OPERATOR'S MANUAL

MARCH 2000

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LP142-OM-E Rev. A 0300

Introduction

- Thank you for purchasing this LeCroy instrument.
- Please read this manual before using the instrument, then keep the manual handy for future reference.
- To ensure safe operation of this instrument and to prevent injury to the user or damage to property, read and carefully observe the warnings and cautions in the following section.
- This operation manual mainly describes notes on use, operation method, exemples of use and performance, RS-232C and GP-IB remote control.

Note

- Parts of the contents of this manual may be modified without notice for improvements in performance and functions.
- Reproduction or reprinting of the contents of this manual without prior permission from LeCroy is prohibited.
- The TFT color LCD contains cold cathode fluorescent lamps. Observe local ordinances and regulations when disposing of the LCD.
- Windows and MS-DOS are registered trademarks of Microsoft Corporation.
- For questions about this instrument, contact LeCroy at the address listed at the end of this manual or our sales agent.

Revision History

May 2000: 1st edition

Safety precautions

To ensure safe operation of this instrument and to prevent injury to the user or damage to property, read and carefully observe the warnings and cautions in the following section and associated symbols marked on the panel diagrams.

Definitions of warnings and cautions used in this manual

⚠ **Warning**	Incorrect operation or failure to observe the warning may result in death or serious injury.
⚠ **Caution**	Incorrect operation or failure to observe the caution may result in injury or damage to instrument.

Explanation of the symbols on the panel

Symbol	Description
	Symbols used throughout the manual together with descriptions, to protect the operator from injury and this instrument from damage.
	Indicates that this is a frame or chassis terminal.
	Indicates that there is a danger of electric shock
	Power ON
	Stand by

STAND BY : Standby mode is set when the main power supply of this instrument is turned OFF.

⚠ Warnings

Installation

- Do not use in an environment with explosive gases. It may cause an explosion.
- If you notice smoke, foul odor or abnormal noise, immediately stop measuring to avoid electric shock or fire. Turn off the instrument to be measured and disconnect the power cable from the power outlet. Please contact LeCroy at the address listed at the end of this manual or our sales agent. Do not attempt to repair the unit yourself.

Power Supply

- Always use this instrument only within the rated operating voltage. If used over the rated range, electric shock, fire or failure may occur. The range of operating voltage is stated on the rear panel.
  This instrument runs on single-phase, 115 V (90 to 132 V) or 220 V (180 to 250 V), AC power source at 45 to 66 Hz. No voltage selection is required, as the instrument automatically adapts to the line voltage.
- Use a 3-prong grounded power cord. By connecting the attached 3-prong power cord to a 3-wire receptacle, the grounding wire of the power cord is connected to ground. If this is not done, an electric shock or instrument damage could result. When supplying power from a 2-wire receptacle using a 3-prong/2-prong conversion adapter, connect the grounding terminal of the 3-prong/2-prong conversion adapter to ground.
- Use of a 2-prong power cord may result in electric shock.

Warnings

- Power cord

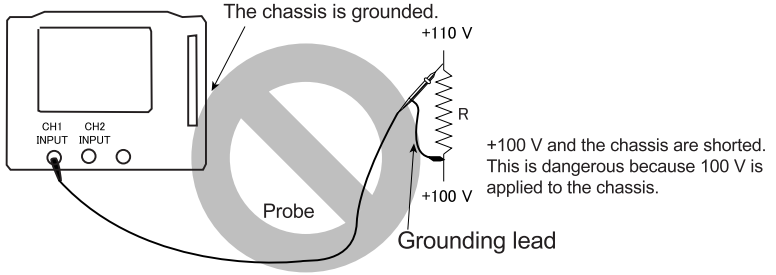
  Do not use a damaged power cord or adapter, otherwise fire or electric shock could result. If the power cord is damaged, please contact LeCroy at the address listed at the end of this manual or our sales agent for repair.

  - Do not modify the power cord.
  - Do not forcibly bend the power cord.
  - Do not twist the power cord.
  - Do not bundle the power cord.
  - Do not put heavy objects on the power cord.
  - Do not pull the power cord.
  - Do not heat the power cord.
  - Do not let the power cord get wet.

When measuring

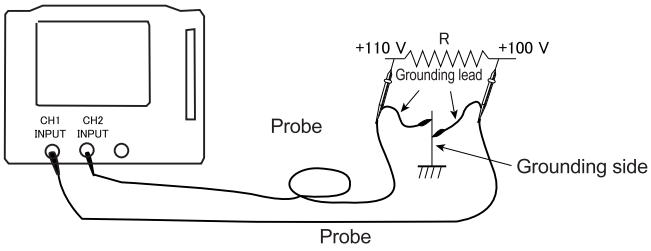
- Connect the probe ground and input connectors to the ground of the device under test. Refer to “improper ground connections” shown below. Improper ground connections may cause electric shock or failure of the instrument, the device under test or other devices connected to the instrument.

[Improper ground connections]



When measuring a floating potential, measurement by the differential method (CH1, CH2 input) is recommended as shown in the example below.

[Example of recommended measurement]



Warnings

Operation

- Make sure no water gets on or inside the product
- Do not use the product if wet, otherwise electric shock or fire could result. If water gets on or inside the unit, turn the power switch to STBY and remove the power cord. Immediately contact LeCroy at the address listed at the end of this manual or our sales agent.
- Do not touch the plug of the power cord with wet hands, otherwise electric shock could result.
- Operate the instrument on a stable platform. Do not place the instrument on an unstable support. Dropping the instrument during operation could result in electric shock, injury, or fire. If the instrument is dropped, turn the power switch to STBY and remove the power cord. Immediately contact LeCroy at the address listed at the end of the manual or our sales agent.
- Do not remove the chassis covers or rear panel. Removing covers exposes lethal high-voltage circuits within and could result in electric shock.
  Please contact LeCroy at the address listed at the end of the manual or our sales agent for inspection, calibration, or repair.
- Do not modify this instrument. Modification of this instrument could result in electric shock, fire, or power failure, and repair of a modified instrument may be refused.
- Do not operate the instrument in conditions where foreign particles such as metals or inflammables could pass through the ventilation holes. Operation under these conditions could result in fire, electric shock, or instrument damage. If any foreign matter has contaminated the unit, turn the power switch to STBY and remove the power cord. Immediately contact LeCroy at the address listed at the end of the manual or our sales agent.

⚠ Cautions

Installation

- Always use this instrument only within the rated operating range. If used over the rated range, failure may occur.
  Use this instrument only indoors.

  Operating conditions
  Temperature: 0 to +40°C
  Humidity: 80% RH or less (non-condensing)
  Height: 2,000 meters or less

- Do not block the air ventilation holes or exhaust fan of this instrument. Blocking the airflow could result in excessive internal heating and fire or electric shock.

- Leave a space behind and to the sides of the instrument.
  Be careful to avoid overheating of the instrument when installing the instrument in a rack mount or on another measurement machine. Failing to observe this precaution may result in faulty operation or performance.

- Do not place this instrument in a location with excessive moisture or dust, otherwise fire or electric shock could result.

Power Supply

- Use only the specified fuse ($\phi 5 \times 20$ mm, 250 V, T3.15 A) when replacing the fuse. Failure to replace the fuse with the correct rating could result in fire, electric shock or damage to the unit.

  To replace the fuse:
  a) Turn the power switch to STBY before disconnecting the power cord.
  b) Disconnect the power cord before replacing the fuse.

When measuring

- Do not apply a voltage exceeding the specified value to the input terminals (CH1, CH2, EXT TRIG). This may cause malfunction. The following is a maximum voltage that can be input.

  Direct
  1 MΩ: ±400 V (DC+ACpeak≤5 k Hz)

- When a probe or measurement cable is connected, be careful so that you do not pull the probe or measurement cable causing the instrument to overturn.

  Letting the instrument overturn may cause electric shock, injury, fire or malfunction.

⚠ Cautions

Handling

- Set the power switch to STAND BY before connecting or disconnecting the power cord.
- Connecting or disconnecting the power cord while the power is supplied to the instrument may cause electric shock or malfunction.
- When disconnecting the power cord from the receptacle, remove it by grasping the plug. Do not pull on the cord itself, as doing so may damage the cord and could result in fire or electric shock.
- Inspect all cables prior to use. Do not use any damaged cable or adapter, otherwise fire or electric shock could result.
- Do not place any objects on this instrument.
  If any objects are placed on this instrument, the cover may be deformed and the internal circuits shorted, which could result in electrical shock, fire, or damage to the instrument.
- Be careful not to let the container fall over during set-up and use, otherwise electric shock, injury, or fire could result.
- Do not use the instrument if broken, otherwise electric shock or fire could result. Contact LeCroy at the address listed at the end of the manual or our sales agent for repair.
- To avoid electric shock or fire, pull out the power supply plug from the outlet for safety if the instrument will not be used for a long time.

Carrying the instrument

- Dropping the instrument could result in human injury or instrument failure. Be careful not to drop the instrument and always firmly grasp the middle of the handle.

  (1) Disconnect the cables.

  1. Disconnect the power cord and bundle it.
  2. Turn counterclockwise and disconnect the connector of the probe.

  (2) Grasp the handle.

  1. Raise the handle.
  2. Grasp the middle of the handle when carrying the instrument.

Check the items included in the package.

When you receive the product, please check the items included. If any item is missing or damaged, immediately contact LeCroy at the address listed at the end of the manual or our sales agent.

Components

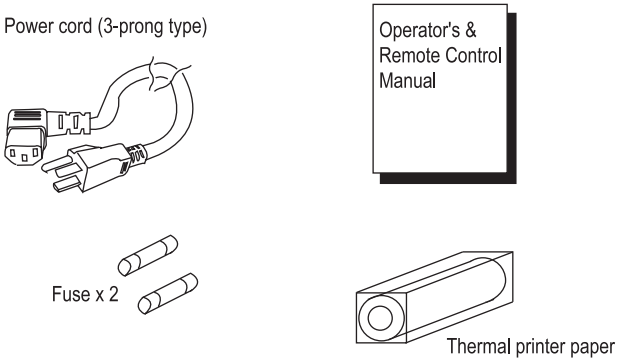
- Main unit 1
- Accessories

  Power cord (3-prong type) 1

  Fuse (250 V T3.15 A) 2

  Operator's & Remote Control Manual 1

  Thermal printer paper 1



* Option

Thermal printer paper 10 pcs

Type : TP80-1 Code : 21392-55-00

Packing Diagram

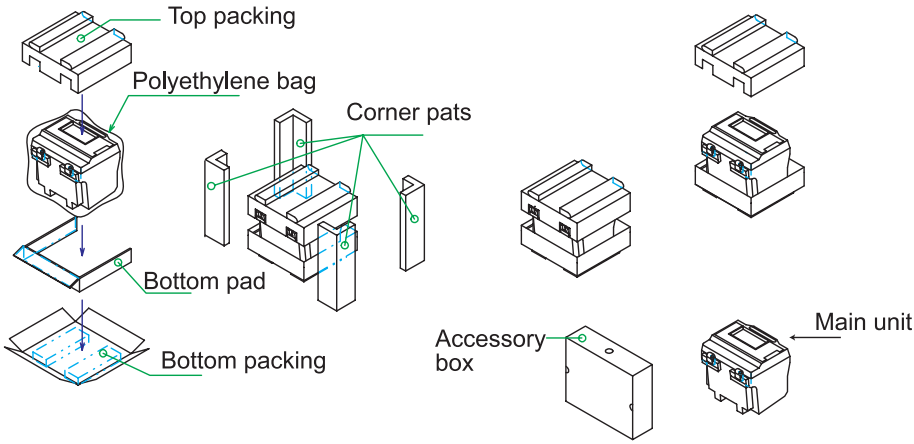


Figure 1 Main Unit Packing Diagram

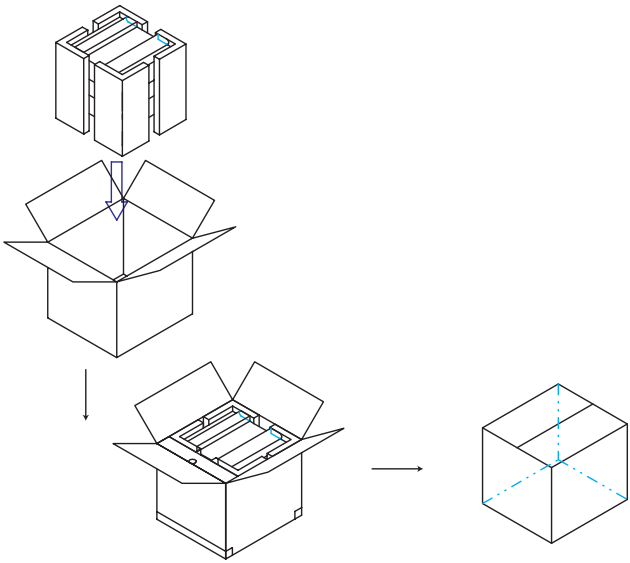
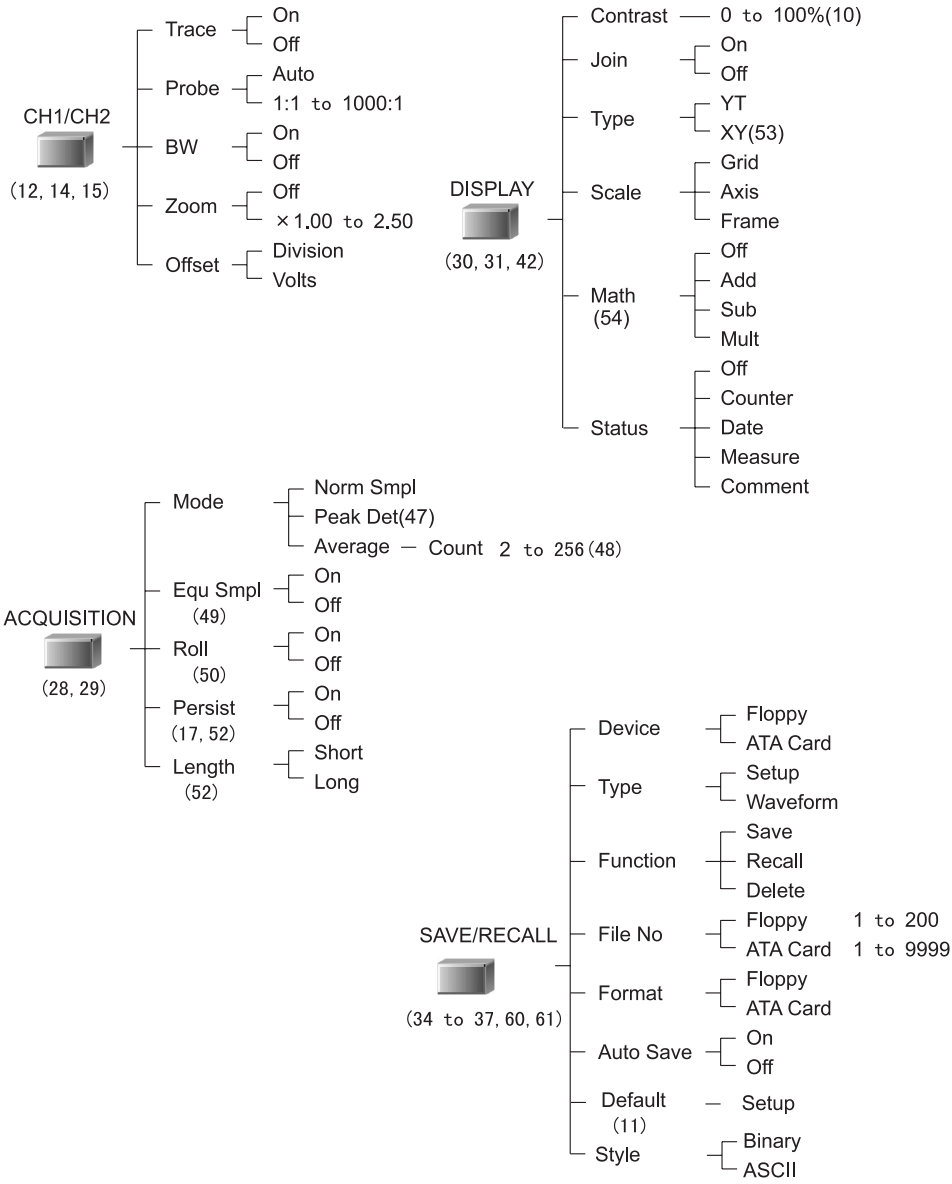


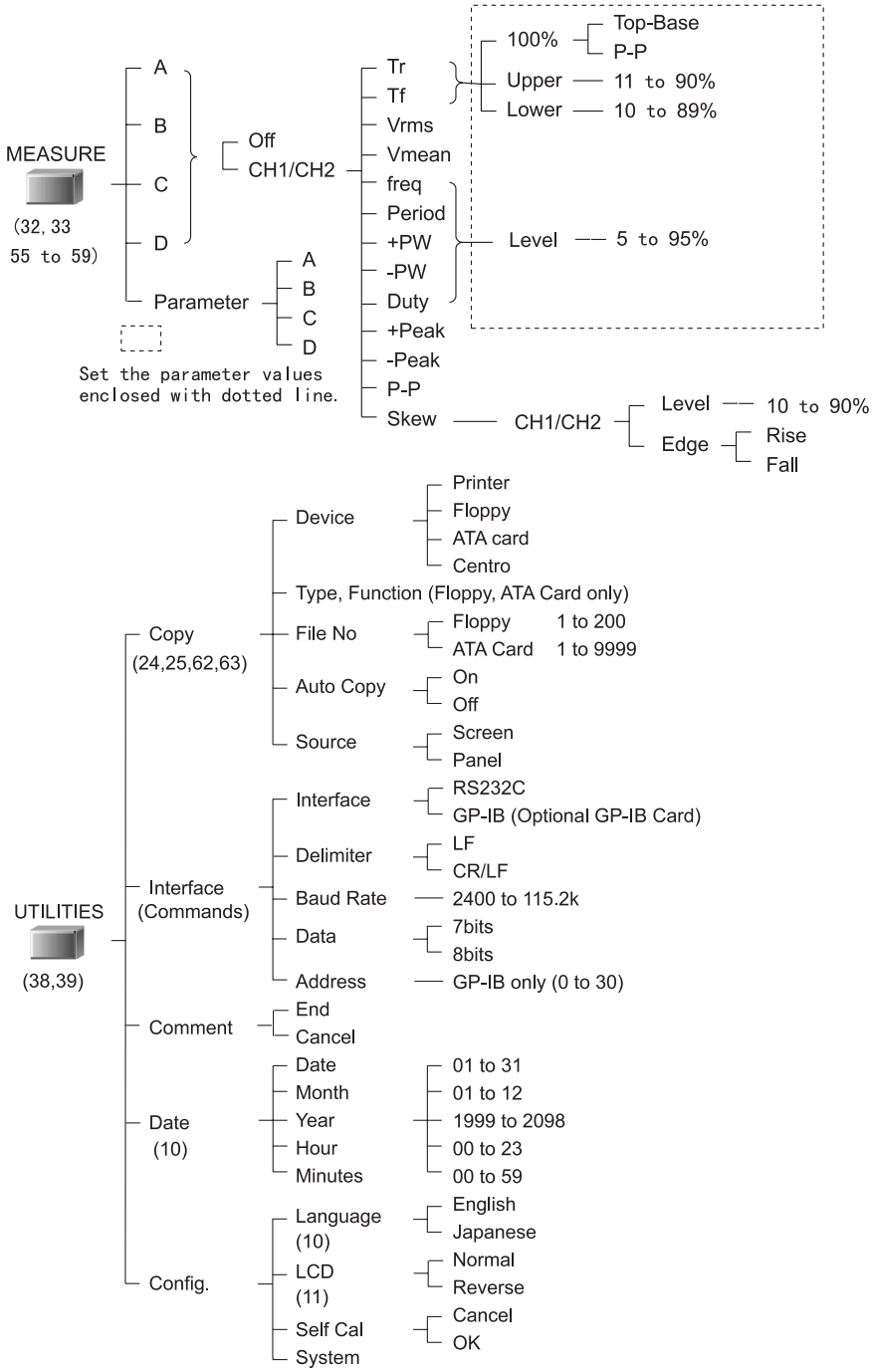
Figure 2 Packing

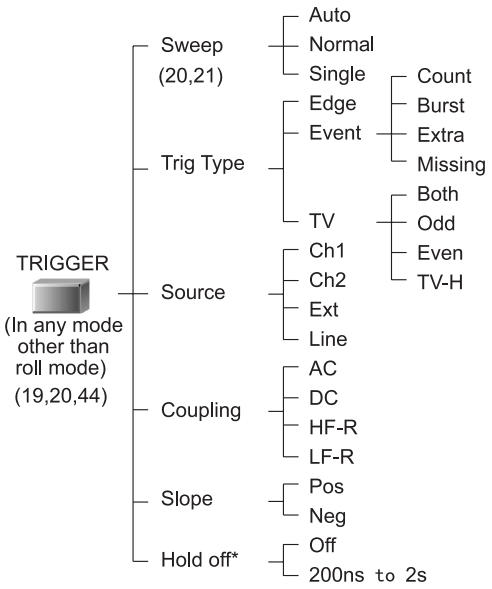
Contents

Menu hierarchy and table of contents

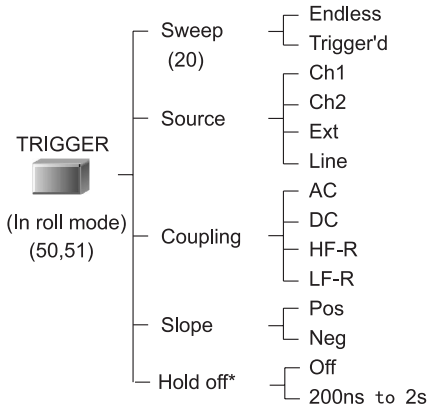
The numbers in parentheses indicate reference pages.




