rejection disabled.

Noise Rejection

ON	Uses DC coupling with low sensitivity to reject noise.
OFF	Noise rejection disabled.

Use the Video trigger

Panel operation



1. Press the Trigger menu key. Press F1 repeatedly until “Video” appears.
2. To select the trigger source signal, press F2 repeatedly.
2.3. To select the video standard, press F3 repeatedly.
4. To select the trigger polarity, press F4 repeatedly.
5. To select the trigger field line, press F5. Then use the Variable knob.

Range

Trigger source

CH1~2(4)	Channel 1~Channel 2 (Channel 4)

Video standard

NTSC	National Television System Committee video standard.
PAL	Phase Alternative by Line video standard.
SECAM	SEquential Couleur A Memoire video standard.

Polarity

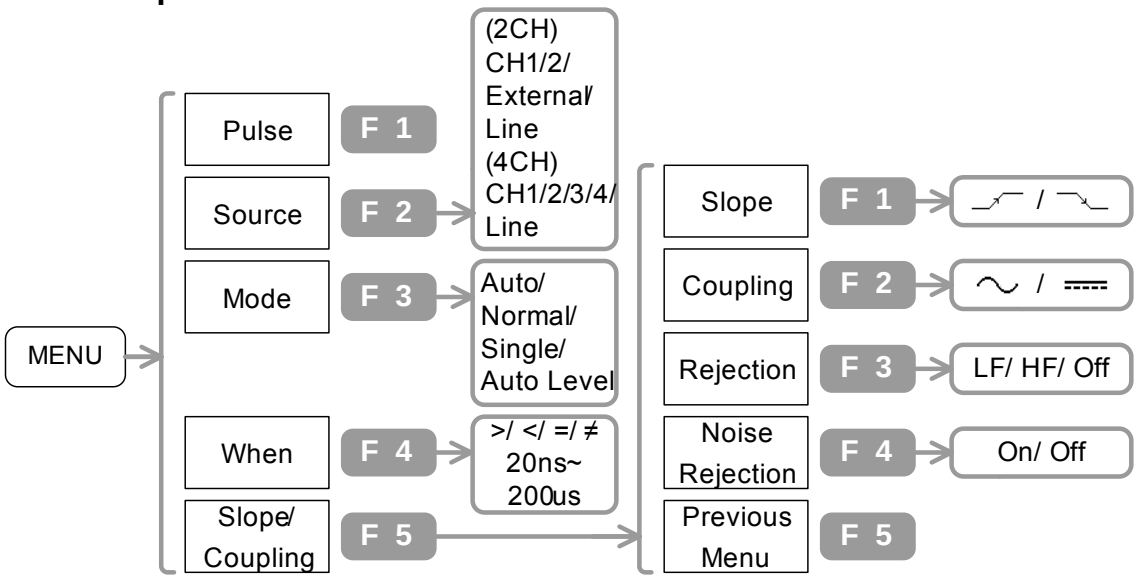
⎍	Positive pulse
⎎	Negative pulse

Video Field

1 ~ 263	For NTSC
1 ~ 313	For PAL/ SECAM

Use the Pulse width trigger

1. Panel operation



1. Press the Trigger menu key. Press F1 repeatedly until “Pulse” appears.
2. To select the trigger source signal, press F2 repeatedly.
3. To select the trigger mode, press F3 repeatedly.
4. To select the trigger condition, press F4 repeatedly. To set the parameter, use the Variable knob.
5. To go into the Slope/Coupling menu, press F5.
6. To select the trigger slope, press F1 repeatedly.
7. To select the trigger coupling, press F2 repeatedly.
8. To select the frequency rejection mode, press F3 repeatedly.
9. To turn On noise rejection, press F4. To turn Off, press again.
10. To go back to the previous menu, press F5.
11. To set the trigger level, use the Trigger knob.

Range

Trigger source

CH1~CH4	Channel 1~Channel 4
External	External trigger input signal (only for 2CH model)
Line	AC power input

Trigger mode

Auto	Oscilloscope generates an internal trigger if there is no trigger event.
Normal	Oscilloscope acquires waveform in a trigger event.
Single	Oscilloscope acquire waveform only once in a trigger event. Press Run/Stop key to acquire again.
Auto Level	Oscilloscope automatically adjusts the trigger level indicator to the center part of the waveform.

Time compare factor

<	Triggers on pulse width smaller than the time setting.
>	Triggers on pulse width larger than the time setting.
=	Triggers on pulse width equal to the time setting.
≠	Triggers on pulse width different from the time setting.

Slope

	Triggers on the positive pulse width
	Triggers on the negative pulse width

Coupling

	AC coupling
	DC coupling

(Frequency) Rejection

LF	Low Frequency rejection. Rejects frequency below 50kHz.
HF	High Frequency rejection. Rejects frequency above 50kHz.
Off	Rejection disabled.

