## **Digital Oscilloscope**

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## DS-5500A/DS-5400 Series

DS-5554A/5552A/5534A/5532A 5524A/5522A/5514A/5512A /5424/5422/5414/5412

## **Instruction Manual**

\* To view the Remote Control Manual, see the PDF file in the bundled CD disk.



#### IWATSU TEST INSTRUMENTS CORPORATION

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## Introduction

- ◇ Thank you for purchasing this IWATSU instrument. We, at IWATSU, ask you to operate this instrument at its optimal operating level for an extended period of time.
- Before using this instrument, thoroughly read this instruction manual to fully understand its contents. After reading the instruction manual, keep it in a safe place for future reference.
- This instruction manual describes cautions on handling, operating procedures, operation examples, and specifications of this instrument in detail. See the Remote Control Manual in the bundled CD disk for description of remote controls that use USB, LAN, or GPIB.
- Parts of the Instruction Manual for the probe (SS-101R, SS-0130R) are shown at the end of this manual. They describe caution points when handling the probe, as well as specifications, etc.
- ◇ In the content of this manual, it explains based on the DS-5500A series. The difference with the DS-5400 series is specified in each part. Especially, both series become common about the content of the explanation without the refusal.
- ◇ In the content of this manual, it explains based on 4CH model. When it is necessary to explain the obvious difference between 2CH model and 4CH model, this manual explains in each part.

## 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 symbol on the panel

٨	General	This symbol warns you to carefully read relevant descriptions of the instruction manual before operating a part with this symbol put in
<u> </u>	caution	order to protect the operator from injury and this instrument from damage.

#### Precautions

- $\diamond$  The contents of this instruction manual are subject to change without prior written notice due to improvement of the specifications and function.
- $\diamond$  No part of the contents of this instruction manual may be reproduced or transmitted in any form or by any means without written permission of IWATSU.
- $\diamond\,$  When disposing of this instrument, strictly observe local governmental regulations and/or rules.
- All product names and brand names in this manual are described only for the purpose of identification: i.e., they are registered trademarks belonging to individuals and corporate bodies.
- $\diamond$  For questions about this instrument, contact lwatsu at the address listed at the end of this manual or our sales distributors.

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## 🕂 Warnings

• Do not use this instrument in an environment where any explosive gas exists.

Doing so may cause an explosion.

• If any smoke, odor, or unusual noise is found, immediately turn OFF the power and disconnect the power plug from the power outlet completely.

If the instrument is used continuously without taking of any corrective actions, this may cause an electric shock or a fire. After the POWER switch has been put in the standby mode and the power plug has been disconnected from the power outlet, contact lwatsu office or our sales distributors for repair. Never attempt to repair the instrument by the customer. Failure to do so may cause a serious accident.

• Pay special attention so that any water does not enter this instrument or the instrument does not get wet.

If the wet instrument is operated, this may cause an electric shock or a fire. If water enters, put the POWER switch in the standby mode and disconnect the power plug from the power outlet, and then contact lwatsu office or our sales distributors for repair.

- Do not touch the plug of the power cord by wet hand. Doing so may cause an electric shock.
- Do not place this instrument on an unstable place, such as a shaky stand or an inclined place.

If this instrument is placed on an unstable place, it may be fallen down or laid down, causing an electric shock, a personal injury, or a fire. If this instrument is fallen down or the cover is damaged, put the POWER switch in the standby mode and disconnect the power plug from the power outlet, and then contact lwatsu office or our sales distributors for repair.

#### Do not remove any cover or panel.

High-voltage parts exist inside the instrument. If you touch such part, this may cause an electric shock. If the inspection, calibration, or repair is required, contact lwatsu office or our sales distributors for such work.

# • Great care should be taken when measuring a high-voltage.

If you touch a high-voltage part during measurement, this may cause an electric shock.

#### Warnings (Continued)

#### Always use a 3-core power cord.

If a 3-core power cord is not used, this may cause an electric shock or a malfunction.

- When the power is supplied from a 2-wire power outlet to the instrument through the 3-core/2-core conversion adaptor, ground the grounding terminal of the 3-core/2-core conversion adaptor.
- When the 3-core power cord supplied with the instrument is used to supply the power from a 3-wire power outlet, ground the grounding line of the power cord.

#### Always use the instrument in a specified power voltage range.

If the instrument is operated in a voltage range other than that specified, this may cause an electric shock, a fire, or a malfunction. Table 1 shows the allowable power voltage and frequency ranges.

#### Table 1 Power Supply Specifications

Frequency	Voltage Range		
Range			
47 to 63 Hz	90 to 264 $V_{\text{RMS}}$		
380 to 420 Hz	90 to 132 $V_{\text{RMS}}$		

- Single-phase, 100 to 120 V (±10%), AC50/60/400 Hz (±5%)
- Single-phase, 200 to 240 V (±10%), AC50/60 Hz (±5%)

The power supply specifications are shown on the rear panel.

#### • When handling the power cord, strictly observe the following cautions.

Failure to do so may cause an electric shock or a fire. If the power cord is damaged, contact lwatsu office or our sales distributors for repair.

- Do not modify the power cord.
- Do not pull the power cord.
- Do not bend the power cord forcibly. Do not heat the power cord.
- Do not twist the power cord.
- Do not bundle the power cord.
- Do not let the power cord get wet.
- Do not place a heavy object on the power cord.

#### Do not modify or repair this product.

Modifications or repairs made by users may result in an electric shock, a fire, or a malfunction. This product cannot be repaired by users. Do not open it to attempt repairs. For repairs, contact lwatsu office or our sales distributors. Note that modified products will not be accepted for repairs.

• If a lightning occurs near the instrument operation place, immediately disconnect the power plug from the power outlet.

A lightning may cause an electric shock, a fire, or a malfunction.

Warnings (Continued)

# • Connect the grounding lines of the probe and input connector to the grounding potential (grounding line) of an object to be measured.

If the grounding line of this instrument is connected to an electric potential other than the grounding potential of an object to be measured, this may cause an electric shock or an accident (object to be measured, this instrument, or other connected unit is broken). (See the following Fig. [Example of improper connection].)

[Example of improper connection]



When measuring a floating potential, it is recommended to perform the measurement by means of the differential method (example shown in the Fig. below shows the subtraction (CH1 - CH2)). (See the following Fig. [Example of proper connection].) [Example of proper connection]



## • Do not put any metallic or flammable foreign object through the ventilation port.

If any metallic or flammable foreign object is put through the ventilation port, this may cause a fire, an electric shock, or a malfunction. If a foreign object has entered, set the power switch to standby, then remove the plug from the outlet, and then contact the lwatsu office or our sales distributors for repair.

• Insert the power plug into the power outlet after checking that any dust is not sticking to the power plug. Additionally, disconnect the power plug or power adaptor from the power outlet once every six months to one year, and inspect and/or clean the power plug.

If the power plug is contaminated, this may cause an electric shock, a fire, or a malfunction.

Warnings (Continued)

Do not allow metal objects, etc., to touch the metal blades of the power plug. Contact with a metal object, etc., may cause a fire or electric shock. Do not use multiple-connection outlets. Power strips and other multiple-connection outlets may cause a fire or overheating. Do not place containers of water or chemicals, small metal objects, etc. near this instrument. If the contents are spilled and enter the product, it may cause a fire or an electric shock. If water, chemicals, or metal objects enter the product, set the power switch to standby, remove the plug from the outlet, and then contact lwatsu office or our sales distributors for repair. Do not use this instrument if it is not functioning correctly. Using a malfunctioning product (due to dropping, etc.) may cause an electric shock or a fire. If the product is not functioning correctly, set the power switch to standby, remove the plug from the outlet, and then contact lwatsu office or our sales distributors for repair. Do not place this instrument in an area where frequent vibrations or impacts occur. If this instrument is dropped or overturned, it may cause a physical injury. If this instrument is dropped, it may result in a physical injury or property damage. Before transporting this instrument, remove all devices under testing, probes, and cables, then grasp the center of the unit with both hands and carry it carefully to avoid dropping.

## **≜** Cautions

#### Installation place

• Always use this instrument in a specified operating environment.

If this instrument is operated in an operating environment other than that specified, this may cause a malfunction.

Use this instrument only indoors.

Specification guarantee temperature and humidity ranges:

+10°C to +35°C, 80%RH or less (No dew condensation allowed.)

Operation guarantee temperature and humidity ranges: 0°C to +40°C,

5 to 80% RH or less (30°C or less, no dew condensation allowed) Upper limit: 55% RH (40°C, no dew condensation allowed)

• Do not place any object close to the ventilation port or fan of this instrument.

If any object is placed close to the ventilation port or fan of this instrument, the air ventilation is blocked and the internal temperature increases, causing a fire or malfunction.

• Keep an appropriate space at the rear and on both sides of this instrument.

If this instrument is put inside the rack mount or on other measuring instrument, carefully check the temperature rise. If the temperature rises excessively, this may cause an operation fault or a specification fault.

• Do not use or store this instrument in a location that is humid (bathroom, etc.) or dusty.

Placing it in a humid or dusty location may cause an electric shock or fire.

- Do not place this instrument in a location next to a worktable or humidifier, where it may be exposed to oily smoke or steam. Doing so may cause an electric shock or fire.
- Do not place this instrument in the location where direct sunshine strikes and the location where humidity is high.

Doing so may cause the going up of internal temperature or a fire.

## **∕**€ Cautions

#### When measuring

- Do not apply a voltage other than that specified to an input terminal (CH1, CH2, CH3<sup>Note 2</sup>, CH4<sup>Note 2</sup>, EXT TRIG). Doing so may cause a malfunction. The following shows the maximum voltage levels that can be input.

  - 50  $\Omega$ : 5 Vrms<sup>Note 1</sup> (500 MHz/350 MHz model only)

[Note 1]: The maximum voltage that can be input may decrease depending on the frequency or high-voltage pulse of the input signal.

[Note 2]: Description of CH3 and CH4 is for 4CH model only.

• When connecting the probe or measurement cable, care should be taken so that you do not pull such cable. If such cable is pulled, this may cause the instrument to be laid down.

If this instrument is laid down, this may cause an electric shock, a personal injury, a fire, or a malfunction.

#### Power supply

• The POWER switch located at the lower left portion of the front panel is intended to control the operation status of this instrument.

This instrument provides two basic modes, "ON" and "STANDBY". In the ON mode, the power is supplied to all parts of this instrument and the instrument is ready for operation. In the STANDBY mode, the power is turned OFF except for specific standby circuit.

When the power cord is connected to the power outlet even though the POWER switch is turned OFF, the standby circuit slightly consumes the electric power as shown below. Unplug the power cord to fully shut off the power.

Standby power: 2 Wmax

• Connect or disconnect the power cord after the POWER switch has been turned OFF completely.

If the power cord is connected or disconnected with the power supplied, this may cause an electric shock or a malfunction.

• When disconnecting the power cord from the power outlet, always hold the power plug firmly.

If the power cord is pulled, the cord is damaged, causing an electric shock or a fire.

• Do not use the power cord provided with product for other products. In accordance with electrical safety regulations, the power cord provided with this instrument is not to be used with other electrical equipment.

## <u>∕</u>Cautions

#### Handling

• Do not use a damaged power cord, cable or probe.

Doing so may cause an electric shock or a fire.

- Do not place any object on this instrument.
- Do not use this instrument if it is faulty.

If the faulty instrument is used continuously, this may cause an electric shock or a fire. If any fault is found, contact lwatsu office or our sales distributors for repair.

- If this instrument is not used for an extended period of time, always disconnect the power plug from the power outlet to ensure the safety. If the power plug is not disconnected, this may cause an electric shock or a fire.
- The liquid crystal display is a touch screen method. In the sharp one such as the pointed one and penpoints (Silicon system rubber is excluded), never do the touch operation. Do the touch operation with the finger or the resin pen (silicon system rubber).

The liquid crystal screen might be damaged when the liquid crystal screen is touched and operated by the sharp one, and it cause the breakdown.

#### Carrying

- If this instrument drops, its shock may cause a personal injury or damage to other unit. Always hold the center of the handle firmly so that the instrument does not drop.
  - (1) Disconnect the cables.
    - a) Disconnect the power cord. (Wind the power cord to bundle it.)
    - b) Turn the probe connector counterclockwise to disconnect it.
  - (2) Hold the handle.
    - a) Raise the handle.
    - b) Hold the center of the handle.



## <u>∧</u>Cautions

#### Transportation

• When transporting this instrument, remove the power cord, cables, probes, etc. and use the original packing materials at time of purchase, or similar materials.

If a large vibration or shock is applied to this instrument during transportation, the instrument may malfunction, causing a fire. If appropriate packing and cushioning materials are not available, contact lwatsu office or our sales distributors for repair.

#### Other

• Prior to maintenance, unplug the power plug from the outlet for safety. Use a cloth to wipe away any moisture.

Cleaning this instrument while the power plug is connected to the outlet or while the instrument is wet may cause an electric shock or a malfunction.

• It is recommended that you contact lwatsu office or sales distributors to check and clean the interior, calibrate, etc., about once per year.

Long-term use of an instrument having a dirty or dusty interior may cause a fire or injury.

## Checking the Items Included in the Package

When you receive the product, check that the following items are included correctly while referring to the list of components and the component diagram shown below. If any item is missing or damaged during transportation, immediately contact lwatsu office or our sales distributors.

#### List of components

Model Name		DS-5554A/5534A	DS-5552A/5532A	DS-5524A/5514A /5424/5414	DS-5522A/5512A /5422/5412		
	Main unit		1				
	Probe (SS-0130R)			4	2		
	Probe (SS-101R)	4	2				
Acces-	es- Power cord 1						
sories	(3-core type)						
	Manual	Instruction Manual & Remote Control Manual CD: 1					
	Mariuai	User's Guide: 1					
	Front panel cover:						
Cord strap: 1							
	Contacts for sales network: 1						

#### Probes

• SS-101R (for DS-5554A/5552A/5534A/5532A)



#### Accessories Lists

	Item	Quantity
1	Arrow tip	1
2	Grounding lead (11 cm)	1
3	Grounding attachment	1
4	IC test tip	1
5	Color ring (red, yellow, blue, green)	4×2
6	Screwdriver for adjustment	1

• SS-0130R (for DS-5524A/5522A/5514A/5512A/5424/5422/5414/5412)



#### Accessories Lists

Item	Quantity
Arrow tip	1
Grounding lead	1
Grounding attachment	1
IC test tip	1
Color ring (red, yellow, blue, green)	4×2
Screwdriver for adjustment	1



## **Control of Instrument**

When disposing of this instrument, it is absolutely necessary to correctly recycle or dispose of the instrument according to the laws and regulations defined in the region. To dispose of this instrument, ask an appropriate recycle company according to the laws and regulations defined in the region.

## **Requests for Repair or Calibration**

If this instrument malfunctions, send it back to IWATSU's service office. If the instrument malfunctions within the guarantee period, IWATSU will repair it free of charge.

When sending back the instrument for repair, clarify the product name, serial No. (label is attached to the back plate of this instrument), contents of fault, name of person in charge, company name or department name, and phone number.

## **About Instruction Manual**

This instruction manual mainly describes functions and operation methods of the ViewGo II (DS-5500A/DS-5400) Series of digital oscilloscope. This instruction manual is organized as listed below.

<User's Guide>

Chapter 1 Overview of ViewGo II (DS-5500A/DS-5400) Series

This chapter introduces the overview of this product and its features, and compares various models.

Chapter 2 Description of Basic Operation

This chapter mainly describes the preparations necessary to quickly use this instrument and basic operating procedures.

<Chapters of description for functions and operating procedures>

Chapter 3 Functions and Operating Procedures

This chapter describes functions and how to operate them so that you can understand this instrument to correctly operate it.

Chapter 4 Math Function

This chapter describes calculation functions, such as addition, subtraction, multiplication, FFT, integral, and derivative, and how to operate them.

Chapter 5 Daily Inspection

This chapter describes the following items.

- a) Inspection and storage
- b) Calibration
- c) Troubleshooting
- d) Returning to initial settings when this instrument has been purchased
- Chapter 6 Specifications

This chapter describes the specifications of this instrument and applicable standards.

Probe SS-101R Instruction Manual

Probe SS-0130R Instruction Manual

Product Warranty

## **About Help Functions**

This instrument includes help functions that explain the function of each button or knob on the panel. To use this help function, press the [HELP] button, and then operate a button or knob you want to know the function. The function and operation of this button or knob are shown on the screen. If you operate other button or knob, the HELP function is then cancelled.

For details, see "2.5.3 HELP function" in the User's Guide, or "3.17 HELP Menu" in this manual.

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## Chapter 1 Overview of ViewGoll (DS-5500A/DS-5400) Series

The DS-5500A series become the successor of the DS-5500 series by the product that add the function further based on the DS-5500 series.

The DS-5400 series become the successor of the DS-5300 series by the product that delete the function based on the DS-5500 series to become equivalent to the DS-5300 series function.

#### 1.1 ViewGo II (DS-5500A/DS-5400) Series Applications

ViewGo II (DS-5500A/DS-5400) Series products can be used in the following applications.

- General-purpose machine for a wide range of engineers, students, and inspection department and maintenance-related departments at manufacturing facilities
- Observation of video signal waveforms, design and evaluation of digital circuits
- Design and evaluation of power electronics devices
- · Design and evaluation of robot, motors, and other mechatronics devices

#### 1.2 Features

#### 1.2.1 Easy to see

ViewGo II (DS-5500A/DS-5400) Series oscilloscopes provide beautiful color displays on large screen even if it is small.

A full array of control functions provide fine-tuning for the setups you want.

- (1) 7.5-inch VGA color LCD screen, 640×480 dots, versatile color display
- (2) Screen area occupies about one-third of front side of case.
- (3) Good contrast, bright and clear.
- (4) Brightness of the observation waveform displayed on the screen can be adjusted.
- (5) Three-level brightness adjustment for backlight
- (6) Intensity of waveform display area grid can be controlled.

#### 1.2.2 Easy to use

The following features are provided to enhance ease of use. (See Figure 1-1)

(1) Touch screen

To open a menu, either operate a button or simply touch the target range information of CH and Math on the touch screen. Menus that are open can also be touched to open sub menus or to switch to another menu. (Touch screen is solely for menus.)

(2) Independent CH and Math setups

For VERTICAL (vertical axis setups), there are dedicated offset and range adjustment knobs for each CH and Math setup, and setups can be entered without even using the CH and MATH buttons.

(3) Multi-language display

All on-screen menus, pop-up lists, messages, and help screens can be displayed in any of Japanese, English, and Chinese.

(4) HELP function

Press the HELP button, then immediately press or turn the target button or knob to open a display on the LCD screen that explains the functions and operation of the buttons and knobs on the front panel.

(5) USB interface

USB jacks are provided on the front and rear panels. The USB interface jacks on the front panel are provided to connect USB memory for easy output of this product's screen data. The USB interface terminals on the rear panel can be used to connect a

PictBridge-compliant printer, and when a USB driver is installed in the computer, remote control of the USB interface becomes possible.

(6) CLEAR function

Replay function, persistence waveforms, results of automatic measurement, judgment results and judgment frequencies of Pass/Fail and logs of logging function can be cleared (initialized) only by pushing CLEAR execute button once.



Figure 1-1 Features of ViewGo II (DS-5500A/DS-5400) Series

#### 1.2.3 High speed (fast)

- (1) The software starts up about three seconds after power-on, and can be used right away.
- (2) Fast waveform refresh speed. (Maximum is 5000 waveforms per second)
- (3) During remote control (LAN control), the time until waveform data acquisition is completed can be shortened by using commands that do not output a waveform display.

\*As for LAN (TCP/IP) interface, it is possible for only DS-5500A series to be controlled.

#### 1.3 Comparison of Models in the ViewGo II (DS-5500A/DS-5400) Series

Table 1-1, 1-2 compare the specification features of ViewGo II (DS-5500A/DS-5400) Series models. Only product models with differing specifications are listed in Table 1-1, 1-2. For further description of product specifications, see Chapter 6 Specifications.

Model	DS-5554A	DS-5534A	DS-5524A	DS-5514A	DS-5552A	DS-5532A	DS-5522A	DS-5512A	
No. of channels		4				2			
Frequency bandwidth	500 MHz	350 MHz	200 MHz	100 MHz	500 MHz	350 MHz	200 MHz	100 MHz	
Frequency bandwidth	200kHz	z∕2MHz	200kH;	200kHz/2MHz		200kHz∕2MHz		200kHz/2MHz	
limit <sup>Note 1</sup>	∕20MHz	./100MHz	/20	0MHz	∕20MHz	/100MHz	/20	∕20MHz	
Maximum sampling	2 GS/s	(interleave	Note 3)	1.08/0	2 GS/s	(interleave	Note 3)	1 0 8/0	
rate	1 GS/s	(non-interle	eave)	1 65/5	1 GS/s	(non-interle	eave)	1 63/5	
Time base range	500 ps /div to 50 s/div	1 ns/div to 50 s/div	2 ns/div to 50 s/div	5 ns/div to 50 s/div	500 ps /div to 50 s/div	1 ns/div to 50 s/div	2 ns/div to 50 s/div	5 ns/div to 50 s/div	
Coupling <sup>Note 2</sup>	GND, DC	1 MΩ,	GND, D	C 1 MΩ,	GND, DC 1 MΩ,		GND, DC 1 MΩ,		
	AC 1 MΩ, DC 50 Ω		AC 1 MΩ		AC 1 MΩ, DC 50 Ω		AC 1 MΩ		
Vertical axis sensitivity	2 mV/div 2 mV/div (50 Ω)	to 10V/div to 2 V/div	2 mV/div	to 10 V/div	2 mV/div t 2 mV/div t (50 Ω)	to 10V/div	2 mV/div	to 10 V/div	
	• 1 MΩ: 40	0 Vmax	• 1 MΩ: 400	Vmax	• 1 MΩ: 400	) Vmax	• 1 MΩ: 400	) Vmax	
Maximum input	(DC + pe	Jak AC ≤ 5 TI	CAT I	<u>(</u> AC ≤ 5 K⊓ <i>2)</i>	(DC + pe kHz) CAT	sak AC ≤ 5 FI	(DC + p kHz) CA1	eak AC ≦o TI	
voltage	• 1 MΩ: 30	0 Vmax	• 1 MΩ: 300	Vmax	• 1 MΩ: 300	) Vmax	• 1 MΩ: 300	) Vmax	
vonage	(DC + pe	eak AC ≤ 5	(DC + peal	$k AC \leq 5 kHz$ )	(DC + pe	ak AC ≤ 5	(DC + pe	ak AC ≤ 5	
	kHz) CA	тп	CAT II		kHz) CAT	C II	kHz) CAT	ГП	
	• 50 Ω: 5	Vrms			• 50 Ω: 5 \	√rms			

Table 1-1 ViewGo II (DS-5500A) Series Specification

Note 1. Low-pass filter setups can be made at or below the frequencies listed in the table.

- Note 2. In models that have a frequency bandwidth of 350 MHz or 500 MHz, coupling with 50  $\Omega$  of input impedance can be set. Specifications are also listed for vertical axis sensitivity and maximum input voltage when coupling with 50  $\Omega$  of input impedance.
- Note 3. This specification can be achieved by using the plural AD converters for per channel. However, it is only 1CH to be able to do 2GS/s simultaneous observation by 2CH model (DS-5552A/5532A/5522A). It is 2CH or less to be able to do 2GS/s simultaneous observation by 4CH model (DS-5554A/5534A/5524A). And in the DS-5554A/5534A/5524A models, the combinations are CH1 and CH3, CH1 and CH4, CH2 and CH3, and CH2 and CH4.

Model	DS-5424	DS-5414	DS-5422	DS-5412
No. of channels	4		2	
Frequency bandwidth	200MHz	100MHz	200MHz	100MHz
Frequency bandwidth limit	200kHz/2MHz/20MHz			
Maximumsampling rate	2 GS/s (interleave <sup>Note1</sup> )	1GS/s	2 GS/s (interleave <sup>Note1</sup> )	1GS/s
Time base range	2ns/div $\sim$ 50s/div	5ns/div~ 50s/div	2ns/div $\sim$ 50s/div	5ns/div~ 50s/div
Coupling	GND、DC1MΩ、AC1MΩ			
Vertical axis sensitivity	$2 \text{ mV/div} \sim 10 \text{ V/div}$			
	• 1MΩ : 400 Vmax			
Maximum input voltage	(DC+peakAC≦5kHz) CAT I			
Maximum input voltage	• 1MΩ : 300 Vmax			
	$(DC + peakAC \leq s)$	5kHz) CAT II		

Table 1-2 ViewGo II (DS-5400) Series Specification

Note 1. This specification can be achieved by using the plural AD converters for per channel. However, it is only 1CH to be able to do 2GS/s simultaneous observation by 2CH model (DS-5422). It is 2CH or less to be able to do 2GS/s simultaneous observation by 4CH model (DS-5424). And in the DS-5424 model, the combinations are CH1 and CH3, CH1 and CH4, CH2 and CH3, and CH2 and CH4.

## Chapter 2 Description of Basic Operation

This chapter mainly describes the basic operations of the ViewGo II (DS-5500A/DS-5400) Series.

#### 2.1 Operation Flow

The following figure describes the overall flow of ViewGo II (DS-5500A/DS-5400) Series operations to help get new users acquainted with ViewGo II (DS-5500A/DS-5400) Series. Some of the items described in this manual are omitted here. For further description of these items, see the section of this manual that describes functions or operation descriptions marked with  $\blacktriangleright$  in this figure.



Figure 2.1 Operation Flow of This Product

#### 2.2 Installation of Equipment

Before using this product, install it in a location that meets the following environmental requirements.

#### 2.2.1 Installation requirements

· Flat, horizontal location

Install this product in a stable location that is flat and horizontal on all four sides. If the installation site is not stable, this product may fall over or rock, possibly causing injury and/or property damage.

- Well-ventilated location
   This product has ventilation holes (at right, facing the front) and air exhaust outlets (at left, facing the front) on both sides. To prevent the internal temperature from rising excessively, maintain ample space around this product so as not to inhibit the flow of air through the ventilation holes and exhaust outlets.
- Guaranteed specification and guaranteed operating temperature and humidity ranges Guaranteed specification temperature range: +10°C to +35°C

Guaranteed operating temperature and humidity ranges: 0°C to +40°C, 5% to 80% RH (30°C or less, no dew condensation allowed) Upper limit: 55% RH (40°C, no dew condensation allowed) Caution) Condensation may occur when moving this product from an environment with low temperature and humidity to one with high temperature and humidity, or when the equipment is otherwise exposed to rapid changes in temperature. In such cases, raise the ambient temperature gradually, and allow the equipment to adjust to the ambient temperature before using it.

#### 2.2.2 Installation position

This product can be set flat on a horizontal surface or can be tilted using its stand. Of the four legs on the product base, the two front ones can be opened forward to provide a tilt (about 10°) such as shown in part (b) of Figure 2.2, to enable easier viewing. These two front legs are normally folded back, and are pulled open when used.



Figure 2.2 (a) Normal Position



Figure 2.2 (b) Tilted Position on Stands

#### 2.3 Power Supply Connection, Power Switch ON/Standby

This product's power supply connection and power cord are described in the warnings and caution points listed in front matter pages i to vi. Be sure to read these warnings and caution points before connecting the power supply.

Power supply connection and power switch ON/Standby operations are described briefly as follows.

#### 2.3.1 Power cord connection Operation Steps

1. Check that the power switch in the lower left corner of the front panel is set to standby mode.



Figure 2.3 Power Switch ON/Standby

- Plug the supplied power cord into the AC input terminal (~LINE) on the rear panel. (See Figure 2.4)
- 3. Plug the other end of the power cord into a power outlet. (See Figure 2.4)



Figure 2.4 Power Supply Connection

#### 2.3.2 Power switch ON/Standby modes

The power switch is in the lower left corner of the front panel, as shown in Figure 2.3 (previous page). Press this push-button once to set ON mode and again to set Standby mode.

#### Operation during ON mode

Set the power switch to ON mode, and a waveform display appears after a few seconds.

Memo) For best precision in taking measurements, allow a warm-up period of at least 20 minutes after turning on the power.

#### Operation during Standby mode

When the power switch is in Standby mode (and even when the power cord is unplugged), the most recent setups are retained in memory. These setups are automatically loaded from memory after the next power-on.

\_\_\_\_\_

Memo) However, the setting condition of Auto Calibration is not memorized. Whenever the power supply is turned on again even if Auto Calibration is set off, Auto Calibration is set on.

8

#### 2.4 Names and Functions of Parts

This section describes the names and functions of parts comprising this product's front and rear panels, with reference to Table 2.1 and Table 2.2.