MEASURE
(32, 33
55 to 59)
A
B
C
D
Off
CH1/CH2
Parameter
A
B
C
D
Set the parameter values
enclosed with dotted line.
Tr
Tf
Vrms
Vmean
freq
Period
+PW
-PW
Duty
+Peak
-Peak
P-P
Skew
100%
Top-Base
P-P
Upper
11 to 90%
Lower
10 to 89%
Level
5 to 95%
CH1/CH2
Level
10 to 90%
Edge
Rise
Fall
UTILITIES
(38,39)
Copy
(24,25,62,63)
Device
Printer
Floppy
ATA card
Centro
Type, Function (Floppy, ATA Card only)
File No
Floppy 1 to 200
ATA Card 1 to 9999
Auto Copy
On
Off
Source
Screen
Panel
Interface
(Commands)
Interface
RS232C
GP-IB (Optional GP-IB Card)
Delimiter
LF
CR/LF
Baud Rate
2400 to 115.2k
Data
7bits
8bits
Address
GP-IB only (0 to 30)
Comment
End
Cancel
Date
(10)
Date
01 to 31
Month
01 to 12
Year
1999 to 2098
Hour
00 to 23
Minutes
00 to 59
Config.
Language
(10)
English
Japanese
LCD
(11)
Normal
Reverse
Self Cal
Cancel
OK
System



* "Hold off" exclusively for when Edge of Trig Type is selected

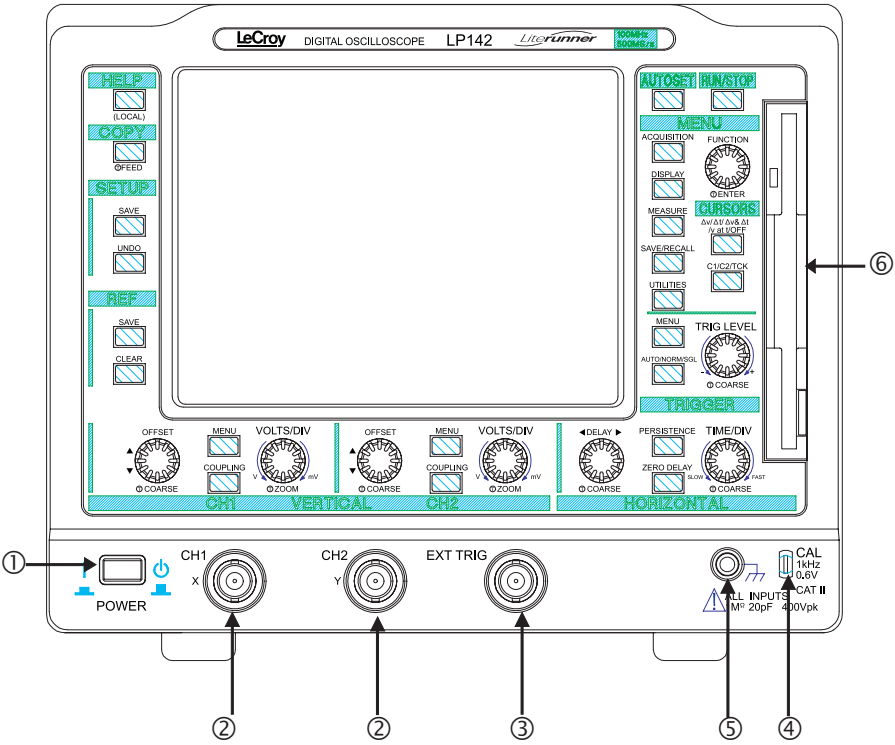


* "Hold off" exclusively for when Edge of Trig Type is selected

Section 1 Basic Operation

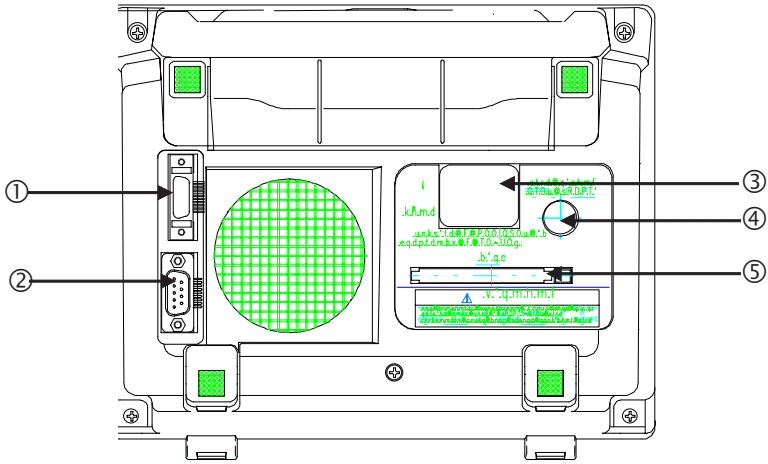
This section describes the basic operation including start-up.
See Section 2, “Explanation of Functions” for details.

Appearance



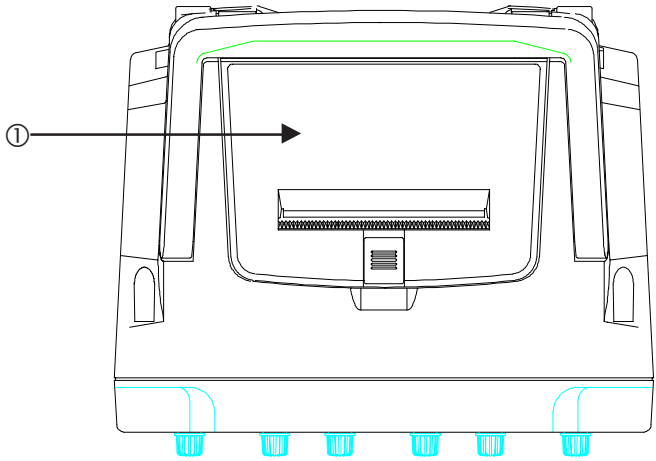
Front View

① Power switch
② Input terminal
③ External trigger input terminal
④ CAL terminal/calibration signal output terminal
⑤ Ground terminal
⑥ Floppy disk drive



Rear View

① Centronics port
② RS-232C port
③ AC power inlet
④ Fuse holder
⑤ PCMCIA Type II slot



Upper View

① Built-in printer

Operating buttons and knobs

Buttons 

Single function button: Pressing the button executes the associated function.

AUTOSET, RUN/STOP, HELP, COPY, SETUP SAVE, SETUP UNDO, REF SAVE, REF CLEAR, ZERO DELAY

Function selection button: Pressing the button changes the function.

Cursor: ΔV/Δt/ΔV&Δt/V at t/OFF, C1/C2/TCK
Sweep mode: AUTO/NORM/SGL
Coupling: COUPLING, PERSISTENCE

[Example] COUPLING DC 1:10mV → GND 1:10mV → AC 1:10mV

Menu display button: Pressing the **MENU** button displays the menu screen. (For the menu hierarchy, see 0-14 to 19.) The color of the button is gray.

ACQUISITION, DISPLAY, MEASURE, SAVE/RECALL, UTILITIES, CH1, CH2, TRIG

Knobs 

Single function knob: Turning or pressing the knob sets a range or level.

CH1/CH2-VOLTS/DIV, CH1/CH2-OFFSET, TIME/DIV, DELAY, TRIG LEVEL

FUNCTION knob: Selects and fixes an item on the menu screen and controls the V/H cursor position during cursor measurement.

Operation when knob is pressed

CH1/CH2-VOLTS/DIV: Toggles the function 1-2-5 sequence or 1 to 2.5 times ZOOM when the knob is rotated.

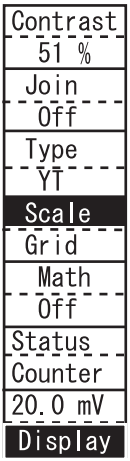
CH1/CH2-OFFSET: The trace shifts in 1-division steps in the direction the knob was last turned.

TIME/DIV: The sweep rate changes 10 times in the direction the knob was last turned.

DELAY, TRIG LEVEL: The setting value changes in 1-division steps in the direction the knob was last turned.

Menu (FUNCTION) operation

There are two ways of selecting a setting item in the menu; one is to turn the FUNCTION knob to select an item, and then press the knob to fix it, and the other is to fix the item by pressing the menu button while the item is displayed.



[Example] Set "Scale" to "Grid" in the Display menu.

Selection method with FUNCTION

1. Press the DISPLAY button to show the display menu.
2. Turn the FUNCTION knob to select Scale.
3. Press the FUNCTION knob to fix the menu item.

The setting item is displayed in reverse video.

4. Turn the FUNCTION knob to select Grid.
5. Press the FUNCTION knob to fix the setting item.

The selected menu item is displayed in reverse video.

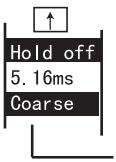
Bear in mind!!

From the following explanations, the operation of setting Scale in the Display menu to Grid (a series of operations 2 to 5 enclosed with dotted line above) is expressed as follows:
Through [FUNCTION operation], set Scale menu to Grid.

Selection method with MENU

1. Press the DISPLAY button to show the display menu.
2. Turn the FUNCTION knob to select Scale.
3. Pressing the DISPLAY button selects Frame, Grid or Axes.

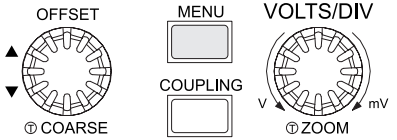
Setting a numerical value



Set the numerical value of Hold off in the trigger menu, Interval of Event trigger or Line of TV as follows:
For the setting of File No. in SAVE/RECALL, Copy menu, see pages 34 to 37.
← Pressing the FUNCTION knob changes the numerical value displayed in reverse video one by one. Pressing the FUNCTION knob again after the numerical setting is done changes the settable menu to "Coarse" after the values are confirmed.
← Pressing the FUNCTION knob changes the numerical value in rough steps. The set value is displayed in reverse video. Pressing the FUNCTION knob again after the numerical setting is done changes the settable menu to "Hold off" after the values are confirmed.

Description of operation section

Shown in ( ) is the reference page.

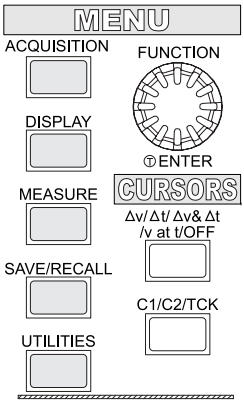


[CH1/CH2 MENU] button: Displays the CH-1 and CH-2 menus. (P14, P15, P42, 43)

[COUPLING] button: Selects the input signal coupling from DC → ⏚ Ground → AC. (P15)

[OFFSET] knob: Sets the vertical position of a trace. (P14)

[VOLTS/DIV] knob: Continuously selects the deflection factor in 1-2-5 sequence or ´1 to ´2.5 zoom as fine adjustment of the vertical deflection factor. Pressing the knob switches between 1-2-5 sequence and zoom. (P14)

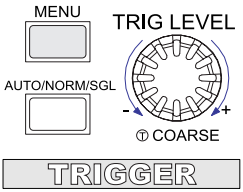


[MENU] button: Displays the ACQUISITION, DISPLAY, MEASURE, SAVE/RECALL and UTILITIES menus.

[FUNCTION] knob: Selects and fixes an item on the menu screen and controls the V/H cursor position during cursor measurement. (P5)

[ΔV, Δt, ΔV/Δt, V at t, Off] button: Selects the cursor measurement item from ΔV → Δt → ΔV/Δt → V at t → Off. The selected item is displayed at the top of the screen. (P22)

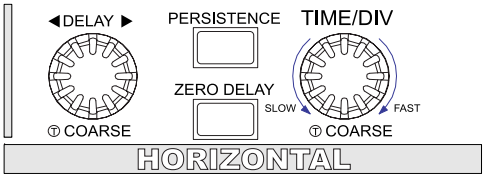
[C1/C2/TCK] button: Selects active cursors (C1, C2, or tracking) to be moved by the FUNCTION knob during cursor measurement. (P22)



[TRIG MENU] button: Displays the TRIGGER menu. (P18)

[TRIG LEVEL] knob: Sets the trigger level. (P18)

[AUTO/NORM/SGL] button: Selects the sweep mode from Auto → Normal → Single. (P20)



[DELAY] knob: Sets the trigger delay time. (P16)

[ZERO DELAY] button: Set the trigger delay time to zero. (P16)

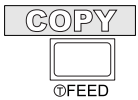
[PERSISTENCE] button: Sets overwrite ON or OFF. When ON, waveforms are accumulated on the display. (P17)

[TIME/DIV] knob: Selects the sweep rate in 1-2-5 sequence. (P16)

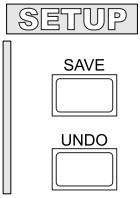
[AUTOSET] button: Automatically sets the vertical, horizontal and trigger condition to show the input signal. (P12)

[RUN/STOP] button: Sets capturing a new signal or stops capturing. The selected condition is displayed at the top right of the screen. (P21)

[HELP] button: Displays an explanation of the currently selected function. (P10). In remote mode, all buttons and knobs on the front panel are disabled except for the [HELP].

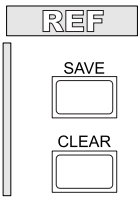


[COPY] button: Outputs a hardcopy of the screen or setup condition to a specified output device. (P24)



SETUP [SAVE] button: Saves the current setup to the internal memory. (P26)

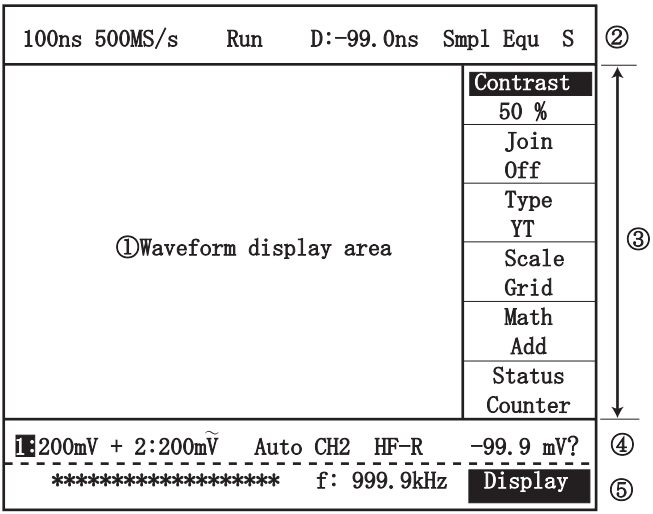
SETUP [UNDO] button: Recalls the saved setup from the internal memory. Pressing the button again undoes the recalling and returns to the previous setup. (P26)



REF [SAVE] button: Saves the waveform data displayed on the screen to the internal memory as a reference waveform. (P27)

REF [CLEAR] button: Displays the reference menu. Pressing the button again erases all displayed reference waveforms. (P27)

How to read screen



① Waveform display area

Displays a waveform and scale.

Displays with a marker GND reference (1) of the CH1 waveform, GND reference (2) of the CH2 waveform and trigger level (T) at the left end of the screen.

② Horizontal axis and acquisition display area

a	b	c	d	e	f	g
100ns	500MS/s	Run	D:-99.0ns	Smpl	Equ	S/L

a: Time/div
b: Sampling rate
c: Run/Stop state
d: Delay time
e: Acquisition mode
f: Roll/equal sampling
g: Short/long

③ Menu display area

Displays the selected menu.

Displays a cursor measuring item during cursor measurement and displays a interface menu during remote control.

④ Vertical axis/trigger display area

h i	j	k	l	m	n
1: 200mV	+ 2:200mV	AUTO	CH2	+HF-R	-99.9mV?

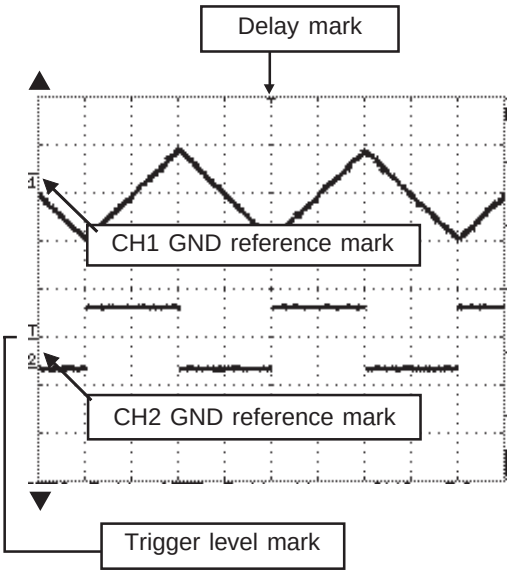
h: Trace ON/OFF (when ON, displayed in reverse video)
i: VOLTS/div
j: Operation setting (addition (Add) = +, subtraction (Sub) = –, multiplication (Mult) = ×)
k: Sweep mode
l: Trigger source
m: Trigger slope/trigger coupling
n: Trigger level

⑤ Message status display area

Displays a selected status, temporary message or alarm.

The selected menu is displayed in reverse video.

Marks on waveform display



GND: Reference mark display

Indicates the GND position with '_'. Up/down arrows ▲ or ▼ are displayed at the upper or lower position when the channel position is outside of the display area.

Trigger level mark display

Indicates the trigger position with 'T' when the trigger coupling is DC or HF-REJ.

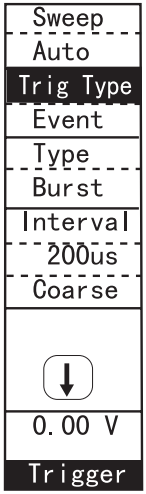
Up/down arrows ▲ or ▼ are displayed at the upper or lower position when the trigger delay position is outside the display area.

Delay mark display

Indicates the trigger position with '▼'.

Right or left arrows ◀ ▶ are displayed when the trigger position is outside the display area.

Understanding the menu structure



← Menu item: Displays the selection status in reverse video.

← Menu setting: Displays the current setting. If the setting is selected in [FUNCTION operation], it is displayed in reverse video.

Numerical value setting menu

Press the FUNCTION **knob** at this position to change the numerical value one by one.

Press the FUNCTION **knob** at this position to change the numerical value in rough steps.

← Indicates that there are more items below.

← Shows the menu displayed in the menu display area.

Before starting the measurement

Make the following adjustments if necessary.

Contrast setting

Adjusts the contrast of the screen.

The contrast is automatically set initially according to the ambient light when the power is turned on. You may adjust the contrast manually if necessary.

This manually-adjusted condition is maintained until the power is turned off.

1. Press the DISPLAY button to show the Display menu.
2. Adjust Contrast between 0 and 100% with [FUNCTION operation] to get the appropriate screen brightness.

Selection of language

Selects the HELP language.

1. Select Config in the UTILITIES menu with [FUNCTION operation].
2. Press the FUNCTION knob to show the Config menu.
3. Select Language in the Language menu with [FUNCTION operation].

HELP function

Press the HELP button at the top left. An explanation of the last operated function is displayed.

HELP is canceled by any operation.

Setting of date

The date is used for time display but also for the time stamp when saving a file and capturing a waveform.

1. Select Date in the UTILITIES menu with [FUNCTION operation].
2. Press the FUNCTION knob to show the Date menu.
3. Select Month from 1 to 12 with [FUNCTION operation].

Set Date, Year, Hours and Minutes in the same way.