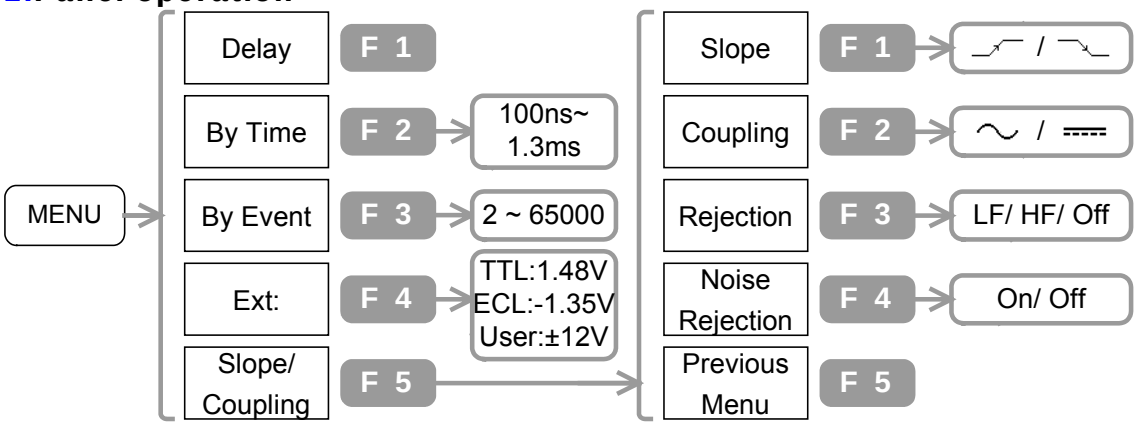
Noise Rejection

On	Uses DC coupling with low sensitivity to reject noise.
Off	Noise rejection disabled.

Use the Advanced delay trigger

Advanced delay trigger is available only in 2CH models.

~~1.~~Panel operation



1. Connect the trigger signal to the External trigger input terminal, and the main signal to Channel1 or 2.

~~1.~~2. Press the Trigger menu key→F1. Press F1 until “Delay” appears.

3. To set the delay time, press F2. Then use the Variable knob.

~~2.~~4. To set the number of trigger event, press F3. Then use the Variable knob.

5. To set the triggering level of start signal, press F4 repeatedly. For user level, use the Variable knob.

6. To select the trigger slope, press F5, then press F1 repeatedly.

7. To select the coupling mode, press F2 repeatedly.

8. To select the frequency rejection mode, press F3 repeatedly.

9. To select the noise rejection mode, press F4 repeatedly.

Range

By Time (Trigger delay time)
100ns ~ 1.3ms

By Event
2 ~ 65000

Ext. (Trigger level of the start signal)

TTL	+1.4V
ECL	-1.3V

USER	±12V range user defined level

Slope

	Rising edge
	Falling edge

Coupling

~	AC coupling
⎓	DC coupling

(Frequency) Rejection

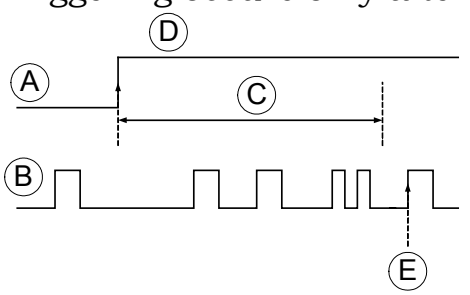
LF	Low Frequency rejection. Rejects frequency below 50kHz.
HF	High Frequency rejection. Rejects frequency above 50kHz.
Off	Rejection disabled.

Noise Rejection

On	Uses DC coupling with low sensitivity to reject noise.
Off	Noise rejection disabled.

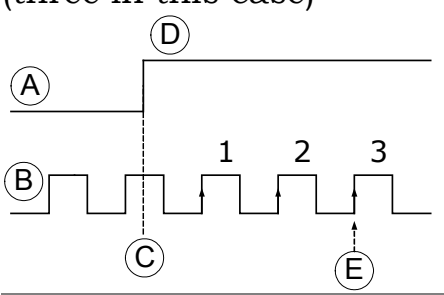
Example:

Triggering occurs only after a pre-defined period of time (T)



A: Start Trigger (External)
B: Main Trigger (CH1 or 2)
C: Set Time (T)
D: Trigger
E: Trigger point

Triggering occurs only after a pre-defined number of user event (three in this case)



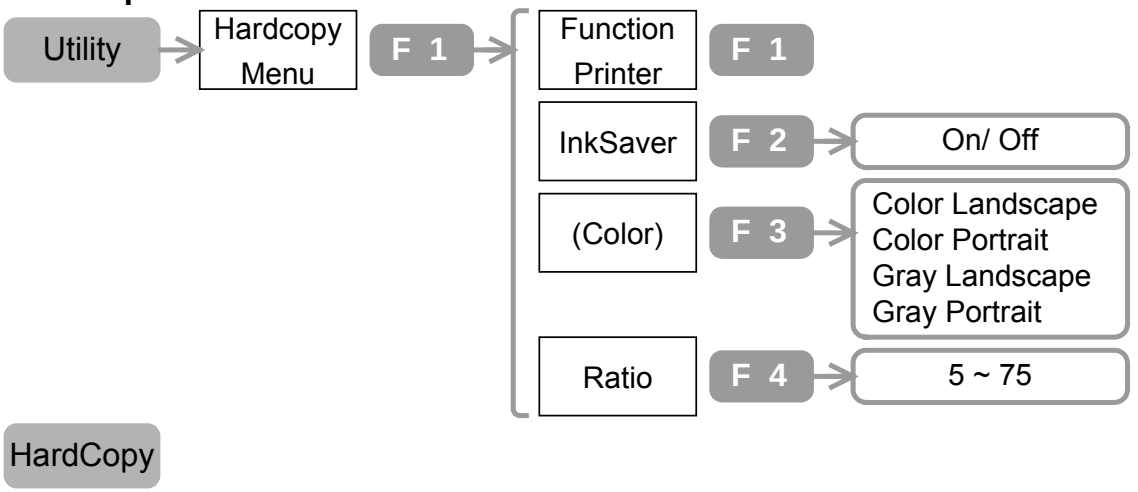
A: Start Trigger (External)
B: Main Trigger (CH1 or 2)
C: Start point of External trigger count
D: Trigger
E: Trigger point

Printout/ Data Transfer

Printout

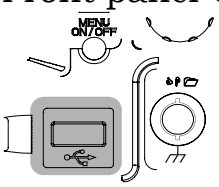
Printout display image

Panel operation

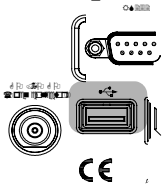


1. Press Utility key→F1. Press F1 repeatedly until “Printer” appears.
2. To select the display background color, press F2 repeatedly.
3. To select the color and portrait, press F3 repeatedly.
4. To select the image size, press F4. Then use the Variable knob.
5. Connect the printer to the front or rear panel USB connector.
   Note: USB rear panel host and rear panel slave connection cannot be used at the same time.