#### 2.4.1 Front panel



(Example of front panel for DS-5554A)

	Table 2.1 Names and Functions of Front Panel Parts			
N⁰	Name	Description	Section	
1	Display	This shows the observed waveform and related readouts,	▶ 3.1	
		menus, readouts of channel-specific or Math-specific, trigger	▶ 3.2	
		information, and status messages.		
		The 7.5-inch VGA color LCD screen has resolution of 640×480		
		dots, with rich colors (16 or more) used in waveforms and		
		channel information.		
2	POWER switch	This switch turns on the power for this product. When pressed,	▶2.3	
		it is in ON mode, and when unpressed it is in Standby mode.		
3	USB terminal	This terminal is used to send and receive data with external	▶ 3.8	
		(USB) memory.	▶ 3.14	
		• Input function: upgrade software and retrieve data and setups.	► Chapter 6	
		Output function: external output of screen data, setups, etc.		
4	INPUT terminal	From left to right on the front panel, these are the signal input	▶3.3	
		(BNC) terminals for CH1, CH2, CH3, and CH4 (CH3 and CH4 in	▶ 3.9	
		4CH models only).	► Chapter 6	
		<ul> <li>Input spec: printed on lower corner of panel.</li> </ul>		
		• During XY waveform measurement, X is assigned to CH1 and		
		Y to CH2.		
5	EXT terminal	This terminal is for input of external trigger signals and clock	▶ 3.6	
		signals.	Chapter 6	
		Input spec: printed on lower right corner of panel.		
6	CAL terminal	This terminal is for output of calibration signals. The upper part	▶2.6	
		is for CAL signal output and the lower part is the GND. It is	Chapter 6	
		mainly used for probe calibration.		
-		The signal is a 3.0 Vp-p, 1 kHz square wave.		
1	AUTO SETUP	When this button is pressed, vertical axis sensitivity, time axis,	▶ 2.6.2	
	execute button	and trigger conditions are all set automatically, and the	▶ 3.16	
		observed waveform and menu (right part of screen) are		
		displayed. When "Undo" is selected at the bottom of a menu,		
0		the setups prior to AUTO SETUP are restored.	<b>N</b> 0 7	
0	PRINT execute	when the USB memory is connected with the terminal USB of 3	► 3.7	
	button	and the button is pushed, the hard copy data of the screen can	$\mathbf{>}3.0$	
		connected with the terminal USB of the back panel (Pefer to 5	2.4.2	
		in Table 2.2), it is possible to output		
٩		This closes the many at the bettern of the biorarchy shown in the		
9		I have right corpor of the screen, and returns to the many on the		
		next higher level. If there is no higher-level menu, it simply		
		closes the menu. (The similar operation can be done even if	(▶311)	
		touching the title part of each menu )	( = 0.1.1)	
10	HELP	Once the HELP button is pressed, the Help function will show a	▶253	
	menu button	help window regarding the function and operation of the next	▶ 3.17	
		button or knob to be used. Afterward, operate any button or		
		knob other than the HELP button to cancel the help function.		
11	CLEAR	When the button is pushed, the following contents are cleared.	▶3.18	
	execute button	•Waveform of Replay function •Average processing	▶3.10	
		•Persistence waveform	► 3.10 ► 3.0	
		•Result of Measure (Max, Min, Num)	▶ 3.9	
		•Judgment result and judgment frequency of Pass/Fail	▶3.12	
		•Log of logging function		
L		* The function of Pass/Fail and Logging are installed only in the		

		DS 55004 Series	
12		This know is for the CURSORS function described in 17 below	▶37
12		and is used to move the on screen surser vertically and	► 3.7
	knob	horizontally. Turn the knob clockwise to move the cursor in the	► 3.11
	KIIOD	nonzontany. Full the knob clockwise to move the cursor in the	
		positive axial direction, and counter-clockwise to move it in the	
		function turn this know to evole through the turner of european	
		that can be used and extent and	
		that can be used and select one.	
		when entering a filename for the UTILITIES function described	
		In 14 below, turn this knob to cycle through characters,	
		numbers, and symbols, and press the knob each time to enter	
		In other menus, this knob is used to set up items that are	
40		marked as "ADJUST".	
13	REPLAY	The REPLAY lamp lights in the state of Stop. The replay screen	▶3.10
	adjust knob	(the first page to the latest page) can be selected by turning the	
		knob at the REPLAY turning on the lamp.	
14	UTILITIES	Press this button to open a menu in the right part of the screen,	▶ 3.7
	menu button	where you can set and enter the following items.	
		<ul> <li>Print: Detailed output setups for USB memory or printing</li> </ul>	
		Remote: Select the interface format.	
		Config: Select the language, date, measurement units, power	
		management options, audible beep sounds, panel lock options,	
		and grid intensity setups.	
		Other: View or set calibration, status display, software	
		upgrades, options, etc.	
15	DISPLAY	Press this button to open a menu in the right part of the screen,	▶3.9
	menu button	where you can set and enter the following items.	
		Type: Selects YT waveform or XY waveform	
		Vector: Selects whether to set vectors connecting	
		waveform data	
		<ul> <li>Waveform Intensity: Selects waveform brightness</li> </ul>	
		Persist Time: Selects waveform persist time	
		Color Gradation: Selects waveform display colors and	
		spectrum	
16	SAVE/RECALL	This button saves each channel's waveform data, SETUP data,	▶3.14
	menu button	and REF data to USB memory or internal memory (SAVE), or	
		retrieves them (RECALL).	
17	CURSORS	This button moves the cursor horizontally or vertically in the	▶3.11
	button	waveform display area, to enable setting of detailed waveform	
		information. Measurement results are shown in the readout	
		area, and channel-specific data is shown in the waveform	
		readout area.	
18	MEASURE	Auto measurement can be used for up to four items listed below	▶ 3.12.1
	button	at the same time.	
		• Horizontal axis: rise/fall time, frequency, cycle, pulse width,	
		pulse count, duty cycle	
		• Vertical axis: maximum value, minimum value, peak-to-peak	
		voltage (Vp-p), rms (root mean square), mean, top value, base	
		value, ± overshoot	
		• Other: area, two-channel skew, time difference between levels	
		The functions listed below can be set in the Measure menu.	
1			

			<b>NO 100</b>
		Pass/Fail (pass/fail judgment) function	▶ 3.12.2
		Logging function	▶ 3.12.3
19	REF	Up to five sets of on-screen waveform data formats and setups	▶3.13
	button	can be saved and retrieved. This is useful when comparing	
		waveforms, for example.	
20	TRIGGER	This sets trigger function-related items for the following buttons	▶3.6
		and knobs.	
		*Refer to final note) in the table for following " trigger signals note)".	
	LEVEL	This controls the trigger level for each. Turn the knob clockwise	
	PUSH FIND	to move to a higher trigger level, and turn it counter-clockwise	
	IEVEL	to move to a lower trigger level. Press the knob once to set the	
	control knob	trigger level as the center of the amplitude range for the trigger	
		source waveform (FIND   EVEL)	
	SETUP	Press this button to open a menu in the right part of the screen	
	Triggor monu	where you can set the following trigger function related items	
	hutton	Types: Edge Edge ALT* Edge OP* Dules count Dules width	
	button	Pariad Dranaut TV OB* NOB* AND* NAND*	
		* The trigger ture of Edge ALT Edge OD OD NOD AND and	
		NAND is installed only in DC 55004	
		NAND IS INStalled ONLY IN DS-5500A.	
		• Sources:CH1, CH2, CH3, CH4, Ext, Ext 10, LINE	
		(There are neither CH3 nor CH4 for 2CH model.)	
		• Slope: Rising, Falling	
		• Coupling: AC, DC, HF Reject, LF Reject, DC Noise Reject	
		• Hold off: OFF, up to 50 s (use ADJUST knob (11) to adjust)	
	AUTO button	Press this button to switch to Auto mode, trigger signals """ are	
		generated automatically when there are no trigger signals note,	
		and acquire waveform data.	
	NORMAL button	A waveform data is acquired each time a trigger signal note) is	
		generated, and enters the state of the trigger waiting.	
		Enables stable measurement of low-frequency signals down to several Hz.	
	SINGLE button	A waveform incorporation is done only once, and the product	
	enters the state of Stop when trigger signals <sup>note)</sup> is generated.		
		The trigger is compulsorily put once, and the product enters the	
		state of Stop if the SINGLE button is pushed when the trigger is	
		waited in SINGLE mode (Ready).	
	RUN/STOP	When this button is pressed during AUTO, NORMAL, or	
	button	SINGLE trigger mode, the trigger is stopped and the last data to	
		be acquired is displayed, then acquiring stops. When this	
~		button is pressed during Stop mode, acquisition is started.	
21	HURIZUNTAL	This selects and sets the trigger delay, range for the horizontal	▶ 3.5
		axis, the waverorm acquiring function and 200m function. These	
		This knob adjusts the trigger delay for all channels	► 2 E
		Turn the knob clockwise to move the waveform in the positive	► 3.5
		direction, and turn it counter-clockwise to move the waveform in	
	DELAY	the negative direction. When this knob is pressed once the	
	control knob	waveform display is moved so it is centered on 0 seconds in the	
		target range, and when it is pressed again the waveform display	
		is restored. Delay times are shown in the readout area in the	
		upper left part of the screen.	

	Time/div control knob	This knob selects the time base range for all channels. Turn the knob clockwise to set a shorter time base range, or counter-clockwise to set a longer time base range. The set time base range is shown in the readout area in the upper left part of the screen.	▶3.5
	SETUP menu button	For acquiring function, this button sets the waveform acquiring mode, memory length, EQU [equivalent sampling], and Roll mode ON/OFF.	▶3.5
	ZOOM execute button	When the source waveform data acquired by the zoom function is being observed, this function magnifies the specified part for closer observation. Press this button to toggle the button lamp ON and OFF. When ON, the screen is divided into top and bottom parts, with the source waveform shown in the upper part and the zoom (magnified) waveform shown in the lower part. When this button is ON (lit), time base-related operations are no longer valid for the zoom waveform.	▶ 3.15
22	VERTICAL	The following knobs and buttons are used to select vertical axis offsets, ranges, and channels.	▶ 3.4
	[CH] trace buttons	The channels are arranged from left as CH1, CH2, CH3, and CH4. When a button is pressed, the button for the target color lights and a waveform is shown on the screen, along with a menu that appears in the right part of the screen. When the button is pressed again, it goes OFF and the waveform display and menu disappear.	▶3.3
	OFFSET control knob	Offset is set independently for each channel. Turn the knob clockwise to move in the positive direction and counter-clockwise to move in the negative direction. Press once to move the waveform display to OV in the target range, and press again to restore the previous waveform display. The offset voltage value for each channel is shown in the waveform readout area in the lower part of the screen.	▶ 3.4
	[Volts/div] control knob	The range can be set independently for each channel. Turn the knob clockwise to move toward a higher sensitivity range, or counter-clockwise to move toward a lower sensitivity range. The range set for each channel is shown in the waveform readout area in the lower part of the screen.	▶3.4
23	MATH	The following knobs and buttons have functions related to Math operations on waveforms, as well as vertical axis offsets and selection of ranges and channels.	► Chapter 4
	Trace button	Press this button to open a Math waveform. Addition, subtraction, multiplication, and operations of FFT, integral* and derivative* are performed for the source channel selected in the Math menu in the right part of the screen. *The operation function of the derivative and integral is installed only in the DS-5500A series.	

OFFSET control knob	This adjusts the offset for the waveform displayed after a math operation. Turn the knob clockwise to move in the positive direction or counter-clockwise to move in the negative direction. Press this
	knob once to move the display so it is centered on O in the target range, and press it again to restore O in the target range to its previous position. Offset values are shown next to "pos" in the waveform readout area in the lower part of the screen.
Range	This selects the range for the Math waveform display. Turn the
control knob	knob clockwise to switch to a higher sensitivity range, or counter-clockwise to switch to a lower sensitivity range. The range set for the math waveform display is shown in the waveform readout area in the lower part of the screen.

Note) When the USB memory is inserted, the noise signal might start the insertion of the USB memory etc. from the terminal etc. USB of the trigger source and the front panel. Might it recognize as a trigger signal when the noise signal enters waiting (Ready) for the trigger, and the operation not intended be done.

For this case, the following measures are recommended.

- Take care to the measurement environment and the connection, etc. the noise signal's not entering.
- •Do the prevention treatment of static electricity to the USB memory and the human body, etc.
- •Put the trigger operation into the state of Stop when neither the noise signal nor static electricity are avoided.

#### 2.4.2 Rear panel



(Example of back panel for DS-5554A)

No	Name	Description	Section
1	AC line input terminal	This is the AC power connector. The AC power	
'	Ao ine input terminal	specifications are printed above	▶ 2.5
2	Security clot and	A clet is provided for locking Use a Konsington lock or	
2	Security Slot and	amiler brend, and need it through the ten of the elet	
	IIIdik	sinnar brand, and pass it through the top of the slot.	
3	Stands	Stands on the rear side are in fixed position. Stands on the	▶22
		front side can be unfolded for use in tilting the unit.	
4	GP-IB terminal	This GP-IB interface terminal can be used to connect to a	▶3.7
·		computer for remote control. GP-IB option DS-576 is	1 011
		required. (Factory-installed option)	
		For description of remote control commands, etc., see the	Remote
		"Remote Control Manual.pdf" file in the bundled CD.	Control
			Manual
			(on CD)
5	USB terminal	This USB terminal can be used to connect to a computer for	▶3.7
		remote control, or to a printer to print screen data.	▶ 3.8
		(Standard equipped)	Remote
		For description of remote control commands, etc., see the	Control
		"Remote Control Manual.pdf" file in the bundled CD.	Manual
			(on CD)
6	LAN terminal	This is the terminal for the LAN interface. It can be used to	▶3.7
		connect to a computer for remote control. (Standard	
		equipped)	
		*LAN interface is installed only in the DS-5500A series	Remote
		(standard equipment).	Control
		For description of remote control commands, etc., see the	Manual
		"Remote Control Manual.pdf" file in the bundled CD.	(on CD)
7	AUX interface	This is a connector terminal that connects probe power	Chapter
	terminal	supply option DS-579. DS-579 is an option only for this	6
		product. The offset of our FET probe can be set on the	►DS-579
		menu of this product by installing DS-579 in this back of the	Instruction
		product, and connecting the interface. Please contact	Manual
		Iwatsu at the address listed at the end of this manual or our	
0		sales distributors for purchase.	
8	AUX IO1 terminal	"Inis terminal can be installed only in the DS-5500A series.	
	AUX IOZ terminar	ALLY IO1: Outpute CH1 input signal with applied effect	► 3.7
		voltage	
		• ALLY IO2: Outputs CH2 input signal with applied offset	0
1			
		When CH1-CH2 output option DS-578 is implemented	
		• AUX IO1: Outputs CH1 input signal with applied offset	
1		voltage.	
		• AUX IO2: When a trigger occurs, this outputs H-level	
		TRIG output (square wave signal).	
		Alternatively, when setting the Pass/Fail	▶3.12.2
1		function, the pass/fail judgment result can be	
		a pulse output (square wave signal).	
1			

Table 2.2 Names and Functions of Rear Panel Parts
## 2.4.3 Conditions for button activation and operation

This product has several buttons with lamps that make them easier to see and easier to use.

Table 2.3 lists the buttons with lamps, and the conditions for their activation and operation.

Button Name	Color	Operation	Activation Condition
CURSORS selection button	Green	Opens Cursors menu. Switches cursor types for Off/Time/Amplitude/ Time & Amplitude/Value.	CURSORS has been set as the target of ADJUST knob operations.
MEASURE selection button	Green	Opens Measure menu. Sets Measure readout ON or OFF when Measure menu is displayed.	Measurement results from "Measure" are displayed in readout.
REF selection button	Green	Opens Reference Waveform menu. Turns reference waveform ON or OFF.	When REF has at least waveform indicated.
AUTO selection button	Green	Starts acquiring waveform data in auto mode.	When auto mode waveform data acquisition has been set.
NORMAL selection button	Green	Starts acquiring waveform data in normal mode.	When normal mode waveform data acquisition has been set.
SINGLE selection button	Green	If pressed during waveform data acquisition is stopped, single mode waveform data acquisition is performed just once, then this button lamp remains ON.	When single mode waveform data acquisition has been set.
RUN/STOP button	Green	This remains ON during auto mode and normal mode. At this time, if it is pressed, acquisition is stopped and the lamp goes OFF. If pressed when OFF, acquisition is started. During single mode, if this button is pressed while acquisition is in progress it goes ON, and goes OFF again after when acquisition is completed and triggers are stopped.	When auto mode waveform data acquisition is in progress. When normal mode waveform data acquisition is in progress. When single mode waveform data acquisition is in progress.
CH1 trace button	Yellow	CH trace ON/OFF	When CH waveform is
CH2 trace button	Magenta	Opens CH menu.	displayed.
CH3* trace button	Blue		*CH3 and CH4 are only in
CH4* trace button	Green		4-channel models.)
MATH trace button	Red	Math waveform ON/OFF Opens Math menu.	When math waveform is displayed.
ZOOM execute button	Green	Zoom ON/OFF	When zoom waveform display mode has been set.

Table 2.3 Button Activation and Operation Conditions

## 2.4.4 Screen display and layout

This product employs a color LCD screen, with color-coded waveforms and setups in each channel. Screen layout and contents are in two types: normal measurement and [MEASURE] (hereafter called Auto Measure). These are described below

## Channel-specific waveform colors and setups

As with the CH menu button described above, the displayed waveform and the first line of the waveform readout area are color-coded as shown in Table 2.4.

	Waveform	Color of First Line in Waveform Readout				
	Display Color					
CH1	Yellow	Yellow				
CH2 Magenta		Magenta				
CH3	Cyan	Blue				
CH4	Green	Green				
Math	Red	Red				
REF	White	_				
*1. Characters in first line of waveform readout area are black.						
(For details of the waveform readout area, see Figure 2.5)						
*2. CH	I3 and CH4 are	installed only in 4CH model.				

Table 2.4 Color Coding of Displayed Waveform and Waveform Readout

- Gray display in waveform readout display region (the second and third lines) It explains the meaning of the gray display of the background color of the second and third lines in waveform readout display region.
  - a) When one or more waveform display is ON among CH and Math

CH or Math on the foremost side of a waveform trace is gray displayed.

b) When all waveform display is OFF

CH or Math operated at the end is gray displayed.

#### Screen layout during normal measurement

Figure 2.5 shows the screen layout during normal measurement.



Figure 2.5 Screen Layout during Normal Measurement

During normal measurement, the screen is roughly divided into six areas, as shown in Figure 2.5.

Since this is a VGA screen, the LCD size is 640 dots horizontally and 480 dots vertically. Section 3.1.1 of the chapter describing functions and operations describes the items shown in areas 1 to 6 in the layout.

#### • Screen layout during MEASURE (Auto Measure)

When MEASURE (Auto Measure) is ON, the waveform display area is contracted vertically so that the waveform display area is divided into a four-line MEASURE (Auto Measure) display area. The screen layout during MEASURE (Auto Measure) is shown in Figure 2.6.



Figure 2.6 Screen Layout during MEASURE (Auto Measure)

# 2.5 Before Using this Product

Enter the following setups, according to the use conditions.

#### 2.5.1 Screen intensity setup

Set the intensity of the waveform display after turning on the power. Brightness is adjusted by the Waveform Intensity submenu of the DISPLAY menu according to the following procedure.

## **Operation Steps**

 Push the DISPLAY menu button of Figure 2.7. The Display menu is displayed in the right of the screen. (Refer to Figure 2.8.)



- 2. Touch (select) menu item of Figure 2.8.
- Set numerical value (%) of brightness with the ADJUST knob of Figure 2.8.
- Push the MENU CLOSE button of Figure 2.8 to close the Display menu.

Figure 2.7 Layout of Buttons



Figure 2.8 Display menu

#### 2.5.2 Language selection

The language of the User Interface displayed on the screen can be selected. The selected language is reflected in the display of a menu, a pop up screen, a temporary display message, and the Help manual. Select the language by the following operation. Operation Steps

- 1. Press the UTILITIES menu button near the top of the panel. The Utilities menu opens in the right part of the screen. (See Figure 2.9)
- In the Utilities menu, select (touch) the Config. menu. This opens the Config. menu. (See Figure 2.10)
- Select (touch) a Language. This opens the Language menu under system setup. (See Figure 2.11)
- 4. Select (touch) a language in the Language menu.
- 5. Press the MENU CLOSE button twice to close the menu.





Figure 2.10 [Config.] Menu

Figure 2.11 [Language] Menu

#### 2.5.3 Help function

A Help manual describing the operations of the various buttons and knobs is included with this product.

Help information is shown for whatever button was pressed immediately after pressing the HELP button. When you press the HELP button, the message "Display help message of selected item." appears briefly in the status information area near the bottom of the screen, and the unit is then ready for the next operation. When an operation is performed, the relevant Help information is shown across the entire waveform display area. In such cases, any temporary messages do not automatically disappear after a certain amount of time as they normally would, but instead remain on screen until Help information for the next operation is shown. To show Help information for another function, press the HELP button again, then operate the target function.

Help messages appear in one screen. (Page down or scroll is not required.)

When the HELP button is awaiting the next operation, if you press it again, the status will remain the same; it does not turn Help ON or OFF.

Operation Steps 1. Press the HELP button in the upper left of the front panel.

The message "Display help message of selected item." appears briefly.

2. Operate the button or knob to be described in the Help manual.

#### 2.5.4 Date and time setups

The year, month, day, and hour can be set for this product. The set date and/or time can be displayed in the bottom line of the screen, along the right edge.

## **Operation Steps**

- Press the UTILITIES menu button near the top of the panel. The Utilities menu opens in the right part of the screen. (See Figure 2.12)
  - 2. Select (touch) the Config. menu in the Utilities menu. This opens the Config. menu. (See Figure 2.13)
  - Select (touch) Date & Time menu. This opens the Date & Time menu. (See Figure 2.14) Perform the operations in a) to e) below to set the year, month, day, hour, and minute.
  - a) Select (touch) Display. This opens the Display menu. Select (touch) one of the following from this menu.
    - Off:

Date and time are not shown on screen.

Real-time clock:

Date and time are shown in bottom right of screen.

• ACQ (Acquisition Time Stamp):

This indicates the trigger time for the displayed waveform.

- b) Select (touch) Year. When an ADJUST mark is shown in the upper left of the Year menu, turn the ADJUST knob to set the numbers to be used in Year.
- c) Select (touch) Month/Day. When an ADJUST mark is shown in the upper left of the Month/Day menu, turn the ADJUST knob to set the numbers to be used in Month/Day.
- d) Select (touch) Hour/Min. When an ADJUST mark is shown in the upper left of the Hour/Min menu, turn the ADJUST knob to set the numbers to be used in Hour/Minute.
- e) Check your setups in a) to d), then touch Enter.



Figure 2.12 Utilities Menu

Figure 2.13 Config. Menu

Figure 2.14 Date & Time Menu

## 2.6 Take Measurements

In this section, you will perform probe position correction while repeatedly displaying square waves in the waveform screen. Afterward, the basic operation methods for the vertical axis, time axis, and triggers are described.

Also, CAL signal output is connected to CH1 as a signal source, and the items to be measured are described specifically below.

## 2.6.1 Initialize setups

This operation is not required for the first time that you use this product.

This initialization operation is convenient for redoing setups from the start to match the input signal. The initialization operation steps are as follows.

## **Operation Steps**

1. Press the SAVE/RECALL menu button shown in Figure 2.15. The Save/Recall menu opens in the right part of the screen. (See Figure 2.16)



Figure 2.15 Layout of Buttons and Knobs

2. Select (touch) the Recall Default Setup menu in the Save/Recall menu as shown in Figure 2.16. Figure 2.17 shows the initialized screen.



Figure 2.16 Select Recall Default Setup Button



Figure 2.17 Initialized Waveform Screen

#### (Memo) Uninitialized setups

The following setups are retained, and are not initialized by this initialization operation.

- UTILITIES menu system setups (language, date and time, audible beep sounds, panel lock, grid intensity, trigger counter, power management, offset setups, delay setups) print setups, remote setups
- SAVE/RECALL menu Saved panel setups
   REF menu
- Saved reference waveforms

2.6.2 AUTO SETUP measurement AUTO SETUP measurement

automatically sets the vertical axis, horizontal axis (time axis), and trigger according to the input signal, and displays a waveform on the screen.

First, this is useful for displaying waveforms or for when the setup requirements are not known because it is unclear what kind of signal the input signal is.

The AUTO SETUP function is used only for the channel for which the channel color is ON (trace ON status) in the waveform readout area in the lower part of the screen. AUTO SETUP measurement operations are described below.

## **Operation Steps**

- 1. Prepare the probe.
- If using the bundled probe, refer to the probe's User Guide.
- Connect the probe's BNC connector side to measurement input terminal CH1. (See Figure 2.18)
- Connect the probe tips to the GND terminal and CAL output terminal. (See Figure 2.18)
- Each turn of the CH1 to CH4 (2CH model: CH1 to CH2) trace button displays a different waveform.
- Press the AUTO SETUP execute button. The Auto Setup menu (see Figure 2.18) opens in the right part of the screen (see Figure 2.18)



Figure 2.18 Probe Connection

opens in the right part of the screen (see Figure 2.19), and the waveform from auto setup measurement is displayed. (See Figure 2.19)

 Select (touch) the Undo menu in the Auto Setup menu. (See Figure 2.19) This restores the setups prior to when the AUTO SETUP execute button was pressed.



Figure 2.19 CAL Signal Waveform Measurement Example 1

#### 2.6.3 Change waveform display conditions

The following describes the operations to change the sensitivity and vertical position setups for the voltage axis (vertical axis) as well as setups for the time axis (horizontal axis). These descriptions follow the Auto Setup measurement example shown in the previous page.

#### Select CH1 only. Other channels are deleted from the screen.

The buttons and knobs related to the vertical axis are shown in Figure 2.20. Operation Steps

- Touch (select) the CH1 data in the waveform readout area. The CH menu (1/2 or 2/2) from Figure 2.21 is opened in the right part of the screen.
- Press the CH2, CH3, and CH4 buttons from Figure 2.20 once each. The waveforms for CH2, CH3, and CH4 are deleted from the screen. Now only the CH1 waveform is shown as in Figure 2.22.



Figure 2.20 Layout of Buttons and Knobs

3. Press the MENU CLOSE button to close the CH menu. (See Figure 2.22)







#### • Move waveform to the center of the screen.

With reference to measurement example 2 in Figure 2.22, move the CH1 waveform to the center of the screen.

#### Operation Steps

 Press just once a Vertical Axis Offset control knob from Figure 2.23. The CH1 offset voltage is moved to the center of the screen, to become as shown in Figure 2.24. The offset voltage is displayed as "ofs 0.00 V" in the lower left part of the screen. There are also other move methods that involve turning a Vertical Axis Offset control knob.



Figure 2.23 Layout of Buttons and Knobs

M200µs	0.0000s		▶Trigʻe	d	70%
			¥ .		
				· ·	
				· · · · · · · · · · · · · · · · · · ·	
					· · · · · · · · · · · · · · · · · · ·
	1			1.	
1	· · · · · <b> </b> · · · <mark> </mark>		· · · · · · · · · · · · · · · · · · ·		
	Of	feat valta	ao: 0 00	$\mathbf{X}$	
			ge. 0.00	• • • • • • • • • • •	
			Edge 🔺	1 DC	1. 34V
1: 1.00	V 2.5.	00mV 3:2.	00mV 4:2.	00mV	
ΩÍS	0.00VEPp	ty Empt	y Empt	y	
IWATS	i Ll	f:1.00100kHz	250kS 500 pc	ints I	RTC:2010/11/0

Figure 2.24 CAL Signal Waveform Measurement Example 3

#### • Set the vertical axis range to 2.00 V/div.

Now, change the vertical axis range of measurement example 3 in Figure 2.24.

#### **Operation Steps**

 Turn the Volt/div control knob shown in Figure 2.25 one click counter-clockwise. The vertical axis range is shown in the waveform readout area in the lower part of the screen. While viewing those numbers, change 1.00 V to 2.00 V. The on-screen CH waveform becomes as shown in Figure 2.26.



Figure 2.25 Layout of Vertical Axis Keys and Knobs



Figure 2.26 CAL Signal Waveform Measurement Example 4

#### • Set the horizontal axis range to 500 µs/div.

Next, change the horizontal axis range, based on Figure 2.26 CAL Signal Waveform Measurement Example 4.

The horizontal axis-related buttons and knobs are shown in Figure 2.27.

#### **Operation Steps**

 Turn the Time/div control knob from Figure 2.27 counter-clockwise to display the horizontal axis range as 500 µs/div in the readout area in the upper left part of the screen. The displayed waveform is shown in Figure 2.28.



Figure 2.27 Layout of Buttons and Knobs

Figure 2.28 CAL Signal Waveform Measurement Example 5

2. If the probe has not been adequately phase corrected, a waveform such as shown in parts (a) and (b) of Figure 2.29 below can be seen. In such cases, perform probe phase correction as described below in section 2.6.4.





Figure 2.29(b) Uncorrected Probe Example 2

If the rising and falling edges of a square wave appear as shown in Figure 2.29, do not perform probe phase correction as described below in section 2.6.4. Instead, go directly to "2.6.5 Change trigger setups".

#### 2.6.4 Phase correction of probe

When an oscilloscope is combined with a probe, probe phase correction means adjusting the capacity of the probe's internal frequency to set constant gain. Accurate measurements cannot be taken unless this adjustment is performed correctly. If you are using a probe with this product for the first time, be sure to perform phase correction for the probe.

Since the input capacitance varies slightly among channels in oscilloscopes of the same type, and even within the same oscilloscope, even after phase correction has been performed once, it should be performed again if the oscilloscope is configured differently, or if the channel to be connected is changed. To perform phase correction, connect the supplied probe to the measurement input terminal and the CAL signal output terminal before starting. This product's CAL signal specifications are as follows.

• Frequency: 1 kHz, Amplitude: 3.0 V<sub>P-P</sub> square wave

Note) Do not apply a voltage from an external source to the CAL signal output terminal. Doing so may damage the internal circuitry.

Perform phase correction of the probe via the following steps.

## **Operation Steps**

- POWER 1. Set the power switch to ON mode.
- 2. Connect the probe's BNC connector side to a measurement input
  - terminal (CH1 to CH4). (See Figure 2.30)
- Connect the probe tips to the GND terminal and CAL output terminal. (See Figure 2.30)
- AUTO SETUP
- 4. Press the AUTO SETUP execute button.
- 5. While viewing the on-screen square wave (Figure 2.31 (a) and (b)), insert the tip of the supplied screwdriver into the probe phase adjustment slot and turn it (see Figure 2.30) to adjust it so that the square wave approximates its ideal waveform (Figure 2.31 (c)) as closely as possible.



#### 2.6.5 Change trigger setups

The trigger setups determine which among the waveforms of acquired input signals will be displayed based on the time when acquired.

Here, we will change the trigger setups for the square wave that was measured and observed after Auto Setup measurement and probe phase correction. Since the point is to simply get oriented with setup of triggers, the detailed setups are not described here. (For details, see "3.6 Functions and Operation Methods".)

When Auto Setup measurement is performed, the trigger type setup sets the trigger source as the CH1 edge trigger.

Trigger source: this is the signal that is used as the set trigger condition.

Edge trigger: this causes a trigger to occur at the rising and/or falling edge of the input signal.

#### • Check the trigger slope.

Figure 2.33 shows a waveform that was measured either before the operations in section 2.6.3 or after the probe phase correction in section 2.6.4. This trigger is an edge trigger and the trigger slope can be checked via the waveform screen or the Trigger menu.

## **Operation Steps**

- Find the ▼ mark in the CH color in the frame in the upper waveform display area. In Figure 2.33, this ▼ mark indicates a trigger point.
- In the Trigger menu, press the SETUP button shown in Figure 2.32. The Trigger menu shown in Figure 2.33 is opened in the right part of the screen.
- Check the Trigger menu to confirm which slope is being displayed. In measurement example 5, the trigger slope is shown as a positive slope.







Figure 2.33 CAL Signal Waveform 3. Slope button Measurement Example 5

## Change the trigger slope.

Change the trigger slope from the slope shown in Figure 2.33 on the previous page. Operation Steps

- 1. Touch a slope in the Trigger menu shown in Figure 2.34 to switch to a negative slope. With the new positional relationship between the waveform and the trigger point, the slope changes from that shown in Figure 2.33 on the previous page to that shown in Figure 2.34.
- 2. Press the MENU CLOSE button to close the Trigger menu.



Figure 2.34 CAL Signal Waveform Measurement Example 6

## • Move trigger position 2div to the left.

This is useful when you wish to observe waveforms after setting a trigger.

#### **Operation Steps**

- 1. Turn the DELAY knob counter-clockwise in the horizontal axis section as shown in Figure 2.35.
- Adjust so that delay time shown in readout area in upper left of screen becomes -1 ms. (See Figure 2.36)



Figure 2.35 Layout of Buttons and Knobs





#### • Change the trigger mode.

Trigger modes are distinguished by the types of conditions (for timing, iterations, etc.) used to update the displayed waveform. When performing Auto Setup measurement, set AUTO MODE. With SINGLE mode, when a trigger occurs, the waveform display is updated just once, then acquiring waveform data is stopped. SINGLE mode is suitable when measuring one-shot signals. The following describes the operation method and a measurement example for SINGLE mode, based on measurement example 7 from Figure 2.36 on the previous page.