The seconds are set to zero when fixing the date menu.

Display date on the screen

To display the date in the message area, select Date in the Status menu.

1. Press the DISPLAY button.
2. Select Date in the Status menu with [FUNCTION operation].
3. The date is displayed at the bottom right of the screen.

Reverse display function (LCD)

Toggles the screen between Normal (white background) and Reverse (blue background).

This function affects only the LCD display and does not affect the copy output.

1. Select Config in the UTILITIES menu with [FUNCTION operation].
2. Press the FUNCTION knob to display the Config menu.
3. Set the LCD menu to Normal or Reverse with [FUNCTION operation].

How to restore the setting at time of purchase

1. Through [FUNCTION operation], set the SAVE/RECALL menu to DEFAULT.
2. Pressing the FUNCTION knob shows a message "Push the FUNCTION to go on".
3. Pressing the FUNCTION knob again returns the panel setting (readout and part of menu) to the factory setting.
   Copy-related or interface-related settings, etc. are not changed (see Document 4).

Displaying CAL waveform by AUTOSET

If you are not sure about the amplitude or frequency of a signal, or how to operate the scope, press the AUTOSET button. The scope then automatically sets the vertical, horizontal and trigger condition for displaying the input signal.
(For details of AUTOSET, see the appendix 3.)

Auto setup function

After the signal is input, press the AUTOSET button first. Optimal setting according to the input signal is automatically performed.

Auto setup UNDO function

Holding down the AUTOSET button for 1 sec or more allows the panel setting (setup) before execution of AUTOSET to be restored.

Probe connection

The following procedure explains how to display the CAL signal through the probe to CH1.

Select a probe to use for CH1 from two probes and attach the color ring (e.g., orange). Keep the remaining color rings as spares.

1. Connect the probe to the CH1 input terminal as shown in the left figure.
2. Connect the arrow chip of the probe to the CAL terminal and the earth leads to the ground terminal.
   The CAL signal is a 1 kHz rectangular wave of 0.6 Vp-p amplitude.

Displaying CH menu

3. Press the CH1 MENU button to display the CH-1 menu.

Trace setting

4. Turn on TRACE to display the CH1 waveform with [FUNCTION operation].
   CH1 and CH2 Trace cannot be turned off simultaneously.

COUPLING setting

DC 1:10mV → GND 1:10mV

Probe setting

5. Set the input coupling to DC with the CH1 Coupling button.
6. Set the Probe menu to Auto with [FUNCTION operation]. This Auto setting converts and displays the CH1 deflection factor automatically depending on the probe attenuation ratio (10:1, 100:1).

Execute Autoset

7. Press the AUTOSET button. The waveform as shown on page 13 appears (when CH2 TRACE is OFF).

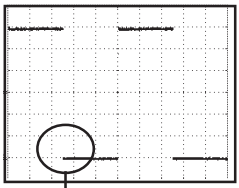
Probe compensation

Before using a probe, it is necessary to perform a probe compensation adjustment. Probe compensation adjusts the frequency characteristic of the probe to match the oscilloscope input. If a probe is used without such probe compensation adjustment, the measured signal may contain a significant error.

Procedures

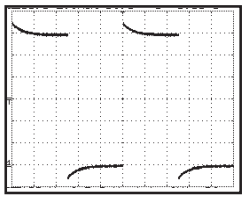
Adjust the variable capacitor of the probe by turning with a screwdriver to achieve a flat response on a square wave.

Correctly compensated waveform

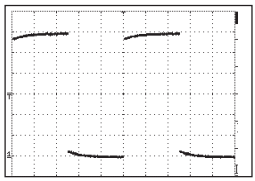


Adjust it so that this part may be flat.

Excessive compensation



Insufficient compensation



10:1 PURPOSE OF THE PROBE

The probe is used to provide a convenient, reliable and repeatable method of coupling the DUT to the oscilloscope. The probe is used to minimize measurement error due to loading, poor shielding and limited frequency bandwidth.

Consider the problems that arise when a wire is connected directly from a DUT to the input terminal of an oscilloscope:

1) Susceptible to interference and noise
2) Limited frequency bandwidth
3) Large loading effect on DUT

The first problem can be remedied by using a coaxial cable or shielded wire. However, this does not resolve the second and third problems.

The second problem of limited frequency bandwidth is caused by the inductance and stray capacitance of the wire. Use of a 10:1 probe will eliminate such an effect.

The third problem, the large loading effect, is due to poor impedance matching between the DUT and oscilloscope. This can be minimized by using an appropriate probe.

Operating vertical axis

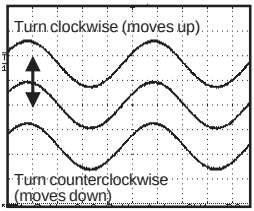
CH1/CH2 MENU Displays CH1 and/or CH2 MENU.

Trace Selects display(On) or non-display(Off) of CH1/CH2 waveform.

OFFSET Sets the position of the waveform in the vertical direction.

Pressing OFFSET moves the waveform in 1-division steps in the direction it was last moved. The offset variable range is as follows:

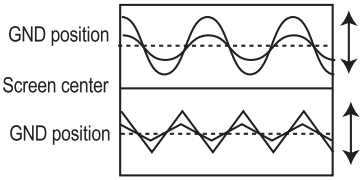
2 mV to 50 mV/DIV:	±1 V
100 mV to 500 mV/DIV:	±10 V
1 V to 10 V/DIV:	±100 V



VOLTS/DIV Selects the deflection factor in 1-2-5 sequence.

This function varies depending on the offset setting in the CH menu.

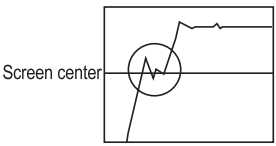
Division Enlarges or reduces the waveform based on the GND reference mark (GND position).



Used to observe waveform at other than the center of the screen, for example, to compare and measure two waveforms.

Volts Enlarges or reduces the waveform based on the screen center.

Set the waveform to the screen center with the OFFSET knob. Useful for observing the exact part of the waveform you are interested in.



Used to observe waveform at the center of the screen, for example, to measure a specific part of waveform or waveform carrying DC bias.

Zoom Pressing the VOLTS/DIV knob allows the vertical deflection factor to be alternately switched between 1-2-5 sequence and Zoom. (The same function is available using the CH menu.)

If “Zoom” is selected, the setting varies continuously from ´1.00 to ´2.50 (maximum 0.8 mV/div). (Expansion by software)

The waveform is enlarged based on the screen center regardless of the offset setting.

COUPLING Selects the input signal coupling from DC → Ground → AC.

Square wave when AC is selected

Square wave when DC is selected

AC coupling ($\tilde{V}$) : The signal is connected via a capacitor and the signal of 10 Hz or below is attenuated and the DC component is blocked.

This coupling is used to observe the signal while canceling the DC level.

DC coupling (V) : All signal frequency components including the DC component are passed.

GND (⏚) : Displays the ground level (0 V).

BW **BW ON/OFF**: The AC component of 10 MHz or higher is attenuated when ON is selected.

BW is used to reduce noise of 10 MHz or higher in the signal.

The same function is available using the CH menu.

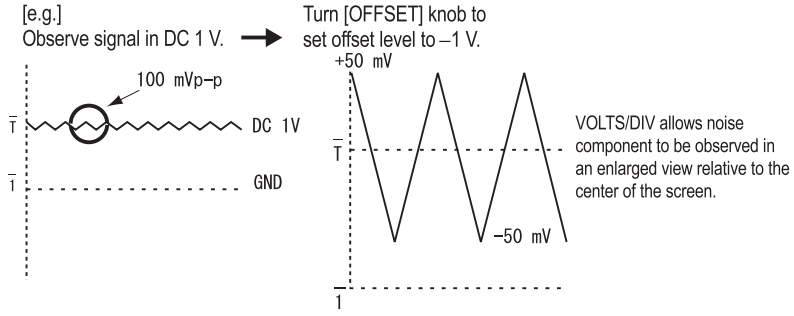
Caution

Do not apply a voltage exceeding the specified voltage to the input terminal.

Direct connection : ±400 V (DC+AC peak)

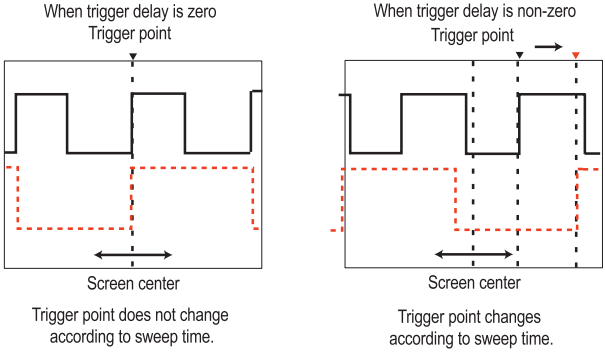
How to use Volts

If ripple or noise occurs in the power output, it is better to use Volts than AC coupling.



Operating the horizontal axis

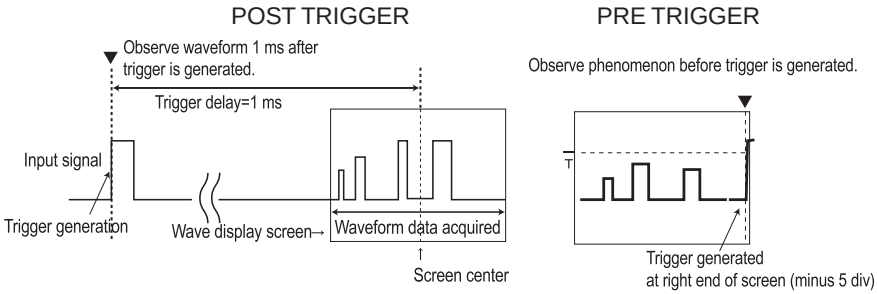
TIME/DIV Select the sweep rate per scale (approximately 9 mm). The setting range is 5 ns to 50 s/div in 1-2-5 sequence. The waveform is expanded or reduced based on the screen center. (See the figure below.) The operation varies depending on the delay setting.



DELAY Sets the position of the trigger point in the horizontal direction.

The Delay time shows from the trigger point to the screen center as the zero point.

Note that the setting range of the delay time varies depending on the sweep rate and memory length setting. (See Section 2.)



ZERO DELAY Sets the trigger delay time to zero.

The trigger point comes to the screen center when zero.

How to use trigger delay (DELAY) zero

To expand/reduce waveform relative to trigger point, set trigger delay time to zero.

Sampling rate This is the number of data points acquired in one second. It is determined by the memory length and sweep rate (see Section 2). This instrument shows the sampling rate next to TIME/DIV at the top left of the screen.

Memory length This is the total number of data points. Short (5 k word) or Long (100 k word) is selectable with Length in the ACQUISITION menu. There are some restrictions of function when memory length Long is selected. (See Section 2).

PERSISTENCE 

The newly acquired waveform is overwritten on the screen. Pressing this button toggles between ON and OFF. (This function can also be set in the ACQUISITION menu.)

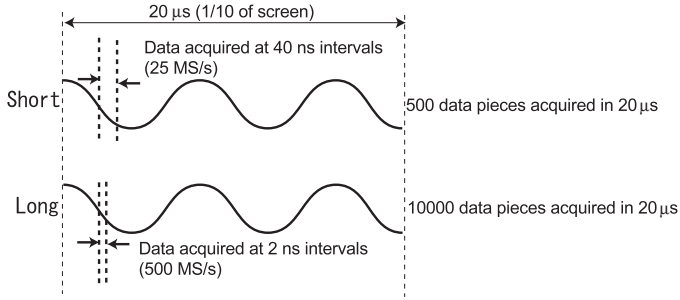
While PERSISTENCE mode is active, the waveform is always displayed in dots regardless of whether the Join setting in the Display menu is ON.

Press STOP to stop the new writing. Press RUN to get new waveforms but erase the former waveform.

The overwritten waveforms are erased when any keys, buttons or knobs are operated while PERSISTENCE is ON.

Memory length and waveform observed

Compare a waveform acquired at 20 µs/div sweep rate.



At the same sweep rate, Long allows the waveform to be observed with more details.

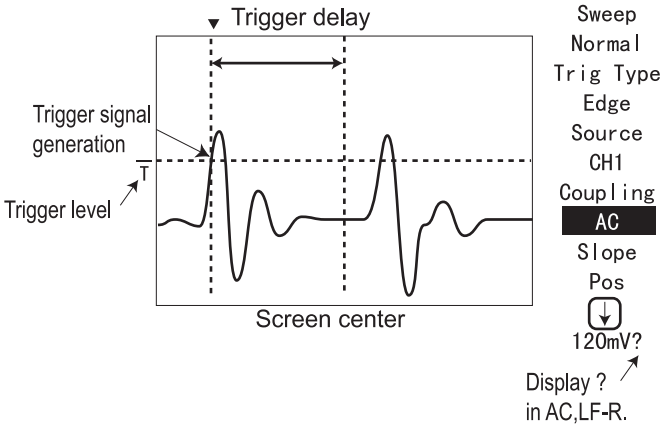
Trigger

Trigger signal: Sets the trigger level within the range of the signal amplitude to trigger.

Level

A trigger signal is generated at the cross point of the input signal and the trigger level.

The relation between the trigger level, delay time and captured waveform is shown in the figure below.



Sets the trigger level voltage to generate a trigger signal.

The trigger level setting range is ±5 div from the screen center.

A T mark is shown at the left end of the screen when the trigger coupling is DC or HF-REJ.

A “?” mark is displayed following the trigger level voltage display when the trigger coupling is AC or LF-REJ or the vertical coupling of the trigger source channel is set to AC.

The T mark position does not change when the voltage deflection factor (VOLTS/DIV) is varied but the trigger level value is varied.

Press the trigger level knob to set the trigger level in rough steps.

Trig Type Selects “Edge”, “EVENT” or “TV” Type in the TRIG menu.
(For EVENT and TV, see Section 2.)
The trigger signal is generated at the cross point of the input signal and the trigger level in the edge trigger as shown in the figure on page 19.

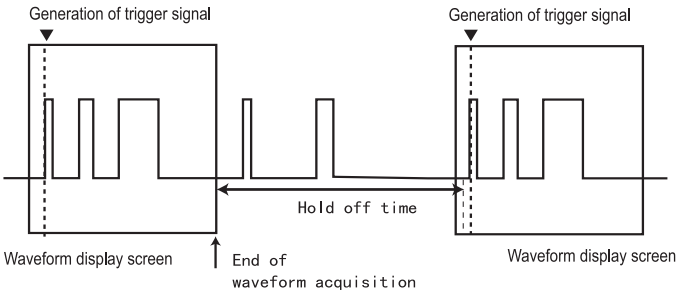
Slope Selects the rising slope (Pos) or the falling slope (Neg) of the input signal to generate a trigger signal.

Source Selects the trigger signal source from CH1, CH2, EXT or LINE. LINE generates a trigger signal the same as the power line frequency. It is used for observing a signal synchronizing with the power supply frequency.

Coupling Selects coupling of a trigger signal.
AC coupling is useful for observing a signal on a DC voltage.
HF-REJ rejects high frequency signal components such as noise to ensure stable triggering.

AC	Blocks the DC component of a trigger signal.
DC	Passes all frequency components of a trigger signal.
HF-REJ	Low pass filter coupling. Rejects the frequency components above 10 kHz.
LF-REJ	High pass filter coupling. Rejects the frequency components below 10 kHz.

Hold off Specifies the trigger ignoring the period from the former trigger time.
Setting range: 200 ns to 2 s and OFF



EVENT trigger and TV trigger

Use of EVENT trigger allows waveform to be acquired when a specific pattern is established by specifying trigger generation count and synchronization.
Use of TV trigger allows stable observation of TV signal.

Sweep mode

AUTO/ NORM/SGL

Changes the sweep mode from AUTO → NORMAL → SINGLE.
(The same operation can also be set by Sweep in the TRIG menu.)
The selection conditions of [Auto] [Norm] [Sngl] are displayed at the bottom of the screen.

AUTO (automatic sweep)

Free run sweep starts when no trigger signal is available. When the trigger signal frequency is low, triggering may be unstable. In this case, change to NORM.

NORMAL (normal sweep)

Captures a waveform every time a trigger signal is generated.
Sweep stops when no trigger signal is available. The last waveform remains on the screen.

SGL (single)

When a trigger signal is generated, captures a waveform only once.
To capture the waveform again, press the RUN/STOP button to enable the waveform to be captured.

Sweep mode in roll function

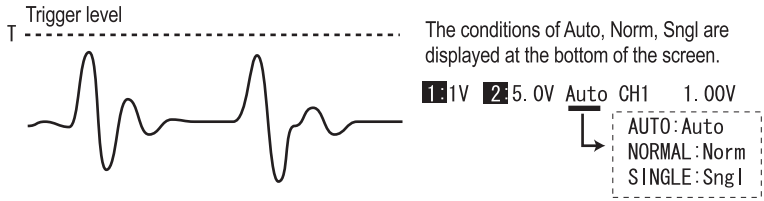
While roll mode is set, the sweep mode is set as follows:

Endless: Continues to capture and display a waveform until the STOP key is pressed.

Trigger'd: When a trigger is generated, stops capturing a waveform. (See Section 2, for details.)

Difference between sweep modes Auto and Norm

When the input signal does not cross the trigger level while the sweep mode has been set to NORMAL or SINGLE, no new waveform is acquired. Selecting Auto automatically acquires new waveforms when no trigger signal is generated.



RUN/STOP Sets start/stop of waveform capturing.

Toggles between Run/Stop and displays the current condition at the top center of the screen.

Operation while STOP Stops capturing a new waveform in the STOP condition. The already captured waveform (currently displayed waveform) can be enlarged or reduced or its position can be varied for both the vertical and horizontal axes.

VOLTS/DIV Can be set to any range.

OFFSET Can be set to any range.

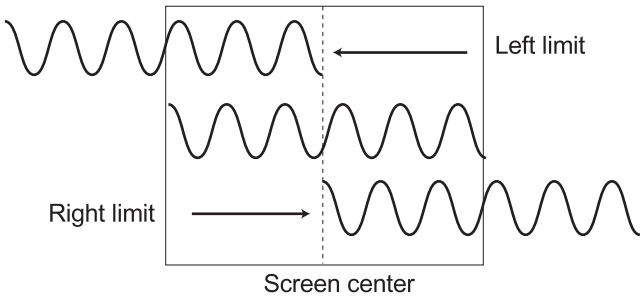
TIME/DIV Can be set to any range. However, there are some limitations of the expansion setting as follows.

When memory length is Short: Max. 7 ranges expansion

When memory length is Long: Max. 11 ranges expansion

The reduction setting is limited to a maximum of 7 ranges irrespective of memory length.

DELAY It is limited up to the screen center at both the top and tail of the waveform.



RUN Starts the waveform capturing. Pressing RUN again while Run mode stops the waveform capturing and captures a new waveform under new conditions.

Cursor measurement

It is possible to measure the voltage and time difference between two cursors.

Horizontal (H cursor) and vertical (V cursor) are displayed simultaneously.

ΔV/Δt/ΔV & Δt/ΔV at t/ OFF

Cycles among the types of cursor measurement. The menu display area shows the cursor measurement item and result.

When another menu is operated

Operating another menu erases the cursor measurement display. To show it again, press the cursor button again.

FUNCTION

The cursor can be moved with the FUNCTION knob when cursor measurement is selected. (Normal menu operation is not possible during cursor measurement.)

Pressing the button of another menu returns to normal menu operations.

Pressing the FUNCTION knob moves the cursor in 1-division steps in the direction the knob was last turned.

C1/C2/TCK

Selects the active cursor, either cursor 1 (C1) or cursor 2 (C2).

When TCK (Tracking) is selected, C1 and C2 can move simultaneously.

The active cursor is displayed in the Select menu.

(In the following example, H-C2 is selected.)

It is selectable from V-C1, V-C2, V-TRACK, H-C1, H-C2 and H-TRACK in ΔV&Δt measurement.

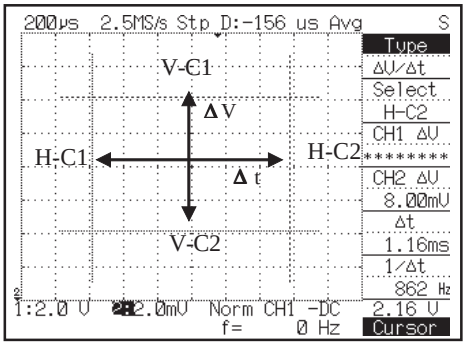
ΔV & Δt measurement

Operating cursors

1. Pressing the ΔV/Δt/ΔV&Δt/ΔVat t/OFF button displays the Cursors menu. Every depressing of the button changes Type (measurement type) from ΔV→Δt→ΔV&Δt→ΔV at t→OFF. Here, ΔV/Δt is set.
2. Every depressing of the C1/C2/TCK button switches Select (operable cursor) from V-C1→V-C2→V-TRACK→H-C1→H-C2→H-TRACK. Here, V-C1 is set.
3. Turn the FUNCTION knob to set the V-C1 cursor.