Front panel USB



Rear panel USB

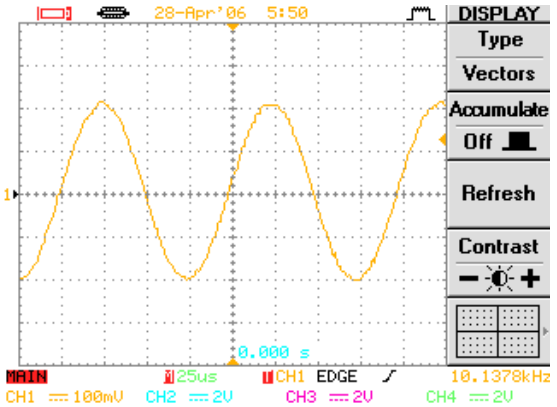


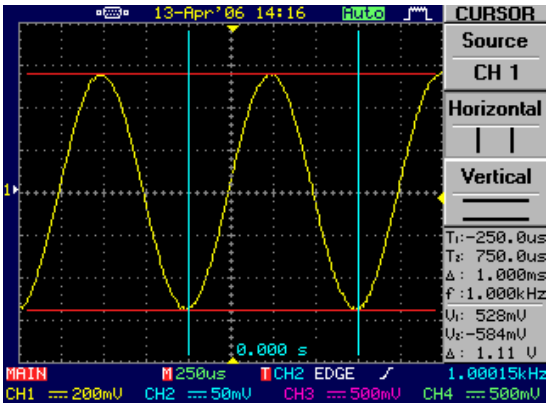
6. To start printing, press the Hardcopy key.
   (Oscilloscope stores the printout setting. From the next time, no need to configure the setting unless changed.)

Range **InkSaver (Display background color)**

On/ Off

InkSaver On InkSaver Off





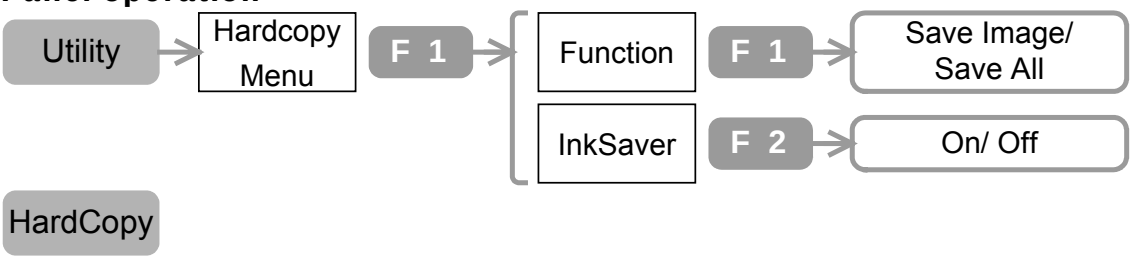
Color/ Portrait
Color Portrait
Gray Portrait
Ratio (Image size)
10~100

Compatible printers list	Check the oscilloscope corner in GWInstek website for the updated list of oscilloscope compatible printers. www.gwinstek.com.tw

Save / Recall

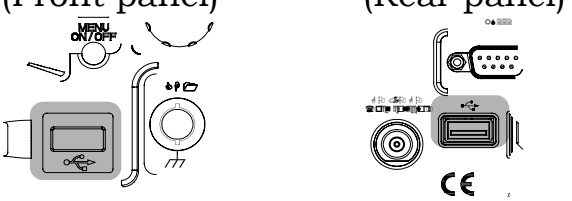
Quick save via USB flash drive

Panel operation



1. Press Utility key→F1.
2. To select the saved information, press F1 repeatedly.
3. To select the display background color, press F2 repeatedly.
4. Connect the USB flash drive to the front or rear panel USB connector. Note: USB rear panel host and rear panel slave connection cannot be used at the same time.