## **Operation Steps**

1. While in AUTO MODE, press the SINGLE button.



Figure 2.37 Layout of Buttons and Knobs

When acquiring waveform data is stopped, "Auto" or "Trig'd" becomes "Stop" in the readout area shown in Figure 2.36. (See Figure 2.38) Afterward, press the SINGLE button to set Single mode, and acquiring waveform data will stop after acquiring one waveform.



"Stop" appears when waveform acquiring is stopped.

Figure 2.38 CAL Signal Waveform Measurement Example 8

# **Chapter 3 Functions and Operating Procedures**

This chapter describes this product's functions and operating procedures.

## 3.1 Screen Layout and Display Contents

This layout was described briefly in section 2.4.4 above. This section describes the screen layout, display items, and other display contents in each display area.

# 3.1.1 Screen layout and display during normal measurement

## a) Readout area

Figure 3.1.1 shows the display format of the readout area. ## nnnus nnnnus ## nnnus xxxx xxxx ## xxxxxx ## nnnn/nnnn <1> <2> <3> <4> <5> <6> <7> <8> <9> <10> Note) The following characters and symbols are used in the figure. • ##: icon, n: numeral, u: unit, x: character Figure 3.1.1 Readout Area Display Format

Table 3.1 describes the display items shown in parts <1> to <10> of Figure 3.1.1. A display example is shown in Figure 3.1.2. This display example shows an enlarged display in which the ZOOM function was used to enlarge the waveform in the time axis direction.



Figure 3.1.2 Readout Area Display Example

NO	Display Item	Display, Symbol	Display Description or Comment		
.1.	Symbols for different	MZ	Shows the display status of the MAIN window and		
<1>	window types		ZOOM window.		
<2>	Horizontal axis range	nnn us	Shows the time scale per div in the MAIN window or		
			ZOOM window.		
<3>	Delay time	nnnnn us	Shows the delay time from the trigger point.		
<4>	MAIN symbol		When the ZOOM function is shown, its symbol is		
		M	shown in the MAIN window, and the MAIN window's		
			horizontal axis range is set and shown.		
<5>	Horizontal axis range	nnn us	Shows the time scale per div in the MAIN window		
	(MAIN)		when the ZOOM function display is being used.		

Table 3.1	Readout Are	a Display	Items
-----------	-------------	-----------	-------

-			
<6>	Acquisition mode	[Blank]	Normal status
		Peak	Peak detection status
		Avg	Averaging view status
<7>	Acquisition mode	[Blank]	Normal status
		Roll	Roll mode status
		Equ	Equivalent sampling status
<8>	Trigger status	<b>D</b> , <b>D</b>	Icons and characters appear as shown below.
		Auto	Trigger has not been set (auto trigger)
		Ready	Trigger standby status (normal/single)
		Trig'd	Triggered status
		Inhibit	Trigger is ignored
		Run	Roll mode status
		Stop 🔳	Stopped trigger status
<9>	Replay symbol	ð	Shown only when REPLAY icon is ON
.10	No. of pages		This shows the current page number and the
<10>	No. of pages	nnnn/nnn	total number of pages.
			The screen information is not shown during Run
			mode, but it is shown during Stop mode.
			Screen operations can be performed only when
			the screen information is being shown.

Note) "n" and "u" indicate the following in the display format.

• n: numbers, decimal numbers, and periods. The number indicates the maximum number of digits that can be displayed.

• Units are shown as u: p (pico), n (nano), µ (micro), m (milli), k (kilo), and M (mega).

#### b) Waveform display area

The waveform display area is illustrated in Figure 3.1.3.



Figure 3.1.3 Illustration of Waveform Display Area

An example is shown in Figure 3.1.4. This display example shows an observed waveform for CH1, cursors, a trigger delay mark, a waveform reference mark, and a trigger level mark.



Figure 3.1.4 Waveform Display Area Example

#### c) $\Delta t$ cursor measured values and trigger data display area

Figure 3.1.5 shows the format of the  $\Delta t$  cursor measured values and trigger data display area.

∆t=nnn us	1/∆t=nnn uHz	XXXXXXX	##	##	XXXXXX	nnn uV	
1	2	3	4	5	6	7	
∆t=nnn us	∆f=nnn uHz	XXXXXXX	##	##	XXXXXX	nnn uV	

Note 1) The following characters and symbols are used in the figure.

##: icon, n: numeral, u: unit, x: character

Note 2) In a FFT waveform display, " $\Delta f$ " is shown as "f".

Figure 3.1.5 Format of  $\Delta t$  Cursor Measured Value and Trigger Data Display Area

Display items in parts <1> to <7> of Figure 3.1.5 are described in Table 3.2 (a), Table 3.2 (b), and Table 3.2 (c). A display example is shown in Figure 3.1.6. This example includes cursor measured value 1, cursor measured value 2, trigger type, trigger slope, trigger source, trigger coupling, and trigger level.

Cursor measured	value 1	Trigger type		Trig	iger slope	Ţ	rigger coupli	ng
X			$\rightarrow$	K		K		
∆t=1.00ms	1/∆t=1.	00kHz	Edge	_ <b>_</b>	1	DC	0. 00V	
	~				1		1	
Cursor measu	red value 2		Trig	ger sou	irce	Trigg	er level	

Figure 3.1.6  $\Delta t$  Cursor Measured Value and Trigger Data Display Area Display Example

Table 3.2 (	(a) ∆t Cursor	Measured	Value	and	Trigger	Data I	Display	Items	

NO	ltem	Description	Format	Comment
	Cursor measured	∆t cursor measurement	∆t=±nnn us	
1	value 1			
		t(V at t) cursor	t=±nnn us	
		measurement		
	Cursor measured	1/∆t cursor measurement	1/∆t=±nnn uHz	
2	value 2			
		∆f cursor measurement	∆f=±nnn uHz	
		f(dbm at f) cursor	f=±nnn uHz	For FFT waveform
		measurement		display
3	Trigger type	Edge trigger	Edge	
Ū		Edge alternate	Edge ALT	Equipped with only
		Edge OR	Edge OR	DS-5500A series
		Pulse count trigger	Pulse Count	
		Pulse width trigger	Pulse Width	
		Period trigger	Period	
		Dropout trigger	Dropout	
		TV trigger	тν	
		OR (logical sum)	OR	
		Negative OR	NOR	Equipped with only
		AND	AND	DS-5500A series
		Negative AND	NAND	

Note) "n" and "u" indicate the following in the display format.

- n: numbers, decimal numbers, and periods. The number indicates the maximum number of digits that can be displayed.
- Units are shown as u: p (pico), n (nano), µ (micro), m (milli), k (kilo), and M (mega).

NO	ltem	Description	Format	Comment
4	Trigger slope	Edge-Pos	<b>A</b>	Rising edge
		Edge-Neg		Falling edge
		Don't care	$\otimes$	
		Pulse Width-Pos	★	Positive polarity
		Pulse Width-Neg	+ +	Negative polarity
		Period-Pos		Rising edge (period)
		Period-Neg		Falling edge (period)
		Pulse Count-Pos		Rising edge (pulse count)
		Pulse Count-Neg		Falling edge (pulse count)
		Dropout·Pos		Positive polarity
		Dropout-Neg		Negative polarity
		TV-Pos	$\pi_{w^{-}}$	Rising edge (TV)
		TV-Neg	u^~	Falling edge (TV)
5	Trigger source	CH1	[1]	
		CH2	2	
		СНЗ	[3]	Only for ACH model
		CH4	<mark>.</mark> 4	Only for 4CH model
		Ext	[Ext]	
		Ext 10	[Ext 10]	
		AC line	[Line]	
6	Trigger coupling	AC coupling	AC	
		DC coupling	DC	
		High frequency rejection	HF-Reject	
		Low frequency rejection	LF-Reject	
		DC noise rejection	DC Noise Reject	
	TV mode	NTSC format	NTSC	
		PAL format	PAL	
		Custom Setup	Custom	Custom setups

Table 3.2 (b)  $\Delta t$  Cursor Measured Value and Trigger Data Display Items

NO	Item	Description	Format	Comment					
7	Trigger level	Trigger level value	±nnn uV	Shown except for TV					
				trigger and line source.					
	Field	Field number	Any Fields	Shown only for TV trigger.					
			1						
			2						
			3						
			4						
			5						
			6						
			7						
			8						

Table 3.2 (  $\rm c$  )  $\Delta t$  Cursor Measured Value and Trigger Data Display Items

Note) "n" and "u" indicate the following in the display format.

• n: numbers, decimal numbers, and periods. The number indicates the maximum number of digits that can be displayed.

• Units are shown as u: p (pico), n (nano), µ (micro), m (milli), k (kilo), and M (mega).



The waveform readout area display formats fall into three general types: CH

d) Waveform readout area

Figure 3.1.7 Waveform Readout Area Display Formats

Items displayed in parts <1> to <12> of Figure 3.1.7 are listed in Table 3.3 (a) and Table 3.3 (b).

Another display example is shown in Figure 3.1.8. The waveform readout area shows, for each of the four channels, the vertical axis Volt/div, setting of the frequency bandwidth, input coupling type, and the cursor measured value (when cursor measurement is ON) for the offset voltage or vertical axis. During Math operations, the right side shows the Math waveform's vertical axis Volt/div, operation type, and the cursor measured value (when cursor measurement is ON) for the offset voltage or vertical axis. (See Chapter 4 for detailed description of Math operations.)



Figure 3.1.8 Waveform Readout Area Display Example

NO	Item	Display	Format	Comment
<1>	CH number	CH1 (YT display)	1:	
		CH2 (YT display)	2:	
		CH3 (YT display)	3:	
		CH4 (YT display)	4:	
		X (XY display)	X:	
		Y (XY display)	Y:	
<2>	Volts/Div	Vertical axis range	nnn uV	<ul> <li>"A" unit for current probe, DC 1 MΩ only for coupling</li> </ul>
<3>	Invert	Inverted display	Blank	
			$\downarrow$	
<4>	Band Width	Bandwidth		
		Bandwidth limiting <sup>*1</sup>	Blank	Full
			BW	100 MHz, 20 MHz, 2 MHz, 200 kHz
		Bandwidth	Blank	Off
		Filter <sup>*2</sup>	L	LPF (Low-pass filter)
			Н	HPF (High-pass filter)
<5>	Coupling	Coupling	DC 1 MΩ	
			AC 1 MΩ	
			GND	
			DC 50 Ω	
<6>		-	Blank	Deskew 0.00 ns, with Rescale OFF
	Deskew	Skew	Deskew	When setting deskew value
			Des Res	When setting deskew value, with
				Rescale ON
	Rescale	Rescale	Rescale	Rescale ON
			Des Res	When setting deskew value, with
				Rescale ON

Table 3.3 (a) Waveform Readout Area Display Items

\* 1. It is only a model of 500MHz/350MHz with BW:100 MHz in the bandwidth limiting of 4. \* 2. As for the Filter function is installed only in the DS-5500A series.

NO	Item	Description, Condition	Format	Comment
<7>	Offset	Cursor is not selected	ofs	• When cursor is
	ΔV cursor	Cursor is selected	ΔV	selected, offset is
			ΔVx	shown temporarily
				only during offset
				operations.
			ΔVy	
	V at t cursor	Cursor is selected	V	
	FFT position	Cursor is not selected	Pos	
		(during FFT operations)		
	∆dBm cursor	Cursor is selected	ΔdBm	
		(during FFT operations)		
	dBm at f cursor	Cursor is selected	dBm	
		(during FFT operations)		
	No data		Empty	
<8>	Offset value	Cursor is not selected	±nnnuV	• Same as <7>.
	∆V cursor	Cursor is selected	±nnnuVV	
	V at t cursor	Cursor is selected	±nnnuV	
	FFT position	Cursor is not selected	±nnnudBm	
		(during FFT operations)		
	∆dBm cursor	Cursor is selected	±nnnudBm	
		(during FFT operations)		
	dBm at f cursor	Cursor is selected	±nnnudBm	
		(during FFT operations)		
<9>	Math symbol		M:	
<10>	Volts/div	Vertical axis range	nnnuV	
		(during add, subtract,		
		or multiply)		
	dB/div	(during FFT operations)	nnnudBm	
<11>	Math type	ADD	CHn + CHn	
		SUB	CHn – CHn	
		MULT	CHn * CHn	
		FFT operations	nFFT	
		Integral operations	∫(CHn)dt	Equipped with only DS-5500A
		Derivative operations	d(CHn)/dt	series
<12>	(CH No.) FFT/div	Horizontal axis range	nnnuHz	

Note) "n" and "u" indicate the following in the display format.

• n: numbers, decimal numbers, and periods. The number indicates the maximum number of digits that can be displayed.

• Units are shown as u: p (pico), n (nano), µ (micro), m (milli), k (kilo), and M (mega).

#### e) Menu display area

In the menu display area in the right part of the screen, menus for each are listed hierarchically. Select (touch) an item in a menu, then use the ADJUST knob to select, enter, and execute. (See Figure 3.1.9) As for the menu, the lowest rank hierarchy is displayed., and the lowest rank hierarchy is cleared each time the MENU CLOSE button is pressed, or the title part on the menu is touched so the next higher level is displayed. Levels that include a large number of items may requires multiple pages, in which case touch "Next" to open the Next menu for turning to subsequent pages. See section 3.2 for description of the menu display area display formats and items.



Figure 3.1.9 Menu Display Area Display Example

## f) Status information area

The display format of status information area $3$ is shown in Figure 3.1.10.							
RTC display (Pass/Fail operation OFF)							
	f:nnr	nnn uHz	nnn uS	nnn u pts	RTC:n	nnn/nn/nn	nn:nn:nn
	<1>	<2>	<3>	<4>	<5>	<6>	<7>
RTC display (Pa	ss/Fail	operation	ON)				
Pass Pass:nnnnn/nnnnn nnn uS			nnn u pts	RTC:n	RTC:nnnn/nn/nn nn:nn:nn		
<	1>	<2>	<3>	<4>	<5>	<6>	<7>
ACQ display							
	f:nnr	nnn uHz	nnn uS	nnn u pts	ACQ:n	nnn/nn/nn	nn:nn:nn:n
	<1>	<2>	<3>	<4>	<5>	<6>	<7>

Figure 3.1.10 Example of Menu Display Area

The three types of display items from Figure 3.1.10 are described below.

The top two parts show a RTC (Real-time clock) indicating the current time, and the bottom part shows the ACQ (Acquisition Time-stamp) that indicates the waveform data acquisition end time. Display items in parts <1> to <7> of Figure 3.1.10 are described in Table 3.4.

When Pass/Fail operation is ON, the RTC display in the second part shows the pass/fail judgment result, the Pass counts and the total judgment counts.

NO	Item	Description	Format	Comment
<1>	Frequency counter	Character	f:	<ul> <li>Frequency f display: When</li> </ul>
	or		or	Pass/Fail operation is ON
	Pass/Fail judgment		Pass:	<ul> <li>Pass/Fail result display:</li> </ul>
	result			When Pass/Fail operation is
				ON
<2>	Frequency counter	Numerical value +	nnnnn uHz	<ul> <li>Frequency counter value</li> </ul>
	value	unit	or	display: When Pass/Fail
	or	or	nnnnn/nnnnn	operation is OFF
	Displays Pass counts	Numerical		$\cdot$ Displays Pass counts and
	and total judgment	value/Numerical		total judgment counts:
	counts	value		When Pass/Fail operation is
				ON
<3>	Sampling rate	Numerical value +	nnn uS	
		unit		
<4>	Memory length	Numerical value +	nnn u pts	
		unit		
<5>	Time type	Current time	RTC:	
		Waveform	ACQ:	Shown only when triggers are
		acquisition end		stopped; RTC is shown during
		time		waveform acquisition.
<6>	YYYY/MM/DD	Date	yyyy/mm/dd	
		(Japanese/English)		
<7>	HH:MM:SS	Time (during RUN)	nn:nn:nn	
		Waveform	nn:nn:nn.n	Shown only when triggers are
		acquisition end		stopped; RTC is shown during
		time		waveform acquisition.

Table 3.4 Status Information Area	Display Items
-----------------------------------	---------------

Note) "n" and "u" indicate the following in the display format.

• n: numbers, decimal numbers, and periods. The number indicates the maximum number of digits that can be displayed.

• Units are shown as u: p (pico), n (nano), µ (micro), m (milli), k (kilo), and M (mega).

#### 3.1.2 Screen layout display during Auto Measure operation via Measure menu

An example of the Auto Measure display area is shown in Figure 3.1.12. Four types of Measure Items can be set and displayed here. As is shown in Figure 3.1.12, auto measurement results are shown in lines A, B, C, D. The display items in parts <1> to <7> of Figure 3.1.12 are listed in Table 3.5 on the next page. As is shown by the display example in Figure 3.1.12, the Auto Measure display area lists measurement numbers, Measure Item names, target sources, the first measurement result in one waveform (VaI) , the maximum value of measurement result (Max) , the minimum value of measurement result (Min) and all measurement frequency (Num). Use the MEASURE button to set Auto Measure. For details, see section 3.12 MEASURE Menu.



Figure 3.1.12 Auto Measure Area Display Example

NO	ltem	Description	Format	Comment
<1>	Measurement number		A:, B:, C:, D:	
<2>	Measure	Rise time (20-80%)	T r 20-80%	
	item	Fall time (80-20%)	T r 80-20%	
		Rise time (10-90%)	Tr 10-90%	
		Fall time (90-10%)	T r 90-10%	
		Frequency	Frequency	
		Period	Period	
		Positive pulse count	No. of +Pulse	
		Negative pulse count	No. of -Pulse	
		Positive pulse width	+Pulse Width	
		Negative pulse width	-Pulse Width	
		Duty cycle	DutyCycle	
		Root mean square	RMS	
		Cycle rms	Cycle RMS	
		Mean	Mean	
		Cycle mean	Cycle Mean	
		Maximum value	Maximum	
		Minimum value	Minimum	
		Peak-to-peak voltage	Peak-Peak	
		Тор	Тор	
		Base	Base	1
		Top-Base	Top-Base	
		+Overshoot	+Overshoot	
		-Overshoot	-Overshoot	1
		Integral	Integral	1
		Skew	Skew	1
		Skew@Level	Skew@Level	1
<3>	Target	Target source not set	Off	
	source	CH1	[1]	]
		CH2	2	]
		СНЗ	3	]
		CH4	4	1
		Math		
<4>	Val	First measurement result	±nnnn uV	• Voltage value: 3 digits
				<ul> <li>Average voltage value: 4 digits</li> </ul>
				• Time: 4 digits, Percentage: 3 digits
<5>	Max	Maximum value	±nnn uV	Same as <4>.
<6>	Min	Minimum value	±nnn uV	Same as <4>.
<7>	Num	Measurement frequency	nnnnnnnn	Integer of 0 to 10 <sup>8</sup>

Table 3.5 Auto Measure Display Area Display Items

Note) "n" and "u" indicate the following in the display format.

- n: numbers, decimal numbers, and periods. The number indicates the maximum number of digits that can be displayed.
- Units are shown as u: p (pico), n (nano),  $\mu$  (micro), m (milli), k (kilo), and M (mega).

## 3.2 Menus and Messages

The basic way to operate this product is to first press a function button, which opens a menu in the right part of the screen, and then touch a menu item and use the ADJUST knob and MENU CLOSE button to select, enter, and execute.

With the CH menu, the main operation is to simply touch the CH or Math data shown in the waveform readout area below the window to open a menu.

This section briefly describes the types of menus and their operations. For description of each button's functions and menu operations, see sections 3.3 to 3.18.

#### 3.2.1 Sub menus and option display menus

Ordinarily, when you press a menu-related button, a menu is opened in the right part of the screen. Items in each menu can be selected by touch. When selected, menu items open either a sub menu or an option display menu. Sub menus correspond to buttons for a wide array of setups, while option display menus correspond to buttons with a more limited range of setups and options. The differences between sub menus and option display menus are shown in Figure 3.2.1.



Figure 3.2.1 Differences between Sub Menu and Option Display Menu

Sub menus are a type of menu after all, and so there needs to be a way to intentionally return to a higher-level menu, which is by pressing the MENU CLOSE button. Items in the option display menu are shown in a temporary list, and when an item is selected, the display automatically returns to the higher-level menu. From the option display menu, you can also return to the higher-level menu by pressing the MENU CLOSE button.

#### 3.2.2 Pop-up menus

Pop-up menus provide an easy-to-see and easy-to-use user interface which opens a large separate menu on the screen, as opposed to the more complicated operations required in ordinary menus, which can sharply reduce usability. An example of device status information is shown in Figure 3.2.2.



Figure 3.2.2 Device Status Information Display Example

#### 3.2.3 Temporary messages

This product's temporary messages are broadly categorized as follows.

- Error messages
- Warning messages
- Status messages

Temporary messages are displayed when an operation results in an error, when another item is forcibly changed, when requested processing has been completed, etc.

The location and deletion conditions of temporary messages are described in Figure 3.2.3.





# 3.3 CH Menu

In the CH menu, display a waveform by either touching channel-specific data in the waveform readout area or pressing the CH trace button. These functions and operations are described below.

The operation methods described in sections 3.3.2 and 3.3.3 below are used not just in the CH menu but in other menus as well.

1

2

## 3.3.1 Display or delete observed waveform

The layout of vertical axis-related buttons and knobs is shown in Figure 3.3.1. Operation Steps

- Press one of the CH1 to CH4 trace buttons shown near the center of Figure 3.3.1 (in red frame) to turn the button lamp ON and open the corresponding CH menu and waveform display.
- Press the same CH trace button again to delete the CH menu and waveform display.



Figure 3.3.1 Layout of Buttons and Knobs

## 3.3.2 Displaying, page viewing, and deleting CH menu

The CH menu is shown in Figure 3.3.2. Operation Steps

- Touch (select) CH data in the waveform on readout area or the CH trace button of Figure 3.3.1. The CH menu appears in the the right part of the screen. (See Figure 3.3.2)
- Touch Next in the bottom of the CH menu. The bottom part of the CH menu, which shows the menu's page as Next (1/2), now switches to Next (2/2).
- Press the MENU CLOSE button. This deletes the CH menu shown in Figure 3.3.2.



Figure 3.3.2 CH Menu (1/2), (2/2)

#### 3.3.3 Set menu items

After the CH menu appears on the screen, the next operation selects a menu item.

#### a) Method for selection from option display menu

This description uses the coupling example shown in Figure 3.3.3.

#### **Operation Steps**

- Touch Coupling in the CH menu. This opens the option display menu.
- Touch an option in the Coupling option display menu to select one of the four coupling types. Note) The DC 50 Ω option is for 350 MHz/500 MHz models only.

The option display menu is cleared, and the selected item is set as the Coupling item 2 - in the CH menu.

The other menu items (Bandwidth,

Probe, and Unit) are selected and set in the same way.



b) Method for selection between two items Figure 3.3.3 Selection from Option Display This operation method description uses the Invert example shown Figure 3.3.4.

#### **Operation Steps**

- Touch (select) CH data in the waveform readout area.
   This opens the CH (1/2) menu, in which Invert is set to IIII. (Refer to section 3.3.4)
- Touch Invert in the menu. Invert is now In.

Similar operation methods are used to select and set the Volts/div menu items.



Figure 3.3.4 Selection between Two Items

1

c) Method for selection from numerical value setups and multiple items This operation method description using the deskew example is shown in Figure 3.3.5. The numerical value is set to +1.04 ns.

## **Operation Steps**

- 1. Perform the same operation as in step 1 of section 3.3.2 to open CH menu (2/2).
- Press the ADJUST knob once.
   Set the ADJUST knob to Coarse. This changes the x mark to x in the Deskew menu item. (See Figure 3.3.5 (a), (b))
- Turn the ADJUST knob clockwise to set the CH menu's Deskew value as +1.00 ns. (See Figure 3.3.5 (a))
- Press the ADJUST knob once to set Fine mode.
   This changes the ADJUST knob mark above the CH menu's Deskew item to the mark shown in part (b) of Figure 3.3.5. (See Figure 3.3.5 (a), (b))
- 5. Turn the ADJUST knob clockwise again, to set the CH menu's Deskew value as +1.04 ns. (See Figure 3.3.5 (a))

1	2	3	4	5		
CH1	CH1	CH1	CH1	CH1	ADJUST	
Volts/div Coarse Fine	Volts/div Coarse Fine	Volts/div Coarse Fine	Volts/div Coarse Fine	Volts/div Coarse Fine	PUSH FINE / COARSE	23 45
Unit Volt	Unit Volt	Unit Volt	Unit Volt	Unit Volt	CURSORS	
Resca l e	Rescale	Resca le	Rescale	Resca l e	MENU CLOSE	
🛱 Deskew	🔶 Deskew	🔶 Deskew	🗘 Deskew	🗘 Deskew		
+0.00ns	+0.00ns	+1.00ns	+1.00ns	+1.04ns		
Next	Next	Next	Next	Next		
(2/2)	(2/2)	(2/2)	(2/2)	(2/2)		

Figure 3.3.5 (a) Setting with ADJUST Knob



Figure 3.3.5 (b) ADJUST Knob Marks (Coarse and Fine)

#### 3.3.4 Menu items and hierarchy

The hierarchy of CH menu items is shown in Figure 3.3.6, 3.3.7. Each of these items and its usage, etc., are described in the right part of the figure.



Sections 3.3.4.1 to 3.3.4.5 on the following pages describe the CH menu items "Invert ", "Rescale", "Deskew", "Filter" and "Probe".




#### 3.3.4.1 Invert

The invert function shows the observed signal as inverted and in the center of the screen, regardless of the vertical axis range selection. This function relates to other functions and menus, so its features and caution points are described as follows.

- a) The invert function can be set independently for each channel.
- b) When Invert is selected, all Math, Auto Measure, and cursor measurements are calculated or measured in relation to an inverted waveform.
- c) The SAVE/RECALL function is used for measurement data. Since these setups are saved when saving the data, only the observation data needs to be saved; it is inverted again after being retrieved from memory.

### 3.3.4.2 Rescale

This function is used when using the current probe to measure current, etc. The rescale formula is as follows.

a x input voltage + b

••••(3.1)

- a: Vertical axis range scaling
- b: Offset

### <Example using lwatsu's model SS-240A, or 250 current probe>

When measuring current, set the vertical axis unit to current. Select Ampere [A] in the CH menu's Unit sub menu.

Set constants a and b in the CH menu's Rescale sub menu.

When using Iwatsu's SS-240A, or 250 model, the output sensitivity is 0.1 V/A, so a = 10 in the following formula.

Current measurement results [A] = 1 / (0.1 [V/A]) × input voltage [V] = 10 × input current [A]

•••• (3.2)

Part (a) of Table 3.6 shows a conversion chart for the vertical axis range converted using the above formula.

Part (b) Table 3.6 shows the Math units when "current" as been set for the vertical axis range of the channel set to Source1 and Source2 for Math.

	Ū.
Voltage Range before Conversion	Current Range after Conversion
2 mV	20 mA
5 mV	50 mA
10 mV	100 mA
20 mV	200 mA
50 mV	500 mA
100 mV	1 A
200 mV	2 A
500 mV	5 A
1 V	10 A
5 V	50 A
10 V	100 A

Table 3.6	(a) Voltage/Current-converted
	Vertical Axis Range

Operation Type	CHx	СНу	Math Unit
<b>x</b> operation	V	V	VV
	А	V	VA
	А	А	AA
	V	V	V
		A→V	V
+, -		(converted to	
operations		voltage)	
	Δ	Δ	Δ

Table 3.6 (b) Math Units

### 3.3.4.3 Deskew

Deskew sets a time differential to correct for the inter-channel phase differential. Figure 3.3.8 shows an example where Deskew is set to  $\Delta t$  for CH2.



Figure 3.3.8 Example where Deskew Is Set to  $\Delta t$  for CH2

To set Deskew, touch Deskew among the CH menu items, then use the ADJUST control knob to set a numerical value.

The setting range of Deskew changes according to Replay/Deskew selected by the Horizontal/Preference menu (section 3.5.4), Time/div, and Max Memory Length. Refer to the table below for details.

\* In the state of default, (setting when shipping or after renewing software ), the Preference menu is set to Replay

Adju		stable range of Deskew		
Time/div	Max Memory Length is	Max Memory Length	Max Memory Length	
	5k to 1 M points	is 1k points	is 500 points	
50 ns/div or less	0 to 5.00 ns	0 to 5.00 ns		
100 ns/div or more	0 to 10.00 ns		0 to 5 00 to	
200 ns/div or more	0 to 20.00 ns	0 to 10.00 ns	0 to 5.00 ns	
500 ns/div or more	0 to 500 ns			

### <When Preference is set to Replay>

#### <When Preference is set to Deskew>

Time/div	Adjustable range ofDeskew
All ranges	0 to 500 ns

#### 3.3.4.4 Filter

\* This function is installed only in the DS-5500A series.

The digital filter function can be set by the CH menu of this instrument. The following are set by the menu items of Bandwidth/Filter and Bandwidth/Cutoff of the CH menu.

#### • Filter

The kind of the following filter is set. The item of Off/LPF/HPF with the following function is selected.

• Off : Doesn't use the digital filter.

- LPF : Attenuates, and removes the signal element of a high region with the low-pass filter.
- HPF : Attenuates, and removes the signal element of a low region with the high-pass filter.

\*When the following one or more requirements are met, the setting of Filter compulsorily becomes Off.

- The acquired mode is excluding normal sampling (NORMAL).
- The real memory length is less than 500 points.
- State of Roll Mode operation
- State of Equivalent Sample (Equ) operation

Moreover, Filter returns to the setting before it switches to Off when the terms and conditions above are not filled.

The setting of the filter is displayed in the CH read-out display region under the screen (Refer to the figure below). "BW" is displayed when BW Limit is on (100MHz, 20MHz, 2MHz or 200kHz), and it is not displayed when BW Limit is off.

"L" is displayed for LPF, "H" is displayed for HPF and nothing is displayed for Off.

BW Limit setting 🔪

Filter setting



Example of the case when BWL is ON and Filter is LPF

#### • Cutoff

When the setting of above-mentioned Filter is LPF or HPF, the cutoff frequency is selected. The element of a frequency that is higher than the cutoff frequency is attenuated, and removed for LPF. The element of a frequency that is lower than the cutoff frequency is attenuated, and removed for HPF. When the setting of Filter is Off, the Cutoff menu item is not displayed.

The range and resolution to be able to set the cutoff frequency depend on the sampling rate, and become the following relations.

- Lower limit of cutoff frequency
- : sampling rate×0.040 [Hz]
- Higher limit of cutoff frequency
- : sampling rate×0.460 [Hz] : sampling rate×0.001 [Hz]

• Resolution of cutoff frequency : sampling ratex0.001 [Hz] The setting range of the cutoff frequency depends on the sampling frequency. Therefore, the same time range is different on the setting range according to the memory length.