   Repeat the operation in 2-3 to set V-C2, H-C1 and H-C2 likewise.
4. Display the measured value of ΔV/Δt in the menu.

[Example] ΔV&Δt measurement



→ Measurement item currently selected

→ Cursor that can be operated by FUNCTION knob

→ ΔV measurement result at CH1 voltage sensitivity (When trace is OFF, *** is displayed)

→ ΔV measurement result at CH2 voltage sensitivity

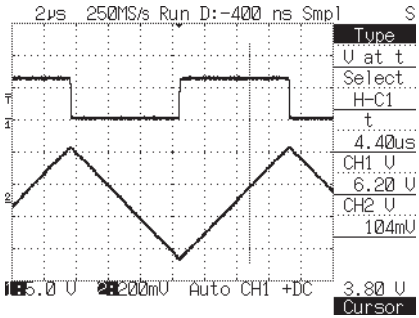
→ Period Δt measurement

→ 1/Δt measurement

Type of cursor measurement

Measurement type	Description	Usable cursor
ΔV	Voltage difference between V cursors	V-C1, V-C2
Δt, 1/Δt	Time difference between H cursors and 1/Δt	H-C1, H-C2
ΔV&Δt	Voltage difference between V cursors	V-C1, V-C2
	Time difference between H cursors and 1/Δt	H-C1, H-C2
V at t	Voltage at point that crosses H cursor	H-C1
	Time difference between trigger point to H cursor	

V at t measurement



Use of V at t allows measurement of the voltage at the point at which waveform crosses the H cursor and the time until the trigger point.

Using H cursors for other than cursor measurement

Use of the MEASURE function allows automatic measurement of the amplitude of waveform, period and other 13 measurement items. (See Section 2.)

The H cursors are also used to specify the measurement area of automatic measurement.

Copy function

Outputs a hard copy of the screen to the built-in printer, floppy disk, ATA card and Centronics port.

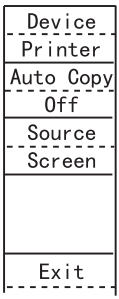
Copy Outputs a hard copy of the screen to a specified device.

See Section 2, for details.

UTILITIES Displays the UTILITIES menu. Select Copy in the UTILITIES menu with [FUNCTION operation].

Copy Menu Select an output device, format and source. (See Section 2 for details.)

Making a hard copy



1. Display the Copy menu in the UTILITIES menu.
2. Through [FUNCTION operation], set the Device menu to Printer.
3. Through [FUNCTION operation], set the Autocopy menu to OFF.
4. Through [FUNCTION operation], set the Source menu to Screen.
5. Every depressing of the Copy button outputs a hard copy of the screen to the built-in printer.

Copy to floppy/ATA card

- If the output device is set to a floppy disk or ATA card, every depressing of the Copy button allows a hard copy of the screen to be saved in TIFF or BMP format. See Section 2 for details.

Auto Copy

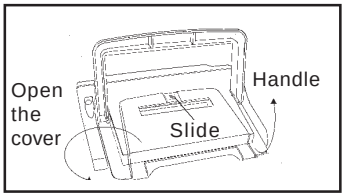
- When Auto Copy is selected, every acquisition of waveform allows a hard copy of the screen to be output to a specified device. See Section 2 for details.

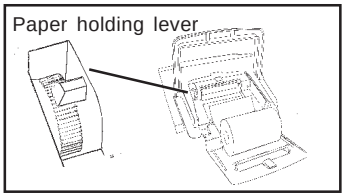
Built-in printer

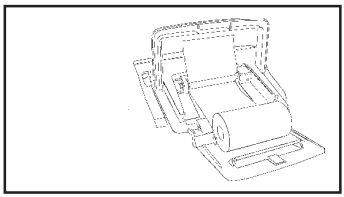
Paper feed

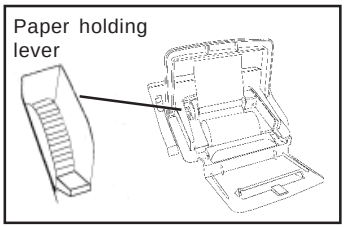
Pressing the Copy button for 1 second or more starts paper feed when the built-in printer is used. The paper feed stops when the button is released.
(Pressing this button for less than 1 sec simply performs normal copy operation.)

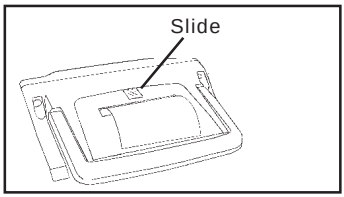
Attachment procedure











Loading printer roll paper

Turn on the power of the scope.
Pull up the handle. Unlock the slide button on the printer cover toward the rear.
Open the cover.

Attention

Be sure to raise the handle before opening the cover.

Cut the roll paper end straight, and pull out the paper end by about 10cm.
Put the paper on the cover between the paper guides. Set the holding lever to the center position (lease) from the rear side position (lock).

Insert the paper end beneath the roller until the paper is fed about 15 seconds automatically.

Move the paper from the cover to the paper holder. Rewind the roll paper slightly to straighten the paper. Set the paper holding lever toward the rear to lock it.

Attention

Printing is not possible if the paper holding lever is set to the Release position at the center.

Insert the paper end into the hole of the cover, and then close the cover.

Lock the slide button on the printer cover toward the front (lock).

SAVE/UNDO of SETUP

Simply pressing these buttons saves the current panel setting to internal memory or recalls the saved setting.

SETUP SAVE

Saves the current panel setting in internal memory. The internal memory stores the condition immediately before the last pressing of the button.

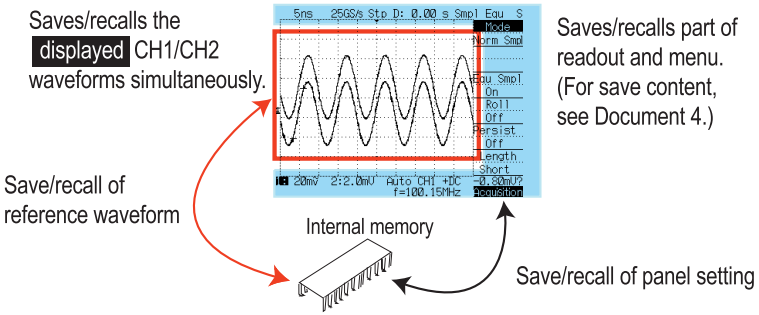
SETUP UNDO

Recalls the saved setup from the internal memory. Pressing this button again undoes the recalling and returns to the previous setup.

How to use SAVE/UNDO of SETUP

[Example] When two settings of measurement are switched alternately, one at a sweep rate of 1 ms and the other at a sweet rate of 0.1 ms.

1. After measurement is performed at a sweep rate of 1 ms/div, press the SAVE button.
2. Set a sweep rate of 0.1 ms/div and carry out measurement.
3. Pressing the UNDO button recalls the panel setting at a sweep rate of 1 ms/div.
4. Pressing the UNDO button again recalls the 0.1 ms/div panel setting. Pressing the UNDO button toggles the sweep rate between 1 ms/div and 0.1 ms/div.



SAVE/CLEAR button of REF

Displays the reference menu. Pressing the button again erases all reference waveforms displayed.

REF SAVE

Stores the currently displayed waveform as a reference waveform on the screen and saves the waveform data to internal memory with panel setting data as reference data. (The CH1 and CH2 current traces are available, but the calculated waveform is not available.)
The oldest record is erased automatically when this button is pressed 6 times or more as the internal memory has 5 units.

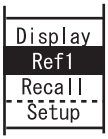
Reference waveform save format

REF1	←Saves the last recorded data.
REF2	↓
REF3	↓ Every depressing of the button shifts the number to be saved.
REF4	↓
REF5	←Depressing the button erases the saved data and replaces it with the data stored in REF4.

REF CLEAR

Displays the REF menu. Pressing the button again erases all reference waveforms on the screen.

How to operate the REF menu



1. Press the REF SAVE button to store the REF waveform on the screen.
2. Press the REF CLEAR button to display the REF menu.
3. Press the REF CLEAR button to erase all the displayed REF waveforms.
4. Select REF 1 to 5 in the Display menu with [FUNCTION operation]; the saved reference waveform is displayed on the screen. The recorded waveform can be restored onto the screen by pressing the FUNCTION knob.
5. Select Recall and press the FUNCTION knob with [FUNCTION operation].
   Press the knob to restore the panel setting for capturing REF waveforms.

REF waveform

The waveform recorded by REF cannot be enlarged or reduced.

REF operation cannot be executed in the XY display.

Acquisition menu

ACQUISITION Displays the acquisition menu.

Sets various functions related to waveform capturing.
(See Section 2 for details.)

ACQUISITION mode setting Selects from the following 3 functions. At the top right of the screen, the selection conditions of [Smpl] [Peak] [Avg] are shown.

Normal sampling (Norm Smpl) Samples the input signal in sweep rate related pitch.

Peak detect (Peak Det) Always samples the input signal at 500 MS/sec regardless of the sweep rate, and displays the waveform with Min/Max peak values between the sweep rate related sample pitch.
Peak detect can capture glitches without missing events that cannot be captured by normal sampling.

Averaging (Average) Averages the same sample point data on the time axis by plural sweeps and displays the averaged waveform. The averaging times (count) can be set by the menu. Averaging can reduce random noise in the signal.

EQU Sample setting Sets the equivalent sampling ON or OFF.

When ON, detects the trigger position of the captured waveform with a time resolution quicker than the sampling cycle and superimposes it on the waveform, increasing the apparent sampling speed (max. 25 GS/s). This setting is used to observe repetitive signals.

Roll setting Sets roll mode ON or OFF.

Displays the waveform in real time when ON. Set to ON to roll incoming data continuously across the screen. Roll is useful for continuously observing low frequency signals. The waveform can be output simultaneously to the built-in printer.

Note: The sweep mode function is varied when roll is ON. (See page 20.)

Operation in persistence mode

In persistence mode, the overwritten waveform display is erased when you change the V/H axis setting, and the scope restarts overwriting under the new setting.

The overwritten waveform display is erased, except when the waveform is acquired just before pressing the RUN/STOP button when you change the V/H axis setting in the STOP condition.

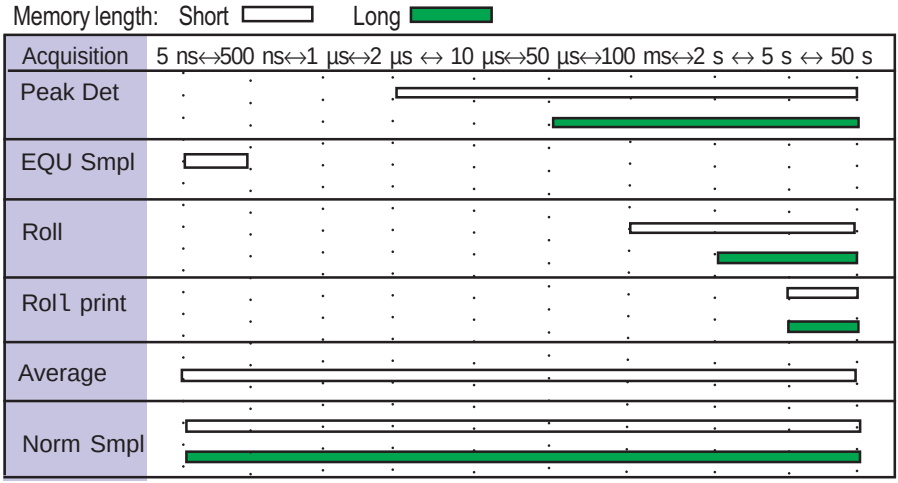
Persist setting Sets persistence ON or OFF. (Can also be set with the Persistence button.)

The captured waveform is overwritten on the display when ON. Persist is useful for a fluctuating signal such as jitter.

Length setting Sets the memory length to Short (5 k word) or Long (100 k word).

Note: Some functions and operations vary depending on the memory length. See page 52.

Acquisition mode vs. Sweep range



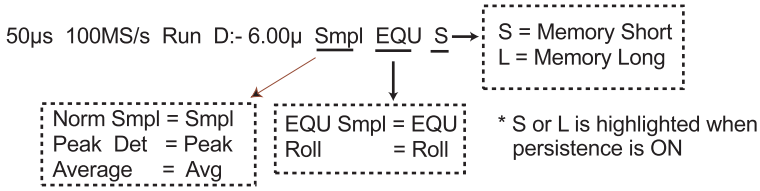
Limitation of acquisition

EQU sampling and averaging are not available for long memory.

Averaging and persistence are not available in Roll mode.

Display of acquisition setting condition

Displays the acquisition condition at the upper part of the screen. If acquisition is not operating even if it is not valid, it is not displayed.

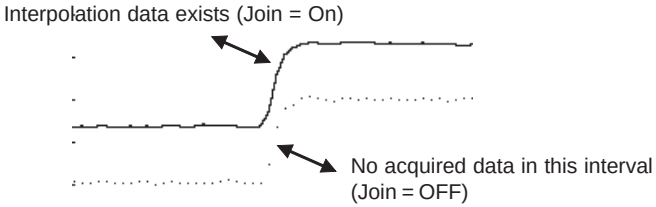


DISPLAY menu

DISPLAY Displays the DISPLAY menu related to the waveform or readout display. (See Section 2 for details.)

Contrast setting Sets the contrast between the waveform and background. (0 to 100%)
The contrast is automatically set initially according to the ambient light when the power is turned on.
You may adjust the contrast manually if necessary.
This manually-adjusted condition is maintained until the power is turned off.

Join setting Sets joining of dots ON or OFF.
Off: Displays the waveform as dots. All data in the display area is always displayed.
On: Joins the dots of waveform data. Useful for observing a pulse waveform or enlarged waveform. Peak compression is automatically performed according to the display data count.



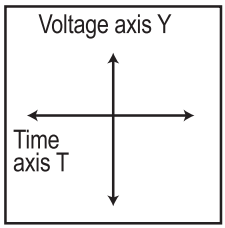
Restrictions on join display

While waveform acquisition is under Run in long memory, waveforms are displayed as joined dots.

If persistence is set to ON, the waveform is always displayed as dots.

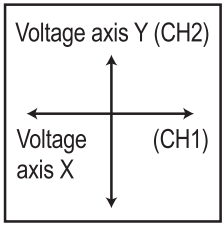
Display TYPE setting Allows selection of YT/XY of waveform display format.

YT display



Displays waveform by expressing vertical direction on the voltage axis and horizontal direction on the time axis.

XY display

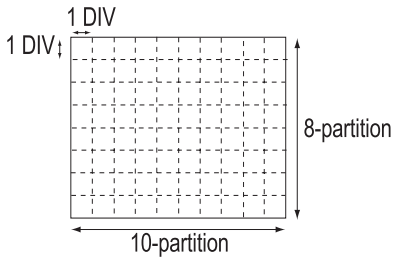


Displays waveform by expressing the horizontal direction on the CH1 voltage axis and the vertical direction on the CH2 voltage axis.
This is used to show phase relationship between CH1 and CH2.

Scale setting

Sets the scale for display (Grid, Axis, Frame) in the waveform display area.

Example of selecting Grid



Grid:
Displays the grid, which divides the vertical direction into eight divisions and the horizontal direction into ten divisions.
The unit of this grid is expressed as 1DIV. Voltage sensitivity VOLTS/DIV and sweep time range TIME/DIV are set using this as the unit.

Math setting

Selects the following 3 types of waveforms calculation.

Add:	Displays addition of the CH1 and CH2 waveforms.
Sub:	Displays subtraction of the CH1 from CH2 waveforms.
Mult:	Displays multiplication of the CH1 and CH2 waveforms.

Status setting

Sets one of the following 4 display items in the temporary display area.

Counter:	Displays the frequency of a trigger signal.
Date:	Displays the time and date.
Measure:	Displays the auto measurement result.
Comment:	Displays the edited comment.

Comments can be edited by setting the UTILITIES menu to Comment through [FUNCTION operation]. (See page 39.)

The status display is erased when CH1/CH2 offset is set or a temporary message is displayed, but can be displayed again by operating the menu and functions.

Counter measurement

Selecting Counter in Status makes it possible to always measure the frequency of the input signal selected as the trigger signal source.

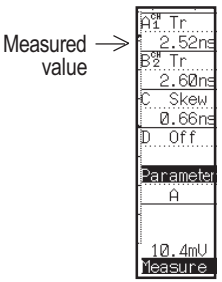
The measurement is performed irrespective of waveform acquisition.

MEASURE (auto measurement) menu

MEASURE

Selects any of the 4 items A, B, C and D from 13 auto-measurement items such as Tr (rise time) and freq (frequency) of a signal, which are executed simultaneously. For some measurement items, parameters need to be set and the measurement points are displayed (+ marks). See Section 2, for details.

Setting measurement items



1. Through [FUNCTION operation], set the MEASURE menu to item A (it is possible to select measurement items in the order shown in the figure at the center left).

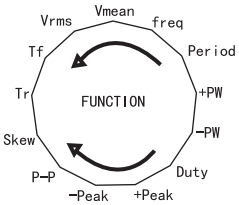
← Selects item B likewise.

← Selects item C likewise.

← Selects item D likewise.

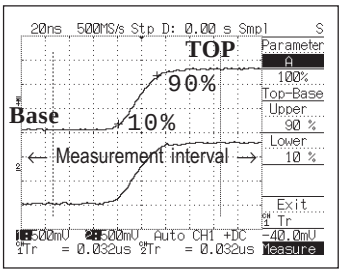
2. Depressing the [FUNCTION] knob displays "Parameter setting for measurement items" corresponding to items A to D as shown in the figure at the bottom left.
The measurement point of the item currently selected is indicated with a + mark. This example shows the measurement interval at the rising edge of the CH1 waveform as shown in the figure at the bottom left.
3. Use cursors to set the automatic measurement interval. Select Δ1 measurement from cursor measurement, display H cursors and set it using the FUNCTION knob. (See "Cursor measurement" on page 22.)
4. Carry out measurement in the interval between cursors (if H cursors are not displayed, the measurement interval corresponds to the entire screen).

Measurement item selection order
(it is possible to select CH1, CH2 for each item)



Setting example
Rise time (Tr)

This example shows the parameter menu of item A (Tr measurement of CH1).



← Sets top and base from the histogram calibration and regards this as 100%.

← Sets the rise time measurement end level.

← Sets the rise time measurement start level.

← Exits the parameter menu.

+ mark display

The level A, B, C or D specified when the menu is displayed is indicated with plus marks. However, no plus mark appears when the reference waveform is displayed.

Measurement item

For the types of auto-measurement and details of the measurements, see the References.

Item	Menu-Symbol	Parameter menu	Measuring point + display
Rise time	CH1/CH2 Tr	①	Yes
Fall time	CH1/CH2 Tf	①	Yes
RMS measurement	CH1/CH2 Vrms	No	No
Average voltage	CH1/CH2 Vmean	No	No
Frequency	CH1/CH2 freq	②	Yes
Cycle	CH1/CH2 Period	②	Yes
+ pulse width	CH1/CH2 +PW	②	Yes
– pulse width	CH1/CH2 –PW	②	Yes
Duty ratio	CH1/CH2 Duty	②	Yes
Maximum value	CH1/CH2 +PEAK	No	No
Minimum value	CH1/CH2 –PEAK	No	No
Peak to peak value	CH1/CH2 P-P	No	No
CH1/CH2 skew	Skew	③	Yes

Auto-measurement parameter

(The following 3 parameters are available depending on the measurement item.)