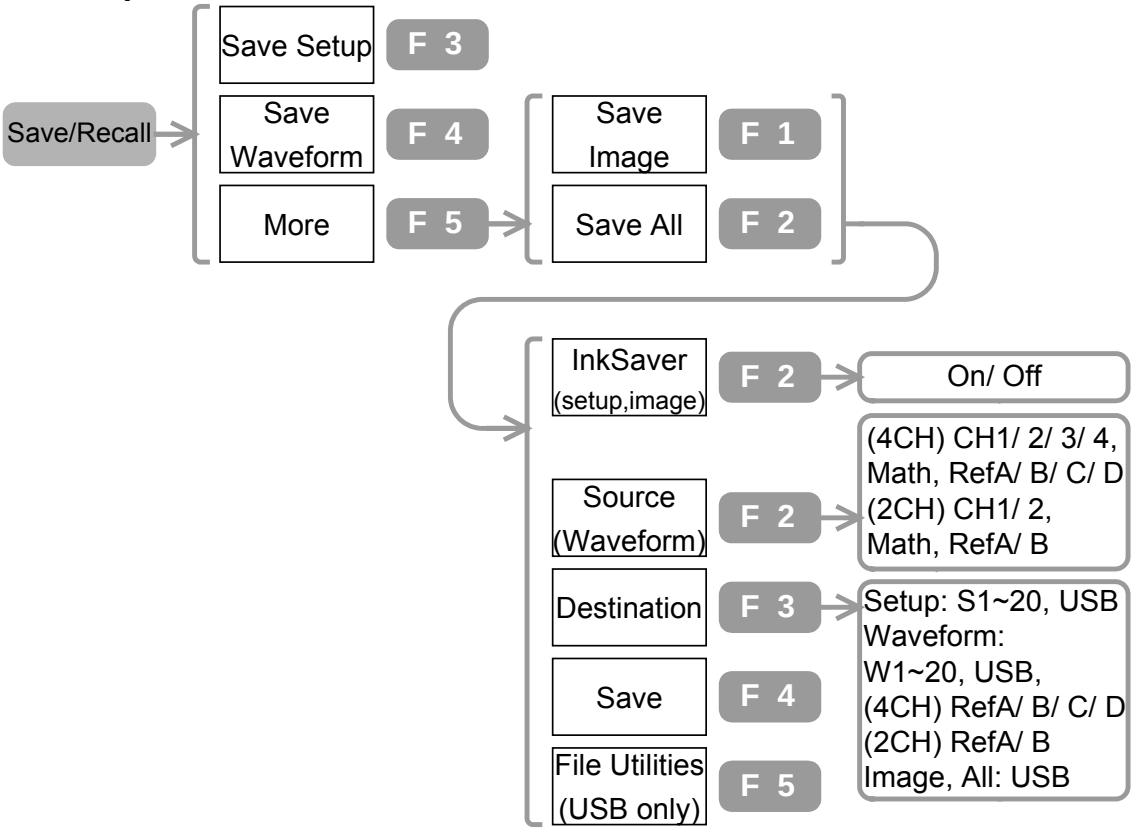
(Front panel) (Rear panel)



5. To store the information, press the Hardcopy key. (Oscilloscope stores the printout setting. From the next time, no need to configure the setting unless changed.)

Range	Image	Saves the display image (DSOxxxx.BMP).
	All	Saves the following data in a folder (Allxxxx). Display image: DSOxxxx.BMP Waveform: xxxx.CSV Setup: xxxx.SET
	InkSaver (Display background color)	
	On/Off	For an example, see the previous page.

Panel operation



1. Press the Save/Recall key→F3 (Setup) or F4 (Waveform) or F5→F1 (Image) or F5→F2 (All).

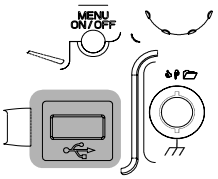
2. (For Image and Save All) To select the display background color, press F2 repeatedly.

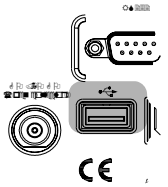
3. (For Waveform) To select the waveform source, press F2. Then use the Variable knob.

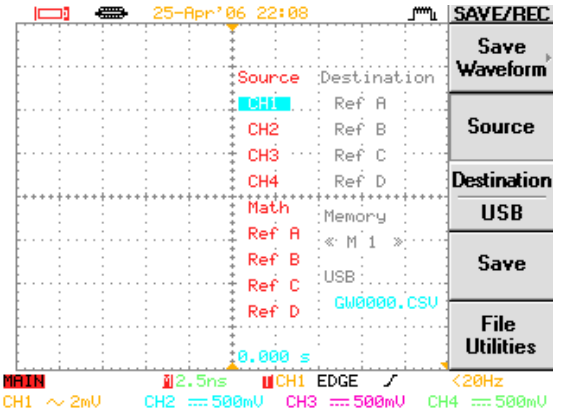
4. To select the location type, press F3 repeatedly. Then use the Variable knob.

5. (Storing to USB flash drive) Connect the USB flash drive to the front or rear panel USB connector.
   Note: USB rear panel host and rear panel slave connection cannot be used at the same time.

Front panel USB Rear panel USB Save dialog screen







6. To save the file, press F4.

7. To configure USB folders, see page98.

Range

File type

Setup	Setup file (xxxx.SET).
Waveform	Waveform file (xxxx.CSV).
Image	Image file (xxxx.BMP).
All	A folder (Axxx) containing setup (xxxx.SET), waveform (xxxx.CSV), and image file (xxxx.BMP).

InkSaver (Display background color)

On/Off	See page93 for the actual effect.

Source

CH1~CH4	Channel1 ~ Channel4 waveforms
MATH	The waveform generated by math operations (page79).
RefA~D	Internal reference waveforms A~D.

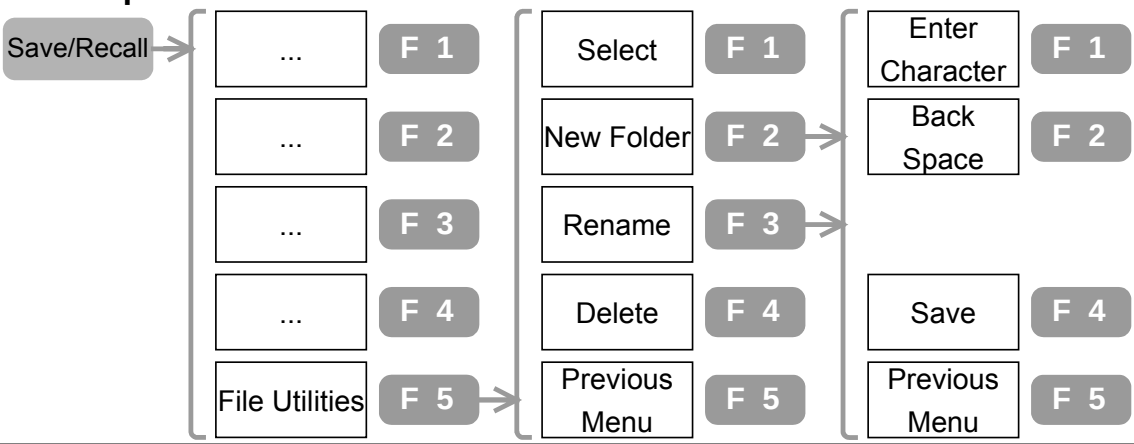
Destination

RefA~D (4CH)	Internal reference waveforms
RefA/B (2CH)	A~D.
Setup	S1~S20 internal setups.
Waveform	W1~W20 internal waveforms.
USB	USB flash drive.