Actually, the cutoff frequency set by operating the ADJUST switch is preserved as an internal value. When the sampling rate is changed, it is likely to be limited to the lower limit value or the upper limit value within the range where the cutoff frequency can be set. However, the cutoff frequency returns to the preserved value when the sampling rate is changed again and the preserved value becomes within the range where the preserved cutoff frequency can be set. Moreover, when Recall Default Setup is executed by the SAVE/RECALL menu, the cutoff frequency is initialized by the lower limit value.

In the next page, the example of measuring the waveforms when the digital filter is set

- to LPF is shown.
- < The measuring example to be set the digital filter function >
- Waveforms to be measured
- $\,\bigcirc\,$  Measuring conditios
- Waveforms : Sine wave
- Vertical axis range
- Frequency : 10 kHz
- Horizontal(Time) axis range : 500 µs/div
- Signal level : 4.5V<sub>P-P</sub>
- Max Memory Length : 500 points

: 1.00 V/div

- \*25 data before and behind waveforms are gained by interpolating, and operating data. Therefore, it may be displayed correctly.
- (1) Filter : Off



(2) Filter : LPF, Cutoff frequency : 15.0000 kHz





#### 3.3.4.5 Probe

In this menu item, the following content concerning probe is set.

- (1) Attenuation ratio of probe
- (2) Preservation and call of setting condition concerning probe
- (3) Setting of offset of output connector P1 and P2 of probe power supply option (DS-579)

Figure 3.3.7 must be referred to, and the setting method must set the content of above-mentioned (1) and (3) set similarly referring to "Setting of paragraph 3.3.3 menu item". This chapter explains the setting method about above-mentioned (2).

Operation Steps1 Preservation method to Probe Setup1 to 4

- ① Touch(or select) the CH trace button, or the CH information on waveform read-out display region under liquid crystal screen The CH menu is displayed in the right of the screen. (Refer to Figure 3.3.9.)
- ② Unit, Attenuation, Bandwidth, Coupling, Rescale, and Deskew are set beforehand by the CH menu.
- ③ The menu item is selected in Figure 3.3.9, and Probe is selected. The Probe submenu is displayed in the right of the screen. (Refer to Figure 3.3.10.)
- ④ Touch the menu item of Save Probe Setup in Figure 3.3.10. The Save Probe Setup submenu opens. (Refer to Figure 3.3.1.)
- Touch the menu item of Probe Setup1 to 4 in Figure 3.3.11. The condition of setting it by above-mentioned ② is preserved in the ProbeSetup menu of the correspondence.
- 6 Push the MENU CLOSE button three times. The CH menu closes.

#### Memo

- After purchase and the upgrade, the set content to be set is in the state of default.
- When the preservation operation is newly done with Probe Setup1-4 preservation ahead, the superscription is preserved.
- The content of probe of CH1-4 set can be preserved in arbitrary Probe Setup1-4.
- Rescale is displayed in the menu by the On setting, and Deskew is displayed in the menu by setting the numerical value.









Fig 3.3.11 Save Probe Setup menu

(4)

### Operation Steps2 Method of call from Probe Setup1-4

- ① Touch(or select) the CH trace button, or the CH information on waveform read-out display region under liquid crystal screen The CH menu is displayed in the right of the screen. (Refer to Figure 3.3.12.)
- 2 The menu item is selected in Figure 3.3.12, and Probe is selected. The Probe submenu 2 is displayed in the right of the screen. (Refer to Figure 3.3.13.)
- ③ Touch the menu item of Recall Probe Setup in Figure 3.3.13. The Recall Probe Setup submenu opens. (Refer to Figure 3.3.14.)
- Touch the menu item of Probe Setup1-4 in Figure 3.3.14. Probe Setup 1-4 of the correspondence is called in CH that opens by above-mentioned ①.
- 5 Then, the menu item of Setup by Probe touched (or selected) Model is tothe Setup displayed to by Probe Model(1/5) submenu in Figure 3.3.14 (Refer to Figure 3.3.15). By touching the Next button one by one, the Setup by Probe Model submenu on page 2/5-5/5 can be switched. The setting condition of  $^{(\underline{4})}$ probe of the correspondence is called in CH to which the type name of probe is touched (selection) and opened then by above-mentioned ①.
- 6 Push the MENU CLOSE button three times.
  - The CH menu closes.

#### Memo

- At purchase or after the upgrade of the firmware, the content of Probe Setup1-4 in the call ahead set becomes defaulting set.
- The content of probe of Probe Setup1-4 can be called in any CH among CH1 to CH4.

\_ . \_ . \_ . \_ . \_ . \_ . \_ . \_ . \_ . \_



Fig 3.3.14 Recall Probe Setup menu

5

Fig 3.3.15 Setup by Probe Model menu

# 3.4 VERTICAL Menu

This section describes the Vertical Axis Offset control knobs and Volts/div control knobs.

## 3.4.1 Offset adjustment

The layout of vertical axis-related buttons and knobs is shown in Figure 3.4.1. Use the Vertical Axis Offset control knob to adjust offset.  $/^{2, 3}$ 

## **Operation Steps**

- Press the trace button for the channel to be adjusted to display the waveform. The target trace buttons (in blue frame in Figure 3.4.1) are displayed in the color corresponding to the waveform color.
- To set the offset to the GND position (0), press the Vertical Axis Offset control knob (in green frame in Figure 3.4.1). This moves the center of the on-screen waveform to the GND position (0).
- To freely set the offset, turn the Vertical Axis Offset control knob. Turn it clockwise to move the waveform upward (vertical positive axial direction).
   Turn it counter-clockwise to move the waveform downward (vertical negative axial direction).

Offset values are shown for each channel in the waveform readout display area at the bottom of the screen. (See Figure 3.4.2)

Offset variation ranges are listed in Table 3.7.

The offset variation range differs according to volts/div.



Figure 3.4.1 Layout of Buttons and Knobs

<mark>1: 20</mark>	OmV
AC1M ofs	0. 00mV
	1
	Offset value

Figure 3.4.2 Offset Value Display Example

Volts/div	Offset Variation Range		
	Voltage Value	div Value	
10 V		-10 div to +10 div	
5 V	100 V to 100 V	-20 div to +20 div	
2 V		-50 div to +50 div	
1 V		-100 div to +100 div	
500 mV		-20 div to +20 div	
200 mV	-10 V to +10 V	-50 div to +50 div	
100 mV		-100 div to +100 div	
50 mV		-20 div to +20 div	
20 mV		-50 div to +50 div	
10 mV	-1 V to +1 V	-100 div to +100 div	
5 mV		-200 div to +200 div	
2 mV		-500 div to +500 div	

Table 3.7 Offset Variation Ranges (Unit: Volt)

### 3.4.2 Set Volts/div (vertical axis)

The layout of vertical axis-related buttons and knobs is shown in Figure 3.4.3. Use the Volts/div control knobs to set the vertical axis range.

- **Operation Steps**
- Press the trace button for the channel to be adjusted to display the waveform. The target trace buttons (in blue frame in Figure 3.4.3) are displayed in the color corresponding to the waveform color.
- Use the Volts/div control knobs (see blue frame in Figure 3.4.3) to set the vertical axis range. Turn the knob clockwise to raise the range, or counter-clockwise to lower it.

Vertical axis is shown for each channel in the waveform readout display area at the bottom of the screen. (See Figure 3.4.4)

The vertical axis's variation range is from 2 mV/div to 10 V/div. In the CH menu, if the probe's damping ratio is set to any value other than 1:1, the variation range shifts to 10x, 100x, 1000x, etc., according to the probe's damping ratio setup.

Normally, this switch uses steps 1, 2, and 5, but the conversion setups are followed unless a conversion function has been set in the CH menu.

## 3.4.2.1 Enlarge/shrink waveform (Division/Volts differences)

There are two ways to enlarge or shrink waveforms in the vertical axis direction, depending on the set basis.

- Division: Enlarge/shrink waveform based on GND position.
- Volts: Enlarge/shrink waveform based on center of screen.

When Division is selected, the channel-specific GND position does not change when the vertical axis range is adjusted, which makes it useful in cases such as shown in Figure 3.4.5.



 OFFSET
 PUSHZERO OFFSET
 PUSHZERO OFFSET
 PUSHZERO OFFSET
 PUSHZERO OFFSET
 PUSHZERO OFFSET

 Image: Construction of the state of the st

VERTICAL

Figure 3.4.3 Layout of Buttons and Knobs



Figure 3.4.4 [Volts/div] Display Example

This is used for measurement when observing a waveform that is not at the center of screen, such a when comparing two waveforms.

Figure 3.4.5 Division Example

With Volts, when only one part of a waveform is enlarged or shrunk, the vertical position of the part to be observed is moved to the screen center by offset adjustment, and this vertical position does not move when the [Volts/div] setup is changed. For example, Figure 3.4.6 shows a valid example in which the center of the screen becomes magnified when the part to be magnified and observed is moved there.



This is used for measurement when observing a waveform that is at the center of screen, such as when viewing part of a waveform or when measuring DC component waveforms.

Figure 3.4.6 Volts Example

These setups are set via Utilities menu. The layout of the UTILITIES menu button is shown in Figure 3.4.7.

## **Operation Steps**

- 1. Press the UTILITIES menu button.
- Touch "Config." in Utilities menu (1/3). (See Figure 3.4.8)



Figure 3.4.7 Selection of UTILITIES Button

- Touch (select) "Division or Volts" under Offset Setting in Config menu (1/2). (See Figure 3.4.8)
- Press the MENU CLOSE button twice to close Config menu (1/2) and Utilities menu (1/3). (See Figure 3.4.8)



Figure 3.4.8 Division/Volts Selection

## 3.4.2.2 Undo operation of [Volts/div] control knob

The previous setups can be restored (undo operation) by pressing the Volts/div control knob once or by turning the [Volts/div] knob. However, this operation is available only when triggering has been stopped.

The layout of vertical axis-related buttons and knobs and layout of trigger-related buttons and knobs are shown in parts (a) and (b) of Figure 3.4.9.

## **Operation Steps**

- Press the SINGLE button or the RUN/STOP button.
   A measurement example is shown in part (a) of Figure 3.4.10.
- Turn the [Volts/div] control knob clockwise to raise the vertical axis range by one level.

A measurement example is shown in part (b) of Figure 3.4.10.

Press the [Volts/div] control knob once.
 The waveform display returns to the screen shown in part (a) of Figure 3.4.10.

A similar function is provided for the horizontal axis direction. If triggering has been stopped, pressing this knob once will restore the previous setups, even when the Time/div control knob has been turned.



Figure 3.4.9 (a) Trigger-Related Layout



Figure 3.4.9(b) Vertical Axis-Related Layout



Figure 3.4.10 (a) When Triggering has been Stopped



## 3.5 HORIZONTAL Menu

This section describes the functions and operations of the DELAY control knob, Time/div control knob, and the Horizontal menu.

#### 3.5.1 Delay adjustment

The Delay time shown is when time 0 is at the center of the screen. The layout of HORIZONTAL (horizontal axis)-related buttons and knobs is shown in Figure 3.5.1. Use the DELAY control knob to adjust the delay time.

#### **Operation Steps**

 Turn the DELAY control knob clockwise. This moves the trigger delay mark and observed waveform from the center to the right side of the screen. The delay time is shown as positive. (See Figure 3.5.2 (a))



Figure 3.5.1 Horizontal Axis-Related Layout

- 2. Turn the DELAY control knob counter-clockwise. This moves the trigger delay mark and observed waveform from the center to the left side of the screen. The delay time is shown as negative. (See Figure 3.5.2 (b))
- To set 0 as the time delay value, press the DELAY control knob once. (See Figure 3.5.2 (c))



Figure 3.5.2 (c) Delay Time Adjustment Example 3

## 3.5.2 Set HORIZONTAL (horizontal axis)

The layout of HORIZONTAL (horizontal axis)-related buttons and knobs is shown in Figure 3.5.3.

Use the Times/div control knob to set the horizontal axis range.

#### **Operation Steps**

 Turn the Times/div control knob to set a higher range, or counter-clockwise to set a lower range.

The Times/div display appears in the readout area in the upper left part of the screen. (See Figure 3.5.4)

Times/div can be set in steps of 1-2-5. The variation range differs among the different models in the ViewGo II

(DS-5500A/DS-5400) Series.

See the variation ranges listed in Table 3.8.



Figure 3.5.3 Horizontal Axis-Related Layout



Figure 3.5.4 Times/div Display Example

Model	DS-5554A/5552A	DS-5534A/5532A	DS-5524A/5522A /5424/5422	DS-5514A/5512A /5414/5412
Frequency bandwidth	500 MHz	350 MHz	200 MHz	100 MHz
Horizontal axis range's	500 ps/div to	1 ns/div to	2 ns/div to	5 ns/div to
variation range	50 s/div	50 s/div	50 s/div	50 s/div
Roll mode variation range	50 ms/div to <sup>(Note 1)</sup>			

Table 3.8 Variation Range for HORIZONTAL Range

Note 1) Operation range varies according to actual memory length. (See Table 3.10 in section 3.5.7.2)

#### 3.5.3 Menu item setups

The layout of HORIZONTAL (horizontal axis)-related buttons and knobs is shown in Figure 3.5.5.

An example of Mode (acquisition mode) menu item setups is described below.

### **Operation Steps**

- Press the SETUP button shown in the figure at right. The Horizontal Measure Item menu appears in the right part of the screen. (See Figure 3.5.6)
- Touch (select) the Mode menu item. This opens the menu item's option display menu. (See Figure 3.5.7)
- Touch (select) the menu item in the option display menu. (See Figure 3.5.7)
- Press the MENU CLOSE button. This opens the Horizontal Measure Item menu shown in Figure 3.5.6.



1

Figure 3.5.5 Horizontal Axis-Related Layout







Touch (select) the menu item "Max Memory Length" to again open the option display menu, and then select 500, 1k, 5k, 10k, 50k, 100k, 500k, or 1M (The selection of the Max Memory Length of 1M is possible only in the DS-5500A series.) as the memory length. The menu items "Equivalent Sample (Equ)" and Roll Mode can be touch-selected in the Measure Item menu to be toggled ON and OFF. The menu item "Average" (averaged count) can be set to a count value of 2, 4, 8, 16, 32, 64, 128, or 256 by turning the ADJUST knob (5 in Figure 3.5.6).

#### 3.5.4 Menu items and hierarchy

The hierarchy of Horizontal menu items is shown in Figure 3.5.8. Each of these items and its usage, etc., are described in the right part of the figure.



Figure 3.5.8 Horizontal Menu Setting Items

The above CH menu items are described in detail in section 3.5.5 below.

#### 3.5.5 Mode setups

Select the Horizontal menu item "Mode" to set one of the three modes: Normal, Peak Detect, or Average.

### 3.5.5.1 Normal

In Normal mode, the observed waveforms are displayed with a drawing time of 100 ms, so that more acquired waveform data is accumulated every 100 ms. If a trigger does not occur during this 100-ms period, the waveform data from the last 100-ms period is displayed.

#### 3.5.5.2 Peak Detect

When Peak Detect is set, this function detects the maximum value and minimum values that are issued at intervals equal to twice the sampling period used when Peak Detect is not set, and alternately records the results to memory. With the ViewGo II (DS-5500A/DS-5400) Series, the minimum time enabling detection of the maximum value and minimum value is 1 ns (1 GS/s). A comparison of cases with and without Peak Detect is shown in Figure 3.5.10 on the next page. If appropriate memory length and sweep time are selected, it is not possible to detect waveform data point A in the figure unless Peak Detect has been set. As is shown in the lower part, when Peak Detect is set, acquisition occurs in 1-ns cycle regardless of the sampling period, so any events that occur during the sampling period can be acquired.



Figure 3.5.10 Comparison Based on Peak Detect Setups

#### (Memo) Constraints on Peak Detect Measurements

• Even when Peak Detect has been set, operation is not possible if the sampling rate is 250 MS/s or above. When the Peak Detect function is operating, "Peak" is shown in the readout area at the top of the screen. Also, the sampling rate is shown in the status information area in the bottom of the screen. If the sampling rate is too high, use the Time/div control knob to adjust it, or change the Max Memory setup in the Horizontal menu.

#### 3.5.5.3 Average

When "Average" is set, averaging is performed for data on the same time axis each time an input signal is acquired, and a waveform is displayed. However, the higher the averaged count value is, the more noise can be reduced in the observed signal, although processing time also increases.

During Run mode (AUTO, NORMAL, or SINGLE button is ON), pressing CLEAR button initializes averaging.

The calculation types of the weighted average in the average processing of this product are as follows.

An = An-1+(Dn-An-1)/n ( $n \le N$ , for all acquisition mode)

An = An-1+(Dn-An-1)/N (n > N, only for Normal and Auto Mode)

n : Current averaging frequency

\*This is the value processed in the equipment, and cannot be displayed on the screen and cannot be set by users.

N : No. of Times

\* This is the value which is set by users in the menu.

An: Mean value of times n

 $\mathrm{D}\,n\mathrm{:}\,\mathsf{Measurements}$  of times n

The value of n used to divide the above-mentioned calculation type adopts the approximate value of n of a table below right row.

n (Current averagingfrequency)	Approximate value of n
1	1
2	2
3	2.67
4	4
5~6	5.33
7~9	8
10~13	10.7
14~18	16
19~26	21.3
27~37	32
38~53	42.7
54~75	64
76~106	85.3
107~149	128
150~213	170.7
214~	256

#### (Memo) Constraints when Average is set

- Even when Average has been set, there is no limit on the maximum memory length setup.
- If Roll is set to ON after Average has been set, the Average setup is forcibly canceled, and normal sampling is set instead. Similarly, if Average is selected after Roll ON has been set, Roll is forcibly turned OFF.

### 3.5.6 Equivalent Sample (Equ) setup

When the signal to be observed is a repetitive signal, the principle of equivalent sampling can be used to raise the apparent sampling rate for measurements. This equivalent sampling principle is illustrated in Figure 3.5.11. Using the trigger time T as a basis, data acquired after times t1, t2, and t3 are indicated by  $\Delta$ ,  $\circ$ , and x respectively. This tn (n = 1, 2, 3...) time is measured, and is compiled with waveform data with consideration given to relative time relationships so that a very high sampling rate can be realized.



Figure 3.5.11 Equivalent Sampling Principle

In this product, the above tn time measurement uses a resolution of 10 ps to realize 100 GS/s sampling equivalently.

### (Memo) Constraints on Equ setup

• When the Equ setup is ON, the Max Memory Length setup can be raised to 1 M points, but Equ operation is not possible. Also, even if the Max Memory Length has already been set to 50 k, 100 k, 500 k, or 1 M points, when the Equ setup is ON the memory length is set to 10 k or less by internal processing.

When the Equ setup is ON, the display indicates that Max Memory Length can be set as high as 1 M points in the Horizontal menu. During actual use, the memory length is up to 10 k.

\* The selection of the Max Memory Length of 1M is possible only in the DS-5500A series.

### 3.5.7 Roll setup

Waveform data can be acquired and displayed in real time. The operational features of Roll mode are described below.

## 3.5.7.1 Roll operations

Roll operations corresponding to trigger modes are listed in Table 3.9.

Table 2.0 Dall	0		4	<b>T</b>	Madaa
Table 3.9 Roll	Operations	Corresponding	το	Irigger	wodes

Trigger Mode	Corresponding Roll Operation	
AUTO	Continues real-time acquisition and display.	
NORMAL	Repeats SINGLE.	
SINGLE	Acquires one trigger signal and then stops.	

## 3.5.7.2 Times/div for Roll operations

Times/div for Roll operations with Max Memory are listed in Table 3.10.

Max Memory	Data Count per div	Times/div for Roll Operations
500	50	
1 k	100	
5 k	500	50 ms/div to 50 s/div
10 k	1,000	
50 k	5,000	
100 k	10, 000	
500 k	50, 000	500 ms/aiv to 50 s/aiv
1 M	100, 000	1 s/div to 50 s/div

Table 3.10 Times/div for Roll Operations

\* The range of the selection of Max Memory becomes the following.

- DS-5500A Series
  - :500 to 1M (points)
- DS-5400 Series :500 to 500k (points)

## 3.5.7.3 Waveform displays during Roll operations

When switching from trigger stop mode to waveform acquisition mode, the displayed waveform is cleared and then shown along the right edge of the screen. Illustrations of the waveforms displayed when switching from trigger stop mode to waveform acquisition mode are shown in Figure 3.5.12.



Trigger stop mode

Immediately after starting sweep

Figure 3.5.12 Waveforms Displayed When Starting Roll Operations

## 3.5.7.4 Relation to other functions

The following describes functions and operations for when Roll operations are set as overlapping with other functions.

a) Overlapping with Average function as Mode

If the Average function is selected while Roll has been set to ON, the Roll setup is forcibly set to OFF. Also, the message "Roll mode off." appears on the screen.

b) Overlapping with Zoom function

Zoom waveforms cannot be displayed when operating if Roll has been set to ON. If Zoom is set to ON during Roll operations, the upper/lower split waveform display areas are output but nothing is shown in the Zoom display area. Also, the message "No Zoom waveform while Roll mode." appears at the bottom of the screen. Zoom waveforms are displayed once triggers are stopped (by pressing the RUN/STOP button). In addition, when Roll operations are resumed (by pressing AUTO, NORMAL, or SINGLE button), Zoom waveforms are cleared.

For details of the Zoom function, see section 3.15.

## 3.6 TRIGGER Menu

This section describes the functions and operations related to the Trigger LEVEL control knob and Trigger menu.

### 3.6.1 Trigger level adjustment

Trigger LEVEL control knob 1, 2, 3

When observing a signal, set the trigger level to within the signal's amplitude range. Use the TRIGGER LEVEL control knob to set the trigger level. The layout of TRIGGER related buttons and knobs is shown in Figure 3.6.1.

## **Operation Steps**

- Turn the TRIGGER LEVEL control knob clockwise. This moves the trigger level mark to the top in the screen. The trigger level is indicated in the waveform readout area near the bottom right corner of the screen. (See Figure 3.6.2 (a), which shows a positive display when the trigger level is higher than the offset voltage. A line shown above or below the T mark indicates the trigger level.)
- Turn the TRIGGER LEVEL control knob counter-clockwise. The trigger level mark is moved toward the bottom of the screen. The trigger level is shown in the waveform readout area near the bottom right corner of the screen. (See Figure 3.6.2 (b), which shows a negative display when the trigger level is lower than the offset voltage.)



Figure 3.6.1 Layout of Trigger Buttons and Knobs





3. To set the trigger level to the center of the waveform amplitude, press the Trigger LEVEL control knob once to go to Find Level. (See Figure 3.6.2 (c))



Figure 3.6.2 (b) Trigger Level Mark and Value



Figure 3.6.2 (c) Find Level Mark and Value

#### 3.6.2 Menu item setups

The layout of TRIGGER-related buttons and knobs is shown in Figure 3.6.3. Trigger menu item setups are described below.

### **Operation Steps**

- Press the TRIGGER SETUP button shown in Figure 3.6.3. The Trigger menu appears in the right part of the screen. (See Figure 3.6.4)
- Touch (select) the menu item "Type" shown in Figure 3.6.4. This opens the menu item's option display menu. (See Figure 3.6.5)
- Touch (select) a menu item in the option display menu shown in Figure 3.6.5.
   Each trigger type is set via menus that are subordinate to the option display menu.





4. Press the MENU CLOSE button two times. This closes the Trigger menu and option display menu shown in Figure 3.6.4 and Figure 3.6.5.

The hierarchical view of menu items from section 3.6.3 and the menu item setup method for trigger type are described in section 3.6.4 below.



Figure 3.6.4 Trigger Menu

Figure 3.6.5 Trigger Option Display Menu

### 3.6.3 Menu items and hierarchy

Trigger menu setups are described below in sections 3.6.3.1 to 3.6.3.9 and are shown respectively by type in parts (a) to (i) of Figure 3.6.6.

Setups for DS-5500A Series are broadly divided into the following nine types.

As for the DS-5400 Series, six kinds of Type is selected from the following 9Type except Edge ALT, Edge OR, and OR/NOR/AND/ NAND.

- Edge
- Edge ALT
- Edge OR
- Pulse Count
- Pulse Width
- Period
- Dropout
- TV
- OR/NOR/AND/NAND





### 3.6.3.2 Type:Edge ALT

\* This function is possible only in the DS-5500A series.



### 3.6.3.3 Type:Edge OR

\* This function is possible only in the DS-5500A series.



Figure 3.6.6 (c) Edge OR Menu

#### 3.6.3.4 Type:Pulse Count



Figure 3.6.6 (d) Pulse Count Menu





Figure 3.6.6(e) Pulse Width Menu

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Figure 3.6.6 (f) Period Menu



#### 3.6.3.7 Type:Dropout

Figure 3.6.6 (g) Dropout Menu





Figure 3.6.6 (h) TV Trigger Menu

### 3.6.3.9 Type:OR/NOR/AND/NAND

\* This function is possible only in the DS-5500A series.



Figure 3.6.6 (i) OR/NOR/AND/NAND Menu

### 3.6.4 Trigger types and setup methods

This section describes how to set menu items for various triggers that can be set with this product.

### 3.6.4.1 Edge

With edge triggering, a trigger signal occurs at the position where the specified trigger source signal intersects the input signal. These setups are described starting in Step 3 in section 3.6.2.

## **Operation Steps**

6.

- Touch (select) "Source" in the sub menu shown in Figure 3.6.7. This opens the Source option display menu (1/2, 2/2). (See Figure 3.6.8)
- Touch (select) a trigger source signal from the Source option display menu (1/2, 2/2) shown in Figure 3.6.8.
- 3. Touch (select) "Slope" in the sub menu shown in Figure 3.6.7.
- Touch (select) "Coupling" in the sub menu shown in Figure 3.6.7. This opens the Coupling option display menu. (See Figure 3.6.9)
- 5. Touch (select) "Coupling" in the Coupling option display menu shown in Figure 3.6.9.

the sub menu shown in Figure 3.6.7.

Turn the ADJUST knob to set "Holdoff" in



Figure 3.6.7 Trigger Menu



Figure 3.6.8 Source Sub Menu



#### Figure 3.6.9 Coupling Sub Menu

### 3.6.4.2 Edge ALT

\* This function is possible only in the DS-5500A series.

Alternate edge triggering generates trigger signals alternately at the rising and falling edges of the trigger source signal.

There is no need to set the slope (positive or negative) as for edge triggering in section 3.6.4.1 of the previous page. For description of the operation steps for options other than Slope, see the steps in section 3.6.4.1 above.

Figure 3.6.10 shows the sub menu for alternate edge triggering.

With alternate edge triggering, processing time is needed after the first detected edge of the trigger source signal and before the waveform is displayed. During this processing time, triggers at rising or falling edge are not detected. After the waveform display is completed, a trigger is detected at the next rising or falling edge



Figure 3.6.10 Trigger Sub Menu

#### 3.6.4.3 Edge OR

\* This function is possible only in the DS-5500A series.

With edge OR triggering, a trigger occurs at a specified edge, the rising edge (positive slope) or falling edge (negative slope) for a single channel or multiple channels.

Select "Don't' Care" in the option display menu, as shown in Figure 3.6.11, for any channels that are not intended as trigger source signals.

#### Operation Steps

- 1. Touch (select) "Source" in the sub menu shown in Figure 3.6.11. This opens the Source option display menu (1/2, 2/2). (See Figure 3.6.12)
- 2. Touch (select) a trigger source signal from the Source option display menu (1/2, 2/2) shown in Figure 3.6.12.
- 3. Touch (select) "Slope" in the sub menu shown in Figure 3.6.11. This opens the Slope option display menu. (See Figure 3.6.13)
- 4. Touch (select) Don't Care, Positive, or Negative in the Slope option display menu shown in Figure 3.6.13.
- 5. Touch (select) "Coupling" in the sub menu shown in Figure 3.6.11. This opens the Coupling option display menu. (See Figure 3.6.14)



Figure 3.6.11 Trigger Menu

- 6. Touch (select) "Coupling" in the Coupling option display menu shown in Figure 3.6.14.
- 7. Use the Trigger Level control knob to adjust the trigger level. (See "3.6.1 Trigger level adjustment")

4

8. Repeat steps 1 to 7, and set the slope, etc. for all sources.



**Option Display Menu** 

Slope Don't Care Ā Positive Negative Figure 3.6.13 Slope

**Option Display Menu** 





## 3.6.4.4 Pulse Count

With pulse count triggering, a trigger occurs when the specified trigger signal count value is reached. This is well suited for checking the operation of a counter circuit or encoder.

The following describes setups for the menu item No. of Pulse (pulse count) described among other items beginning in operation step 3 of section 3.6.2 above. (For description of setups for the Source, Slope and Coupling items, see the operation steps in section 3.6.4.1 above.)

### **Operation Steps**

- Touch (select) "Pulse Count" in the Type sub menu shown in Figure 3.6.5 in section 3.6.2. This opens the Trigger sub menu. (See Figure 3.6.15)
- Touch (select) "No. of Pulse" to set the pulse count.
- Turn the ADJUST knob shown in Figure 3.6.15 to set the value for No. of Pulse (pulse count: integer from 1 to 9999). Turn the knob clockwise to increase the value in the sub menu, or counter-clockwise to reduce it.



Figure 3.6.15 Type Sub Menu

#### 3.6.4.5 Pulse Width

With pulse width triggering, a trigger occurs when the input pulse meets conditions that include a specified polarity and specified pulse width.

This trigger is set as a positive pulse or negative pulse according to its polarity, and the acquisition conditions for the pulse width are set via the Pulse Width option.

The following describes setups for the menu item described among other items beginning in operation step 3 of section 3.6.2 above. (For description of setups for the Source and Coupling items, see the operation steps of edge trigger in section 3.6.4.1 above.)

## **Operation Steps**

- 1. Touch (select) "Polarity" in Figure 3.6.16.
- Touch (select) "Pulse Width" in Figure 3.6.16.
  This opens the Pulse Width sub menu. (See

Figure 3.6.17)

- Touch (select) "When" as shown in Figure 3.6.17 to specify the pulse width range and conditions. This opens the When option display menu. (See Figure 3.6.18)
- Touch (select) one of the conditions shown in Figure 3.6.18. The display returns to the Pulse Width sub menu shown in Figure 3.6.17.
- To set the pulse width range, touch (select) the button that sets the range for m or n, as shown in Figure 3.6.17.
- Turn the ADJUST knob as shown in Figure 3.6.17 to set a value for m or n.



Figure 3.6.16 Type Sub Menu



Figure 3.6.17 Pulse Width Sub Menu



Figure 3.6.18 When Option Display Menu

#### 3.6.4.6 Period

With period triggering, conditions are set for a certain signal period to enable triggering. This type of function can be used for pulse measurements, such as in motors.