Parameter menu	Setting item	Set value
①	100% value	Top-Base/P-P
	Upper	5 to 95%
	Lower	5 to 95%
②	Level	5 to 95%
③	CH1 Edge	Rise/Fall
	CH1 Level	5 to 95%
	CH2 Edge	Rise/Fall
	CH2 Level	5 to 95%

To perform automatic measurement while operating another menu

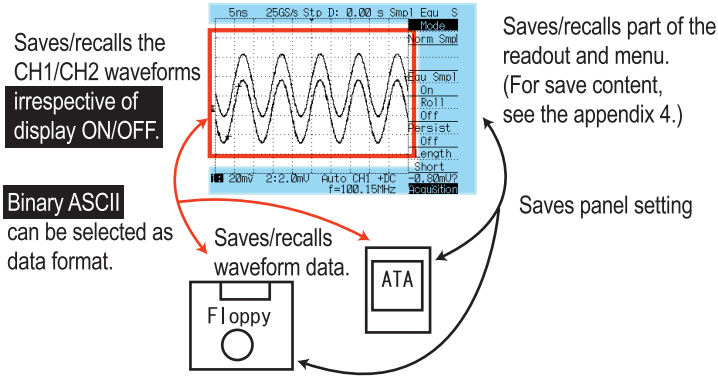
The automatic measurement value is erased when operating other menu. To show the automatic measurement values, use the following procedure.

Display the Display menu and select Measure from Status through [FUNCTION operation]. This allows the measured results of items A and B to be displayed at the bottom of the screen all the time.

SAVE/RECALL menu

SAVE/ RECALL

Saves and recalls SETUP (panel setting) and WAVEFORM (waveform data) to a floppy disk or ATA card. Both the CH1 and CH2 waveforms are saved simultaneously. Both the panel setting and the waveform data are recalled simultaneously.



Device setting Selects a floppy disk or ATA card.

Type setting Selects Setup (panel setting) or Waveform (waveform data).
Note: Select the save type (next item) when selecting the waveform.

Style setting Selects Binary or ASCII. The SAVE type of the panel settings is Binary format.
Note: There is a setting item at the end of the Save/Recall menu.

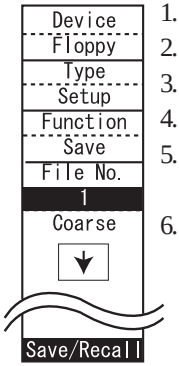
Function Selects Save, Recall or Delete.
Execute the function by specifying file No.

- **Setup**: Saves, recalls or deletes panel settings in Binary format. The file extension is set.
- **WAVE**: Saves, recalls or deletes waveform data in Binary format. The file extension is wfm.
- **ASCII**: Saves or deletes waveform data in ASCII format. The file extension is csv.

The above directory is automatically created when save is executed, and the data is saved as the specified file number.

The selected file is found automatically from the above directory, and is recalled or deleted when Recall or Delete is executed.

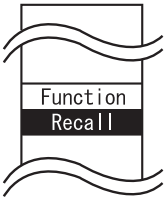
Saving panel settings to floppy disk



1. Press the SAVE/RECALL button to display the SAVE/RECALL menu.
2. Set Device to Floppy with [Function operation].
3. Set Type to Setup (panel setting) with [Function operation].
4. Set Function to Save with [Function operation].
5. Specify the File No. (e.g. specify “1”).
   You can set the file No. in steps of 10 when Course is set.
6. After specifying the File No., press the FUNCTION knob.
   The message “Press FUNCTION to save” appears.
   Press the knob again to execute SAVE.
   If the specified file already exists, the message “Press FUNCTION again to overwrite” appears.
   Press the FUNCTION knob again.

Recalling panel settings from floppy

1 to 3. Set in the same way as “Save panel setting to floppy disk.”



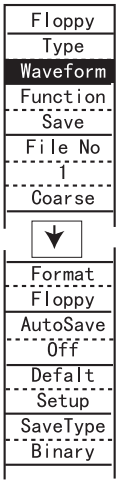
4. Select Recall in Function with [Function operation].
5. Specify the File No. with [Function operation]. (e.g. specify “1”).
   All saved files are displayed. When the panel setting is recalled, only file No. of existing files are selected and displayed.
   You can set the file No. in steps of 10 when Course is set.
   If there is no file, “*****” is displayed.
6. After specifying the File No., press the FUNCTION knob. The message “Press FUNCTION to recall” appears. Press the knob again to execute RECALL.

Number and capacity of files that can be saved

It is possible to save the panel settings and waveform data (Binary/ASCII) in files (No.1 to 200).
It is also possible to save the panel settings and waveform data (Binary/ASCII) in an ATA Card (No.1 to 9999).
The number of files that can be saved depends on the remaining capacity of a floppy disk or ATA card.

Type of file	File capacity	Storage time
Panel setting	1 kB	Approx. 5 sec.
Waveform data for short memory (Binary)	11 kB	Approx. 12 sec.
Waveform data for short memory (ASCII)	56 kB (max.)	Approx. 30 sec.
Waveform data for long memory (Binary)	201 kB	Approx. 90 sec.
Waveform data for long memory (ASCII)	1101 kB (max.)	Approx. 9 min.

Saving waveform to floppy disk

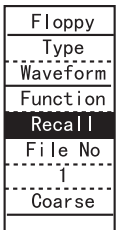


1. Press the SAVE/RECALL button to display the SAVE/RECALL menu.
2. Set Device to Floppy with [Function operation].
3. Set Type to Waveform with [Function operation].
4. Set Style to Binary with [Function operation].
5. Set Function to Save with [Function operation].
6. Specify the File No. with [Function operation] (e.g. specify "1").
   You can set the file No. in steps of 10 when Coarse is set.
7. After specifying the File No., press the FUNCTION knob.
   The message "Press the FUNCTION knob to save" appears.
   Press the knob again to execute SAVE.
   If the specified file already exists, the message "Press the FUNCTION knob again to overwrite" appears.
   Press the FUNCTION knob again.

Note: Saving or recalling waveform data saves or recalls both the CH1 and CH2 waveform data at the same time without any relation to whether trace is ON or OFF.

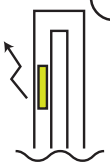
Recalling waveform data from floppy disk

1 to 4. Set in the same way as saving waveform data to floppy disk.



5. Select Recall in Function with [Function operation].
6. Specify the File No. with [Function operation] (e.g. specify "1").
   All saved files are displayed. When the waveform data is recalled, only file No. of files in which the data was saved are selected and displayed.
   You can set the file No. in steps of 10 when Coarse is set.
   If there is no file, "*****" is displayed.
7. After specifying the File No., press the FUNCTION knob. The message "Press FUNCTION to recall" appears. Press the knob again to execute RECALL.

Operation during floppy disk access



Do not operate any other function while the scope is accessing the floppy disk (green lamp is lit).

Save/Recall menu (continuation)

Format setting Formats a medium inserted to a specified device. Note that formatting the medium will erase all data saved in the medium. Using a medium such as floppy disk or ATA card requires formatting.

Formatting the floppy disk

The format operation erases all stored data.

1. Set Format to Floppy with [Function operation].
2. Press the FUNCTION knob. The message "Push the FK to format Floppy" appears.

   Press the knob again to execute formatting.

   Note: Before using a new floppy disk or ATA card, the device must be formatted.

Auto save Saves waveform data to the specified device sequentially when a new waveform is captured.

Press ON to start Auto save.

Press STOP to stop Auto save.

Press RUN to restart Auto save.

When the Auto save function is active, all operations except RUN/STOP are ignored.

During Auto execution, the data is saved as binary data.

Default Resets the settings to the factory settings. (See page 10.)

Delete Deletes the specified file.

Waveform data format (Style)

Binary coded waveform data (CH1/CH2) is saved with the panel settings, time and comment.

In Binary format, the data is saved as binary data. The saved data is recalled by the scope.

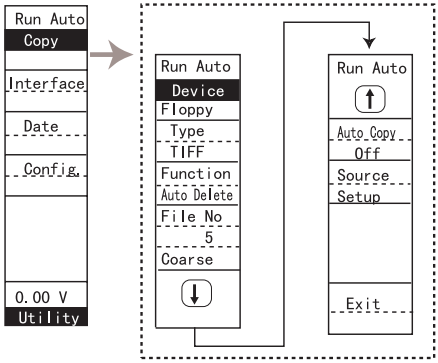
ASCII waveform data (CH1/CH2) is saved in CSV format with limited panel settings and time. (CSV: Comma Separated Value)

ASCII data can be displayed using Windows applications such as Excel (not provided with the scope).

UTILITIES menu

UTILITIES Displays the Copy, Interface, Comment, Date or Config menu.

Copy menu setting Selects a device or sets the output format (Style) and output destination (Source), etc.



Example where Floppy is selected from Device in Copy menu

Output device	Menu	Output format	Output source
Built-in printer	Printer	- - -	Screen, Panel Setup
Floppy disk	Floppy	BMP, TIFF	Screen, Panel Setup
ATA card	ATA CARD	BMP, TIFF	Screen, Panel Setup
Centronics	Centro	DPU-414	Screen, Panel Setup
		ESC-P09	
		ESC-P24	
		PC-PR201	

A hard copy of the screen can be output when the output destination is set to the screen, and the setup settings can be output when the output destination is set to the panel.

The File No. can be specified when the output destination is set to floppy disk or ATA card.

The file No. is incremented by 1 automatically after copying by pressing the Copy button.

Interface menu setting Sets the delimiter, baud rate and data length (Data) of the RS-232C (no parity, stop bit is 1 bit).

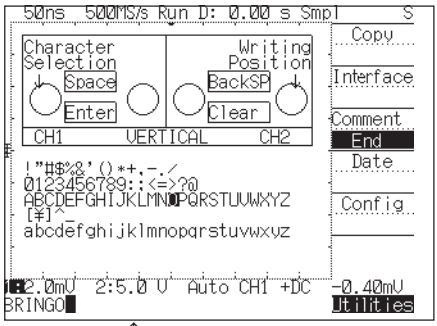
When the GP-IB Card is inserted to the card slot, any address and the delimiter can be set by the GP-IB menu.

Comment menu setting

Displays the following comment menu.

The edited comment is displayed at the bottom of the screen when Comment is selected for Status of the Display menu.

The comment is stored as auxiliary information with the waveform and panel setting data, and is recalled with those data.



Comment display/edit area

Editing the comment

1. Select the comment edit position by the CH2 VOLTS/DIV knob.
2. Select the comment characters by the CH1 OFFSET knob.
3. Press the CH1 COUPLING button to set the comment characters.
4. Select END in the Utilities menu above and press the FUNCTION button. The comment is saved.

   Press Cancel to cancel the saving.

Date menu setting

Sets the year, month, day, hour, and minute. Seconds are set to zero when the new setting is set. The date is displayed at the bottom of the screen when Date is selected for Status of the Display menu.

The date data is used for time display, and also for the time stamp when saving a file and for the time stamp of captured waveform data.

Config menu setting

Sets the Help language (Screen Display: Language), LCD display (LCD), Self-calibration (Self cal) and software version.

Self cal

Performs self-calibration for the vertical axis, offset and trigger automatically. While self cal is executing, do not apply any signal to CH1, CH2 or EXT input.

Section 2 Explanation of Functions

This section gives detailed explanations of functions.

Waveform display

There are three types of waveforms displayed on the screen: CH1/CH2, REF1 to REF5 and Math.

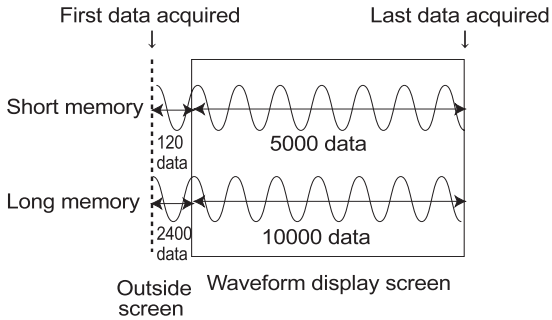
CH1, CH2 waveforms Displays sampling results of signals input to channel 1 and channel 2. Displayed waveforms can be expanded or reduced.
While a Math waveform is displayed, CH1 and CH2 can be turned OFF simultaneously.
CH1 and CH2 waveforms are also used as waveforms to be saved/recalled to an ATA card or floppy disk.

REF1 to REF5 (reference) waveform Displays reference waveforms recorded by the REF SAVE button. Displayed waveforms cannot be expanded or reduced.

Math (calculation) waveforms Displays results of calculations selected by Math in the DISPLAY menu on CH1, CH2 waveforms. Calculations are executed regardless of display (non-display) of CH1, CH2 waveforms.
Displayed waveforms cannot be expanded or reduced.

Horizontal display position immediately after acquisition of waveform

CH1 and CH2 waveforms are displayed as shown in the figure below immediately after they are acquired (until any panel operation). Data outside the screen can be observed by DELAY operation or reduction operation by TIME/DIV after acquisition of waveform is stopped. Depending on the sweep rate setting or ACQUISITION setting, the amount of displayed data may be less than the value. See the appendices 1 and 2.



Vertical axis

Probe setting Selects an attenuation ratio of the probe used by the probe setting in the CH1, CH2 menu from 1:1, 10:1, 100:1 and 1000:1.
Selecting Auto automatically recognizes the probe with a probe sense function (1/10, 1/100) and sets an attenuation ratio.

Horizontal axis

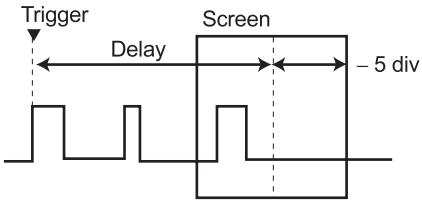
DELAY

The setting range for a trigger delay in a waveform acquisition (RUN) state varies depending on the sweep time and memory length.
The waveform acquisition stop (STOP) state is –500 s to +750 s regardless of sweep time and memory length.

Trigger delay setting range (RUN state)

Memory length	Sweep time	Setting range
Short	5 ns to 1 ms/div	–5 div to +10 ms
	2 ms to 50 s/div	–5 div to +500 s
Long	5 ns to 20 ms/div	–5 div to +200 ms
	50 ms to 50 s/div	–5 div to +500 s

In the RUN state, the time from the trigger point to the center of the waveform screen is set.



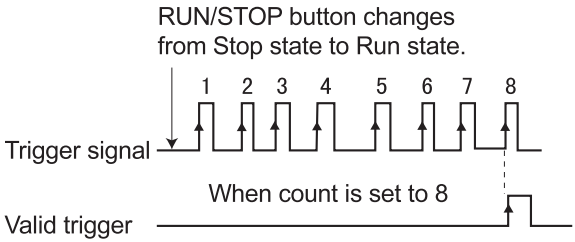
The STOP state is used to move an acquired waveform in horizontal direction.
See page 16 for Post trigger and Pre trigger.

Synchronization

EVENT trigger Specifies trigger count or trigger period (interval time setting), and generates valid trigger signal and acquires waveform only a specific condition is satisfied.

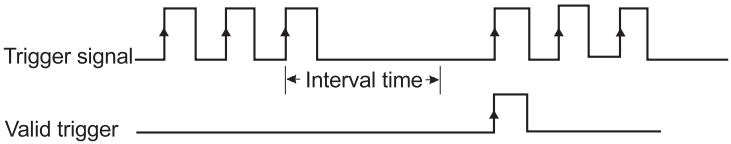
Type setting Selects Count, Burst, Extra or Missing as event type.

Count (COUNT) Generates valid trigger signal every specified count of trigger signal. It is suitable for operation check of counter circuit.
Count setting: 1 to 9999 (selecting Coarse allows setting every 100 steps)

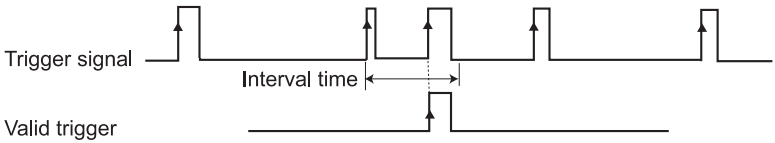


To start operation
Press
RUN/STOP button.

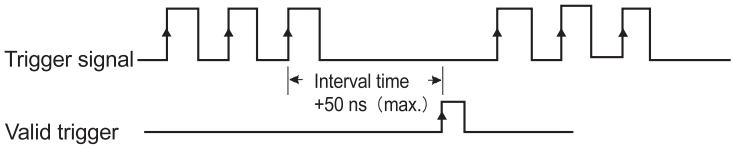
Burst (BURST) Generates valid trigger signal when trigger signal period exceeds the interval time. It is suitable for observation of burst waveforms, etc.
Interval time: 0.15 µs to 1 s (can also be set roughly by Coarse)



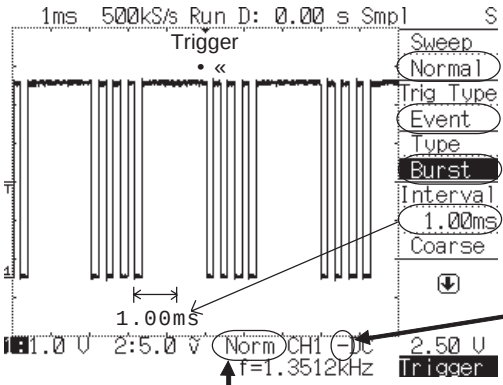
EXTRA Generates valid trigger signal when trigger signal period is smaller than the interval time.
Acquires waveform when the trigger period is shortened by glitch in a clock signal or spike noise in the power line. It is suitable for observation of glitches.
Interval time: 0.20 µs to 1 s (can also be set roughly by Coarse)



MISSING Automatically generates valid trigger signal when there is no trigger signal within specified time. The valid trigger is generated within 50ns after the interval time has passed from the last trigger. It allows waveform to be acquired when part of repetition signal is missing due to power interruption or data dropout.
Interval time: 0.25 µs to 1 s (can also be set roughly by Coarse)



Example of Burst signal	Signal cycle	360 µs
	Stop period	1.6 ms



Selects Normal or Single.

Selects Event.

Selects Burst.

Sets interval time

Generates a trigger signal at the falling edge (Neg) of signal.

Indicates the sweep mode selected.

Auto:	Auto
Normal:	Norm
Single:	Sngl

Sweep mode when EVENT trigger is used

When using an EVENT trigger, set the sweep mode to Normal or Single.

If Auto is set, waveforms are acquired automatically even if it does not satisfy the specified condition and it is not possible to acquire the specified phenomenon correctly.

TV trigger

TV trigger displays NTSC or PAL (SECAM). It generates trigger in the selected field (Both, Odd, Even) or line.

Type Selects field and horizontal synchronization.

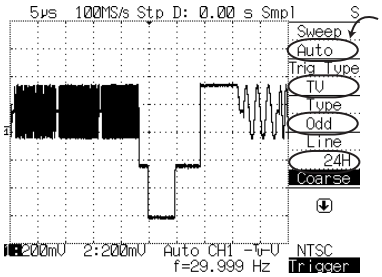
- Both: Triggers by selecting a line number of horizontal sync signal from vertical odd field or even field.
- Odd: Triggers by selecting a line number of horizontal sync signal from vertical odd field.
- Even: Triggers by selecting a line number of horizontal sync signal from vertical even field.
- TV-H: Triggers by a horizontal sync signal.

Line Specifies a line number in the field selected by Type.
While NTSC is selected: 5 to 2000 can be set.
While PAL (SECAM) is selected: 2 to 2000 can be set.
Lines can also be set with Coarse in 100 steps.

Source Selects a signal source to be triggered.
CH1, CH2 or EXT can be set.

Slope Selects a trigger slope plus (Pos) or minus (Neg) of a TV sync signal.
Slope is always performed minus (Neg) when Type is selected TV.

Example of measurement with line No. 24 of odd field (Odd) of NTSC signal



Selecting any of Auto/Norm/Sngle allows stable observation of a TV signal.

Specifies TV.

Specifies Odd.

Specifies line No.

TV system and features

System	Line number	Field frequency	Video signal bandwidth	Country
NTSC	525	Approx. 60 Hz	4.2 MHz	USA, Canada, Japan, Korea, Taiwan, Philippine, M,S-America
SECAM	625	Approx. 50 Hz	6 MHz	France, Russia, E-Europe
PAL	625	Approx. 50 Hz	5 MHz	W-Europe, Asia, India, Oceania
HDTV	1,125	Approx. 60 Hz	20 MHz	(Reference)

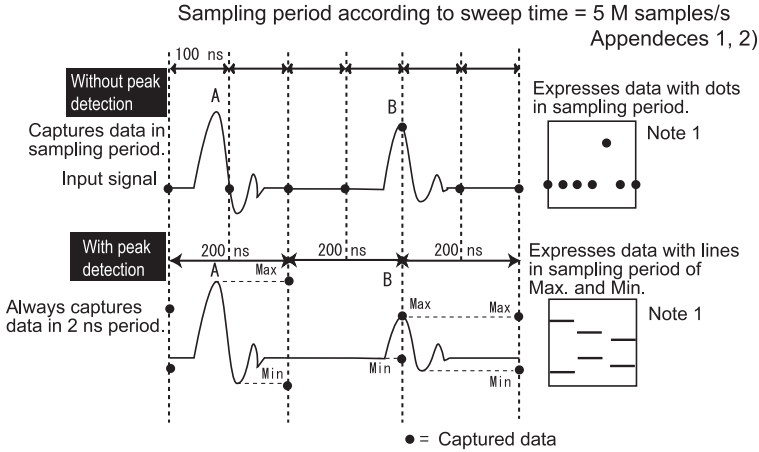
ACQUISITION

Peak detection (Peak Det)

Detects Max./Min. of an input signal by capturing the input signal in 500 M samples/s and alternately records the Max and Min values in memory in a period corresponding to the sweep time (see Appendices 1 and 2).