Configure folders and files in USB flash drive

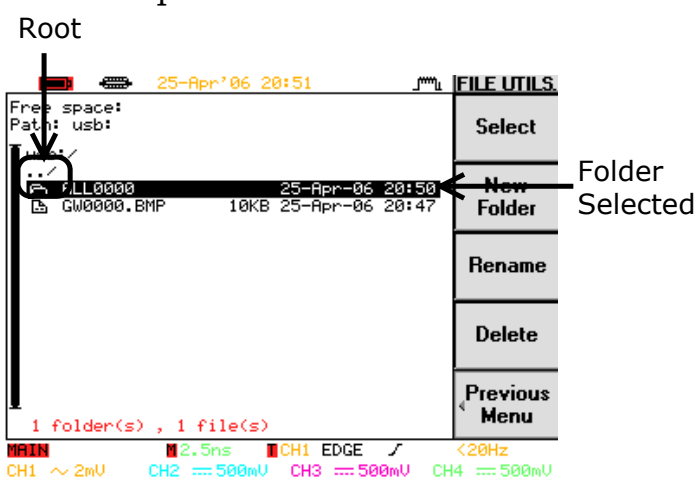
This part assumes you have connected a USB flash drive to Oscilloscope and have already selected F5 “File Utlities” in other save and recall menus.

Panel operation



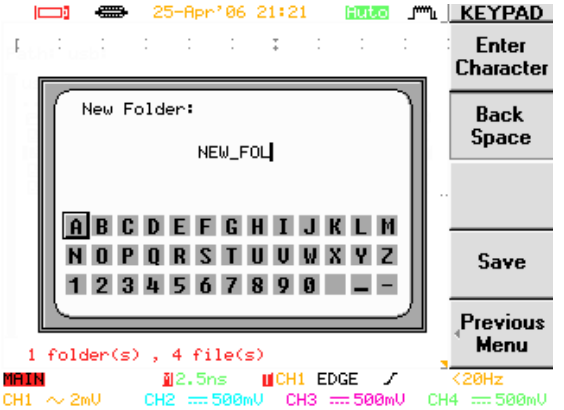
See the folder contents

1. Use the Variable knob to select the folder.
2. To enter the folder, press F1.
3. To go back to the previous level, select the root and press F1.



Create a new folder & rename a file / folder

1. Press F2 (new folder) or F3 (rename a file or a folder). The editing screen appears.

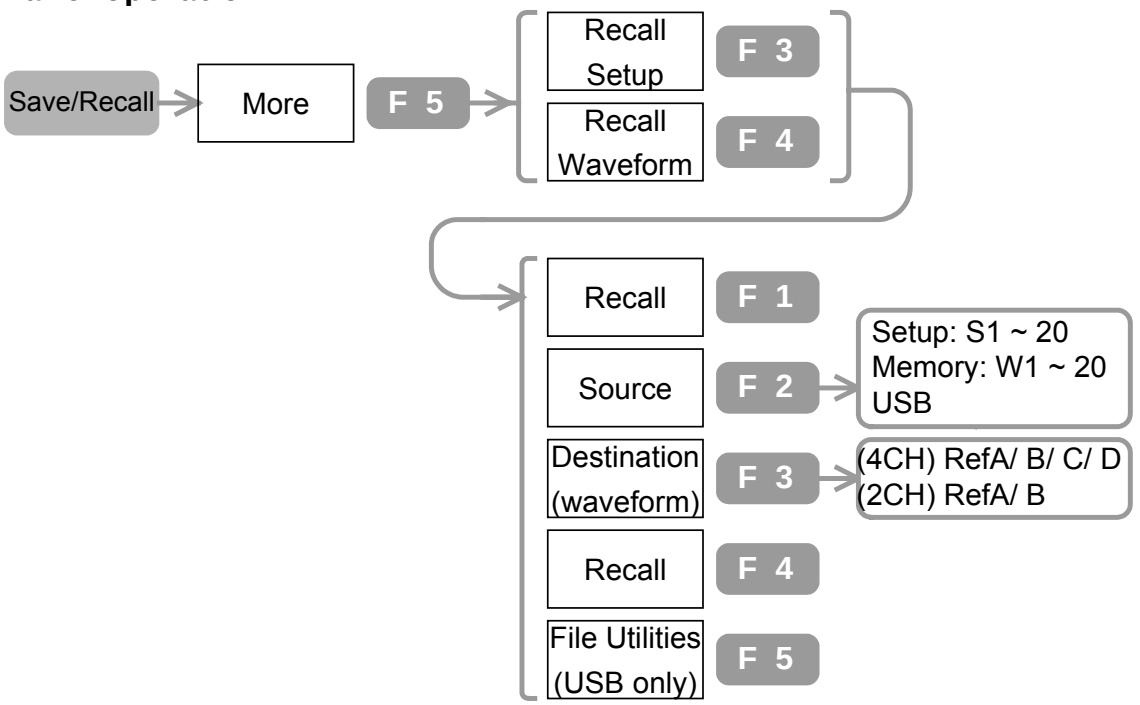


2. To enter a character, select the letter using the Variable knob and press F1.
3. To delete a character, press F2.
4. To save the result, press F4.