This section describes how to set the Interval Time as a period trigger menu item. (For description of setups for Source, Slope and Coupling, see operation steps 1 to 5 in section 3.6.4.1.)

## **Operation Steps**

- Touch (select) "Interval Time" to set the interval time as shown in Figure 3.6.19. This opens the Interval Time sub menu. (See Figure 3.6.20)
- Touch (select) "When" to set the range and conditions of the interval time as shown in Figure 3.6.20. This opens the When option display menu. (See Figure 3.6.21)
- Touch (select) one of the conditions shown in Figure 3.6.21. The display returns to the Interval Time sub menu shown in Figure 3.6.20.
- Turn the ADJUST knob as shown in Figure 3.6.20 to set a value for m (Interval Time).



Figure 3.6.19 Type Sub Menu







Figure 3.6.21 When Sub Menu

(Caution) Constraints on period (period trigger) For the period trigger function, there is a limit on the operating frequency, and operation is not guaranteed if the input frequency is over this limit. The upper limit frequency for operation varies as shown below, according to		
the period setup.		
Period setup		Max. operating frequency
to 167.6 msec		40 MHz
to 335.2 msec		20 MHz
to 670.4 msec		10 MHz
to	1.3 sec	5 MHz
to	1.6 sec	4 MHz
to	3.3 sec	2 MHz
to	6.7 sec	1 MHz
to	13.4 sec	500 kHz
to	16.7 sec	400 kHz
to	33.5 sec	200 kHz
to	50.0 sec	100 kHz
L		

### 3.6.4.7 Dropout

With dropout triggering, a trigger occurs after the specified dropout time has elapsed if the specified edge was not detected during this period, which follows the specified rising edge (positive slope) or falling edge (negative slope).

As such, dropout triggering is used to check whether pulses are being generated as per the specifications.

This section describes how to set the Dropout Time as a dropout trigger menu item. (For description of setups for Source, Slope and Coupling, see operation steps 1 to 5 in section 3.6.4.1.)

#### **Operation Steps**

 To set the dropout time, turn the ADJUST knob shown in Figure 3.6.22, then set a value for t (Dropout Time).



Figure 3.6.22 Type Sub Menu
#### 3.6.4.8 TV

With TV triggering, a specified TV signal field or line is used to trigger a device. This section describes how to set "TV Setting" as a TV trigger menu item. (For description of setups for Source and Slope, see operation steps 1 to 5 in section 3.6.4.1.)

#### Operation Step 1

- Touch (select) "TV Setting" as shown in Figure 3.6.23 to set up the TV. This opens the TV Setting sub menu. (See Figure 3.6.24)
- Touch (select) "TV Standard" in Figure 3.6.24. This opens the TV Standard option display menu. (See Figure 3.6.25)
- Touch (select) one of the TV standards (NTSC, PAL, or Custom) as shown in Figure 3.6.25.

See the next page for descriptions of setups in the NTSC and PAL menu, and in the Custom menu.



Figure 3.6.23 Type Sub Menu





Figure 3.6.24 TV Setting Sub Menu

Figure 3.6.25 TV Standard Option Display Menu

#### Operation Step 2 NTSC and PAL menu setups

- Touch (select) one of the values under "Line Number" in the TV Setting sub menu, as shown in Figure 3.6.26.
- Touch (select) "Field Sequence", then turn the ADJUST knob to select. There four options for "Line No.": 1, 2, 4, or 8.
- Touch (select) "Field No." and turn the ADJUST knob to set a number.
   As a constraint pertaining to Field No. setups, the selected Field No. must be either a positive integer that is equal to or less than the value specified for the number of lines in step 2, or "Any Fields".
- Touch (select) "Any Fields/Line No" and turn the ADJUST knob to set a number. As a constraint pertaining to the Any Lines/Line No. setup, the Any Lines/Line No. specification must be either a positive integer that is equal to or less than the value

specified for the Line/Line No. in step 1, or



Figure 3.6.26 TV Setting Sub Menu

#### Operation Step 3 Custom menu setups

 Touch (select) "Custom Setups" to open the related sub menu. (See Figure 3.6.27)

"Any Lines".

- Touch (select) "Field Frequency" and use the ADJUST knob to set it.
- Touch (select) "No of Scan Line" and use the ADJUST knob to set it.
- 4. Press the MENU CLOSE button to close the TV Setting sub menu.
- Touch (select) "Field Sequence" and use the ADJUST knob to set it.
- Touch (select) "Fields No." and use the ADJUST knob to set it.
- Touch (select) "Any Fields/Line No" and use the ADJUST knob to set it.



Figure 3.6.27 TV Setting Sub Menu

#### 3.6.4.9 OR/NOR/AND/NAND

\* This function is possible only in the DS-5500A series.

Set high or low level for a single channel or multiple channels, then it is assumed to be "High" at time when the trigger source is larger than the trigger level (threshold level), and "Low" at the time when the trigger source is smaller than the trigger level (threshold level).

If "Don't Care" has been selected in the option display menu for a trigger source signal channel, as shown in Figure 3.6.29, that channel can be excluded as a target for triggering.

#### Operation Step OR trigger example

- Touch (select) one of the four trigger patterns listed in the sub menu shown in Figure 3.6.28.
- Touch (select) "Source" in the sub menu shown in Figure 3.6.28. This opens the Source option display menu. (See Figure 3.6.29)
- Touch (select) a trigger source signal from the Source option display menu shown in Figure 3.6.29.
- Touch (select) "State" in the sub menu shown in Figure 3.6.28. This opens the State option display menu. (See Figure 3.6.30)
- Touch (select) any item in the State option display menu shown in Figure 3.6.30.



Figure 3.6.28 Trigger Menu

- Touch (select) "Coupling" in the sub menu shown in Figure 3.6.28. This opens the Coupling option display menu. (See Figure 3.6.31)
- Touch (select) "Coupling" in the Coupling option display menu shown in Figure 3.6.31.

5



3

Figure 3.6.29 Source Option Display Menu



Coupling



7

Option Display Menu

## 3.7 UTILITIES Menu

This section describes the functions and operations of UTILITIES menu buttons. Use the UTILITIES menu to enter the following function-related setups, which enables to this product to be more effectively used to measure observed waveforms.

- Print function setups: used for output of on-screen data
- Config: setups include date, time user interface language, and power supply system
- Calibration: calibration-related setups and operations, and save/recall of calibration data
- Status & Update: status display, setups, and updates for this product's hardware, software, and options
- Remote: selection of remote control via a TCP/IP, GPIB, or USB connection.
- AUX IO 2:

\*DS-578 (factory option) can be installed only in the DS-5500A Series, and the AUX IO2 menu item is displayed.

This is the menu item when equipped with the DS-578 CH1/TRIG output option in the DS-5500A Series. The signal output from the AUX IO2 BNC output terminal on the rear panel can be set to TRIG output or pulse output of the pass/fail judgment results.

#### 3.7.1 UTILITIES-related buttons, knobs, and menus

The layout of UTILITIES-related buttons and knobs is shown in Figure 3.7.1. Operations using these buttons, knobs, and menus are described below.

#### **Operation Steps**

- Press the UTILITIES menu button shown in Figure 3.7.1. The Utilities menu appears in the right part of the screen. (See Figure 3.7.2)
- 2. Touch (select) a menu item shown in Figure 3.7.2.
- Use the ADJUST knob to select and set a menu item shown in Figure 3.7.2.
- Use the MENU CLOSE button to close the menu shown in Figure 3.7.2.

The menu items and their hierarchy in sub menus and option display menus for these setups are described below in section 3.7.2.



Figure 3.7.1 Layout of Buttons and Knobs



Figure 3.7.2 Utilities Menu

#### 3.7.2 Menu items and hierarchy

The hierarchy of items in the Utilities menu is shown in parts (a) to (g) of Figure 3.7.3. The first level of the hierarchy in the Utilities menu has six sub menus: Print, Config, Calibration, Status & Update, Remote and AUX IO 2. The level of each menu item is shown, along with descriptions at right of each items' setups, use conditions, applications, etc.

#### 3.7.2.1 Utilities menu

The hierarchy of Utilities menu items is shown in part (a) of Figure 3.7.3.

	Print	•••• See Figure 3.7.3 (b)
	– Config.	•••• See Figure 3.7.3 (c)
Utilities menu	- Calibration	••••See Figure 3.7.3 (d)
	<ul> <li>Status &amp; Update</li> </ul>	•••• See Figure 3.7.3 (e)
	<ul> <li>Remote</li> </ul>	•••• See Figure 3.7.3 (f)
		•••• See Figure 3.7.3 (g)

\*DS-578 (factory option) can be installed only in the DS-5500A Series, and the AUX IO2 menu item is displayed.

AUX IO2 is the menu item when equipped with the DS-578 CH1/TRIG output option in the DS-5500A Series.

Figure 3.7.3 (a) Utilities Menu



Figure 3.7.3 (b) Print Sub Menu, Option Display Menu

#### 3.7.2.2 Print menu





Figure 3.7.3 (c) Config Sub Menu, Option Display Menu





Figure 3.7.3 (d) Calibration Sub Menu





Figure 3.7.3 (e) Status & Update Sub Menu

#### 3.7.2.6 Remote menu

Set up remote control with this menu. For description of the remote control method and commands, see Remote Control Manual that is included in the attached CD.



\* The interface of TCP/IP (LAN) is installed only in the DS-5500A series.

Figure 3.7.3 (f) Remote Sub Menu

## 3.7.2.7 AUX IO2 menu (option)

DS-578 (factory option) can be installed only in the DS-5500A Series, and the AUX IO2 menu item is displayed.

Use this menu to select and set the signal to be output from the AUX IO2 terminal on the rear panel.



#### 3.7.3 Entering characters, symbols, and numerals

This section describes how to enter filename-related characters, numerals, and symbols using the sub menus described above in sections 3.7.2.2 to 3.7.2.5. Similar methods are used with pop-up windows related to setups entered via other menus. These filename entry methods are described below.

#### **Operation Steps**

- 1. Touch (select) the target item for entering a file name. A pop-up with the characters that can be entered appears in the left side of the screen for the Characters menu item. (See the figure below.)
- 2. Use the ADJUST knob to move the cursor position to select a character, then press the knob to enter that character.

An example of characters entered via a pop-up menu is shown below.

ABCDEFGHIJKLMNOPQRSTUVWXYZ!#\$%&' ()+,=@ [] ^{}~0123456789	File Name WBIN0000
Turn the ADJUST click.	knob to the right for one
Pop-up	Menu box
ABCDEFGHIJKLMNOPQRSTUVWWYZ!#\$%&' ()+,=@ [] ^{}~0123456789	File Name XBIN0000
* "X" is shown in inverted mode in the pop-up, and "W" is changed to "X" in the menu box.	
Press the ADJUS	T knob.

 Pop-up
 Menu box

 ABCDEFGHIJKLMNOPQRSTUVWXYZ!#\$%&' ()+, -.=@ [] ^{} 0123456789
 File Name

 XBIN0000
 XBIN0000

\* "B" is shown in inverted mode in the menu box, and also in the pop-up.

Note 1) Characters displayed in pop-up

Only characters that can be entered are shown in the pop-up. For "File Name" in the following menu box, these characters are: Digits held by four  $\circ$  symbols: Enter English alphanumerics and symbols Digits held by four  $\Delta$  symbols: Enter only numerals

Menu box
File Name
$\circ \circ \circ \circ \circ \Delta \Delta \Delta \Delta$

Note 2) The pop-up for file name input is cleared when another operation is executed.

#### 3.7.4 Software updates

This section describes how to update the software.

Please visit lwatsu's website (http://www.iti.iwatsu.co.jp) for information regarding the most recent software updates, device compatibility, and downloads, etc.

Follow the instructions provided on this website when updating.



- Insert the USB memory device containing the software into the USB connector in the lower left part of the front panel. (See Figure 3.7.4)
- Press the UTILITIES menu button shown in Figure 3.7.5. The UTILITIES menu (2/3) appears in the right part of the screen. (See Figure 3.7.6)
- Touch (select) the Status & Update item shown in Figure 3.7.6. This opens a sub menu.
- Touch (select) the Update menu shown in Figure 3.7.6. This opens the Update option display menu. (See Figure 3.7.6)
- 5. Touch (select) "OK" in the menu shown in Figure 3.7.6.

This starts the software update, during which a progress tracking message is shown in the status information display area at the bottom of the screen. When installation is completed, completion is reported in a pop-up window that appears in the center of the screen. (Caution) To avoid possible operation faults, during a software update, never turn OFF the power or unplug the USB memory device.

- 6. Turn the POWER switch to OFF.
- Turn the POWER switch back ON. The updated software will be started and displayed in the device.



Figure 3.7.4 Front Panel



Figure 3.7.5 Layout of Buttons and Knobs



Figure 3.7.6 Status & Update Sub Menu

#### 3.7.5 Remote (IP connection) setups

\* The interface of TCP/IP (LAN) is installed only in the DS-5500A series.

Using the TCP/IP network protocol, connect the oscilloscope to a computer via an Ethernet cable. For this Ethernet connection, use a straight cable when connecting via a network (using a hub, for example), and use a cross cable when connecting the oscilloscope's Ethernet interface to a computer. If an address must be set for the oscilloscope, set it via the UTILITIES menu. The setups for remote control of the oscilloscope are described below.

#### Operation Steps

- 1. Press the UTILITIES menu button to open the UTILITIES menu in the right part of the screen.
- 2. Touch (select) "Remote", then touch DHCP and select ON or OFF. Set DHCP to OFF when using a cross cable to connect the oscilloscope directly to the host computer. Check with the network administrator to determine whether or not

the DHCP can be used with the target network.

DHCP Off: Manually enter the IP address, Subnet Mask, and Default Gateway.

DHCP On: The IP address, Subnet Mask, and Default Gateway are set automatically. This requires support from the target network.

- 3. When DHCP has been set to OFF, Touch (select) "IP Address" and enter the IP address, Subnet Mask, and Default Gateway in the IP Address window that pops up. (See reference example in Figure 3.7.8)
- 4. Touch (select) the ENTER.
- 5. When "Please reboot Scope" appears, turn the power back ON. Time until the address is allocated depends on the connected network.

#### Example of direct connection using cross cable

- 1. Connect the oscilloscope to the host PC using a cross cable.
- 2. Set the oscilloscope's DHCP to OFF, and then set "192.168.1.101" as the address and "255.255.255.0" as the Subnet Mask.
- 3. On the computer side, set "192.168.1.100" as the address and "255.255.255.0" as the Subnet Mask.
- 4. From the host computer, bring up the command prompt and use a command such as Ping 192.168.1.101 to check the connection to the oscilloscope.
- 5. Use an application such as ScopeViewer, or a user-generated program to connect to the scope.



Figure 3.7.8 IP Address Setting Pop-up Window



Figure 3.7.7 Remote Sub Menu

Remote



Memo) Before connecting this product to a network, request the required information from the network administrator. If an invalid address is specified for the network, unexpected operations may occur both on the network and in this product.

## 3.8 Screen Output (File or Print Output)

With this product, you need only to press a button to output screen data to a file in USB memory or to a PictBridge-compliant printer for printing. However, USB memory and a PictBridge-compliant printer cannot be used for output at the same time. These operations are described below.

# 3.8.1 Output screen data to file in USB memory UTILITIES

- 1. Press the UTILITIES menu button. Touch (select) the Print menu item.
- In the Print sub menu, touch (select) the Device menu item.
- In the Device sub menu, touch (select) the USB Memory item.
- Insert the USB memory device into the USB connector in the lower left part of the front panel. (See Figure 3.8.2) "USB memory is connected." is displayed below the screen.
- 5. Press the PRINT execute button. (See Figure 3.8.1) The memory device then blinks and output of screen data starts. The following temporary message is displayed in the status information area at the bottom of the screen, after which the original display (with a logo mark in the bottom left of the screen) is restored when data output is completed.

"Saved XXXXXXXXX.YYYY. XXXXXXXX: file name YYYY: file format extension



Figure 3.8.1 Layout of Buttons and Knobs

#### MENU CLOSE button



4 USB connector

Figure 3.8.2 USB Memory Connector

USB Memory Information	<ul> <li>(Caution) During screen data output, do not remove the memory device if it is still blinking, and wait until the logo is again shown in the status information area. If the memory device is removed before data output is completed, not only will the screen data fail to be copied to the memory device but other data may be lost as well.</li> <li>(Memo) To check the write-enabled capacity of USB memory, press the UTILITIES button to open the Utilities menu, then touch (select) "Status &amp; Update" → "USB Memory Information" to display the memory information in the center of the screen.</li> </ul>					

#### 3.8.2 Print screen using PictBridge-compliant printer

Print using the printer, via the following steps.

#### **Operation Steps**

- Press the UTILITIES menu button. (See Figure 3.8.3)
- Touch (select) the Remote menu item. (See Figure 3.8.4)
- In the Remote sub menu, set "Interface" to OFF.
- Press the MENU CLOSE button to close the Remote sub menu.
- 5. In the Utilities menu, touch (select) the Print menu item.
- Touch (select) the Device menu item in the Print sub menu. (See Figure 3.8.5)
- 7. Touch (select) the Printer menu item in the Device sub menu item. (See Figure 3.8.5)
- Connect the printer to this product via a USB cable, connecting to the USB connector on the rear panel.
- 9. Wait until the newly connected printer is detected and "Printer is connected." appears at the bottom of the screen.

Memo) In the Remote sub menu, only the OFF setup can be changed while a printer is connected to this product via a USB cable.

10. Insert paper into the printer. (Refer to your printer's User's Guide for information regarding paper types, printer setups, etc.)









Figure 3.8.5 Print Sub Menu

- Touch (select) the Paper Size menu item in the Print sub menu. Touch a menu item or use the ADJUST knob to select the paper size. (See Figure 3.8.6)
- 12. In the Print sub menu, touch (select) the Background menu item. In the Background sub menu, touch (select) Black/White as the background color.
- 13. Press the PRINT execute button on the front panel.

When printing setup starts, the message "Preparing to print." pops up in the middle of the screen. When printing starts, the message "Printing... Press PRINT button to cancel printing." pops up.





Memo 1) In the Device menu, only the Printer item can be changed while printing is in progress.
 Memo 2) To cancel printing, press the PRINT Button on the front panel.

When printing is completed, the message "Printing complete." pops up in the center of the screen.

#### Memo) Constraints on hard copies of screen data

- It is not possible to connect a printer unless the Interface menu item in the Remote sub menu is set to [OFF].
- Screen data cannot be saved to a file in USB memory while printing is in progress.
- When Printer has been set under the Device menu item in the Print sub menu, any changes made to the Remote sub menu's Interface menu items (other than [OFF]) will automatically change the Print sub menu's Device menu item in USB Memory. At that time, "Copy Device is changed to USB Memory." is shown at the bottom of the screen.

## 3.9 DISPLAY Menu

This section describes the functions and operations of DISPLAY menu buttons. Setups in the Display menu are related to the following functions.

Type setup	Select screen display type by setting the screen's horizontal axis				
	and vertical axis.				
Vector setup	Select whether to interpolate among observed waveform data or to				
	display using unmodified dots.				
Waveform Intensity	The brightness of the observation waveform on the screen is				
	numerical value (%) set with the ADJUST adjustment knob.				
Persist.Time setup	Select whether or not to overwrite waveform data.				
Color Gradation	Select between a monochrome gradation display of waveform data				
setup	and a spectrum display.				

#### 3.9.1 DISPLAY-related buttons, knobs, and menus

The layout of DISPLAY-related buttons and knobs is shown in Figure 3.9.1. Operations using these buttons, knobs, and menus are described below.

#### Operation Steps

- Press the DISPLAY menu button shown in Figure 3.9.1. The Display menu appears in the right part of the screen. (See Figure 3.9.2)
- Touch (select) a menu item shown in Figure 3.9.2.
- 3. Use the ADJUST knob or the sub menu to select and set a menu item shown in Figure 3.9.2.
- 4. Use the MENU CLOSE button to close the menu and the Display menu shown in Figure 3.9.2.

The menu items and their hierarchy in sub menus and option display menus for these setups are described below in section 3.9.2.



Figure 3.9.1 Layout of Buttons and Knobs



Figure 3.9.2 Display Menu

#### 3.9.2 Menu items and hierarchy

The hierarchy of items in the Display menu is shown in Figure 3.9.3. Each of these items and its usage, etc., are described in the right part of the figure.



Figure 3.9.3 Display Menu

#### 3.9.3 PERSISTENCE

This overwrites the screen display of acquired waveforms. In this product, persistence can be set to OFF, 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, or  $\infty$ .

This function is used to change the signal while continuing observation. An example of an observed signal with amplitude modulation is shown in Figure 3.9.4.

Note that if you press the CLEAR knob During Run mode (i.e., when the AUTO, NORMAL, or SINGLE button is ON),



500 μs/div 100 mV/div 1 MS/s

Figure 3.9.4 Example of Persistence Display

the persistence function is initialized, and acquisition with overwrite starts over again.

Overwritten Function (Other Function)	Supported Operations
Roll Mode function	When operating in Roll mode, the persistence function will not operate even though it has been set to ON.
Measure function	When the persistence function is ON, turning the Measure function ON or OFF deletes the original waveform and starts persistence display from the beginning.

Table 3.10 Use of Persistence Function as an Overwrite Function

## 3.10 REPLAY Functions

In this product, the REPLAY control knob can be used for the following functions.

- It is possible to display it by selecting the waveforms taken in the past when the knob is turned. An old waveform is displayed when knob is turned counterclockwise, and when knob is turned clockwise, a new waveform is displayed.
  - \* However, when CLEAR Functions are executed by pushing the CLEAR button, the waveforms acquired in the past is deleted. Under such a condition, it is not possible to display it by selecting the waveforms acquired in the past even if the REPLAY knob is turned. (Refer to section 3.18 for CLEAR Functions.)
- When the knob is pushed, the latest waveform is displayed.
- A left icon of the knob lights when the waveform can be selected with this knob.
- The current page and the total number of waveforms are displayed in the readout region at the upper right of the screen.

In the section 3.10.1 and 3.10.2, the operation methods and the limitations are explained.

#### 3.10.1 Operation methods

Operation methods for the REPLAY function are described below.

The layout of buttons and knobs related to the REPLAY function is shown in Figure 3.10.1.

#### **Operation Steps**

- Press the STOP or SINGLE button. (See Figure 3.10.1) A "stop" mark and page indication are shown in the readout area at the top of the screen. (See 1 in Figure 3.10.2) In addition, the screen displays the most recent acquired data. (See Figure 3.10.2)
- Turn the REPLAY control knob shown in Figure 3.10.1 to select a page. The current page and the total number of waveforms is shown on the first screen. (See 2 in Figure 3.10.2) The current page data that is fixed at the total number of waveforms is the most recent data.

Turn the knob counter-clockwise to reduce the number of the current page (see part (a) of Figure 3.10.3), or clockwise to increase the number of the current page (see part (b) of Figure 3.10.3).

When the REPLAY knob is pushed, the latest page is displayed.

The total number of waveforms is determined based on the Max Memory setup and the measurement conditions. Constraints related to the REPLAY

functions and relations with other functions are described below in sections 3.10.2.



Figure 3.10.3 (a) Current Page Selection Example



1 SINGLE select button Figure 3.10.1 Layout of Buttons and Knobs



Figure 3.10.2 Trigger Stop Display



Figure 3.10.3 (b) Current Page Selection Example

#### 3.10.2 Constraints on REPLAY functions

Operation of the INTENSITY and REPLAY functions may be constrained depending on the waveform acquisition status. This is described below in Table 3.11.

Waveform acquisition status	Valid functions and operations			
Run mode	Even if the REPLAY knob is turned, the replay function			
(Auto or Ready)	cannot be operated.			
Stop mode	The REPLAY icon lights.			
	The current page can be switched by turning the REPLAY			
	knob.			

Table 3.11 Constraints on INTENSITY Function and REPLAY Function

The REPLAY function internally performs page management of waveform data and, after stopping, previous acquired waveforms can be observed with this function. The total number of waveforms that can be stored internally varies depending on the specified Max Memory Length. The relation between this Max Memory Length and the total number of waveforms is shown in Table 3.12. When giving priority to Deskew by the Horizontal/Preference menu (Refer to section 3.5.4), it is likely to become fewer than the total number of waveforms of Tables 3.12.

Table	3.12	Relation	between	Max	Memory	Length	and	Total	Number	of	Waveforms
					,						

Max Memory	DS-55	00A Series	DS-5400 Series			
(points)	Total Number of Waveforms	Selection of Current Page	Total Number of Waveforms	Selection of Current Page		
500	2048	0	1024	0		
1k	1024	0	512	0		
5k	128	0	64	0		
10k	64	0	32	0		
50k	16	0	8	0		
100k	8	0	4	0		
500k	2	0	1	× <sup>Note1</sup>		
1M	1	×Note 1	Note 2	_ Note 2		

Note 1. The display of the current page / the total number of waveforms becomes 1/1, and the page cannot be selected.

Note 2. Max Memory can be set to 1M points only for the DS-5500A Series.

In the high-speed range, this may not be the case if the actual memory is less than the specified Max Memory. In this case, the number of pages acquired so far is the total number of waveforms.

The REPLAY function does not operate if any of the following functions or modes have also been set up (the current page / the total number of waveforms is "1/1".).

- Average Mode
- Max Memory Length
  - When Max Memory Length is 1 M points for DS-5500A Series.
  - When Max Memory Length is 500 k points for DS-5400 Series.

Note) The waveform data preserved internally is cleared at the time of the next wave taking when the setting condition such as a vertical axis range and the horizontal axis range is changed.

## 3.11 CURSORS Menu

The following two functions are provided in the cursor measurement.

- (1) Function to display two cursors on screen respectively vertically and horizontally, and to measure the difference between two cursors and position of each cursor.
- (2) Function to display two cursors in vertical direction on screen, and to measure voltage value of point that waveform data intersects with cursor.

## 3.11.1 Types of cursor measurement

This product provides the following four types of cursor measurement for YT displays. For XY displays, there are three types of cursor measurement: Amplitude (X), Amplitude (Y), and Amplitude (X & Y). The functions and operations are similar for XY displays and YT displays.

Time Time	Two cursors are displayed in the vertical direction on the screen. The difference of the time at the point that displays two cursors is calculated. Difference $\Delta t$ during that time and frequency $1/\Delta t$ are displayed in the cursor measurement display region under screen.
Amplitude Amplitude	Two cursors are displayed in the horizontal on the screen. The difference of the voltage value at the point that displays two cursors is calculated. The voltage difference $\Delta V$ of each CH is displayed in the wave read out display region under the screen.
Time & Amplitude	Two cursors each (total of four cursors) are displayed in the vertical and horizontal on the screen. As in Time and Amplitude above, the time and voltage differentials are calculated. Cursor measurements under the screen, time difference $\Delta t$ , and frequency $1/\Delta t$ are displayed, and the voltage difference $\Delta V$ of each CH is displayed in the wave read out display region.
Value at Cursor	Two cursors are displayed in the vertical direction on the screen. Voltage value V@t at the point that waveform data intersects with the cursor and difference t of the time from the trigger point to the point that displays the cursor are calculated. Voltage value V@t is displayed in the wave read out display region under the screen. Time difference $\Delta t$ is displayed in the cursor measurement display region at that time.

#### 3.11.2 Cursors menu operation methods

The layout of buttons and knobs related to the cursor measurement is shown in Figure 3.11.1. The operations methods are described below.

Operation Step 1 Select cursor measurement type

- Press the CURSORS button. (See Figure 3.11.1) The Cursors menu appears in the right part of the screen. (See Figure 3.11.2)
- Touch (select) the Type menu. This opens the Type sub menu. (See Figure 3.11.3)





Figure 3.11.1 Layout of Buttons and Knobs

 Touch (select) a cursor measurement type.(See Figure 3.11.3)

Figure 3.11.2 Cursors Menu

## Operation Step 2 Time & Amplitude measurement example

- Touch (select) Time & Amplitude as shown in Figure 3.11.3. A menu appears in the right part of the screen. (See Figure 3.11.4)
- Touch (select) Source as shown in Figure 3.11.4. Here, and select waveform that displays the position of the cursor for Time and Amplitude.
- Touch Time and select Cursor 1 (broken line) in Figure 3.11.4. The cursor line displayed on the screen in the broken line is emphasized in brightness. (See Figure 3.11.5 (a))

The selected cursor changes in the following order if touching Time.

Cursor 1 (broken line)  $\Rightarrow$  Cursor 2 (one point chain line)  $\Rightarrow$  both Cursor 1 (broken line)and Cursor 2 (one point chain line)  $\Rightarrow$  Cursor 1 (broken line)  $\Rightarrow$ 

 Turn the ADJUST knob shown in Figure 3.11.4 to move Cursor1 as shown in part (a) of Figure 3.11.5.

Turn the knob clockwise to move Cursor1 leftward on the screen, or counter-clockwise to move it rightward.

 Touch Time and select Cursor 2 (one point chain line) in Figure 3.11.4. Then, turn the ADJUST knob as shown in Figure 3.11.4 to move Cursor2 as shown in part (b) of Figure 3.11.5.



Figure 3.11.4 Time & Amplitude Menu



Figure 3.11.3 Type Sub Menu



Figure 3.11.5 (a) Select and Move Cursor1



Figure 3.11.5 (b) Select and Move Cursor2

9. Touch Time in Figure 3.11.6, and select both Cursor1 (broken line) and Cursor2 (one point chain line), then turn the ADJUST knob as shown in Figure 3.11.6 to move Cursor1 and Cursor2 simultaneously as shown in Figure 3.11.7. The two cursors' time differential Δt and frequency 1/Δt are shown in the cursor measurement and trigger data display area at the bottom of the screen.





Figure 3.11.7 Both Cursor 1 (broken line) and Cursor 2 (one point chain line) selections and movements

Figure 3.11.6 Time & Amplitude Menu

The above description uses only a Time measurement example, not both a Time and Amplitude measurement example. However, in an Amplitude measurement example, the operations are similar after selecting the Time & Amplitude option. The operation steps for an Amplitude measurement example are described in 10 and 11 below.

- Touch (select) Amplitude as shown in Figure 3.11.8. Select the cursor which you want to move. The selected cursor line is emphasized in brightness. (See Figure 3.11.9)
- 11. Turn the ADJUST knob to move the on-screen cursors. (See Figure 3.11.9)





Figure 3.11.9 Time & Amplitude Menu

Figure 3.11.8 Time & Amplitude Menu

#### Operation Step 3 Value at Cursor measurement example

- Touch (select) Value at Cursor as shown in Figure 3.11.10. The Value at Cursor menu appears in the right part of the screen. (See Figure 3.11.11)
- 13. Turn the ADJUST knob shown in Figure 3.11.10 to move the cursor. Now voltage value V@t of two intersections are displayed in the wave read out display region and time interval Δt at each intersection with two cursors and waveforms is displayed in the cursor measurement display region under screen. (See Figure 3.11.11)



Figure 3.11.11 Value at Cursors Measurement Example

Figure 3.11.10 Type Option Display Menu

#### 3.11.3 Useful menu and button operations

This section describes some useful operations for cursor measurement.