If the sweep time is set to 10 µs/div (5 M samples/s) with short memory, it is not possible to capture the waveform peak A in the figure below which occurred in the sampling interval without peak detection.

Peak detection always captures waveforms in 2 ns period (500 M samples/s) irrespective of the set sampling period and alternately records Max./Min. as data, making it possible to capture phenomena that occur in the sampling period correctly.

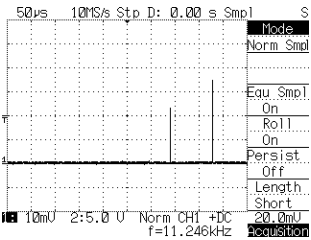


Note 1: Screen display when Join in Display menu is set to Off

Pulse signal

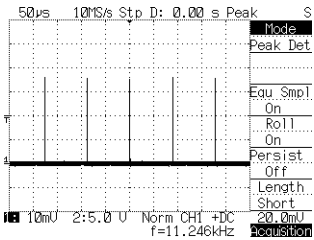
Example of measurement of 10 ns pulse signal with repetition frequency of approx.11 kHz

Peak detection mode is OFF



Since the pulse width (10 ns) of the signal is 1/10 of the sampling period (100 ns), the pulse signal cannot be captured completely.

In peak detection mode



Since sampling is always performed in 2 ns period, pulses in the sampling period (100 ns) are captured correctly.

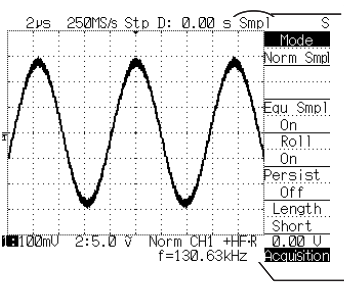
Average (Average)

Every capturing of an input signal averages data on the same time axis and displays the waveform.

Average count (Count)

Selecting Average shows the Count on the menu. Set an average count (2, 4, 8, 16, 32, 64, 128 and 256) depending on the waveform condition.
The greater the count, the greater the effect of eliminating noise in the signal becomes, but processing takes more time.

Example of measurement when averaging is not performed



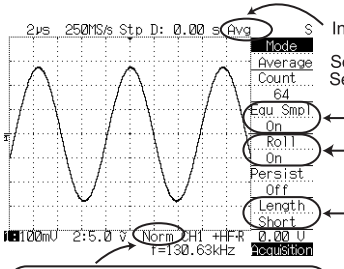
Indicates normal sampling.

←Sets acquisition mode to Norm Smpl.

Signal with large noise

Since a signal (sine wave of approx.130 kHz) includes noise of over 10 MHz, the trigger coupling is set to HF-R to stabilize triggering.

Example of measurement when averaging is performed



Indicates averaging operation.

Sets acquisition mode to Average.
Sets average count to 64. L is effective.

Performs averaging even when equivalent sampling is set.

Averaging is not performed in the roll mode (short memory with sweep time slower than 100 ms/div).

Averaging is not performed with long memory.

Set the sweep mode to Auto or Norm when averaging is used.
Averaging operation is not performed in single sweep mode.

Noise in the signal is eliminated by averaging.

Averaging restrictions

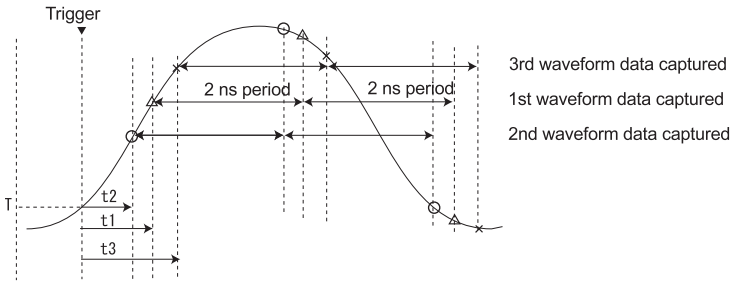
In the roll mode or long memory, Norm smpl (normal sampling) is set automatically even if Average is selected.

Equivalent sampling (EQU SMPL)

Using equivalent sampling for a repetition signal can speed up apparent sampling rate.

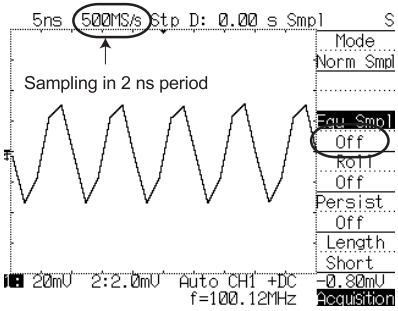
Principle

Every time waveform data is captured, the time tn (n=1, 2, 3,...) after trigger generation until data is sampled is measured and data is overwritten taking account of relative time relationship.
This instrument implements 25 G equivalent sampling by measuring the time with 40 ps resolution.



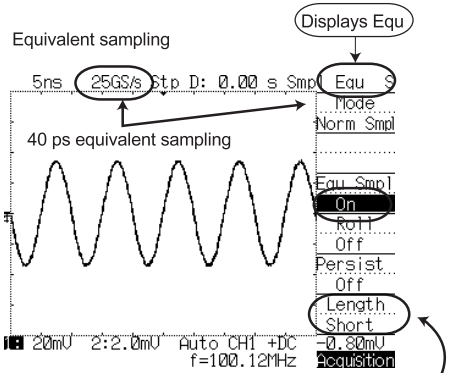
Example of measurement by normal sampling and Equ sampling for approx.100 MHz sine wave

Norm sampling



Mainly used to measure single-shot signal.

Equivalent sampling



Can displays detailed waveform.

Join setting in Display menu

This Norm sampling example is shown by Join ON.
Data pieces captured in 2ns period are linked with a line.

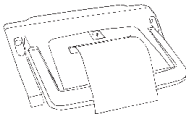
Restriction on equivalent sampling

With long memory, equivalent sampling is not performed even if Equ Smpl is set to ON.

Roll (ROLL)

The acquired waveform is displayed in real time. Available sweep range is 100ms to 50s in Short memory length, 2s to 50s in Long memory length.
When operating at slower sweep rate with roll mode off, the waveform is displayed on the screen after all waveform data has been captured up to the specified memory length, and so it is not possible to observe the phenomenon in real time.
A roll operation performs acquisition and displaying of waveform data on the screen simultaneously like a recorder, making it possible to observe changes in the waveform in real time.

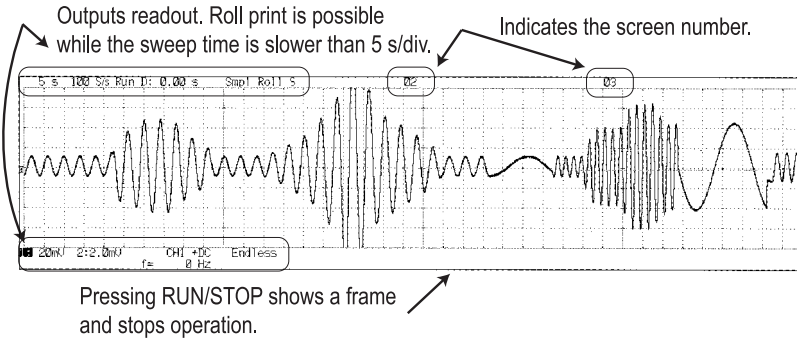
Roll print



Outputs waveforms to a built-in printer simultaneously.
Roll print is performed by pressing the Copy button, while the sweep time is 5, 10, 20 and 50 s/div in the roll mode.
(Set Device to Printer and set Source to Screen in the Copy menu of UTILITIES beforehand.)
While roll print is in progress, no operation is possible other than RUN/STOP button operation.
To stop roll print operation, press the RUN/STOP button.

Roll print format

While roll print is in progress, the waveform is continuously output as a recorder image as shown in the figure below.



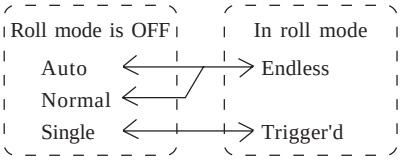
Restrictions in roll mode

- Averaging and persistence are not executed.
- Automatic measurement results, Math (calculated) waveforms and XY are displayed in a Stop state.
- Turning On the Auto Copy or Auto Save function automatically sets Roll to Off.

Sweep mode in Roll operation

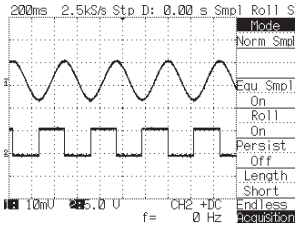
The setting of the sweep mode is performed by Sweep in the TRIGGER menu or with the AUTO/NORMAL/SGL button.

The sweep mode setting is changed depending on whether the roll mode is OFF or ON.

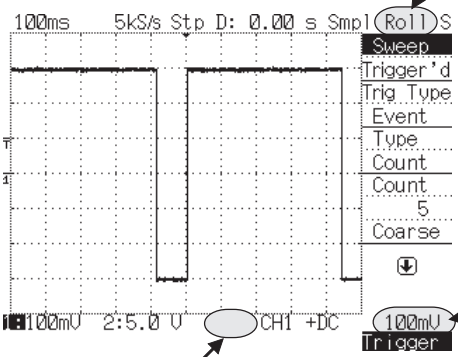


Roll operation

Roll is turned on and "Roll" is displayed **at the top right**.



Example of sweep mode
Trigger'd



1. Set Sweep to Trigger'd.
   The setting can also be changed by the AUTO/NORM/SGL button.
2. **In the roll mode, Edge or Event can be selected as TrigType. TV cannot be selected.**
   In this case, Event trigger count is set to 5.

In the roll mode, the display varies depending on the sweep mode.

Trigger'd:	Displays the trigger level.
Endless:	Displays Endless.

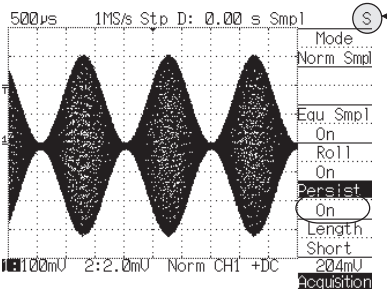
In roll mode:	Displays nothing.
Roll mode is OFF:	Displays sweep mode. (Auto, Norm, SGL)

In this example, pressing the RUN button starts roll operation, and stops roll operation when five rising edges are detected.

In this way, a waveform in the roll mode can be stopped under a specific trigger condition.

Persistence (PERSISTENCE) The acquired waveforms are overwritten infinitely on the screen. This is convenient to continuously observe changes of a signal.
If the state is changed from STOP to RUN by pressing the RUN/STOP button, persistence operation is started and the screen is initialized when the first captured waveform is displayed.
For the operation in persistence mode, see page 28. With persistence ON, waveforms are displayed with dots irrespective of Join setting.

AM modulation signal Measurement example of signal with modulated amplitude



When PERSISTENCE is ON, this is displayed in reverse video.

In this example, Burst of the Event trigger is used for stable triggering.

Limitation on PERSISTENCE

In the roll mode, PERSISTENCE is not performed.

Memory length (Length) The function and operation change depending on the memory length.

Short 5 k (5120) words/channel
Waveforms are displayed depending on the Join setting in display menu.
100 k (102400) words/channel

Long In RUN state, waveform is always displayed in join irrespective of Join setting.
In STOP state, waveforms are displayed depending on the Join setting.

Limitation on long memory

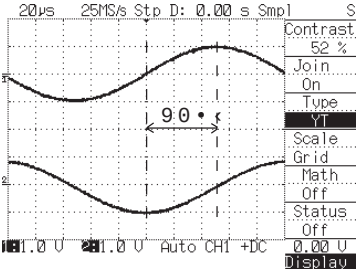
- Average or equivalent sampling is not available.
- The voltage value in automatic measurement or V at t measurement is displayed in STOP state.

XY display

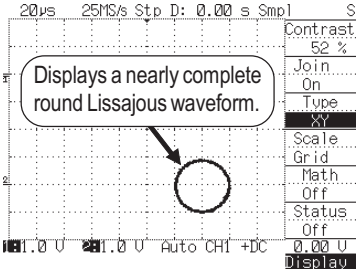
Displays a waveform by expressing the horizontal direction (X) on the CH1 voltage axis and the vertical direction (Y) on the CH2 voltage axis. Allows observation of the phase difference of CH1 and CH2 signals, etc.

Measurement example of 90° phase different sine waves

YT display



XY display



Limitation on XY display

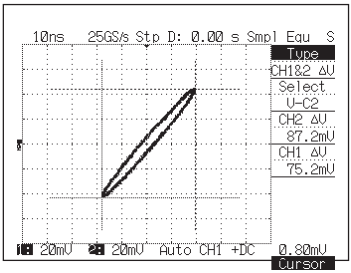
- Calculated waveform display, reference waveform display or automatic measurement is not possible.
- Always displays with dots irrespective of Join setting.
- In the roll mode, waveforms are displayed in YT mode and if the state is changed from RUN to STOP by pressing the RUN/STOP button, waveforms are displayed in XY mode.

Cursor measurement in XY display

Time related measurement is not available in XY display.

Measurement type	Content	Operable cursor
CH1 ΔV	Potential difference between H cursors	H-C1, H-C2
CH2 ΔV	Potential difference between V cursors	V-C1, V-C2
CH1&2 ΔV	Potential difference between H cursors	H-C1, H-C2
	Potential difference between V cursors	V-C1, V-C2

Measurement example of CH1 & CH2 ΔV



← Measurement item currently selected

← Cursor that can be operated by FUNCTION knob

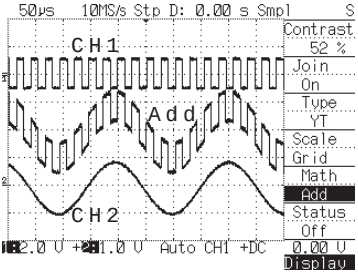
← V measurement in vertical direction (measured by CH2 volts/div)

↖ V measurement in horizontal direction (measured by CH1 volts/div)

Calculated waveform (Math)

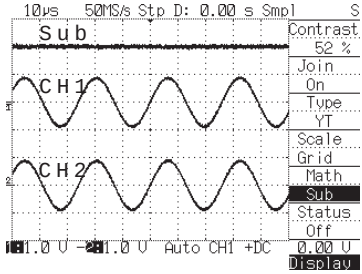
Displays results of calculation between CH1 and CH2 waveform data.

Measurement example of added waveform



Addition of CH1 and CH2 waveform data

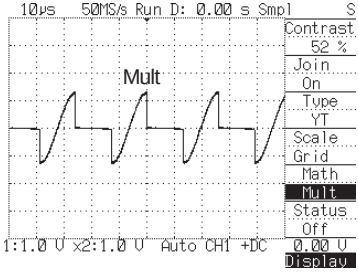
Measurement example of subtracted waveform

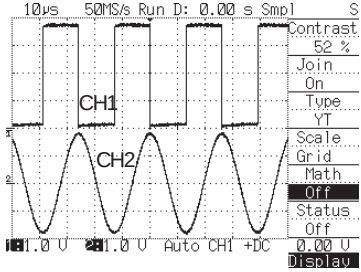


Subtraction of CH2 from CH1 waveform. Used for a differential signal without common mode signal.

Multiplication (Mult)

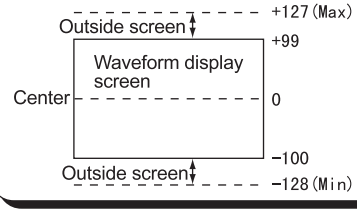
Measurement example of multiplied waveform





Multiplying CH1 by CH2 waveform in the figure on the right. Used for power from a voltage waveform and current waveform, etc.
Multiplications are performed according to the following expression:
Mult = (CH1 waveform data – CH1 GND position) × (CH2 waveform data – CH2 GND position)/128

Numeric expression of waveform data



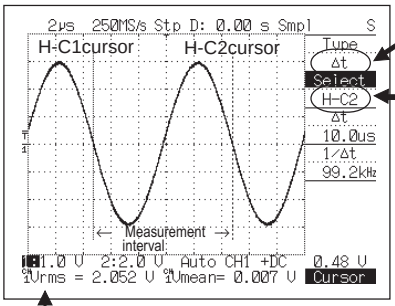
This instrument converts the voltage of an input signal from analog to digital with 8-bit resolution (–128 to +127) and displays the data corresponding to -100 to +99 on the screen. The data outside the screen can be observed by operating OFFSET or VOLT/DIV after waveform acquisition is stopped.

Automatic measurement (MEASURE)

Measurement area

Specifies the measurement area between H cursors. If no H cursors are shown, the measurement area is the entire screen.

The H cursors are displayed by pressing the ΔV/Δt/ΔV&Δt/V at t/ OFF button and selecting Δt of cursor measurement. (Likewise, the H cursors can also be displayed by selecting ΔV&Δt measurement.)



Select Δt for cursor measurement.

Cursor that can be operated

The cursors are moved by turning the FUNCTION knob.

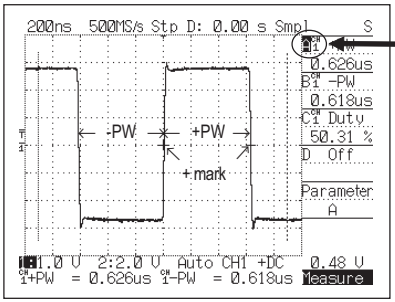
The cursor to be operated is selected by pressing the C1/C2/ TCK buttons.

In this example, the root mean square (Vrms) and average (Vmean) of the CH1 waveform are measured.

While another menu is displayed during cursor operation, etc., selecting Measure as Status in the DISPLAY menu displays measurement results of A and B at the bottom of the screen.

Measurement point display

With measurement that allows selection of measurement parameters, if no reference waveform is displayed, the level of measurement point is indicated with a + mark.



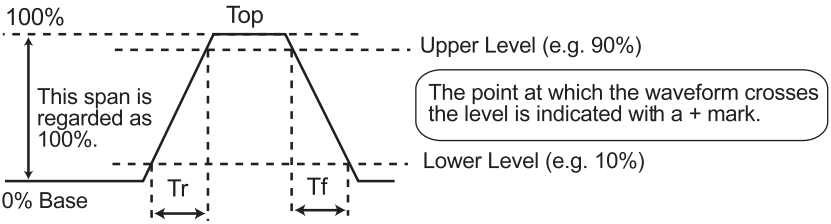
The + mark is displayed as the level of measurement point selected in the menu.

In this example, the level of measurement of A is indicated with a + mark.

In this example, + pulse width (+PW) and – pulse width (–PW) and duty ratio (Duty) of CH1 waveform are measured.

Rise time (Tr) Measures rise time of waveform in the specified area.

Fall time (Tf) Measures fall time of waveform in the specified area.
Set the following parameters.



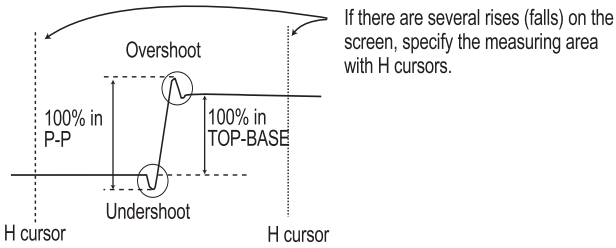
100% Sets a reference waveform amplitude.
If Top-Base is selected, Top and Base are found from a waveform data histogram and are set as 100%.
If P-P is selected, the span between Max. and Min. of the waveform data in the specified area is set as 100%.

Upper The measurement end level is set at the Tr and the measurement start level is set at the Tf. The setting range is 11 to 90%.

Lower The measurement start level is set at the Tr and the measurement end level is set at the Tf. The setting range is 10 to 89%.

Amplitude parameter (100%) setting and specification of measurement interval

When a waveform has an overshoot or undershoot as shown in the figure, the measured value varies depending on Top-Base or P-P selection.