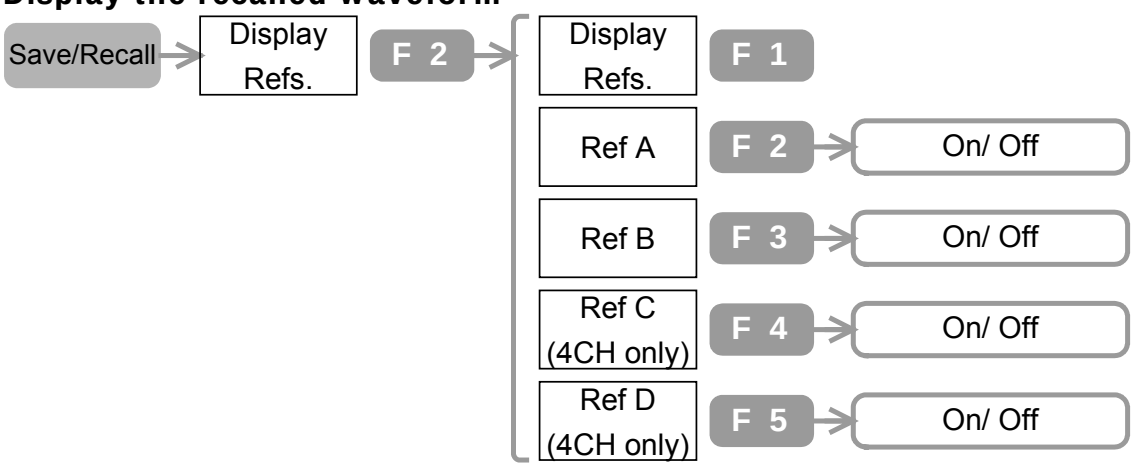
Delete a file / folder

1. Use the Variable knob and move to the file or folder.
2. Press F4. Press again to confirm deletion.

Panel operation

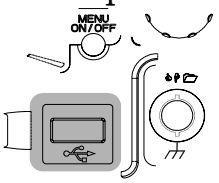


Display the recalled waveform



1. Press the Save/Recall key→F5→F3 (setup)/ F4 (waveform).
2. To select the source, press F2 repeatedly.
3. To select the memory location, use the Variable knob.
4. (Recalling from USB flash drive) Connect the flash drive to the front or the rear USB connector.
   Note: USB rear panel host and rear panel slave connection cannot be used at the same time.

Front panel USB



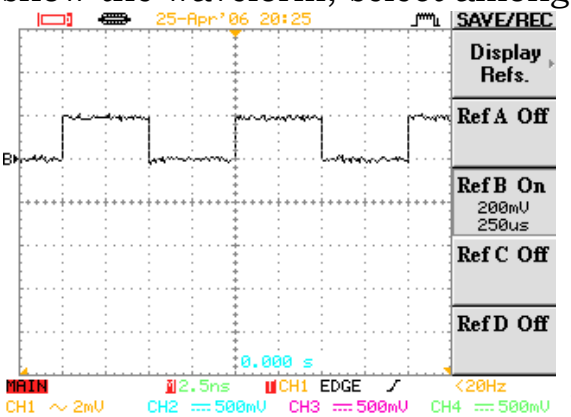
Rear panel USB

5. (Recalling waveforms) To select the destination (reference waveform), press F3 repeatedly.

6. To recall waveform/setup, press F4.

7. To configure USB drive folders, see page98.

8. (Showing the recalled waveform) Press Save/Recall key→F2. To show the waveform, select among F2~F4 and press it.



Ref B waveform recalled

Range		
	File type	
	Waveform	Waveform file (xxxx.CSV).
	Setup	Panel setup file (xxxx.SET).
	Source	
	Setup	S1~S20 internal setups.
	Waveform	W1~W20 internal waveforms.
	USB	USB flash drive (xxxx.SET)
	Destination	
	Ref A~D (4CH)	Reference waveforms stored
	Ref A/B (2CH)	internally.

Recall default settings

Panel Operation

Press Save/Recall key→F1. Oscilloscope recalls the factory installed panel settings, listed below.

Acquisition	Mode: Normal	Memory Length: 500
Channel (Vertical)	Scale: 2V/Div Coupling: DC BW Limit: Off	Invert: Off Probe Attenuation: x1
Cursor	Source: CH1 Vertical: None	Horizontal: None
Display	Type: dots Graticule:	Accumulate: Off
Go-NoGo	Go-NoGo: Off NoGo when:	Source: CH1 Violating: Stop
Horizontal	Scale: 2.5us/Div	Mode: Main Timebase
Math	Type: + Position: 0.00 Div	Channel: CH1+CH2 Unit/Div: 2V
Measure	Source1: CH1 Volt type: VPP Delay type: FRR	Source2: CH2 Time Type: Frequency
Program	Mode: Edit Item: Memory	Step: 1
Trigger	Type: Edge Mode: Auto Coupling: DC Noise Rejection : Off	Source: Channel1 Slope: Rejection: Off
Utility	Hardcopy: SaveImage, Inksaver Off	Sound: Off

Calibration

Calibrate the vertical scale

*Run Calibration under two conditions.
1 When using Oscilloscope in a new environment, such as field measurement.
2 When the temperature changes more than 5°C.