The layout of buttons and knobs is shown in Figure 3.11.12.

#### **Operation Steps**

- Press the CURSORS button. This opens the cursor's Type menu.
- Keep pressing the CURSORS button to cycle through the cursor measurement types. In a YT display, the sequence of types is Off → Time → Amplitude → Time & Amplitude → Value at Cursor → Off .... In a XY display, the sequence of types is Off → Amplitude(X) → Amplitude(Y) → Amplitude (X&Y) → Off ....



Figure 3.11.12 Layout of Buttons and Knobs

#### 3.11.4 Menu items and hierarchy



Figure 3.11.13 Cursors Menu

#### 3.11.5 Cursor measurements in Main window and Zoom window

This section describes cursor measurements in the Main and Zoom windows. For detailed description of the Zoom function, see "3.15 Zoom Menu".

#### **Operation Steps**

- Press the ZOOM execute button shown in Figure 3.11.14. The Main window appears in the upper part of the screen and the Zoom window is in the lower part.
- Turn the Time/div control knob one click clockwise. Now the two cursors for indicating the blue range are shown in the Main window. (See Figure 3.11.16)
- Press the CURSORS button shown in Figure 3.11.15.
- Select Time in the Cursors menu. Now the cursors appear in the Zoom window side. (See Figure 3.11.17)

Afterward, as was described in section 3.11.2, cursor measurement is performed in the Zoom window. For Time & Amplitude measurement, six cursors are shown on the screen.









Figure 3.11.16 Range Setting Cursors in Main Window and Zoom Window

Figure 3.11.15 Layout of Buttons and Knobs



Figure 3.11.17 Cursor Measurement in Zoom Window

#### 3.11.6 Relations between Cursor Measurement function and other functions

Other function	Relation
Main window display	The Main waveform is the target for cursor measurement.
Main window and Zoom window displays	The Zoom waveform is the target for cursor measurement.
Persistence Mode ON	Value at Cursor measurement is performed for the most
	recent waveform.
Offset operations	When the type of the cursor measurement is either Amplitude, Time&Amplitude or Value at Cursor, the offset in the CH or Math area under the screen displays the measurement result corresponding to the selected cursor type. After these operations, offset is shown, but the display switches to a cursor measured value after a specified
	period has elapsed.

Table 3.13 Relations between Cursor Measurement Function and Other Functions

## 3.12 MEASURE Menu

This section describes the following functions of the Measure menu.

Measure (auto measure) function
Pass/Fail (pass/fail judgment) function
Logging function
Relations to other functions
Section 3.12.1
Section 3.12.2
Section 3.12.3

\* Pass/Fail and Logging function can be used only for the DS-5500A Series.

#### 3.12.1 Measure (auto measure) function

Measurements can be taken simultaneously for up to four measure items out of a total of 26, including 11 items for signal Tr, Mean, Frequency, etc. along the horizontal axis direction, 12 along the vertical axis direction, and three others.

Measurement source can be selected from the waveforms of CH1 to CH4 (2CH model: CH1 to CH2) and Math.

When the Measurement items are selected, the measurement results of each measurement item are displayed in Measure under screen display region.

(1) Content of display of measurement result

As for the content of the display of the measurement result of the automatic measurement, the display item is different as shown in the table below according to the selection of Off/On of submenu Min/Max.

Display Item	Min/Max : On	Min/Max : Off	
)/al	The first measurement result in one waveform	Same as left	
Vai	displayed on the screen		
Max	The maximum value of Measure result	- (No display)	
Min	The minimum value of Measure result	- (No display)	
Num	All measurement frequency of Measure	- (No display)	

Table 3.14 Automatic measurement and display of measurement result

The example of Measure is shows in Figure 3.12.1(a) and (b) of section 3.12.1.1. (2) About the measuring object by the presence of the cursor specification

The measurement target is divided about the measurement result in each measurement item as follows by each measurement item and the cursor specification. (Please refer to Table 3.16 in section 3.12.1.5 for a detailed measurement target of each measurement items.)

- When there is no cursor specification Note1 The measurement target is divided into two kinds of the following by each measurement item.
  - a) Measurement from the entire waveform
  - b) The measurement value is measured from the left end of the waveform by the first phenomenon waveform.
- 2 When there is a cursor specification  $^{\text{Note2}}$

The measurement target is divided into two kinds of the following by each measurement item.

- a) Measurement between the two cursors
- b) The measurement value is measured from the cursor in the left end by the first phenomenon waveform between the two cursors.
  - Note1) When there is no cursor specification
    - : When the cursor type is either Off or Amplitude
  - Note2) When there is a cursor specification
    - : When the cursor type is either Time, Time & Amplitude or Value at Cursor

The example of Measure is shows in Figure 3.12.1(c) and (d) of section 3.12.1.1.

#### 3.12.1.1 Example of Measure (auto measure)

The measurement example of showing the difference of Off/On of submenu Min/Max is shown in Figure 3.12.1(a) and Figure 3.12.1(b), and the measurement example of showing the difference by the presence of the cursor specification is shown in Figure 3.12.1(c) and Figure 3.12.1(d)

#### (1) When Min/Max is Off



Figure 3.12.1(a) Example of Measure

(2) When Min/Max is On



Figure 3.12.1(b) Example of Measure

(3) When there is no cursor specification

What there is no cursor specification is to set the cursor type to either Off or Amplitude, as being in an opening explanation (2) of section 3.12.1



Figure 3.12.1 (c) Example of Measure (When there is no cursor specification)

The example of measurement in Figure 3.12.1(c) automatically measures Maximum (maximum value), Minimum (minimum value), Tr20-80% (At the risetime of 20-80%), and Tf80-20% (standing fall time of 80-20%) of the observation waveform of CH1, and displays the measurement result in the automatic measurements display region. As for the measurement values of Max (maximum value) and Min (minimum value), those are **the values measured in one entire waveform displayed on the screen (range of a dotted line arrow)**. As for Val of the measurement result of Tr20-80% (At the risetime of 20-80%) and Tf80-20% (standing fall time of 80-20%), those are the values measured from **the left end of one waveform displayed on the screen at the first phenomenon waveform** (standing up shape of waves/standing fall shape of waves in the yellow oval). And then, as for Max and Min of the measurement result of Tr20-80% (At the risetime of 20-80%) and Tf80-20% (standing fall time of 80-20%), those are the maximum and minimum values of the measured values in standing up / standing fall (in this case, five times detection) detected by one waveform displayed on the screen.

(4) When there is a cursor specification

What there is a cursor specification is to set the cursor type to any of Time, Time & Amplitude and Value at Cursor as being in an opening explanation (2) of section 3.12.1



Figure 3.12.1 (d) Example of measure (When there is a cursor specification)

The example of measurement in Figure 3.12.1(d) automatically measures Maximum (maximum value), Minimum (minimum value), Tr20-80% (At the risetime of 20-80%), and Tf80-20% (standing fall time of 80-20%) of the observation waveform of CH1 between cursors in two vertical directions, and displays the measurement result in the automatic measurements display region.

As for the measurement values of Maximum (maximum value) and Minimum (minimum value), those are the values measured in the waveform of **the entire screen between cursors in two vertical directions (range of a dotted line arrow)**. As for Val of the measurement results of Tr20-80% (At the risetime of 20-80%) and Tf80-20% (standing fall time of 80-20%), those are the values measured from the left end of the waveform displayed on the screen **between cursors in two vertical directions at the first phenomenon waveform** (standing up shape of waves/standing fall shape of waves in yellow oval). And then, as for Max and Min of the measurement result of Tr20-80% (At the risetime of 20-80%) and Tf80-20% (standing fall time of 80-20%), those are the maximum and minimum values of the measured values in standing up / standing fall (in this case, Tr:three times detection, Tf:four times detection) detected by one waveform displayed on the screen between cursors in two vertical directions.

#### 3.12.1.2 How to use the Measure menu

The layout of buttons and knobs related to the Measure menu is shown in Figure 3.12.2. The operations methods are described below.

#### **Operation Steps**

 Press the MEASURE button shown in Figure 3.12.2. The Measure menu appears in the right part of the screen. (See Figure 3.12.3)



Figure 3.12.2 Layout of Buttons and Knobs

- Either Touch (select) a menu item shown in Figure 3.12.3 on the previous page, or turn the ADJUST knob to select A, B, C, or D as the Measure No. Next, select a Source and Measure Item for each Measure No. (A, B, C, and D).
- Touch (select) a menu item in Figure 3.12.4. The Source sub menu is opened in the right part of the screen. (See Figure 3.12.5)
- 4. Touch a menu item shown in Figure 3.12.5 to select a Source.
- Touch (select) a menu item in Figure 3.12.4. The Measure Item sub menu is opened in the right part of the screen. (See Figure 3.12.6)
- Touch a menu item shown in Figure 3.12.6 to select a Measure Item. A sub menu appears in the right part of the screen. The items in this sub menu are described below in "3.12.1.3 Menu items and hierarchy".
- Touch a Measure menu item shown in Figure 3.12.4 to select ON or OFF for display of auto measurement results. If ON is selected, the measurement result is shown at the bottom of the screen and the MEASURE button lamp lights.



Figure 3.12.3 Measure Menu



Figure 3.12.4 Measure Menu

8. Touch a menu item shown in Figure 3.12.4 and select OFF or ON to set whether or not to display Auto Measure measurement results with Min/Max on the right. When ON is selected, Min/Max is shown for all measurements. When Min/Max is OFF, Auto Measure is performed asynchronously in relation to waveform acquisition. Conversely, when Min/Max is ON, Auto Measure is performed in sync with waveform acquisition.



Figure 3.12.5 Source Option Display Menu



Figure 3.12.6 Measure Item Sub Menu

#### 3.12.1.3 Menu items and hierarchy

The hierarchy of Measure menu items is shown in Figure 3.12.7. For description of the Measure Items "Vertical, " "Horizontal, " and "Other", see Figure 3.12.8 on the next page, where all 26 items are shown.

See section 3.12.2.6 for description of the Pass/Fail menu items and hierarchy, and see section 3.12.3.2 for description of the Logging menu items and hierarchy.







Figure 3.12.8 Measure Item Sub Menu
### 3.12.1.4 Content of measurement of each measurement item

As for the "Measure Items" in the Measure menu, the contents of measurement are listed in Table 3.15. Specific Measure Items are described in sections 3.12.1.4.1 to 3.12.1.4.6. Refer to Table 3.16 of section 3.12.1.5 for the measuring target of each measurement item.

Туре	Measure Item	Summary	Parameter (Sub menu)	Unit	
	Maximum	Maximum value			
	Minimum	Minimum value			
		Differential between			
	Peak-Peak	maximum value and			
		minimum value			
	RMS	RMS			
cal	Cycle RMS	Mean		V	
erti	Mean	Cycle rms	None	-	
>	Cycle Mean	Cycle mean			
	Top <sup>Note3</sup>	Top value			
	Base	Base value			
	Top-Base <sup>Note3</sup>	Differential between top value and base value			
	+OverShoot	+ overshoot			
	-OverShoot	- overshoot			
	Tr20-80% <sup>Note3</sup>	20% to 80% of rise time	None (top-base <sup>Note1</sup> is fixed at 20% to 80%)		
	Tf80-20% <sup>Note3</sup>	80% to 20% of fall time	None (top-base <sup>Note1</sup> is fixed at 20% to 80%)	s	
	Tr10-90% <sup>Note3</sup>	10% to 90% of rise time	None(top-base <sup>Note1</sup> is fixed at 10% to 90%)		
Ital	Tf90-10% <sup>Note3</sup>	90% to 10% of fall time	None(top-base <sup>Note1</sup> is fixed at 10% to 90%)		
roz	Frequency	Frequency		Hz	
ori	Period	Period	Period		
Ŧ	No of +Pulse	Positive pulse count			
	No of-Pulse	Negative pulse count	None	puise	
	+PulseWidth	Positive pulse width	(peak-to-peak is fixed at 50% level)		
	- PulseWidth	Negative pulse width		S	
	Duty Cycle	Duty cycle		%	
	Integral	Integral	None	Vs	
Other	Skew	Time differential between measurement points Specify this relatively, at a rate based on amplitude.	Each target source has the following parameters. • Level1, Level2 Peak-to-Peak percentage (%) • Slope1, Slope2 Rise/fall	s	
	Skew@Level	Time differential between measurement points Specify level as an absolute value	<ul> <li>Level1, Level2</li> <li>Specify setups using full scale of setup range.</li> <li>Other parameters are the same as for Skew.</li> </ul>		

#### Table 3.15 Content of measurement of each measurement item

- Note1) With Top-Base, the top value and base value are determined based on the probability density distribution of waveform amplitude in the measurement range, and takes the amount between these two values as 100%. Peak-to-Peak takes as 100% the differential between the waveform's maximum value and its minimum value within the measurement range.
- Note2)The Duty Cycle measures the ratio of the waveform's cycle to its pulse width within the measurement range.
- Note3) When neither an effective top value nor an effective base value are requested from the probability density distribution of a waveform amplitude within the range of the measurement, the measurement result becomes an invalid display "\*\*\*\*\*\*\*\*".

## 3.12.1.4.1 No. of Pulses [pulse count]

No of + pulses	One pulse is counted when the waveform passes from the base to the top and then from the top back to the base, based on a level that is 50% of Peak-to-Peak.
No of – pulses	One pulse is counted when the waveform passes from the top to the base and then from the base back to the top, based on a level that is 50% of Peak-to-Peak.

### 3.12.1.4.2 Cycle RMS and Cycle Mean

This measures the rms of the integer cycle part of the waveform in the measurement range.

• Cycle RMS

The period during which a level based on 50% of the Peak-to-Peak level is passed within the measurement range is determined and the rms of that period is measured.

• Cycle Mean

The period during which a level based on 50% of the Peak-to-Peak level is passed within the measurement range is determined and the mean of that period is measured. As in the measurement example shown in the following figure, the rms and mean are measured from the measurement start point where the level was fixed as 50% of Peak-to-Peak to the measurement end point.





## 3.12.1.4.3 Overshoot

Measure overshoot in rising and falling signals within the measurement range.

+Overshoot

The rise that occurs where 50% of Peak-to-Peak within the measurement range crosses the first waveform data is detected, and overshoot in that rise is measured. The formula for calculation is shown as equation 3.1 below.

+ Overshoot value (%) = 100 × [(+ peak value) - top value] /

(Top value – base value) •••• Equation (3.1)

–Overshoot

The fall that occurs where 50% of Peak-to-Peak within the measurement range crosses the first waveform data is detected, and overshoot in that fall is measured. The formula for calculation is shown as equation 3.2 below.

- Overshoot value (%) = 100 x [base value -(- peak value] / (Top value - base value)

alue – base value)

### 3.12.1.4.4 Integral

This measures the area (integral) of the waveform in the measurement range. In area (integral) measurements, measurements are based on the reference level of the channel to be measured (set via the vertical axis offset control knob).

A measurement example is shown in the figure below. In this example, the reference level (base line) is based on the measurement range sandwiched between two time points, and integral values are measured at S1+S2+S3+S4+S5+S6 (sections filled in black).



## 3.12.1.4.5 Skew / Skew@Level

This measures the time differential (skew) between the selected waveform's rising (or falling) edge1 and its falling (or rising) edge2.

Edge 1 and edge 2 can be set either between two CH selected or in CH the same.

There are two kinds of following measurement items for the method of specifying the level of the measurement point.

1) Skew

Specify the measurement point's level as a percentage relative to the amplitude. This measurement is illustrated in the figure below.



2) Skew@Level

Specify the measurement point's level as an absolute value. This measurement is illustrated in the figure below.



Note) The following edge 2 is detected in Skew@Level at time when edge 1 is detected. The automatic measurement result becomes a display of "\*\*\*\*\*\*\*\*" when the detection time of edge 2 is before the detection time of edge 1. Thus, please execute the automatic measurement with Skew of 1) when the detection time of edge 2 is before the detection time of edge 1.

### 3.12.1.5 Measuring target and frequency of each measurement item

Table 3.16 shows the measuring target and the measurement frequency (in one waveform) of each measurement item of the automatic measurement.

As for some of Horizontal of the classifications of the automatic measurement, the measuring object and the measurement frequency (in one waveform) of each measurement item are different according to the setting of Off/On of Min/Max submenu. Among the measurement items in following Table 3.16, the measurement item of the bold-faced type corresponds. Moreover, the example of the automatic measurement of the 1st waveform and the 2nd waveform is shown in (1) and (2) of next page about the measurement frequency in one waveform of Period.

Class	l t a m	Min/Max:Off (on	ly for Val)	Min/Max:On	
Class	item	Target Note1	Frequency	Target Note1	Frequency
	Maximum	Entire waveform	1	Entire waveform	1
	Minimum	Entire waveform	1	Entire waveform	1
	Peak-Peak	Entire waveform 1		Entire waveform	1
	RMS	Entire waveform	1	Entire waveform	1
_	Cycle RMS	Integer cycle (N Cycle)	1	Integer cycle (N Cycle)	1
ica	Mean	Entire waveform	1	Entire waveform	1
ert	Cycle Mean	Integer cycle (N Cycle)	1	Integer cycle (N Cycle)	1
>	Тор	Entire waveform	1	Entire waveform	1
	Base	Entire waveform	1	Entire waveform	1
	Top-Base	Entire waveform	1	Entire waveform	1
	+Overshoot	Part detected first	1	Part detected first	1
	-Overshoot	Part detected first	1	Part detected first	1
	Tr 20-80%	First standing up	1	Standing up ( N detection)	N <sup>Note3</sup>
	Tf 80-20%	First standing fall	1	Standing fall (N detection)	N <sup>Note3</sup>
	Tr 10-90%	First standing up	1	Standing up (N detection)	N <sup>Note3</sup>
_	Tf 90-10%	First standing fall	1	Standing fall (N detection)	N <sup>Note3</sup>
nta	Frequency <sup>Note2</sup>	First cycle	1	Integer cycle (N Cycle)	N <sup>Note3</sup>
IOZ	Period Note2	First cycle	1	Integer cycle (N Cycle)	N <sup>Note3</sup>
lori	No. of +Pulse	Entire waveform	1	Entire waveform	1
т	No. of -Pulse	Entire waveform	1	Entire waveform	1
	+Pulse Width	First positive pulse	1	Positive pulse (Ndetection)	N <sup>Note3</sup>
	-Pulse Width	First negative pulse	1	Negative pulse (N detection)	N Note3
	Duty Cycle	First one cycle	1	Integer cycle (N Cycle)	N <sup>Note3</sup>
L	Integral	Entire waveform	1	Entire waveform	1
the	Skew	Part detected first	1	Part detected first	1
đ	Skew@Level	Part detected first	1	Part detected first	1

#### Table 3.16 Measuring target and frequency of each measurement item (in one waveform)

Note 1. When the length cursor is displayed, the range placed with two cursors becomes a measuring target.

Note 2. Only the measurement result at the first cycle is displayed.

Note 3. Because the measurement frequency (in one waveform) is different because of the cycle and the frequency of the measurement waveform, this is assumed N.

(1) Example of measurement frequency in one waveform of Period (the first waveform)



(2) Example of measurement frequency in one waveform of Period (the 2nd waveform)



### 3.12.2 Pass/Fail function

\* Pass/Fail function can be used only for the DS-5500A Series.

The Measure menu includes a Pass/Fail function. This function is briefly described below.

- (1) Judgment results
  - <1>Judgment results are indicated in colored text (Pass: green/Fail: red) in the status information area at the bottom of the screen.
  - <2>Judgment results are temporarily stored in internal memory, and saving to USB memory is also possible when necessary. (See section 3.12.3 Logging function)
  - <3>According to the judgment result, pulse output can also occur from the AUX IO2 terminal on the rear panel. (This requires the CH1/TRIG output option DS-578.)
- (2) Judgment target

Select from the following two judgment targets.

<1>Method using measured values from Measure measurement result (select among four types: A, B, C, and D)

Example 1) A: Maximum (maximum value) for CH1

<2>Method using Mask set in relation to measure value of Math for CH1 to CH4 (2CH model: CH1 to CH2)

Example 2) Mask is edited based on observed CH1 waveform, and a measurement example from the result of a pass/fail judgment under this judgment condition is shown in the figure below. In this example, all parts of the CH1 waveform between the cursors are in a mask, and since the All In (all in mask) condition is met, a pass judgment result is shown in green text at the bottom of the screen.

Since the observed waveform on CH1 has noise, overshoot, etc., both within this screen and between the cursors (between Time cursors when the cursor type is Time or Time & Amplitude), when it extends outside the Mask shown in gray, the pass/fail judgment result becomes Fail. (See example 3 on next page)



Example 3) Mask is edited based on an observed CH1 waveform, and a measurement example from the result of a pass/fail judgment under this judgment condition is shown in the figure below. In this example, parts of the CH1 waveform between the cursors are outside of the mask, and since the "All In" (all in mask) condition is not met, a Fail judgment result is shown in red text at the bottom of the screen. Also, the parts of the waveform judged as Fail are drawn in blue.



Pass/Fail function settings and operations for each menu item are described in sections 3.12.2.1 to 3.12.2.5 below.

## 3.12.2.1 Operation (judgment operation) settings

Operation menu items are shown at the top of the Pass/Fail sub menu.

- Select On to execute a Pass/Fail judgment and display the judgment result.
  However, when judging by the measurement result of Measure, this requires that the Measure menu item is already set to On.
- If Off is selected, there is no Pass/Fail judgment and no judgment results are displayed.

The operation steps for these settings are

## described below.

## **Operation Steps**

- Press the Measure button shown in Figure 3.12.11. The Measure menu is displayed on the right side of the screen. (See Figure 3.12.12)
- Touch (select) On in the Measure menu item in Figure 3.12.12.
- Touch (select) the Pass/Fail menu item in Figure 3.12.12.

This opens the Pass/Fail sub menu shown in Figure 3.12.13.

 Touch (select) the Operation menu item shown in Figure 3.12.13.

The Pass/Fail judgment result is shown in the status display area at the bottom of the screen, such as in Figure 3.12.14.



Figure 3.12.11 Layout of Buttons and Knobs



Figure 3.12.12 Measure Menu





Figure 3.12.14 Pass/Fail Judgment Result Example

## 3.12.2.2 Judge By (judgment target) settings

Select between the following two Judge By settings.

- (1) Method using measured value from Measure (auto measurement) measurement result (select among four types: A, B, C, and D)
   Example) A: Maximum (maximum value) for CH1
   However, this requires that Measure is already set to On.
- (2) Method using Mask set in relation to measure value for Math or CH1 to CH4 (2CH model: CH1 to CH2)

This method using a mask performs a judgment regardless of the Measure On/Off setting.

The operation steps for these settings are described below. (Continuation of Operation Steps from section 3.12.2.1)

### **Operation Steps**

 Touch (select) Measure or Mask among the Judge By menu items shown in Figure 3.12.15.



Figure 3.12.15 Judge By Sub Menu

## 3.12.2.3 Condition (judgment condition) settings

Condition (judgment condition) settings differ depending on whether Measure or Mask is selected under Judge By as described in section 3.12.2.2.

Condition(judgment condition) settings are described below separately for Measure and Mask.

## 3.12.2.3.1 Measure (auto measurement)

When the Judge By setting is Measure, enter settings such as the pass condition and numerical value range for measured values obtained under the various settings, after which a pass/fail judgment is made. Specifically, set or select menu items for the following judgment conditions.

(1) Source (target source)

For Measure, select among four measured value types: A, B, C, and D.

(2) Pass If (pass condition)

Select among four pass conditions for the measured value selected at (1) above. When Value is a measured value, the four pass condition types are as follows.

<1> m  $\leq$  Value <2> Value  $\leq$  m <3> m  $\leq$  Value  $\leq$  n <4> Value  $\leq$  m or n  $\leq$  Value

(3) m, n value and unit settings

Set the numerical values of  $\,m\,$  and  $\,n\,$  for the Pass If (pass condition) from (2) above.

The units used for m and n differ among the various Measure items. For details, see Table 3.15 in section 3.12.1.4.

Operation steps related to judgment conditions under each Measure item are described below.

## **Operation Steps**

- 1. Touch (select) Measure as the Judge By menu item, as shown in Figure 3.12.16.
- Touch (select) the Condition menu item, shown in Figure 3.12.16. This opens the Measure Condition sub menu, shown in Figure 3.12.17 on the next page.



Figure 3.12.16 Judge By Sub Menu

 Touch (select) Source, shown in Figure 3.12.17.

Touch or turn the ADJUST knob to select A, B, C, or D.

- Touch (select) the Pass If menu item, as shown in Figure 3.12.17. This opens the Pass If sub menu, shown in Figure 3.12.18.
- Touch (select) one of the four menu items under Pass If, shown in Figure 3.12.18. This returns to the menu shown in Figure 3.12.17.
- Touch or turn the ADJUST knob to select numerical values and units for m and n to set Pass If (pass condition) as shown in Figure 3.12.17.



Figure 3.12.17 Condition Sub Menu



Figure 3.12.18 Pass If Sub Menu

### 3.12.2.3.2 Mask

When the Judge By setting is Mask, pass/fail judgments are made for waveforms for Math or CH1 to CH4 (2CH model: CH1 to CH2), based on the pass condition of whether or not the waveforms are entirely within or outside of the mask for the set mask range.

Specifically, the following Judge By menu items are set, selected, or edited.

- (1) Display (display of MASK)
   Select On or Off for mask display on the measurement screen.
   Select On to display the mask as a gray area on the screen.
   Select Off to turn off mask display.
- (2) Source (target source)Select among CH1, CH2, CH3, CH4 (2CH model: CH1 to CH2), and Math.
- (3) Pass If (pass condition)
  For the mask to be edited in (4) below, select either
  <1> All In (all are within mask)
  <2> All Out (all are outside mask)
  as the pass condition for the measured waveform selected at (2) above.
- (4) Edit Mask (edit mask)

Edit Mask by setting the horizontal and vertical ranges in div units, based on the displayed CH1 to CH4 (2CH model: CH1 to CH2) and Math. Edit Mask is further described in section 3.12.2.3.3.

(5) Save/Recall (save/recall mask)

The mask edited at (4) above can be saved to USB memory and recalled. Mask save/recall is further described in section 3.12.2.3.4.

Operations for setting Mask judgment conditions are described below.

## **Operation Steps**

- 1. Touch (select) Mask as the menu item under Judge By, as shown in Figure 3.12.19.
- 2. Touch (select) the Condition menu item, shown in Figure 3.12.19.

This opens the Measure Condition sub menu, shown in Figure 3.12.20 on the next page.



Figure 3.12.19 Judge By Sub Menu

- 3. Touch (select) On in the Display menu item shown in Figure 3.12.20.
- Touch (select) the Source menu item shown in Figure 3.12.20.

This opens the Source sub menu.

- 5. Touch (select) among the 5 menu items (3 menu items for 2CH model) under Source.
- Touch (select) a Pass If menu item, shown in Figure 3.12.20.
   Touch (select) a Pass If sub menu item, shown in Figure 3.12.21.
- Touch (select) either All In (all is within mask) or All Out (all is outside of mask), shown in Figure 3.12.21.
- Touch (select) an Edit Mask menu item, shown in Figure 3.12.20.

Touch (select) an Edit Mask sub menu item, shown in Figure 3.12.22.

\*For description of Edit Mask, see section 3.12.2.3.3.

9. Touch (select) a Save/Recall Mask menu item, shown in Figure 3.12.20.

This opens the Save/Recall Mask sub menu, shown in Figure 3.12.23.

\*For description of Save/Recall Mask, see section 3.12.2.3.4.



Figure 3.12.21 Pass If Sub Menu

Figure 3.12.22 Edit Mask Sub Menu



Figure 3.12.20 Condition Sub Menu



Figure 3.12.23 Save/Recall Mask Sub Menu

### 3.12.2.3.3 Edit Mask

Edit Mask is included among the Condition menu items for the Pass/Fail function. This section describes the Edit Mask operation steps.

### **Operation Steps**

 Touch (select) the Edit Mask menu item in the Mask Condition sub menu shown in Figure 3.12.24.

This opens the Edit Mask sub menu shown in Figure 3.12.25.

 Touch (select) the Source menu item, shown in Figure 3.12.25.
 When the Source sub menu item appears, touch (select) one of the CH1 to CH4 (2CH

model: CH1 to CH2), Math, or REF1 to REF5 menu items.

- 3. Touch (select) the Horizontal menu item, shown in Figure 3.12.25.
  Turn the ADJUST knob to set a numerical value in div units for horizontal mask range.
  Setting range: 0.08 to 4.00 div
- 4. Touch (select) the Vertical menu item, shown in Figure 3.12.25.
  Turn the ADJUST knob to set a numerical value in div units for vertical mask range.
  Setting range: 0.09 to 4.00 div
- Touch (select) the Make Mask menu item, shown in Figure 3.12.25.
   A mask in the range set at steps 3 and 4 above is shown in gray on the screen.
- Touch (select) the Undo Mask menu item, shown in Figure 3.12.25. This returns to the mask display that preceded the one created at step 5 above.









### 3.12.2.3.4 Save/Recall Mask

Save/Recall Mask is included among the Condition menu items of the Pass/Fail function.

The mask created as described above in section 3.12.2.3.3 can be saved to and recalled from USB memory. The operation steps for saving and recalling a mask are described below.

## Operation Steps Mask save method

Before performing operation step 4 below to save, connect USB memory to the connector in the lower left of front panel.

 When the mask is displayed on the screen, touch (select) the Save/Recall Mask menu item, shown in Figure 3.12.26.

This opens the Save/Recall Mask sub menu, shown in Figure 3.12.27.

- 2. Touch (select) the Save/Recall menu item, shown in Figure 3.12.27, and select Save.
- Touch (select) File Name, shown in Figure 3.12.27.

This opens the Character List pop-up window to the left of the menu items.

Press and turn the ADJUST knob to move the cursor and select characters, numbers, and symbols for a file name.

- Note 1) See section 3.7.3 for description of how to enter characters, numbers, and symbols.
- Note 2) Unless a particular file name must be specified, use the default "MASKxxxx" in which the final four digits are incremented starting from 0000.
- Touch (select) the Save menu item, shown in Figure 3.12.27.

This saves the Mask file to USB memory.



Figure 3.12.26 Mask Condition Sub Menu



Figure 3.12.27 Save/Recall Mask Sub Menu

## Operation Steps Mask recall method

Before performing the operation steps described below, connect USB memory to the connector in the lower left of front panel.

- Touch (select) the Save/Recall Mask menu item, shown in Figure 3.12.28. This opens the Save/Recall Mask sub menu, shown in Figure 3.12.29.
- 2. Touch (select) the Save/Recall menu item, shown in Figure 3.12.29, then select Recall.
- 3. Touch (select) File List, shown in Figure 3.12.29.