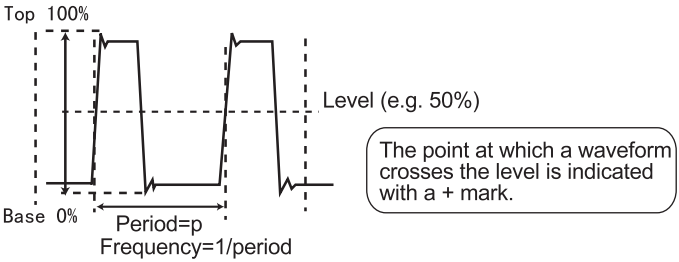
If no area to be measured is specified, the rise (fall) time at the leftmost part of the screen is measured.

Root square mean (Vrms) Measures root square mean of waveforms in the specified area.

Mean value (Vmean) Measures mean value of waveforms in the specified area.
Note that measured values of both Vrms and Vmean vary greatly depending on the setting of measurement interval.
There are no measurement parameters (no + mark is displayed either).

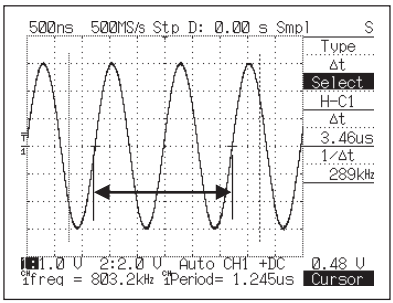
Frequency (freq) Measures frequency of waveforms in the specified area.

Period (period) Measures cycle of waveforms in the specified area.
The following parameter can be selected.



Level The span between Max. and Min. of waveform data in the measurement area is set as 100% and the period is obtained from the point at which the waveform crosses the level. Frequency is calculated from the period. The setting range is 10 to 90%.

Measurement example of frequency and period



Select Δt of cursor measurement and set the area to be measured between H cursors.

Selecting Measure as Status in the DISPLAY menu displays measurement results of A and B at the bottom of the screen.

Detect the time from the first rise to the last rise (or from the first fall to the last fall) between two H cursors and calculate the period from the frequency.

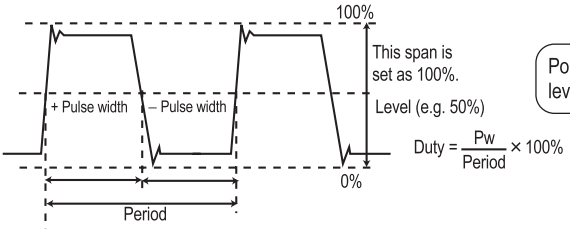
In this example, the frequency and period are calculated from the 2 periods.

+Pulse width (+PW) Measures + pulse width of waveform in the specified area.

–Pulse width (–PW) Measures – pulse width of waveform in the specified area.

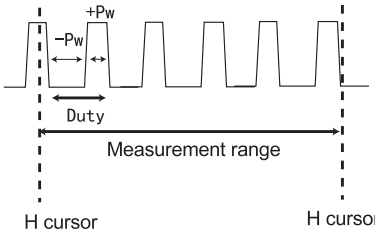
Duty ratio (Duty) Measures the ratio of waveform period to + pulse width in the specified area.
The following parameter can be selected:

Level Top and Base are set from Max. and Min. of waveform data in the specified area, and it is set as 100% and ± pulse width and period are calculated from the point at which the waveform data crosses the value specified by Level.



Point at which waveform crosses the level is indicated with a + mark.

Measuring + pulse width, – pulse width and duty ratio

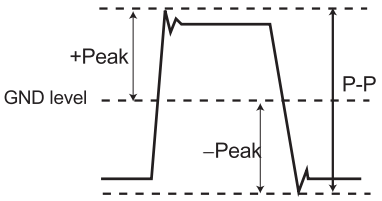


If there are plural pulses in the specified area as shown in the figure, the leftmost pulse is measured.

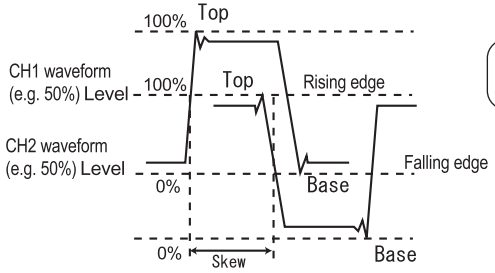
Maximum value (+PEAK) Measures maximum value of waveform in the specified area.

Minimum value (–PEAK) Measures minimum value of waveform in the specified area.

Difference between maximum value and minimum value (P-P) Measures difference between maximum value and minimum value of waveform in the specified area.
There is no measurement parameter (no + mark either)



Skew (SKEW) Measures time difference between rising (falling) edge of CH1 waveform and rising (falling) edge of CH2 waveform in the specified area.
Set the following parameters.



Point at which waveform crosses the level is indicated with a + mark.

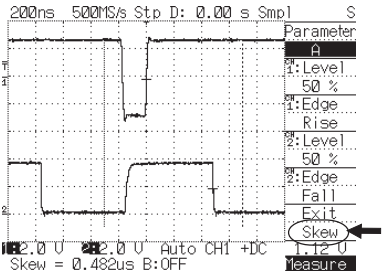
CH1 Level Sets the level at which the waveform data crosses the level as reference regarding the span between maximum and minimum values of CH1 waveform as 100% in the specified area .
The setting range is 10 to 90%.

CH1 Edge Selects edge of CH1 waveform.
Rise: Uses rising edge.
Fall: Uses falling edge.
The first specified edge in the specified area becomes the skew measurement start or end point.

CH2 Level Sets the level of CH2 waveform in the same way as for the CH1 level.

CH2 Edge Selects the edge of CH2 waveform in the same way as for the CH1 edge.

Skew measurement example



Select Parameter in the Measure menu and display the Skew parameter menu.

Select Edge or Level.

Indicates that this is the Skew parameter menu.

In this example, the time from the CH1 waveform rise to the CH2 waveform fall between two H cursors is measured.

Save/recall/delete (SAVE/RECALL/DELETE)

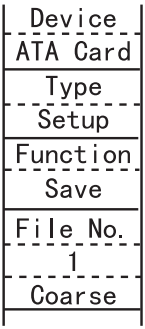
Also see Section 1 "SAVE/RECALL menu" (pages 34 to 37).

Capacity display

Selecting DEVICE in the SAVE/RECALL menu shows the remaining capacity of a medium.

While Floppy or ATA Card is highlighted, the remaining capacity of the medium is displayed at the bottom of the screen.

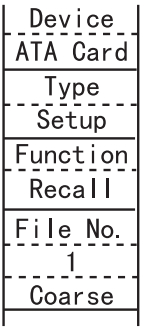
Saving panel setting to ATA card



1. Display SAVE/RECALL menu.
2. Through [FUNCTION operation], set Device to ATA card.
3. Through [FUNCTION operation], set Type to Setup (panel setting).
4. Set Function to Save with [Function operation].
5. Specify the File No. (e.g. specify "1").

   You can set the file No. in steps of 20 when Course is set.
6. After specifying the File No., press the FUNCTION knob. The message "Press FUNCTION to save" appears. Press the knob again to execute SAVE. If the specified file already exists, the message "Press FUNCTION again to overwrite" appears.

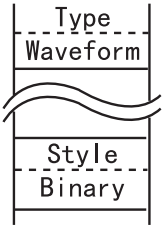
Recalling panel setting from ATA card



1 to 3. Perform the same setting as that for saving.

4. Through [FUNCTION operation], set Function to Recall (recall).
5. Specify the File No. (e.g. specify "1"). Only existing file Nos. are selected and displayed during a recall. If Coarse is selected, the existing files are selected and displayed at every 20 steps. If no files are found, **** is displayed. When recalling the panel setting from an ATA card, selected file Nos. are recalled sequentially.
6. Pressing the FUNCTION knob stops the recall.

Saving waveform data to ATA card



1. Display SAVE/RECALL menu.
2. Through [FUNCTION operation], set Device to ATA card.
3. Through [FUNCTION operation], set Type to Waveform (waveform).
4. Through [FUNCTION operation], select Binary or ASCII as Style.

4 to 6. Perform the same setting as for saving of the panel setting.

Recalling waveform data from ATA card

1. Display SAVE/RECALL menu.
2. Through [FUNCTION operation], set Device to ATA card.
3. Through [FUNCTION operation], set Type to Waveform (waveform).
4. Through [FUNCTION operation], select Binary as Style.

4 to 6. Perform the same operation as for recalling of the panel setting.

Editing waveform data saved in ASCII format by Excel

Waveform data saved in ASCII format cannot be recalled by this instrument.

In a file saved in ASCII format, CH1, CH2 waveform data and auxiliary information are stored in CSV format. Therefore, simply clicking on them from a PC can start Excel or Lotus and edit them. (CSV: Comma Separated Value)

Waveform acquisition time	2022-3-4 6:51		
Time/DIV	200 ns/DIV	0.00 s	Delay
CH1 waveform On/Off	ON	ON	CH2 waveform On/Off
CH1 Volts/DIV	2.0 V/DIV	2.0 V/DIV	CH2 Volts/DIV
CH1 Offset	1.96 DIV	–3.00 DIV	CH2 Offset
CH1 waveform data	82	–74	CH2 waveform data
	83	–74	
	83	–73	
	⋮	⋮	

Waveform data saved in ASCII formats is converted to the voltage by the following equation.

(Calculation) = (Waveform data / 25 - OFFSET)×volts per division [V/div]

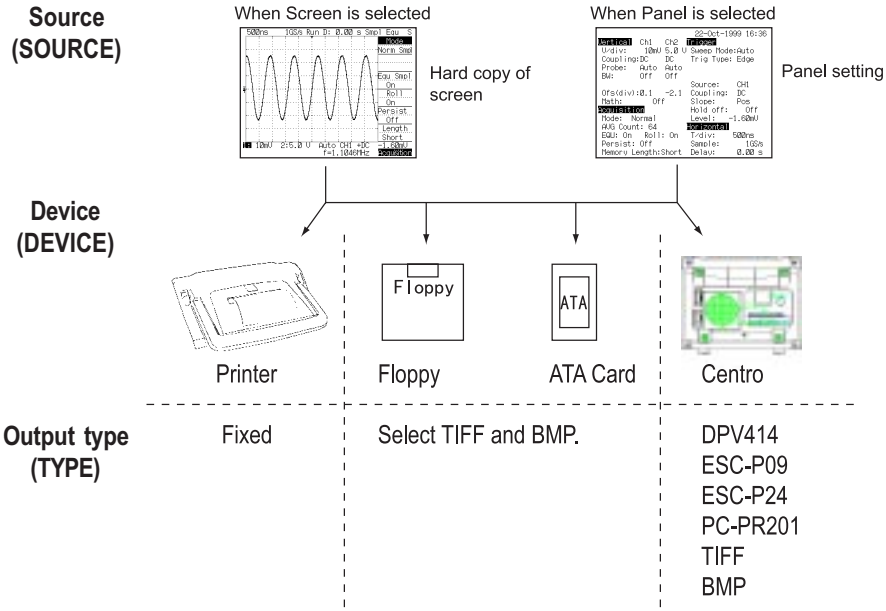
When waveform is Off, no data is displayed.

Deleting file Display the SAVE/RECALL menu and through [FUNCTION operation] set Function to Delete and specify the File No. and execute it.
If no file exists in the device, File. No. is displayed as ****.

Copy (COPY)

Also see Section 1 "Copy function" (page 24), "Built-in printer" (page 25) and "UTILITIES menu" (page 38) together.

Outputs a hardcopy of the screen and panel setting to the built-in printer, floppy disk, ATA card and Centronics port.



Function setting

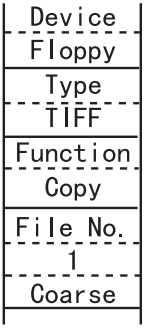
If the device is Floppy or ATA Card, select the function Copy/Delete. To execute the function, specify File No.

- TIFF: Saves/deletes TIFF format screen or panel setting. The file extension is TIF.
- BMP: Saves/deletes BMP format screen or panel setting. The file extension is BMP.

Executing a copy creates the above directory under the root of the specified device and saves the file with specified file No.

Executing Delete detects the existing files from each directory under the root of the specified device and deletes specified file No.

Copy to floppy disk



1. Select Copy in the UTILITIES menu and display the copy menu.
2. Through [FUNCTION operation], set Device to Floppy.
3. Through [FUNCTION operation], set Type to TIFF (or BMP).
4. Through [FUNCTION operation], set Function to Copy.
5. Through [FUNCTION operation], set File No. at every step (e.g."1"). If Coarse is selected, File No.can be set at every 20 steps.
6. After file No. is selected, press the FUNCTION knob to confirm the setting. Every depressing of the Copy button executes a copy and increments file No. by 1 when the copy is completed.

Copy to ATA card

1. Select Copy in the UTILITIES menu and display the copy menu.
2. Through [FUNCTION operation], set Device to ATA Card.

3 to 6. Perform the same setting as for floppy.

If Coarse is selected for ATA card, File No. can be set at every 20 steps.

Deleting file Selecting Delete in the Function menu allows a specified file to be deleted.

Setting Auto Copy Auto Copy makes a copy to a specified device every new waveform is acquired automatically.
Turning On Auto Copy stops waveform acquisition and pressing the RUN/STOP button restarts waveform acquisition.
No operation other than RUN/STOP button operation is accepted while Auto Copy is in progress. While operation is stopped, the Auto Copy setting can be turned Off.

Number of files and capacity

A floppy disk can save up to 200 TIFF or BMP files.

An ATA card can save up to 9999 TIFF or BMP files.

Each file requires a capacity of 10Kbytes, but the number of files that can be saved depends on the remaining capacity of a floppy disk or ATA card.

Appendix 1

Table 1 Sampling Period and On-Screen Data Count for Short Memory

Time axis (range)	Sampling rate	Sampling period	On-screen data count
50 s/div	10 S/s	100 ms	5,000 words
20 s/div	25 S/s	40 ms	5,000 words
10 s/div	50 S/s	20 ms	5,000 words
5 s/div	100 S/s	10 ms	5,000 words
2 s/div	250 S/s	4 ms	5,000 words
1 s/div	500 S/s	2 ms	5,000 words
500 ms/div	1 kS/s	1 ms	5,000 words
200 ms/div	2.5 kS/s	400 µs	5,000 words
100 ms/div	5 kS/s	200 µs	5,000 words
50 ms/div	10 kS/s	100 µs	5,000 words
20 ms/div	25 kS/s	40 µs	5,000 words
10 ms/div	50 kS/s	20 µs	5,000 words
5 ms/div	100 kS/s	10 µs	5,000 words
2 ms/div	250 kS/s	4 µs	5,000 words
1 ms/div	500 kS/s	2 µs	5,000 words
500 µs/div	1 MS/s	1 µs	5,000 words
200 µs/div	2.5 MS/s	400 ns	5,000 words
100 µs/div	5 MS/s	200 ns	5,000 words
50 µs/div	10 MS/s	100 ns	5,000 words
20 µs/div	25 MS/s	40 ns	5,000 words
10 µs/div	50 MS/s	20 ns	5,000 words
5 µs/div	100 MS/s	10 ns	5,000 words
2 µs/div	250 MS/s	4 ns	5,000 words
1 µs/div	500 MS/s	2 ns	5,000 words
500 ns/div	500 MS/s (1 GS/s)	2 ns (1 ns)	2,500 words (5,000 words)
200 ns/div	500 MS/s (2.5 GS/s)	2 ns (400 ps)	1,000 words (5,000 words)
100 ns/div	500 MS/s (5 GS/s)	2 ns (200 ps)	500 words (5,000 words)
50 ns/div	500 MS/s (10 GS/s)	2 ns (100 ps)	250 words (5,000 words)
20 ns/div	500 MS/s (25 GS/s)	2 ns (40 ps)	100 words (5,000 words)
10 ns/div	500 MS/s (25 GS/s)	2 ns (40 ps)	50 words (2,500 words)
5ns/div	500 MS/s (25 GS/s)	2 ns (40 ps)	25 words (1,250 words)

Note 1. Figures in parentheses apply when equivalent sampling is performed.

Note 2. The remaining data after subtracting the on-screen data count from memory length (5 kwordss) is not displayed on the screen, but is stored into internal memory as the data preceding the left end of the screen.

Appendix 2

Table 2 Sampling Rate and Display Memory Length for Long Memory

Time axis (range)	Sampling rate	Sampling period	On-screen data count
50 s/div	200 S/s	5 ms	100,000 words
20 s/div	500 S/s	2 ms	100,000 words
10 s/div	1 kS/s	1 ms	100,000 words
5 s/div	2 kS/s	500 µs	100,000 words
2 s/div	5 kS/s	200 µs	100,000 words
1 s/div	10 kS/s	100 µs	100,000 words
500 ms/div	20 kS/s	50 µs	100,000 words
200 ms/div	50 kS/s	20 µs	100,000 words
100 ms/div	100 kS/s	10 µs	100,000 words
50 ms/div	200 kS/s	5 µs	100,000 words
20 ms/div	500 kS/s	2 µs	100,000 words
10 ms/div	1 MS/s	1 µs	100,000 words
5 ms/div	2 MS/s	500 ns	100,000 words
2 ms/div	5 MS/s	200 ns	100,000 words
1 ms/div	10 MS/s	100 ns	100,000 words
500 µs/div	20 MS/s	50 ns	100,000 words
200 µs/div	50 MS/s	20 ns	100,000 words
100 µs/div	100 MS/s	10 ns	100,000 words
50 µs/div	100 MS/s	10 ns	50,000 words
20 µs/div	500 MS/s	2 ns	100,000 words
10 µs/div	500 MS/s	2 ns	50,000 words
5 µs/div	500 MS/s	2 ns	25,000 words
2 µs/div	500 MS/s	2 ns	10,000 words
1 µs/div	500 MS/s	2 ns	5,000 words
500 ns/div	500 MS/s	2 ns	2500 words
200 ns/div	500 MS/s	2 ns	1,000 words
100 ns/div	500 MS/s	2 ns	500 words
50 ns/div	500 MS/s	2 ns	250 words
20 ns/div	500 MS/s	2 ns	100 words
10 ns/div	500 MS/s	2 ns	50 words
5 ns/div	500 MS/s	2 ns	25 words

Note 1. Equivalent sampling is not available when long memory is selected.

Note 2. The remaining data after subtracting the on-screen data count from memory length (100 kwordss) is the same as for short memory.

Appendix 3

AUTOSET measuring conditions

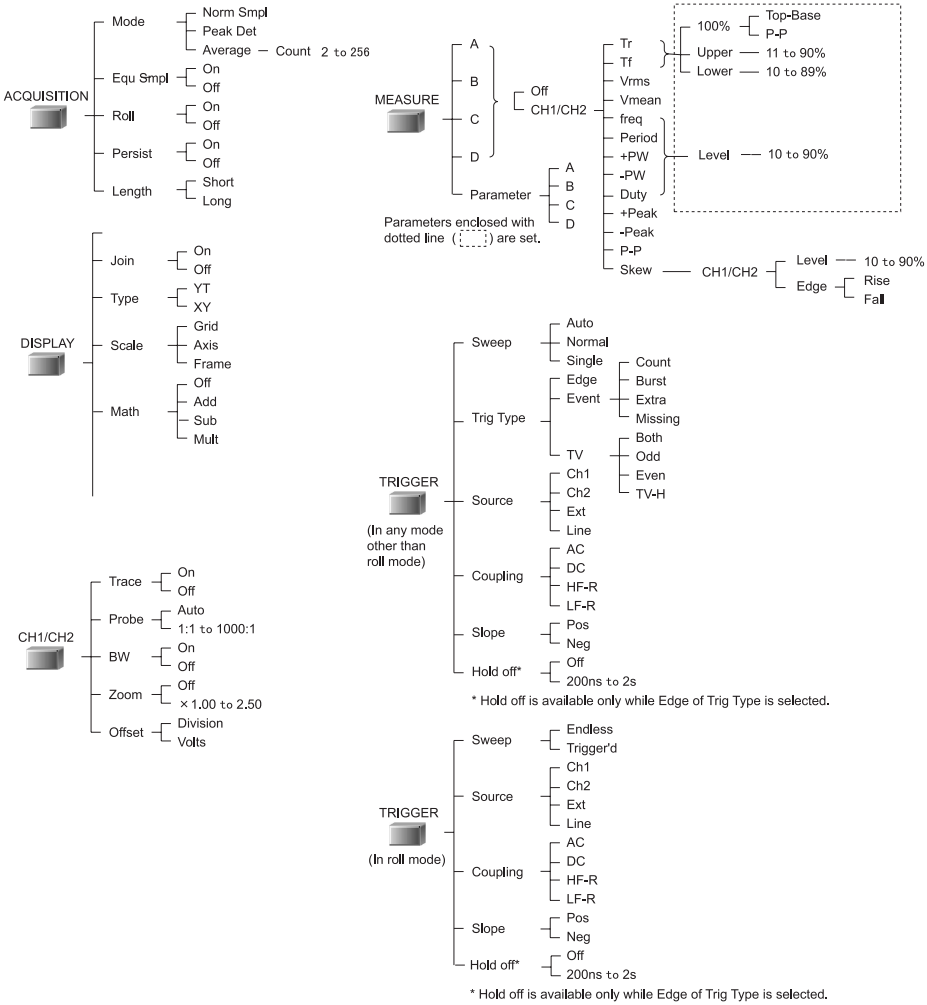
VERTICAL	Trace selection	CH1: Do not change the setting. CH2: Do not change the setting.
	VOLT/DIV	When frequency is 50 Hz to 50 MHz 2 mV to 10 V/div and amplitude approx. 2 to 7 div
	Zoom	Off
	Coupling	DC or AC
	Offset	When 1 trace is displayed: Near center When 2 traces are displayed: CH1: Near +2 div from center CH2: Near –2 div from center
	Offset setting	Division
	Probe ratio	Auto
	Band Width	Off
TRIGGER	Sweep Mode	Auto
	Trig Type	Edge
	Source	Detect CH1 and CH2, in that order.
	Coupling	DC
	Slope	+
	Level	Near center of waveform
	Holdoff	Off
HORIZONTAL	TIME/DIV	10 ms to 5 ns/div Approx. 2.5 to 5 periods of signal
	Delay	0.00
ACQUISITION	Mode	Norm Smpl
	Equ Smpl	Depends on TIME/DIV setting.
	Roll	Do not change the setting.
	Persist	Off
	Length	Do not change the setting.
DISPLAY	Join	Do not change the setting.
	Type	YT
	Math	Off
Others	REF waveform	Do not change the setting.