Panel operation

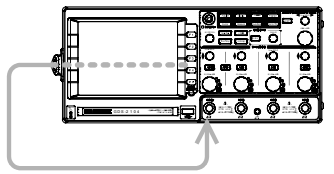
Utility → More → F 5 → Self Cal Menu → F 1 → Vertical → F 1

1. Make sure the environment fits these conditions.
   Temperature: 26 ± 5°C
   Relative humidity: ≤ 80%

2. Connect the rear panel Calibration output to Channel1. (BNC male – male connector)

Calibration Output

Connect to Channel1



3. Press the Utility key→F5→F1→F1

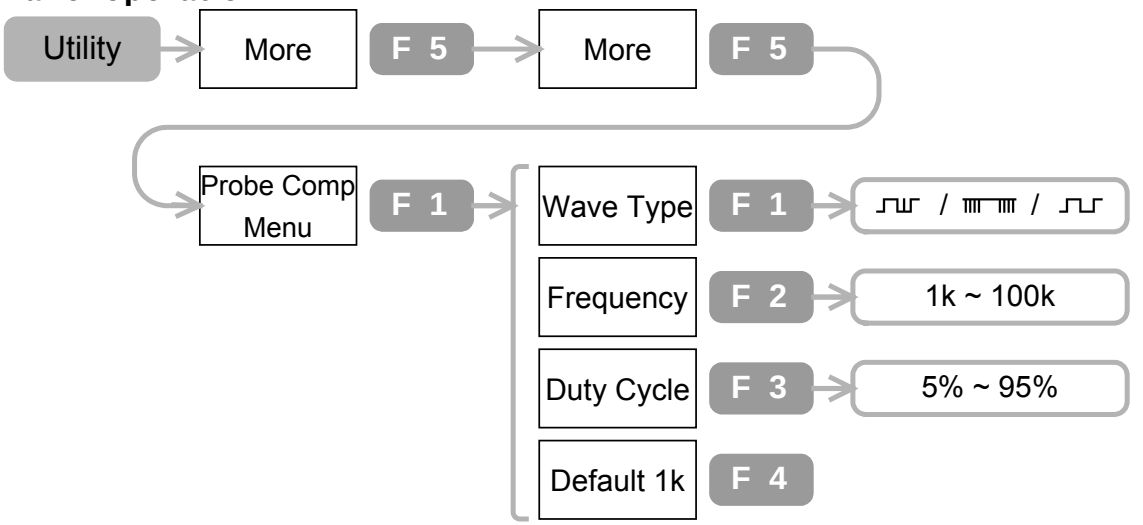
4. Press F5 and start the calibration. It takes approximately 2 minutes.

5. When completed, switch the connection to channel 2. Repeat the above process for the whole channel.

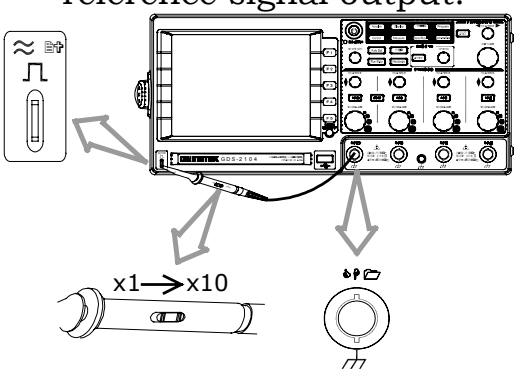
Compensate the probe

Run probe compensation when using it for the first time.

Panel operation



1. Connect the probe to Channel1 and reference signal output.

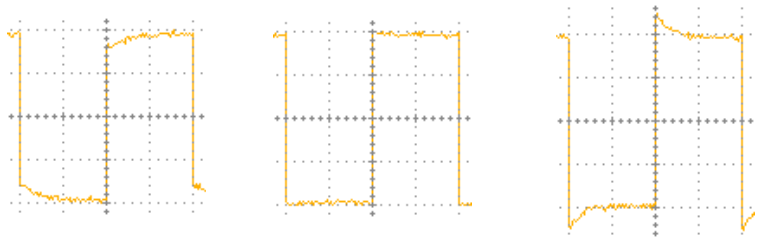


2. Press the Utility key→F5→F5→F1→F1. Press F1 again and select the wave type ⎍⎍ .

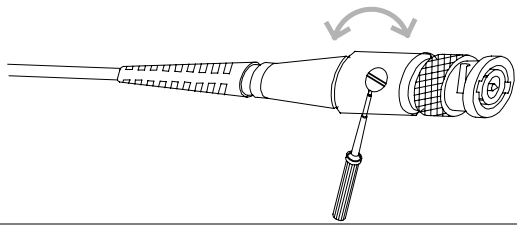
3. Press F2. Use the Variable knob and set the frequency.

4. Press F3. Use the Variable knob and set the Duty cycle.

5. Compensate the probe viewing the waveform shape.



Over Compensation | Normal | Under Compensation



Range	**Wave type**	
		Probe compensation signal, 2Vpp at x10 probe attenuation.
		Demonstration signal for showing the effects of deep memory length.
		Demonstration signal for showing the effects of peak detection.
	Frequency	
	1k~100k	1k step.
	Duty Cycle	
	5%~95%	5% step.

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

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

Make sure you turned On the rear panel Power switch. For details, see page12.
Note that it takes around 15~20 seconds for the display to become active.

The probe waveform is distorted.

You might need to compensate the probe. For details, see page104. Note that the frequency accuracy and duty factor are not specified for probe compensation waveform and therefore it should not be used for other reference purpose.

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

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

Autoset does not catch the signal well.

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

I want to clean up the cluttered panel settings.

Recall the default settings by pressing Save/Recall key→F1.

The display image printout is too dark on the background.

Use the Inksaver function which reverses the color: from (display background-black & waveform-white) to (display background-white & waveform-colored).

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

The battery pack needs additional internal components to work properly. They are factory installed items: contact your dealer.

The date and time setting is not correct.

To set date and time, please see page64. If it does not help, the internal battery controlling the clock might be worn out. Contact your service dealer or GWInstek.

USB does not work.

USB rear panel host and rear panel slave connection cannot be used at the same time. Disconnect all USB devices, reboot Oscilloscope, and try again.