This opens the File List pop-up window in the center of the screen (see example in Figure 3.12.30).

Turn the ADJUST knob to align the cursor with the file name to be recalled.

Note 1) This displays a file list of Mask files saved to the MASK folder in USB memory. Note 2) File List pop-up

Up to 20 files can be listed in this window. If the number of files exceeds 20, turn the ADJUST knob to scroll the window or push the ADJUST knob to page the window and select a file.

4. Touch (select) the Recall menu item, shown in Figure 3.12.29.

This recalls the Mask file that was specified at step 3 above.

The mask recalled to the screen is shown in gray.

5. Touch (select) the Undo Mask menu item, shown in Figure 3.12.29.

This displays the mask prior to the mask currently shown on the screen.



Figure 3.12.30 File List







Figure 3.12.29 Save/Recall Mask Sub Menu

## 3.12.2.4 Actions (Events for Actions) settings

When using the Pass/Fail function, operations (1) to (5) below can be performed under the Actions settings.

## (1) Stop Sweep

Select whether to stop waveform capture according to the judgment result following pass/fail judgment.

- None: Does not stop waveform capture, regardless of pass/fail judgment result.
   Pass: Stops waveform capture when pass/fail judgment result is PASS.
- · Fail: Stops waveform capture when pass/fail judgment result is FAIL.
- (2) Save Screen

Select whether to save the screen according to the judgment result following pass/fail judgment.

When Save Screen is executed in the display of Log Entries (content of the log) on the pop up screen, the content of the display of the pass or fail judgment result and the pop up screen might not be corresponding.

- None: Does not save screen, regardless of pass/fail judgment result.
  - · Pass: Saves screen when pass/fail judgment result is PASS.
- · Fail: Saves screen when pass/fail judgment result is FAIL.
- Any Results (during pass/fail judgment): Saves screen, regardless of pass/fail judgment result.

Moreover, the form and the file name of the preserved file can be selected according to the following procedure.

- 1. Push MEASURE (measurement) button.
- 2. Touch Pass/Fail.
- 3. Select Off with Operation (judgment operation).
- 4. Push UTILITIES button.
- 5. Touch Print.
- 6. Select the form of the picture file that preserves the screen with File format.
- 7. Select the file name preservation ahead with File Name.
- (3) Save Waveform

Select whether to save the waveform according to the judgment result following pass/fail judgment.

- None: Does not save screen, regardless of pass/fail judgment result.
  - Pass: Saves screen when pass/fail judgment result is PASS.
- · Fail: Saves screen when pass/fail judgment result is FAIL.
- Any Results (during pass/fail judgment): Saves screen, regardless of pass/fail judgment result.

Moreover, the file name of the preserved file can be selected according to the following procedure.

- 1. Push MEASURE (measurement) button.
- 2. Touch Pass/Fail.
- 3. Select Off with Operation (judgment operation).
- 4. Push SAVE/RECALL button.
- 5. Touch Save/Delete to USB Memory.
- 6. Select Waveform (Binary) with File format.
- 7. Select the file name preservation ahead with File Name.

(4) Output Pulse

Select whether or not to output a pulse from the [AUX IO 2] terminal, according to the judgment result following pass/fail judgment.

This function cannot be used unless the CH1-TRIG output option DS-578 is attached. To use this function, first select Pass/Fail Signal under AUX IO 2 in the Utilities menu.

- None: Does not output pulse from [AUX IO 2] terminal, regardless of pass/failresult.
- Pass: Outputs pulse from [AUX IO 2] terminal when pass/fail result is PASS.
- Fail: Outputs pulse from [AUX IO 2] terminal when pass/fail result is FAIL.
- Any Results (during pass/fail judgment): Outputs pulse from [AUX IO 2] terminal when pass/fail judgment result is FAIL.

## (5) Beep

Select whether to emit a beep according to the judgment result following pass/fail judgment.

• None: Does not emit a beep, regardless of the pass/fail judgment result.

- $\boldsymbol{\cdot}$  Pass: Emits a beep when the pass/fail judgment result is PASS.
- · Fail: Emits a beep when the pass/fail judgment result is FAIL.
- Any Results (during pass/fail judgment): Emits a beep, regardless of the pass/fail judgment result.

The following menus and buttons are invalid if a setting other than None was selected for Save Screen or Save Waveform among the operations described in (1) to (5) of the previous page.

- Save/Delete to USB Memory menu
- Recall from USB Memory menu
- PRINT button, Print menu
- Save/Recall Mask menu
- $\boldsymbol{\cdot}$  Save to USB Memory button in Logging menu
- Update button in Status & Update menu
- USB Memory Information button in Status & Update menu

Operation steps for Actions settings are described below.

## Operation Steps

- Touch (select) the Actions menu item, as in Figure 3.12.31. This opens the Events for Actions sub menu, shown in Figure 3.12.32.
- 2. Touch (select) one of the 5 menu items, shown in Figure 3.12.32.

Touch (select) the Stop Sweep menu item to open the sub menu shown in Figure 3.12.33(a).

Touch (select) any menu item other than Stop Sweep to open the sub menu shown in the Figure 3.12.33(b).

 To select pass/fail operation settings for Stop Sweep, touch (select) one of the three types of pass/fail operations shown in Figure 3.12.33(a). To select pass/fail operation settings other than for Stop Sweep Stop Sweep, (select) one of the four types of pass/fail operations shown in Figure 3.12.33(b).



Figure 3.12.31 Pass/Fail Sub Menu



Figure 3.12.32 Events for Actions Sub Menu

Figure 3.12.33(a) Stop Sweep Sub Menu

Figure 3.12.33(b) Save Screen Sub Menu (same as other sub menus except Stop Sweep)

# 3.12.2.5 Page Search settings

This searches previously captured waveforms for a waveform (page) with Pass or FAIL judgment for the Condition specified under Measure.

The search range is limited to waveforms that can be displayed by the replay function [REPLAY].

Page Search is performed while waveform is stopped ("STOP" appears in red on the screen readout area, and the RUN/STOP button is OFF).

Page Search is not able to search for any pass/fail judgment that used a mask pattern.

The Page Search operation steps are described below.

# **Operation Steps**

- Press the RUN/STOP button to stop waveform capture. Waveform capture is stopped as shown in Figure 3.12.37(a) on next page.
- Touch (select) the Page Search menu item shown in Figure 3.12.34. This opens Page Search Sub Menu, shown in Figure3.12.35.
- Touch (select) the Search For menu item shown in Figure 3.12.35 on next page. This opens Search For Sub Menu, shown in Figure3.12.36 on next page.
- Touch (select) the Pass or Fail menu item shown in Figure 3.12.36 on next page. When either item is selected, the selected search object is displayed in the menu item of Search For of Figure 3.12.35 on next page.
- To search the acquired waveforms with Figure 3.12.35 before the displayed waveforms, touch (select) Previous. To search the acquired waveforms with Figure 3.12.35 after the displayed waveforms, touch (select) Next.





When Previous is selected, the waveforms and the page information that become the pass or fail judgment result of specification with Search For

(seached object) among waveforms acquired from the displayed waveforms ahead are displayed.

When Next is selected, the waveforms and the page information that become the pass or fail judgment result of specification with Search For

(seached object) among waveforms acquired from the displayed waveforms backward are displayed.

When a corresponding waveforms to the searchedl object in the full page

doesn't exist, it is not changed like page present display.



Figure 3.12.35 Page Search Figure 3.12.36 Search For Sub Menu

Sub Menu

When the number on the searched page reaches one when Previous is operated, the search is restarted on the page that the page number becomes the maximum and the result is displayed.

When the number on the searched page reaches the maximum value when Next is operated, the search is restarted on the page that the page number becomes one and the result is displayed.

< Example of displaying page information >

This searches for a waveform (page) with Pass or Fail judgment result. If such a waveform (page) is found, the waveform and page information are displayed on the right on-screen readout area as shown in the example in Figure 3.12.37.

If it is not found, the displayed waveform does not change.

After a Page Search, the page information number on the right on-screen readout area is incremented by Next operation and decremented by Previous operation.



The page can be returned, or advanced by making the replay function effective by pushing STOP button and turning REPLAY button when Operation of the Pass/Fail function is Off (Refer to section 3.10 for details).

## 3.12.2.6 Menu items and hierarchy

The Pass/Fail menu items and hierarchy are shown in Figure 3.12.38(a) to (d).



Figure 3.12.38(a) Pass/Fail Menu



Figure 3.12.38(b) Condition Menu (Judge By: Measure)



Figure 3.12.38(c) Condition Menu (Judge By: Mask)



Figure 3.12.38(d) Save/Recall Mask Menu (Judge By: Mask)

### 3.12.3 Logging function

\* Logging function can be used only for the DS-5500A Series.

The Logging function uses internal memory to record logs of measurement results from Measure and judgment results from Pass/Fail. Up to 86,400 log entries can be recorded, along with time stamps, in internal memory.

Recorded logs can be displayed in pop-up windows and saved to USB memory.

Logging menu items are described below.

(1) Capture

Select On or Off for recording of measurement results and pass/fail judgment results.

• Off: Does not record logs of measurement results and pass/fail judgment results to internal memory.

• On: Records logs of measurement results and pass/fail judgment results to internal memory.

Once On is selected, recording of logs to internal memory begins. When the setting that relates to Measure and Pass/Fail is changed, log entries in internal memory may be initialized.

If the number of log entries exceeds 86,400, only the most recent 86,400 entries are retained in internal memory.

(2) Show Log Entries

This displays the most recent 16 entries from the logs recorded in internal memory in a pop-up window.

The title of the pop-up window is the position of the selected (Reversed display) log entry among the total number of log entries.

When the RUN/STOP button turns off, the log selection can be changed by turning the ADJUST knob. When the selected position is changed, the 16 log entries prior to the selected one can also be checked.

The amount by which the selected log position is changed can be set using the ADJUST knob, changing each time the knob is pressed.

The pop-up window is closed when an operation that does not use the ADJUST knob or a Show Log Entries menu item is performed.

(3) File Name

Select the file name to be used when saving to USB memory log entries that were recorded to internal memory.

Touch (select) a menu item to open the Character List pop-up window. Press and turn the ADJUST knob to enter a file name. (See section 3.7.3 for description of how to enter characters, numbers, and symbols.)

Enter a file name of eight characters. Alphabet letters and symbols can be selected for the first four digits of the file name, and four numerals can be selected for the second four digits.

(4) Save to USB Memory

Log entries recorded to internal memory are stored to USB memory under the selected file name. The saved files are stored in the LOG folder in USB memory. Connect USB memory to the USB connector on the lower left of the front panel,

then press a menu item.

### 3.12.3.1 Logging menu settings

Perform the following operation steps to set up the Logging menu.

To display log entries, the Measure and/or Pass/Fail function must be set and performed beforehand. Also, to save log entries, the USB memory must be already set up and connected to the USB connector on the lower left of the front panel, prior to executing items from the Save to USB Memory menu.

### **Operation Steps**

 Touch (select) a Logging menu item, shown in Figure 3.12.39.

This opens the Pass/Fail sub menu shown in Figure 3.12.40.

- 2. Touch (select) a Capture menu item and set it to ON, as shown in Figure 3.12.40.
- Touch (select) a Show Log Entries menu item, shown in Figure 3.12.38.

This displays log entries such as in the example in Figure 3.12.39.

Touch (select) a File Name menu item, shown in Figure 3.12.40.

This opens the Character List pop-up window to the left of the menu items.

- Note 1) See "(3) File Name" on the previous page before entering characters.
- 5. Touch (select) the Save to USB Memory menu item, shown in Figure 3.12.40.

Log entries recorded to internal memory are stored to internal memory under the selected file name.

Note 2) Before saving, connect USB memory to the USB connector on the lower left of the front panel.

		Log Ent	tries		
♦ 16/	192				
Time	Α	В	C	D	Judgment
16:15:50	3.057	-11.2m∀	2. 400µs	3.023m∀s	Pass
16:15:50	3. 02V	-11.2m∀	2. 400µs	3.004m∀s	Pass
16:15:50	3. 02V	-11.2m∀	2. 400µs	3.021m∀s	Pass
16:15:50	3. 02V	-11.2m∀	2. 400µs	3.023m∀s	Pass
16:15:50	3. 05V	-11.2m∀	2. 400µs	3.027m∀s	Pass
16:15:50	3. 05V	-11. 2m∀	2. 400µs	3.022m∀s	Pass
16:15:50	3. 02V	-11.2m∀	2. 400µs	3.029m∀s	Pass
16:15:50	3. 02V	-11.2m∀	2. 400µs	3.026m∀s	Pass
16:15:50	3. 02V	-11.2m∀	2. 360µs	3.023m∀s	Pass
16:15:50	3. 02V	-11.2m∀	2. 400µs	3.020m∀s	Pass
16:15:50	3. 05V	-11.2m∀	2. 400µs	3.028m∀s	Pass
16:15:50	3. 05V	-11.2m∀	2. 400µs	3.031m∀s	Pass
16:15:51	3. 05V	-11.2m∀	2. 400µs	3.028m∀s	Pass
16:15:51	3. 05V	-11.2m∀	2. 400µs	3.025m∀s	Pass
16:15:51	3. 05V	-11.2m∀	2. 400µs	3.019m∀s	Pass
16:15:51	3.02V	-11. 2mV	2. 400µs	3.017mVs	Pass

Figure 3.12.41 Log Entries Pop-Up Window









## 3.12.3.2 Logging menu items and hierarchy

The Logging menu items and hierarchy are shown in Figure 3.12.42.



Figure 3.12.42 Logging Menu

### 3.12.4 Relations to other functions

- a) When measuring inverted waveforms, values for sign, slope, etc. are shown in reverse (highlight) mode. Also, Tr, Tf, Top, and Base are themselves handled as inverted. Also inverted are the measured values found for RMS, Mean, Maximum, and Minimum.
- b) The following constraints apply only to multiplication, integral and derivative under the Math option for Measure.
  - \* The Math operation of Integral and Derivative can be measured only for the DS-5500A Series.
  - Among the vertical axis-related Measure Items, Top, Base, Top-Base, +Overshoot and –Overshoot cannot be measured using Auto Measure. When any of these five types of Measure Item is selected, only "\*\*\*\*\*\*\*\*" is shown in Auto Measure's measured value display area.
  - Among the horizontal axis-related Measure Items, when calculating with the four Tr and Tf items, calculate from Peak-to-Peak rather than Top-Base.
- c) During Run mode (AUTO, NORMAL, and SINGLE buttons are ON), the following items are initialized by pushing the CLEAR button.
  - Max, Min, and Num that are results of Measure
  - Result and number of judgment of Pass/Fail
  - Entries of the Logging function

# 3.13 REF Menu

The Reference Waveform function saves, recalls, and redisplays the waveform data currently shown on the screen and the related setups. This section describes Reference Waveform menu operation methods and menu items.

## 3.13.1 REF menu, operation method

The layout of buttons and knobs related to the Reference Waveform menu is shown in Figure 3.13.1. This section describes operations that save, recall, and display data.

## Operation Step 1 Save waveform data and setups

- 1. Measure waveform data.
- Press the REF button shown in Figure 3.13.1. The Reference Waveform menu appears in the right part of the screen. (See Figure 3.13.2)
- Touch (select) a menu item shown in Figure 3.13.2 or turn the ADJUST knob to select a Ref. No. from REF 1 to REF 5.
- Touch (select) a Source menu item. The Source sub menu will appear on top of the current menu. (See Figure 3.13.3)
- Touch (select) a menu item shown in Figure 3.13.3 to select the Source to be saved.
- Touch (select) a menu item shown in Figure 3.13.2 and select Save. The Ref. No. specified in step 3 above and the Source specified in step 5 above are saved as the waveform data and setups for the specified Source.

The waveform data to be saved includes the CH1 to CH4 (2CH model: CH1 to CH2) data as specified under Source and the Math waveform data, which can be stored even when waveform acquisition has been stopped.

This waveform data and setups can be saved even when the observed waveform is not being shown on the screen.







Figure 3.13.3 Source Option Display Menu

### Operation Step 2 Recall and display waveform data and setups

- Press the REF button shown in Figure 3.13.4. The Reference Waveform menu appears in the right part of the screen. (See Figure 3.13.5)
- Touch (select) a menu item shown in Figure 3.13.5 or turn the ADJUST knob to select a Ref. No. from REF 1 to REF 5.
- Touch (select) Recall REF Setup shown in Figure 3.13.5. This recalls the Ref. No. setups from step 2 and displays them in the screen's readout area or waveform readout area. (See Figure 3.13.6)
- Again, press the REF button shown in Figure 3.13.4. Next, touch (select) Waveform as shown in Figure 3.13.5 and turn Waveform to "ON". The waveform data from the Ref. No. selected at step 2 is displayed on the screen. (See Figure 3.13.6)



Figure 3.13.4 Layout of Buttons and Knobs



Figure 3.13.5 Reference Waveform Menu



Figure 3.13.6 Recalled Reference Waveform Data and Setups

### 3.13.2 Menu items and hierarchy



Figure 3.13.7 Reference Waveform Menu

## 3.13.3 Supplementations on saving, recalling, and displaying data

This section provides some supplemental explanations pertaining to the descriptions in sections 3.13.1 and 3.13.2 above.

- a) When the Main and Zoom windows are being displayed, the Zoom window's waveform data is saved.
- b) The XY display's waveform data cannot be saved as a reference waveform. When you press the REF button, no menus or waveform data are displayed.
- c) When saving, old data is overwritten. There is no way to manually clear the data.
- d) When a reference waveform is displayed, all of it is shown in white on the screen.
- e) Zoom display of reference waveforms is not possible.
- f) During processing of reference waveforms, Roll mode is stopped. It is resumed when RUN mode is set after the processing ends.
- g) In some cases, when the REF button is pressed, a reference with a different waveform number is shown on the screen. This is because a waveform with another waveform number has been set to ON. If it is not needed, specify that reference waveform number and set the waveform to OFF.

# 3.14 SAVE/RECALL Menu

With this product, waveform data, waveform information, and related setups can be saved to internal memory or USB memory and then recalled.

This section describes menus and operations involving data and data formats targeted by the Save and Recall functions.

## 3.14.1 SAVE function

## 3.14.1.1 Save targets

The types of waveform data, information, and setups that can be saved by this product are listed below in Table 3.17.

Save data Save targets	Waveform data (Binary format)	Waveform information (Binary format)	Setups (Text format)
Waveform data (shown on screen) *Excludes Math	0	0	0
Waveform information (not shown on screen) *Excludes Math	×	×	0
REF data	0	×	0
Setups	×	×	0

Table 3.17 Save Targets and Saved Data

Note 1) After saving to USB memory, the file name is indicated in a message shown in the status information area at the bottom of the screen.

- Note 2) When saving REF data, if waveform data has not been acquired (Empty), the message "Cannot save: waveform data not found." is shown in the status information area at the bottom of the screen.
- Note 3) With data produced by the Invert or Skew function, the Invert and Skew functions are retained as part of the setups, and the waveform data that is saved is raw data (data that has not been inverted or skewed).

## 3.14.1.2 Data format

Three data formats can be saved by this product: Binary format, ASCII format, and Text format.

## a) Saved binary format data

When the saved data is in Binary format, in addition to the CH1 to CH4 (2CH model: CH1 to CH2) waveform data, other waveform information such as time values are also saved at the same time. In Binary format, all information, including the waveform data, is stored as binary values, and the saved data can be recalled and used by this product. The binary waveform data format is shown in the figure below.

Setups (Text)			Waveform information (Binary)		Waveform data (Binary)			
Model Inform ation	CH1 (On)	CH2 (Off)	CH3 (On)	CH4 (Off)	CH1	CH3	CH1	CH3

Figure 3.14.1 Binary Waveform Data Format

Note) This is shown only when Trace (screen display) ON was set while saving waveform information and waveform data.

## b) Saved ASCII format data

When the saved data is in ASCII format, in addition to the CH1 to CH4 (2CH model: CH1 to CH2) waveform data, other waveform information such as panel setups and time values are saved in CSV format.

Since the comma is the separator symbol in data saved in CSV format, it can be easily edited using software applications such as Excel. However, data saved in ASCII format cannot be recalled and redisplayed by this product. The saved data can be recalled from USB memory and opened by a computer. Also, if Trace (screen display) was set to OFF via the CH menu, then waveform data in ASCII format cannot be saved.

## 3.14.2 Recall function

This product is able to recall all data, information, and setups marked with a " $\circ$ " in Table 3.18 below.

Restored data Restore targets	Waveform data (Binary format)	Waveform information (Binary format)	Setups (Text format)	Remark
Waveform data (screen display: ON/OFF)	。 (ON only)	0	0	
REF data	0*	×	0*	Forcibly sets ON for Reference Waveform ON and all REF functions (button LED is ON).
REF setups	×	×	0	Forcibly sets ON for Reference Waveform ON and all REF functions (button LED is ON). Perform the Recall REF Setup menu item to make those setups the currently displayed setups. REF menu is also displayed.
Setups	×	×	0	

#### Table 3.18 Recall Targets and Recall Data

Note 1) When  $\circ$  appears with an asterisk (\*), the REF function's Ref. No. is specified as REF 1 to 5, and it is recalled to that area.

Items marked with only  $\circ$  are basically target traces and setups that were saved and can be recalled.

Note 2) The recalled data format is the data format that was saved.

## 3.14.3 Target devices

The target devices for the Save function and Recall function are the internal memory and USB memory. The functions and data used with these target devices are described below.

Device	Target function	Target data
Internal memory (with backup)	<1> Save <2> Recall	<1> Setups
USB memory	<1> Save <2> Recall	<1> Waveform data + setups <2> Setups <3> REF <4> Math data

Table 3	.19	Target	Devices
---------	-----	--------	---------

Note 1) This product's internal memory comes with a backup function, so that internal memory contents are retained even when this product's power has been set to standby or even OFF.

Note 2) Up to five sets of data can be saved to internal memory, after which the latest data overwrites older data and is saved during updates.

When using USB memory, the amount of free memory remaining is shown in the center of the screen during operation step 1 described below. (See Figure 3.14.2) This Free Area value should be confirmed as adequate before starting. Press the MENU CLOSE button to delete this display.

1. When Status & Update/USB Memory Information was selected in the Utilities menu

USB N	lemory	Information	
All Area		126, 710	KB
Used Area		3, 326	KB
Free Area		123, 384	KB

All Area: USB memory size Used Area: Amount of used memory Free Area: Amount of free memory

Figure 3.14.2 Free Area Display for USB Memory

## 3.14.4 File specifications

The following describes a file stored in USB memory.

### 3.14.4.1 Directory configuration

Directories include a Waveform directory, Setup directory, REF directory, and Math directory as fixed directories where waveform data, setup data, REF data, and math data can be stored respectively. Their configuration is illustrated in the figure below. As in the example, in each directory the first four characters in each file name are fixed as extension characters.



## 3.14.4.2 File name

File names have eight (English) alphanumeric characters, starting with four alphanumeric characters and ending with four numerals. The last four characters are a sequential number from 0000 to 9999 that relates to the first four characters, and this number is incremented automatically as more files are saved. After the file ending in 9999 is saved, sequential numbering starts over from 0000.

(Example)

WBIN 0000, WBIN 0001, WBIN 0002 ..... WASC 0000, WASC 0001, WASC 0002 .....
#### 3.14.5 SAVE/RECALL menu

The layout of buttons and knobs related to the Save/Recall menu is shown in Figure 3.14.4. This section describes operations that save and recall data.

#### Operation Step 1 How to Save to Internal Memory

- 1. First, prepare a setup for saving.
- Press the SAVE/RECALL menu button shown in Figure 3.14.4. The Save/Recall menu appears in the right part of the screen. (See Figure 3.14.5)
- Touch a menu item as shown in Figure 3.14.5, then select Save Setup to Int. Memory. The Save Setup to Int.Memory sub menu appears in the right part of the screen. (See Figure 3.14.6)
- 4. Touch a menu item as shown in Figure 3.14.6, then select from among Setup 1 to Setup 5 to save the setups. When setups are saved, the date and time when saved are shown below each Setup number in the Save Setup to Int. Memory menu. (See Figure 3.14.7)



Figure 3.14.4 Layout of Buttons and Knobs



Figure 3.14.5 Save/Recall Menu

5. Press the CLOSE button shown in Figure 3.14.7 two times. This closes the menu. Before saving any of these setups, the Default Setup set at time of shipment is shown. When a setup that has already been saved once is saved later, the previous setup and date are overwritten.



Figure 3.14.6 Save Setup to Int.Memory Sub Menu



#### Operation Step 2 How to save to USB memory

- Prepare the waveform data and setups to be saved.
- Plug the USB memory device into the USB terminal in the lower left part of the front panel.
- Press the SAVE/RECALL menu button shown in Figure 3.14.8. The Save/Recall menu appears in the right part of the screen. (See Figure 3.14.9)
- Touch a menu item as shown in Figure 3.14.9, then select Save/Delete to USB.Memory. The Save/Delete to USB.Memory menu appears in the right part of the screen. (See Figure 3.14.10)
- 5. Touch a menu item as shown in Figure 3.14.10, then select Save.
- Touch a menu item as shown in Figure 3.14.10, then select the File format menu. The File format sub menu appears in the right part of the screen. (See Figure 3.14.11)
- 7. Touch a menu item as shown in Figure 3.14.11, then select Next (1/2, 2/2). (See Figure 2.14.11)



Figure 3.14.10 Save/Delete to USB Memory Sub Menu



- Touch a menu item as shown in Figure 3.14.12, then select File Name.
- Note) In this file format, the default name is fixed as the first four characters. Also, the



Figure 3.14.8 Layout of Buttons and Knobs



Figure 3.14.9 Save/Recall Menu



Figure 3.14.11 File Format Sub Menu

numerical value of the last four characteristics is automatically increased in the range from 0000 to 9999. For instructions on entering file names, see "3.7.3 Entering characters, symbols, and numerals".

- If you chose Reference Waveform as the file format at step 8 above, either touch or a menu item as shown in Figure 3.14.12 or turn the ADJUST knob to select a Ref. No from among REF 1 to REF 5.
- 11. Touch any menu item shown in Figure 3.14.12 and run Save. This causes the USB memory lamp to blink and the display "XXXXYYYY (file name)" to be shown in light blue in the logo, counter, and clock display area at the bottom of the screen. The save operation is completed when the file name is deleted and the USB memory device is no longer blinking.
- Press the CLOSE button shown in Figure 3.14.12 two times to close the menu. Next, remove the USB memory device from the USB terminal.

#### Operation Step 3 How to delete data from USB memory

- 1. Plug the USB memory device into the USB terminal in the lower left part of the front panel.
- Press the SAVE/RECALL menu button shown in part 3 of Figure 3.14.8 on the previous page. The Save/Recall menu appears in the right part of the screen. (See Figure 3.14.13)
- Touch a menu item as shown in Figure 3.14.13, then select Save/Delete to USB.Memory. The Save/Delete to USB Memory sub menu appears in the right part of the screen. (See Figure 3.14.14)



Figure 3.14.12 Save/Delete to USB Memory





Figure 3.14.13 Save/Recall Menu



- Touch any menu item shown in Figure 3.14.15, then select Delete in the Save/Delete menu.
- Touch a menu item as shown in Figure 3.14.15, then select File format menu. The File format menu (1/3, 2/3, 3/3) appears in the right part of the screen. (See Figure 3.14.16)
- Touch a menu item as shown in Figure 3.14.16, then select File format. The display returns to the File format menu shown in Figure 3.14.15, and the selected file format is displayed.
- Touch a menu item as shown in Figure 3.14.15, then select File List menu.
   A File List window containing the file format selected at step 5 is shown in the middle of the screen. (See Figure 3.14.17)
- Check the contents of the file list shown in Figure 3.14.17, then turn the ADJUST knob to select a file to be deleted. (Note) The selected file has a white background in the File List.
- Touch any menu item shown in Figure 3.14.15, select the Delete File menu and then delete the file selected at step 7.
- Press the MENU CLOSE button shown in Figure 3.14.15 three times to close the menu.





Figure 3.14.16 File Format Sub Menu (1/3, 2/3, 3/3)



Figure 3.14.17 File List Example

#### (Memo) File Lists

Up to 20 files can be displayed in one File List page. When there are more than 20 files in the list, use the ADJUST knob to scroll downward and view all of the files.

#### Operation Step 4 How to recall setups from internal memory

- Press the SAVE/RECALL menu button shown in Figure 3.14.18. The Save/Recall menu appears in the right part of the screen. (See Figure 3.14.19)
- Touch a menu item as shown in Figure 3.14.19, then select Recall Setup from Int.Memory menu. The Recall Setup from Int.Memory menu appears in the right part of the screen. (See Figure 3.14.20)
- Touch (select) a menu item shown in Figure
   3.14.20 to select Setup 1 to 5. The setups are recalled to the device.
- Press the MENU CLOSE button shown in Figure 3.14.20 two times to close the menu.

The only data that is saved to internal memory is the Setup data (setups).

As shown in the menu example in Figure 3.14.20, there are two types of setups.

- Setups with date and time indications
   These are setups that were saved after this product was shipped.
- b) Setups indicated as the Default Setup These are initial setups that were saved to this product prior to shipment.

#### Operation Step 5 Recall default setup menu

 Touch (select) a menu item shown in Figure 3.14.19 to select the Recall Default Setup menu. These setups were made at shipment, and specify that trace is ON (with screen display) for CH1 to CH4 (2CH model: CH1 to CH2).

#### Caution) Default Setup

When the observed waveform is shown on the screen while measurement is in progress, **do not inadvertently select this menu** if you do not want to change the setups.



Figure 3.14.18 Layout of Buttons and Knobs



Figure 3.14.19 Save/Recall Menu





#### Operation Step 6 How to recall data from USB memory

- Plug the USB memory device into the USB terminal in the lower left part of the front panel.
- Press the SAVE/RECALL menu button shown in Figure 3.14.21. The Save/Recall menu appears in the right part of the screen. (See Figure 3.14.22)
- Touch a menu item as shown in Figure 3.14.22, then select Recall from USB Memory menu. The Recall from USB Memory menu appears in the right part of the screen. (See Figure 3.14.23 (a))
- Touch a menu item as shown in Figure 3.14.23 (a), then select File format menu. The File format sub menu appears in the right part of the screen. (See Figure 3.14.2 (b))
- Touch any menu item in part (b) of Figure 3.14.23 to select among three file formats. Next, the File format sub menu is cleared and the file format that was selected via the Recall from USB Memory menu is shown. (See Figure 3.14.23 (a))
- Touch a menu item as shown in Figure 3.14.23 (a), then select File List menu. The File List appears in a pop-up window in the center of the screen. (See Figure 3.14.24)
- Turn the ADJUST knob shown in Figure 3.14.22 to set the target file name as highlighted with a white background.
- Touch a menu item as shown in Figure 3.14.23, then select the Recall menu. The File List in the center of the screen disappears and the recalled Setup, Waveform (binary), or Reference Waveform is recalled to the screen or to reference waveform memory.