Appendix 4

<Panel setting> to be saved

All ACQUISITION menu items
All DISPLAY menu items except Display and Status
All MEASURE menu items
All CH menu items
All TRIG menu items

Detailed menu trees



Section 3 Daily Care

a. Maintenance method

- Cleaning

  Disconnect the power cord before cleaning to prevent electric shock. Wipe off the dirt on the surface of the instrument and cover with a small volume of water or mild detergent. Use only recommended cleaning solvents; failure to comply could result in discoloration or damage.

- Usable solvents or detergents: Water, detergent (diluted)
- Prohibited: Alcohol, gasoline, acetone, lacquer, ether, thinner, and cleansers containing ketones

- Cleaning display

  Remove dirt in the following manner:

  - Wipe off ordinary dirt with a soft cloth.
  - Wipe off stubborn dirt with a cloth dampened with mild detergent.

b. Automatic self-calibration

Automatically self-calibrates sensitivity, offset, and trigger level.

Procedure of automatic calibration

1. Through [FUNCTION control], set the UTILITIES menu to Config.
2. Pressing FUNCTION knob shows the Config menu.
3. Through [FUNCTION control], set the Config menu to Self Cal.
4. Pressing FUNCTION knob twice shows “Pressing FUNCTION again starts calibration” and pressing FUNCTION knob again in this condition starts calibration .

While automatic calibration is in progress, no panel operation is possible. Calibration takes approx. 4 minutes.

When calibration ends normally, “Calibration has ended” is displayed.

If “Failed to calibrate” is displayed, try again automatic calibration several times and if the same message still appears, contact our service representative.

Caution

While automatic self-calibration is in progress, do not apply any signal to the input connectors (CH1, CH2, EXT).

c. Recommended interval of calibration

Carry out calibration every 2000 hours if the instrument is in constant use and once a year in the case of normal use.

d. Automatic temperature control function

This instrument always checks ambient temperature. If the specified temperature is exceeded, the power is automatically turned off. The acceptable temperature and humidity ranges are as follows:

Temperature: 0°C to +40°C

Humidity: 80% RH (40°C) or below

e. Repair and return of repaired product

In the event of malfunction, contact our service representative. The product under warranty will be repaired free of charge.

When returning the product to repaire, please describe the model name, serial number, details of defect, name of person in charge, department and telephone number, etc.

f. Return

In order to avoid accidents during transportation, return the product packed in the original package or equivalent cushioned material. If an appropriate packing box is not available, consult with our service representative.

g. Storage and transportation

- Storage

  Do not store this instrument in the following places:

  - Under direct sunlight
  - In dusty environment
  - In corrosive gas atmosphere

  The conditions for storage of this instrument should be as follows:

  Temperature: –10°C to +60°C

  Humidity: 80% RH or less (0°C to + 60°C)

- Transportation

  When transporting this instrument, use original package or equivalent cushion & packaging.

h. Diagnostic guideline

If this instrument does not work or some abnormality is suspected, check the descriptions in Table 1.

Table 1 Diagnostic Guideline

Symptom	Check item	Action
Power switch turned ON but LCD does not light up.	Is the power cord connected to the AC receptacle?	Connect the power cord to the AC receptacle.
	When the power cord was connected to the AC receptacle, did the power switch remain ON?	Turn OFF the power switch and then turn it ON again.
	Does the fan motor on the back run?	If it, does the LCD backlight may be burnt out. Contact our service representative.
Power turns ON, then immediately turns OFF.	Is the instrument used within the operating temperature range (0 to 40°C)?	Use the instrument within the operating temperature range.
	Are the air ventilation holes on both sides or the exhaust fan motor air outlet clogged with some objects?	Remove the obstacle, turn OFF the power and turn it ON again after cooling.
Insufficient contrast	Is the instrument used at too a high or low temperature?	Adjust it with CONTRAST in the DISPLAY menu.
Signal is input, but no waveform appears.		Press the AUTOSET button.
	Is a wrong channel selected?	Turn ON the trace display of the channel to which the input signal is connected.
	Is the probe wire disconnected?	Replace the probe.
No triggering		Press the AUTOSET button.

Symptom	Check item	Action
No triggering	Is a wrong trig signal selected?	Set the trig signal input channel as the trig signal source.
Not possible to access floppy disk or ATA card.	Is the medium formatted?	Format the medium using Format in the SAVE/RECALL menu.
	Is the ATA card the one recommended by LeCroy?	Use the product recommended by LeCroy. See our homepage or contact your nearest our sales office.
Paper jam of built-in printer	When inserting roll paper, was the end of paper placed properly against the roller?	Cut the roll paper end straight and insert it beneath the roller.
	Is the roll paper the genuie one ?	Use the genuine roll paper.
Probe ratio is not set automatically.	Is the probe provided with a probe sense function?	Use the probe with a probe sense function.
Waveform sways.	Did the AC power supply voltage drop too much?	Use proper AC power supply voltage.
The time is not correct.	Did you set the time?	Set the time with DATE in the UTILITIES menu.
		The built-in battery may be aged. Contact our service representative.
Panel setting when power was turned OFF is not restored when power is turned ON.		The built-in battery may be aged. Contact our service representative.
The GP-IB menu is not displayed.	Did you insert the DS-534 GP-IB Card?	Use the DS-534 GP-IB Card.

How to restore the setting at time of purchase

1. Press the power switch to turn OFF the power.
2. While holding down the ACQUISITION button, press the power switch to turn ON the power.
3. “SHUT DOWN...” is displayed and the power is automatically turned OFF.
4. Turn OFF the power switch and then turn it ON again. All panel setting and internal memories are cleared and the factory setting is restored.

   Note that carrying out this procedure will also initialize the content stored in internal memory by operating the SETUP button or REF button.

Section 4 Specifications

Display

Form	5.8 inch diagonal LCD with high intensity backlight Color: blue
Display resolution	320 × 240 pixels (115.17 × 86.37 mm)
Display contrast	Automatic adjustment function available (arbitrary setting also possible)

Vertical section (Y axis) — Specification common to CH1 and CH2

Range	2 mV/div to 10 V/div (1-2-5 sequence), accuracy: ±2%
Bandwidth	DC to 100 MHz –3 dB Lower frequency limit in AC coupling: 10 Hz
Rise time	Approx. 3.5 ns
Input coupling	AC, DC, GND
Input RC	1 MΩ ±1.5%//20 pF ±2 pF
Maximum input voltage	±400 V (DC+ACpeak)
Bandwidth limiter	DC to 10 MHz –3 dB (can be selected for CH1, CH2 separately)
Offset	2 mV/div to 50 mV/div: ±1 V 100 mV/div to 500 mV/div: ±10 V 1 V/div to 10 V/div: ±100 V (Division and volts can be set for CH1 and CH2 separately)
Probe ratio	1:1, 10:1, 100:1, 1000:1 (1:1, 10:1, 100:1 can be recognized automatically)

Triggering

Sync system	Edge, Event, TV
Signal source	CH1, CH2, EXT, LINE
Coupling system	DC, AC, HF-Rej, LF-Rej
Polarity	Pos (positive polarity), Neg (negative polarity)
Trigger level range	±5 div

Trigger delay

Memory length	Vertical deflection range	Setting range
Short	5 ns/div to 1 ms/div	–5 div to +10 ms
	2 ms/div to 50 s/div	–5 div to +500 s
Long	5 ns/div to 20 ms/div	–5 div to +200 ms
	50 ms/div to 50 s/div	–5 div to +500 s

–500 s to +750 s (fixed) when waveform acquisition is stopped

Hold off	200 ns to 2 s, OFF

External Trigger Input

Input coupling	DC
Input RC	1 MΩ ± 1.5% // 20 pF ± 2.5 pF
Maximum Input Voltage	±400 V (DC+ACpeak)

Minimum trigger level

Frequency	CH1, CH2	EXT
DC to 10 MHz	0.5 div	50 mVp-p
10 MHz to 100 MHz	1.5 div	150 mVp-p

TV Trigger

TV system	NTSC, PAL, (SECAM)
Field selection	Both, Odd, Even, TV-H (Specify the number of lines for Both, Odd and Even)

Horizontal section (X axis)

Sweep time	5 ns/div to 50 s/div (1-2-5 sequence)
Sweep system	Auto, Normal, Single

Acquisition function

A/D conversion

Resolution	8 bits
Maximum sampling rate	500 MS/s
Acquisition memory	Short: 5 k words/CH Long: 100 k words/CH

Acquisition Mode

Roll	Short memory:	100 ms to 50 s/div
	Long memory:	2 s to 50 s/div
Norm Smpl.	Short/Long memory:	5 ns to 50 s/div
Peak Det.	Short memory:	2 µs to 50 s/div
	Long memory:	50 µs to 50 s/div
Equ Smpl.	Only at Short memory:	5 ns to 500 ns/div
Time resolution	Max. 40 ps (25 GS/s)	
Averaging	2 to 256 (power of 2) only when short	
Persistence	Yes	

Display

Type	Displays Y-T, X-Y in dedicated waveform display area (250×200 dots).
X-Y display	X: CH1, Y: CH2 fixed display
Interpolation	Linear
Expansion/reduction	
Vertical axis	Expanded/reduced within voltage sensitivity setting range
Zoom	Voltage sensitivity setting continuously expanded up to ×2.5
Horizontal axis	Expanded/reduced centered on the center of screen
Number of traces	Max. 3 traces (CH1, CH2, calculated waveform) + Max. 10 traces (reference waveform)
Waveform calculation	
Calculation type	CH1 + CH2, CH1 – CH2, CH1 × CH2
Scale display	Grid, Axis, Frame
Help function	Japanese HELP, English HELP
Comment	Display using alphanumerics, symbols is possible
Maximum number of characters	30 characters
Clock function	Displays year, month, day, hour, minute
Status display	Selects counter, time, automatic measurement or comment

Cursor Measurements and Automated Measurements

Channel	CH1, CH2
Type of cursors	Voltage difference, time difference and frequency, voltage difference and time difference, V at t
Type of measurement	Tr, Tf, Vrms, Vmean, freq, Period, +PW, –PW, Duty, +PEAK, –PEAK, P-P, Skew
Number of measurement	4 parameters (individual source channel selectable)

Frequency counter

Number of display digits/accuracy	5 digits, ±0.01%
Frequency measurement range	1 Hz to 100 MHz

Interfacing

RS-232C	
Baud rate	2.4 k, 4.8 k, 9.6 k, 19.2 k, 38.4 k, 57.6 k, 115.2 k
Data bits	7 bits or 8 bits
Parity	None (fixed)
Delimiter	Select from LF or CR/LF
GP-IB (Option)	DS-534 GP-IB Card
Address	0 to 30
Delimiter	LF, CR/LF

Panel setting/waveform data save/recall

SETUP	
SAVE/UNDO function	Save/undo (internal memory) of panel setting using single key
REF	
SAVE/CLEAR function	Display/erasure (internal memory) of reference waveform using single key
SAVE/RECALL function	
Medium	ATA card, floppy disk
Data type	Panel setting, waveform data (CH1, CH2 simultaneously)
Record format	Waveform data selectable from binary or ASCII Only binary for panel setting
Record count	Per data type and record format ATA card: Max. 9999 Floppy disk: Max. 200
Time stamp	Saves time and comment simultaneously (time unit: sec)
Auto Save function	Saves waveform data for every acquisition of waveform

Hard Coping

Type of copy devices	Built-in printer, Floppy Disk, ATA Card, Centronics
Output source	Screen, panel setting
Auto Copy function	Outputs screen hard copy for every acquisition of waveform
Internal printer	
Type	Line Thermal Printer
Paper width	80 mm×48ϕ, 75microns, Thermal paper
Paper feed	Available
Roll print	Available
Floppy, ATA Card	
Format	TIFF, BMP
Record count	Per data type and record format ATA card: Max. 9999 Floppy disk: Max. 200
Centronics	
Format	DPU-414, ESC-P09, ESC-P24, PC-PR201, TIFF, BMP

Calibration signal output

Waveform	Square waveform
Output voltage	0.6 V ± 1%
Frequency	1 kHz ± 0.01%

Other functions

Auto setup	With UNDO function
Self-calibration function	Calibrates sensitivity, offset, sync level.
LCD reverse video	White background, blue background

Power supply

Input voltage	100 to 240 VAC
Frequency	50/60 Hz
Power consumption	
When printer is operating	90 VA Max. (75 W Max.)
When printer is not operating	75 VA Max. (59 W Max.)

Weight, dimensions

Weight	Approx. 3 kg
Dimensions	215 (W) × 1700 (H) × 166 (L) mm (excluding protrusions)

Environmental conditions For indoor use only

Specification assurance temperature		10°C to 35°C
Operating	temperature	0°C to 40°C
	humidity	80% RH or less (at 40°C)
Storage	temperature	–10°C to 60°C
	humidity	80% RH or less (at 60°C)
Altitude		
In operation		2,000 m, atmosphere: approx. 79 kPa
Not in operation		15,000 m, atmosphere: approx. 12 kPa
Warm-up time		The specifications for this instrument are the assured values after more than 30 min of power on.

CE Declaration of Conformity

The Oscilloscope meets requirements of the EMC Directive 89/336/EEC for Electromagnetic Compatibility and Low Voltage Directive 73/23/EEC for Product Safety.

EMC Directive	: EN 61326-1:1997+Amd1:1998 EMC requirements for electrical equipment for measurement, control, and laboratory use.	
Electromagnetic Emission	: EN 55011:1998, Group 1, Class A Radiated and conducted emissions	
	EN 61000-3-2:1995	Harmonic Current Emission
	EN 61000-3-3:1995	Voltage Fluctuations and Flickers
Warning	: This is Class A product. In a domestic environment this product may cause radio Interference in which case the user may be required to take adequate measures.	
Electromagnetic Immunity	: EN 61000-4-2:1995*	Electrostatic Discharge (4 kV/8 kV contact/air)
	EN 61000-4-3:1996	RF-Radiated Electromagnetic Field (10 V/m)
	EN 61000-4-4:1995*	Electrical Fast Transient/ Burst (2 kV - AC mains; 1 kV - I/O signals)
	EN 61000-4-5:1995**	Surges (1 kV - Line-Line; 2 kV - Line-Ground)
	EN 61000-4-6:1996	RF Conducted Electro-magnetic Field (3 V – AC mains & I/O signals)
	EN 61000-4-8:1993	Power Frequency Magnetic Field (30 A/m)
	EN 61000-4-11:1994*	Mains Dips and Interruptions (0.5 cycle, each polarity/100 %)

*Meets Performance Criteria “B” limits — at certain test levels, during the disturbance, product undergoes a temporary degradation or loss of function of performance which is self recoverable.
**Meets Performance Criteria “C” limits — at certain test levels, during the disturbance, product undergoes a temporary degradation or loss of function of performance which requires operator intervention or system reset.

Low Voltage Directive	: EN 61010-1:1993+Amd2:1995 Safety Requirements for electrical equipment for measurement, control and laboratory use. The oscilloscope has been qualified to the following EN 61010-1 category: Protection Class I 300 V Installation (Over-voltage) Category II Pollution Degree 2
UL and cUL Certifications	: UL and cUL Listed (File E183826) UL Standard: UL 3111-1 Canadian Standard: CSA-C22.2 No. 1010.1-92

LeCroy

DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014:1998

Manufacturer's Name: LeCroy Corporation

Manufacturer's Address: 700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
USA

herewith declare that

Product(s) Name: LeCroy Literunner Digital Oscilloscope

Model Number(s): LP142

are in conformity with the provisions of the following EC directive(s), including the latest amendments, and with national legislation implementing these directives:

73/23/EEC Low Voltage Directive
89/336/EEC EMC Directive

and that conformity with Council Directive 73/23/EEC is based on

EN 61010-1: 1993	Safety requirements for electrical equipment for measurement control and laboratory use

and that conformity with Council Directive 89/336/EEC is based on

EN 61326-1: 1997	EMC requirements for electrical equipment for measurement control and laboratory use	
Emissions:	EN 55011: 1998 Class A	Conducted and Radiated Emissions
	EN 61000-3-2: 1995	Harmonic Current Emissions
	EN 61000-3-3: 1995	Voltage Fluctuations and Flicker
Immunity:	EN 61000-4-2: 1995	Electrostatic Discharge
	EN 61000-4-3: 1996	RF Radiated Electromagnetic Field
	EN 61000-4-4: 1995	Electrical Fast Transient/Burst
	EN 61000-4-5: 1995	Surge
	EN 61000-4-6: 1996	RF Conducted Electromagnetic Field
	EN 61000-4-8: 1993	Power Frequency Magnetic Field
	EN 61000-4-11: 1994	Mains Dips and Interruptions

By: R Kalyandrug
Product Compliance Manager

Place: LeCroy Corporation
700 Chestnut Ridge Road
Chestnut Ridge, NY 10977
USA

Date: May 25, 2000

European Contact:
Your local LeCroy Sales Office or

LeCroy Europe GmbH
Waldhofer Str 104
D-69123 Heidelberg
Germany

Tel: (49) 6221 82700
Fax: (49) 6221 834655

Warning: This is a Class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.

Index

U

V

W

X

Z

Others

LeCroy National Contact Numbers

Argentina: Search SA
1 777 4000
Australia: Philips Test and Measurement
2 9888 8222
Austria: Dewetron GmbH
0316 3070
Benelux: LeCroy UK, Ltd.
UU 1235 52y 288
Brazil:ATP/Hi-Tek Electronica Ltda
11 725 5822
Canada: Allan Crawford Assoc. Ltd.
Mississauga:905 890 2010
N. Vancouver:604 878 1002
Chile: Sistemas de Instrumentaction Ltda
2 6951137
Denmark: Lutronic ApS
43 42 9764
Eastern Europe: Elsinco GmbH, Vienna
1 815 04 00
Finland: Orbis OY, 0478 830
France: LeCroy Sarl,
1 69 18 83 20
Germany: LeCroy Europe GmbH,
6221 82700
Greece:IFIPCO, 1 67 25 970
Israel: Ammo, 3 547 2747
Italy: LeCroy S.r.l., Venice
41 456 9700
Mexico: Electroingenieria de Precision SA
559 7677
New Zealand: Philips Test and Measurement
649 8494 160
Norway: Avantec AS
22 76 38 70
Pakistan: Electro Tech Corp. Ltd.
21 493 9593/5171
Portugal:M.T. Brandao Lda.
2 830 27 09
Singapore: Abex Eng. Ltd.
841 2818
South Africa: Westplex Ltd.
11 787 0473
Spain:MT Brandao SL
1 803 1767
Sweden:MSS AB
8 544 107 00
Switzerland: LeCroy SA
North:62 885 8050
West:22 719 2228
Turkey:NETES
212 237 32 26
Unite Arab Emirates: Arab Engineers for
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