The accuracy does not match the specification.

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

If there is still a problem, please contact your local dealer or GWInstek at www.gwinstek.com.tw / marketing@goodwill.com.tw.

Appendix

Specifications

The specifications apply under the following conditions: Oscilloscope is powered on for at least 30 minutes, within +20°C~+30°C.

	DSO-8062/64	DSO-8104	DSO-8204
Channels	2/4	4	4
Bandwidth	DC~60MHz (−3dB)	DC~100MHz (−3dB)	DC~200MHz (−3dB)
Rise Time	5.8ns approx.	3.5ns approx.	1.75ns approx.

DSO-8062/8064/8104/8204		
Vertical	Sensitivity	2mV/div~5V/Div (1-2-5 increments)
	Accuracy	± (3% x |Readout|+0.1div + 1mV)
	Input Coupling	AC, DC, & Ground
	Input Impedance	1MΩ±2%, ~16pF
	Polarity	Normal & Invert
	Maximum Input	300V (DC+AC peak), CATII
	Waveform Signal Process	+, −, FFT
	Offset Range	2mV/div~20mV/div: ±0.5V 50mV/div~200mV/div: ±5V 500mV/div~2V/div: ±50V 5V/div: ±300V
	Bandwidth Limit	20MHz (−3dB)
Trigger	Sources	CH1, CH2, Line, EXT(for 2ch model only), CH3&CH4(for 4ch model only)
	Modes	Auto-Level, Auto, Normal, Single, TV, Edge, Pulse Width (2ch model only: Time-Delay and Event-Delay)
	Coupling	AC, DC, LFrej, HFrej, Noise rej
	Sensitivity	DC~25MHz: Approx. 0.5div or 5mV 25MHz~max: Approx. 1div or 10mV
Ext Trigger (for 2ch model only)	Range	±15V
	Sensitivity	DC~30MHz: ~50mV 30MHz~max: ~100mV
	Input Impedance	1MΩ±2%, ~16pF
	Maximum Input	300V (DC + AC peak), CATII
Horizontal	Range	1ns/div~10s/div, 1-2-5 increment
	Modes	Main, Window, Window Zoom, Roll, X-Y
	Accuracy	±0.01%
	Pre-Trigger	20 div maximum
	Post-Trigger	1000 div
X-Y Mode	X-Axis Input	Channel 1

	Y-Axis Input	Channel 2
	Phase Shift	$\pm 3^0$ at 100kHz
Signal Acquisition	Real Time	1G Sa/s maximum
	Equivalent	25G Sa/s maximum
	Vertical Resolution	8 bits
	Record Length	25K Dots Maximum
	Acquisition Mode	Sample, Peak Detect, Average
	Peak Detection	10ns
	Average	2, 4, 8, 16, 32, 64, 128, 256
Cursors and Measurement	Voltage	Vpp, Vamp, Vavg, Vrms, Vhi, Vlo, Vmax, Vmin, Rise Preshoot/ Overshoot, Fall Preshoot/ Overshoot
	Time	Freq, Period, Rise Time, Fall Time, Positive Width, Negative Width, Duty Cycle
	Delay	FRR, FRF, FFR, FFF, LRR, LRF, LFR, LFF
	Cursors	Voltage difference (ΔV) Time difference (ΔT)
	Trigger Frequency Counter	Resolution: 6 digits Accuracy: ±2% Signal source: All available trigger source except the Video trigger
Control Panel Function	Auto Set	Automatically adjust vertical Volt/div, Horizontal Time/div, and Trigger level
	Save Setup	Internal memory: 20 sets USB Flash drive: > 20 sets
	Save Waveform	Internal memory: 20 sets + 4 Reference waveforms USB Flash drive: > 20 sets
Display	LCD	5.6 inch, TFT, brightness adjustable
	Resolution (dots)	234 (Vertical) x 320 (Horizontal)
	Graticule	8 x 10 divisions (menu On) 8 x 12 divisions (menu Off)
Interface	Go-No Go Output	5V max/ 10mA TTL open collector
	RS-232C	DTE DB 9-pin male
	GPIB (Optional)	24-pin female
	USB	Host: Flash drive, Printer Device: Data communication
Power Source	Line Voltage	100V~240V AC, 47Hz~63Hz
	Battery (Optional)	11.1V Li-Ion pack, 6600mAh per pack 8hour charge time (from AC line) 3 hour operating time (depend on conditions)
Miscellaneous	Multi-Language Selection	English/Traditional Chinese/Simplified Chinese/Russian/Korean/Spanish/
	On-Line Help	English/ Traditional Chinese/Simplified Chinese/Russian/Korean/Spanish/

	Time Clock	Display: yy/mm/dd/hh/ss (time stamp for saved data)
Dimensions	254D x 142H x 310W (mm)	
Weight	Approx. 4.3kg	
Temperature	Operating	0°C~50°C
	Storage	-20°C~70°C
Humidity	Operating	80% R.H. @35°C
	Storage	80% R.H. @70°C

Declaration of Conformity

We
GOOD WILL INSTRUMENT CO., LTD.
(1) No.7-1, Jhongsing Rd., Tucheng City, Taipei County, Taiwan
(2) No. 69, Lu San Road, Suzhou City (Xin Qu), Jiangsu Sheng, China
declare, that the below mentioned product
Type of Product: Digital Storage Oscilloscope
Model Number: DSO-8062, DSO-8064, DSO-8104, DSO-8204
are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (89/336/EEC, 92/31/EEC, 93/68/EEC) and Low Voltage Directive (73/23/EEC, 93/68/EEC).
For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Directive, the following standards were applied:

EMC

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

Safety

Low Voltage Equipment Directive 73/23/EEC
Safety Requirements IEC/EN 61010-1: 2001