Figure 3.14.21 Layout of Buttons and Knobs







Figure 3.14.23 Recall from USB Memory Menu

5.1	
FII	e list
🔘 Rotate:Select	
STUP0000. SET	05/11/02 11:50:42
STUP0001. SET	05/11/02 22:19:50
STUP0002. SET	05/11/02 22:19:52
STUP0003. SET	05/11/02 22:19:54
STUP0004. SET	05/11/02 22:19:54
STUP0005. SET	05/11/02 22:19:54

Figure 3.14.24 File List

#### 3.14.6 Menu items and hierarchy

The hierarchy of Save/Recall menu items is shown in Figure 3.14.25.

The Save/Delete to USB Memory menu and the Recall from USB Memory menu are shown in Figure 3.14.26, Figure 3.14.27, and Figure 3.14.28.













## 3.15 ZOOM Menu

The Zoom function creates a separate, enlarged display of a specified part of a waveform while viewing the original acquired waveform.

When this menu is selected, the screen is divided into upper and lower parts, with the original waveform shown in its entirety in the Main window (upper half) and the enlarged waveform shown in the Zoom window (lower half).

This section describes the Zoom function's operations, screen displays, and relations with other functions.

#### 3.15.1 Zoom menu, operation method

The layout of the Zoom execute button is shown in Figure 3.15.1.

#### Operation Steps

- Press the Zoom execute button shown in Figure 3.15.1. The Zoom execute button lamp goes ON, and a Main window appears in the upper half of the screen and a Zoom window appears in the lower half. (See Figure 3.15.2)
- Turn the Time/div control knob shown in Figure 3.15.1 to enlarge only the content of the Zoom screen. Turn it clockwise to increase the Times/div value, which enlarges the Zoom window. (See Figure 3.15.3)

#### 3.15.2 Main window/Zoom window

The waveform data now appears in both the Main window and the Zoom window, as is shown in Figure 3.15.2. Also, "Times/div" is shown in the left side of the readout area at the top of the screen.

- [Figure 3.15.2 Display Example 1]
  - Zoom window: 200 µs/div
  - Main window: 200 µs/div
- [Figure 3.15.3 Display Example 2]
  - Zoom window: 100 µs/div
  - Main window: 200 µs/div

Although there is a Main window and a Zoom window, the Times/div and Delay values can be set only in the Zoom window. Channel-related functions such as Volts/div can be set in both windows.

#### 3.15.3 Range setting cursors

Two range setting cursors (two blue lines) are shown along the vertical axis in the Main window, as shown in Figure 3.15.3. The range between these two cursors is shown as enlarged in the Zoom window below.



Figure 3.15.1 Horizontal Axis-Related Layout







Figure 3.15.3 Main Window/Zoom Window Display Example 2

## 3.16 AUTO SETUP Menu

With this product, if you wish to measure an input signal and display it on the screen right away, simply press the AUTO SETUP execute button to automatically enter setups (vertical axis, horizontal axis, and trigger-related setups) that are optimized for the input signal by the AUTO SETUP function.

This section describes this function and its operation methods.

#### 3.16.1 Operation method

The AUTO SETUP execute button's layout is shown in Figure 3.16.2.

#### **Operation Steps**

- Connect the signal to be measured to one of the CH1 to CH4 (2CH model: CH1 to CH2) input terminals.
- Press the CH trace button above the CH terminal used for signal input at step 1, to set trace ON (screen display ON). This turns ON the CH trace button lamp.
- Press the AUTO SETUP execute button shown in Figure 3.16.2. After a brief ticking sound occurs, the observed waveform will appear on the screen, and the Auto Setup menu will appear in the right part of the screen. (See Figure 3.16.3)
- 4. Next, select the options in a) and b) below.
  - a) To close the menu and start the next operation, press the MENU CLOSE button shown in Figure 3.16.3 to close the Auto Setup menu.
  - b) To restore the setups prior to auto setup, touch a menu item shown in Figure 3.16.3, then select the Undo menu.

#### Caution) Undo menu

If any buttons or knobs are operated after auto setup is completed, this menu becomes invalid and the previous setups are not restored.



Figure 3.16.1 Layout of Buttons and Knobs



Figure 3.16.2 Layout of Buttons and Knobs





#### 3.16.2 Auto setup for Math

For Math, basically whenever trace (screen display) is ON, it is handled as if trace (screen display) is ON for the target channel for Math. For example, if trace is set to OFF for CH1 and CH2, and a Math waveform display is created by adding CH1 and CH2, using the auto setup function will set trace for CH1 and CH2 ON again.

## 3.17 HELP Menu

This product provides a Help menu that provides on-screen descriptions of front-panel button and knob-related function and operations. If you selected a language via the Utilities menu (Utilities/Config/Language menu), help information is shown in that language.

The HELP menu button's layout is shown in Figure 3.17.1, and its functions and operation methods are described below.

#### **Operation Steps**

- Press the HELP menu button shown in Figure 3.17.1. The temporary message "Display help message of selected item." appears in the logo, counter, and time display area at the bottom of the screen.
- Press the target button or knob. A help screen about that button or knob will appear across the screen's waveform display area. (See Figure 3.17.2) [Display example]

In this example, the HELP menu button was pressed and then [UTILITIES] menu button was selected.

 Next, operate any button or knob. This closes the Help window shown in Figure 3.17.2.

To view a Help window for a different button or knob while viewing a Help window for the current button or knob, press the HELP menu button again, then operate the target button or knob. All messages and other content in Help windows are shown on one screen page only.



Figure 3.17.1 Layout of Buttons and Knobs

#### [UTILITIES] menu button



Figure 3.17.2 HELP Window Display Example

## 3.18 CLEAR Functions

This product has the function which can clear (initialize) the data of acquired waveforms to be measured, measured values and measurement results. The contents that can be cleared (initialized) become the followings.

- Waveform of the Replay function	Section 3.10 Reference
- Average processing	Section 3.5.5.3 Reference
- Persistent waveform	Section 3.9.3 Reference
- Measure result value	Section 3.12.1 Reference
Min (Minimum), Max (Maximum), and Num (Numb	er of Pass/Fail)
- Result and number of judgement of Pass/Fail	Section 3.12.2 Reference I
- Entries of the Logging function	Section 3.12.3 Reference

#### Caution)

- . The above-mentioned acquired data are all cleared (initialized) at the same time when CLEAR function is executed, and note handling enough.
- When CLEAR function is done, the above-mentioned measurement data cannot be restored. Execute CLEAR function after necessary measurement data are preserved and recorded.

#### **Operation Steps**

- 1. When data are necessary, preserve and record them.
- Push CLEAR execute button like as In right Figure 3.18.1



Figure 3.18.1 Layout of Buttons and Knobs

#### < Example of the CLEAR function >

In the following example, when CLEAR button is pushed in the state of the left screen, the contents of ① to ③ on the right screen are cleared.

E	0.0000-			1 1/ 1			
Moons	0.0000s	· · · · ·		a/ a	Pass/Fail		Pagg/Fail
					1455/1411		1455/1411
					0	① Waveforms of the Replay function (in	0
					Uperation		Uperation
					044	frame)	044
۲	r	n					
						· · · · · · · · · · · · · · · · · · ·	
					Judge By		Judge By
					Measure		Measure
					Mask		Mask
استنبا	ليستنا			السيسا		free hand been here here here here here here here h	
					Condition	2 Measure results (in frame)	Condition
							- 4
						3 Result and number of judgement	or
			<u> </u>		Actions	Pass/Fai (in frame)	Actions
A 1 Max	inun <sub>v</sub>	1.447	1.44	1.447 3	Accions	A Maximum 1.44V soosees secondoor soosee	ACCIONS
	20-80% a	7 400us	7 400us	-1.52VH 3		-1.32 $+3.42$ $+3.4$	
D 1 Tf	80-20%	7. 000µs	7.000µs	6.000µs 14		D 1 Tf 80-20% 7.000us **********************************	
		Edge	; 🚣 ं 🚺	DC -20. OmV		Edge 🖌 🚺 DC -20.0mV	
1: 1.00	V BW 2: 500mV	3: 100mV	4: 100mV	M:10.0MV/s	Page Search	1: 1.00V BW 2: 500mV 3: 100mV 4: 100mV M:10.0MV/s	Page Search
ACTM2	ACTHN 20. 0mVEmpty	Empty	Empty	Empty		ofs 20 0m/Empty Empty Empty	
WATE	LL Pass Pass'	3/ 3.10	nks 500 pts	RTC:2013/03/	15 17:01:37	WATELL Pass 100kS 500 pts RTC:2013/03/	15 17:01:55

# Chapter 4 Math Function

This chapter describes this product's Math function.

## 4.1 Math Operation Types

With this product, addition, subtraction, and multiplication operations can be performed among the various waveform data observed via CH1 to CH4 (2CH model: CH1 to CH2). Also, FFT, Integral\* and Derivative\* operations can be performed on CH1 to CH4 (2CH model: CH1 to CH2)'s waveform data. And, as with ordinary observed waveform data, the Math results can be displayed on the screen. The various types of Math operations are described below in sections 4.1.1 to 4.1.3.

\* The measurement by the operation function of Integral and Derivative is possible only in the DS-5500A Series.

## 4.1.1 Addition and subtraction

As shown below, addition and subtraction are performed using data from multiple channels. The target data is from the signals input to CH1 to CH4 (2CH model: CH1 to CH2).

a) Addition: (CHm data) + (CHn data)	(m, n: 1, 2, 3, 4)
--------------------------------------	--------------------

b) Subtraction:(CHm data) - (CHn data) (m, n: 1, 2, 3, 4)

The setups are not kept consistent among the channels being used; in Math operations, data that was measured independently in each channel is added or subtracted and the result is displayed.

When performing a Math operation among the various channels, the data along the vertical axis of the Math waveform is determined as described below.

• Using the larger vertical axis range among two channels as the standard, the smaller vertical axis range's size is calculated as a ratio that is applied to determine the Math operation data.

Example: Addition of CH1 = 2V/div and CH2 = 10 mV/div

Math operation data = CH1 + CH2  $\times$  0.01 / 2

When displaying the results, set a display range that will enable the Math waveform data to fit within the screen, such as is shown in Table 4.1. Afterward, this Math waveform data range can be manually adjusted as necessary.

/						CH	l range	е					
	V	10V	5V	2V	1V	0.5V	0.2V	0.1V	50mV	20mV	10mV	5mV	2mV
_	10V	10	10	10	10	10	10	10	10	10	10	10	10
С	5V	10	5	5	5	5	5	5	5	5	5	5	5
н	2V	10	5	2	2	2	2	2	2	2	2	2	2
2	1V	10	5	2	1	1	1	1	1	1	1	1	1
	0.5V	10	5	2	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
r	0.2V	10	5	2	1	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2
а	0.1V	10	5	2	1	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1
n	50mV	10	5	2	1	0.5	0.2	0.1	50m	50m	50m	50m	50m
g	20mV	10	5	2	1	0.5	0.2	0.1	50m	20m	20m	20m	20m
e	10mV	10	5	2	1	0.5	0.2	0.1	50m	20m	10m	10m	10m
	5mV	10	5	2	1	0.5	0.2	0.1	50m	20m	10m	5m	5m
	2mV	10	5	2	1	0.5	0.2	0.1	50m	20m	10m	5mV	2m

Table 4.1 Display Range Setting for Addition and Subtraction (CH1 and CH2)

#### 4.1.2 Multiplication

As shown below, multiplication is performed using data from multiple channels. The target data is from the signals input to CH1 to CH4 (2CH model: CH1 to CH2).

c) Multiplication: (CHm data)  $\times$  (CHn data) (m, n: 1, 2, 3, 4) The setups are not kept consistent among the channels being used; in Math operations, data that was measured independently in each channel is multiplied and the result is displayed. However, the unit becomes VV. When displaying the results, set a display range that will enable the Math waveform data to fit within the screen, such as is shown in Table 4.2. Afterward, this Math waveform data range can be manually adjusted as necessary.

/	CH1 range												
	VV	10V	5V	2V	1V	0.5V	0.2V	0.1V	50mV	20mV	10mV	5mV	2mV
	10V	100	50	20	10	5	2	1	0.5	0.2	0.1	50m	20m
С	5V	50	20	10	5	2	1	0.5	0.2	0.1	50m	20m	10m
н	2V	20	10	2	2	1	0.2	0.2	0.1	20m	20m	10m	2m
2	1V	10	5	2	1	0.5	0.2	0.1	50m	20m	10m	5m	2m
	0.5V	5	2	1	0.5	0.2	0.1	50m	20m	10m	5m	2m	1m
r	0.2V	2	1	0.2	0.2	0.1	20m	20m	10m	2m	2m	1m	0.2m
а	0.1V	1	0.5	0.2	0.1	50m	20m	10m	5m	2m	1m	0.5m	0.2m
n	50mV	0.5	0.2	0.1	50m	20m	10m	5m	2m	1m	0.5m	0.2m	0.1m
g	20mV	0.2	0.1	20m	20m	10m	2m	2m	1m	0.2m	0.2m	0.1m	20u
e	10mV	0.1	50m	20m	10m	5m	2m	1m	0.5m	0.2m	0.1m	50u	20u
	5mV	50m	20m	10m	5m	2m	1m	0.5m	0.2m	0.1m	50u	20u	10u
	2mV	20m	10m	2m	2m	1m	0.2m	0.2m	0.1m	20u	20u	10u	2u

Table 4.2 Display Range Setting for Multiplication (CH1 and CH2)

#### 4.1.3 FFT operation

This product also comes equipped with an FFT function. The FFT target is the input signals input via CH1 to CH4 (2CH model: CH1 to CH2). FFT is performed on the data in a specified channel, and then only that specified channel's data is shown. For details of the FFT function, see section 4.5 below.

#### 4.1.4 Integral operation

\* The measurement by this function is possible only in the DS-5500A Series. This product also comes equipped with an Integral function. The integration waveform is displayed in a red waveform on the screen by the one that calculation object was integrated at time.

The Integral target is the input signals input via CH1 to CH4 (2CH model: CH1 to CH2). The integration operation for the data of specified CH is executed, and only one specified CH is displayed.

#### 4.1.5 Derivative operation

\* The measurement by this function is possible only in the DS-5500A Series. This product also comes equipped with an Derivative function. The differentiation waveform is displayed in a red waveform on the screen by the one that calculation object was differentiated at time.

The Derivative target is the input signals input via CH1 to CH4 (2CH model: CH1 to CH2). The differentiated operation for the data of specified CH is executed, and only one specified CH is displayed.

\* When there are a lot of noise elements in the waveform of the operation source, properly, make to the Average mode, and measure using the filter function etc. together.

## 4.2 Data Display

Display of Math data is also described above in sections 2.4 and 3.1. This section provides a supplementary description.

Although the various channels shown on the screen are color-coded, Math screen data (waveform data in upper CH menu and first line of waveform readout area) is always shown in red. It can be displayed on the same screen as ordinary CH data.

As with the CH trace button, press the MATH trace button to turn ON its lamp and display the waveform data under the specified conditions. To delete the displayed waveform data, press the MATH trace button again.

A Math measurement example is shown below.



#### 4.3 Menu Item Setups

This section describes operation methods in Math-related menus. The layout of buttons and knobs related to the Math menu is shown in Figure 4.3.1. The operations methods are described below.

#### Operation Step 1 Method of selecting operator and operation source

- Press the MATH trace button shown in Figure 4.3.1. The Math menu appears in the right part of the screen. (See Figure 4.3.2)
- Select a menu item shown in Figure 4.3.2 to select Operator menu. The Operator option display menu appears in the right part of the screen. (See Figure 4.3.3)
- Touch a menu item shown in Figure 4.3.3 and select +, -, x, or FFT as Operator. Now go back to the Math menu shown in Figure 4.3.2, where the selected operators are shown in the Operator menu. (See example in Figure 4.3.2)
- Select menu items in the order shown in Figure 4.3.2 to select Source1 and Source2. The Source option display menu appears in the right part of the screen. (See Figure 4.3.4)
- Touch a menu item shown in Figure 4.3.4 and select channels from CH1 to CH4 (2CH model: CH1 to CH2) as sources. Now go back to the Math menu shown in Figure 4.3.2, where the selected channels are shown in the Source menu. (See example in Figure 4.3.4)

Press the MENU CLOSE button to close the Math



Figure 4.3.1 Vertical Axis-Related Layout



Figure 4.3.2 Math Menu



6.

Figure 4.3.4 Source Option Display Menu



Figure 4.3.3 Operator Option Display Menu

#### Operation Step 2 FFT operation setting methods

The source selection method is the same as in 4 and 5 in operation step 1 on the previous page. The following describes how to select operators and FFT windows.

- Input target signals for FFT via CH1 to CH4 (2CH model: CH1 to CH2), then display the waveform data on the screen.
- Press the MATH trace button, as was done in 1 in operation step 1 on the previous page. The Math menu appears in the right part of the screen. (See Figure 4.3.5)
- Touch a menu item shown in Figure 4.3.5 to select the Operator menu. The Operator option display menu appears in the right part of the screen. (See Figure 4.3.6)
- Touch a menu item shown in Figure 4.3.6 to specify an FFT operation. The specified FFT appears as an Operator menu item, as shown in Figure 4.3.5. (See Figure 4.3.7)
- Touch a menu item shown in Figure 4.3.7 to select the FFT Window. The FFT Window option display menu appears in the right part of the screen. (See Figure 4.3.8)
- Touch any of the menu items shown in Figure 4.3.8 to select FFT Window from the three types. The FFT window specified for the FFT Window menu items in Figure 4.3.7 is then displayed.
- Press the MENU CLOSE button shown in Figure 4.3.7 two times to close the menu.



Figure 4.3.8 FFT Window Option Display Menu







Figure 4.3.6 Operator Option Display Menu



Figure 4.3.7 FFT Window Menu

## 4.4 Menu Items and Hierarchy

Math menu items are divided hierarchically into groups based on math operations (with outline of operation as one group in the above figure and FFT (details) as another group in the figure below), as is shown in the following figures.



Figure 4.4.2 Math Menu (FFT operation detailed)

## 4.5 FFT Function

This product has a Math menu with an FFT function. FFT operations in general are described below, as are caution points and measurement examples for this product.

#### 4.5.1 Description and uses

With digital oscilloscopes, the observed signal data is normally shown as time axis area waveform data. Data acquired by this oscilloscope undergoes an FFT operation, and the observed signal data can be displayed as frequency area data, similar to a spectrum analyzer (See Figure 4.5.1). One of the advantages of



Figure 4.5.1 Time Axis & Frequency Axis Displays

FFT over other frequency transformation methods is that it can be performed on both single-shot signals and slow repetitive signals. Also, high-speeds operations can be performed, similar to the oscilloscope's time domain recording function. Consequently, this product is able to perform burst waveform analysis and frequency analysis or amplitude analysis of repetitive waveforms.

#### 4.5.2 Product features and caution points

This product's features related to FFT waveform observations are described below.

a) Power spectrum

The energy (electric power) of each signal frequency component is shown in dBm units along the vertical axis. 1 dBm is the voltage equivalent to 1 mW when the load is 50  $\Omega$  (0.316 Vpk /0.224 Vrms).

b) Time axis (YT waveform) and frequency axis (FFT waveform) on same screen The selected CH1 to CH4 (2CH model: CH1 to CH2) time axis (YT) waveform and frequency axis (FFT) waveform can be shown on the same screen. However, the YT waveform's time base range is shown in the upper-screen readout area and YT waveform information and FFT waveform information are shown separately in the waveform readout area in the lower part of the screen. (See Figure 4.5.2)



Figure 4.5.2 Sine Wave YT Waveform and FFT Waveform Displays

 FFT waveform information

#### c) FFT Window

Three types of windows are provided so that different parameters can be emphasized when measuring.

- Rectangular: Suited for analysis of transient phenomena in which a waveform continues beyond operation range, such as with a burst waveform.
- Vonhann: Suited for analysis of repetitive waveforms, etc..
- Flat Top: Suited for analysis of amplitude in repetitive waveforms, etc.

#### d) Amount of target data for FFT operation

The amount of target data in the FFT waveform display ranges from 4 to 8192.

Although Max Memory Length can be set within the horizontal axis menu, the amount of target data for FFT operations must be determined according to the Time/div and sampling rate (S/s). For example, if the number of points is set as 1 k (which is not 1024), the amount of target data for the operation is the number closest to a power-of-two number, which is 512. The FFT operation target is shown on the screen's left edge.

#### e) Cursor measurement

Vertical axis components (dBm) and horizontal axis components (frequency in Hz) can be measured at the intersect point between the vertical axis direction and the FFT waveform. The cursor type is "Value at Cursor".

#### f) Aliasing

As a digital oscilloscope, the observable range of signal frequencies extends until one half the sampling rate frequency (Nyquist frequency). If components with a frequency higher than this are observed, they are observed as a waveforms with frequency components that have lower frequency than the actual ones (this is called "aliasing").



Figure 4.5.3 Aliasing

Similarly, when creating an FFT waveform display, if it includes frequency components that have a higher frequency than one half the target data's sampling rate (Nyquist frequency), aliasing occurs so that they are observed as a waveforms with frequency components that have lower frequency than the actual ones.

During measurements with this product, the sampling rate and frequency counter values are shown in the status information area at the bottom of the screen. Be cautious when comparing these values to the observed waveform frequency.

#### (Memo) Prevention of aliasing

Aliasing can be prevented in the following ways.

- Adjust in the direction of a higher sampling rate.
  - a) Increase the maximum memory length.
  - b) While a time axis (YT) waveform is being displayed, turn the Time/div knob clockwise to raise the sampling rate.
- Remove components from the observed signal that have frequency higher than the Nyquist frequency.
  - c) Use the Bandwidth item in the CH menu or the Coupling item in the Coupling and Trigger menu to remove high frequency components.
  - d) Use an external filter with this product.

#### g) Frequency range of FFT waveform

With digital oscilloscopes, unlike with dedicated spectrum analyzers, the frequency range cannot be freely set.

The frequency axis range of FFT waveforms is determined by this product, based on its sampling rate, memory length, and horizontal axis setups.

The frequency axis range is from 0 Hz (DC) to the Nyquist frequency (half of the FFT sampling rate frequency). In the measurement example shown in Figure 4.5.2, the sampling rate is 1 MS/s, so the horizontal axis range is 50 kHz/div. In other words, the frequency of the entire horizontal axis is:

50 kHz/div  $\times$  10 div = 500 kHz •••• Equation (4.1)

So, as explained above, the range is from 0 Hz to 500 kHz.

#### h) Selection of FFT window

During an FFT operation, data within the operation range is handled as continuous. Consequently, if the input signal cycle is not kept within the operation range by the integer cycle, the time axis waveform will become discontinuous, causing the spectrum obtained by the FFT to spread. This is called leakage.

Such spectral leakage can be prevented by using an FFT window that is suitable for the signal to be analyzed.



Figure 4.5.3 Frequency Response for Continuous and Discontinuous Signals within Operation Range

In the burst signal shown in <1>, the signal converges within the operation range and the signal is continuous between points a and b, in which case spectral leakage does not occur. In <2>, however, points c and d before and

after the operation range are discontinuous, so in the case of a repetitive signal, spectral leakage may occur and preclude accurate measurements. When using the FFT window, processing can be performed to reduce discontinuous points before and after the operation range such as in <2> above, which can suppress spectral leakage.

#### 4.5.3 Measurement examples

This section shows examples of 20 kHz sine wave measurements and FFT waveform displays, which are shown in Figure 4.5.5 to Figure 4.5.7. For repetitive sine wave measurements, it became clear that the Vonhann window shown in Figure 4.5.6 is the type of FFT window with the least amount of spectral spread.



Figure 4.5.6 FFT Waveform FFT Window: Vonhann

Figure 4.5.7 FFT Waveform FFT Window: Rectangular

## 4.6 Constraints and Overlap with other Functions

The following constraints apply to FFT operations performed during Math measurements.

#### a) Overlap with Roll Mode

During output of an FFT waveform display, if you set Roll mode to ON via the Horizontal menu, it will appear in the menu that Roll Mode has been set, but when you turn the Time/div knob to set 50 ms/div or above and go to Roll mode measurement, the FFT waveform will disappear.

However, if you then set a value of less than 50 ms/div with the Time/div knob, the FFT waveform will appear again.

#### b) Overlap with Measure

When you select Math as the target source in the Measure menu, numerical values for addition, subtraction, and multiplication are shown in the Auto Measure display area but those for FFT operations are not shown there; "\*\*\*\*\*\*\*\*" is shown instead.

# Chapter 5 Daily Inspection

This chapter describes daily maintenance and calibration methods that help ensure correct use of this product for highly precise measurements.

## 5.1 Maintenance Tasks

a) Cleaning

Before cleaning this product, unplug its power cord to prevent possible electric shocks. Lightly wipe the exterior with a soft cloth moistened with water or diluted neutral detergent.

Use of a solution or detergent that is inappropriate for cleaning may cause product discoloration or an unexpected problem may occur. Select and use one of the following solutions and detergents.

- Solution or detergent that may be used: Water, neutral detergent (diluted)
- Solution or detergent that must not be used: Alcohol, gasoline, acetone, lacquer,

ether, thinner, ketone-based detergent

b) Dirty liquid crystals

Dirt can be removed in the following ways.

- Ordinary dirt can be removed by wiping with a soft cloth.
- For more stubborn dirt, dampen the cloth with detergent before wiping.

## 5.2 Calibration

This product is equipped with an Auto Calibration function. Or, if you prefer to calibrate it yourself, there is also a Self Calibration mode.

These calibration functions are able to maintain the usual precision of this product for a certain amount of time. The guideline is that it should be calibrated regularly after approximately 2000 hours of continuous use, which usually works out to about one calibration per year.

Each type of calibration is described below.

With this product, recalibration of the vertical axis range is required after each power-on (wait three minutes after power-on). This calibration is separate from Auto Calibration and Self Calibration.

#### 5.2.1 Auto Calibration

The AD converter full-scale and the offset and straight line are proofread by Auto Calibration proofreading. When the temperature change of 5°C occurs, an automatic proofreading is executed when Auto Calibration proofreading is set on. When the power supply is turned on, Auto Calibration proofreading is set on without fail to demonstrate the ratings performance of the AD converter. Please the Persis chest of drawers screen must be cleared when an automatic proofreading is executed, and turn off and use Auto Calibration proofreading is explained as follows.

#### **Operation Steps**

 Press the UTILITIES menu button shown in Figure 5.1. The Utilities menu appears in the right part of the screen. (See Figure 5.2 on next page)



Figure 5.1 Layout of Buttons and Knobs

2. Touch a menu item in the 1/2 page of the

Utilities menu as shown in Figure 5.2, then select the Calibration menu. The Calibration option display menu is opened in the right part of the screen. (See Figure 5.3)

- 3. Touch Off in the Auto Calibration menu item shown in Figure 5.3. (See Figure 5.3)
- 4. Press the MENU CLOSE button shown in Figure 5.3 two times to close the menu.

This completes the Auto Calibration setup. Afterward, if a  $5^{\circ}$ C temperature change occurs, the vertical axis range will be automatically recalibrated.

Note, however, that when recalibration is performed, the Persistence screen is cleared. To prevent this, turn OFF Auto Calibration.

#### 5.2.2 Self Calibration

Self Calibration includes calibration of the vertical axis range, horizontal axis range, offset, and trigger level. About an hour is needed to complete this calibration. The Self Calibration methods are described below.

Caution) Please do not add the signal while self-proofreading removing the probe or the cable from the input connector (CH1 to CH4 (2CH model: CH1 to CH2) and terminal EXT) before the Self Calibration is executed.

#### **Operation Steps**

- Perform operation steps 1 and 2 in section "5.2.1 Auto Calibration" above. This opens the Calibration option display menu shown in Figure 5.3.
- Touch a menu item as shown in Figure 5.3, then select the Self Calibration menu.



Figure 5.2 Utilities Menu



Figure 5.3 Calibration Option Display Menu

Self Calibration now starts, and ends in about one minute. When finished, the message "Self Calibration completed." is displayed in the status information area at the bottom of the screen as shown in Figure 5.3.

If Self Calibration does not end normally, the message "Self Calibration failed." is displayed. If calibration does not end normally after several attempts, please contact an lwatsu service center (see contact information in section 5.3 below).

#### 5.2.3 Touch Screen Calibration

This product uses touch screen technology in its on-screen menus and waveform readout area, so that menus can be opened or switched by touching the screen.

Touch screen calibration corrects touch positions. During touch screen calibration, red  $\times$  symbols make two circuits of the screen, starting from the upper left corner. Touch these red x symbols as they appear. Perform the following operation steps.

#### **Operation Steps**

- Press the UTILITIES menu button shown in Figure 5.4. The Utilities menu appears in the right part of the screen. (See Figure 5.5)
- Touch a menu item in the 1/2 page of the Utilities menu as shown in Figure 5.5, then select the Calibration menu. The Calibration option display menu is opened in the right part of the screen. (See Figure 5.6)
- Touch a menu item as shown in Figure 5.6, then select the Touch Screen Calibration menu.
- 4. The Touch Screen Calibration window is displayed, as shown in Figure 5.7.
- A red x is displayed in the upper left. Touch this x symbol (with your finger or other object).
- Next, the red x is displayed in the upper right. Touch this one also, and then each one that appears in the four corners successively for two circuits (total of eight x symbols).
- When all eight x symbols have been touched, touch screen calibration ends and the menu shown in Figure 5.6 is displayed.
- Press the MENU CLOSE button shown in Figure 5.6 two times to close the menu.



Figure 5.7 Touch Screen Calibration Window



Figure 5.4 Layout of Buttons and Knobs



Figure 5.5 Utilities Menu



Figure 5.6 Calibration Option Display Menu

#### 5.2.4 Periodic calibration

The calibration methods described above in sections 5.2.1 to 5.2.3 are for daily calibration, but periodic calibration is recommended after a longer period of continuous use, normally about 2000 hours or about once a year. For periodic calibration, please contact an lwatsu service center (see contact information in section 5.3 below).

## 5.3 Requests for Repair or Calibration

If this instrument malfunctions, send it back to the customer service center indicated below. If the instrument malfunctions within the guarantee period, IWATSU will repair it free of charge.

When sending back the instrument for repair, clarify the product name, serial No. (label is attached to the back plate of this instrument), contents of fault, name of person in charge, company name or department name, and phone number.

 Customer Service Center IWATSU TEST INSTRUMENTS CORPORATION Sales Office Address: 7-41 Kugayama 1-chome Suginami-ku Tokyo, 168-8511 Japan Phone: +81 3 5370 5483 Facsimile: +81 3 5370 5492

## 5.4 Storage and Transportation

## 5.4.1 Storage

Do not store the product where it will be subject to any of the following.

- Direct sunlight
- Dust
- Corrosive gas

Store the product within the following conditions.

- Temperature: -20 to +60°C
- Humidity: 5% to 80% RH (no condensation)

## 5.4.2 Transportation

When transporting the product, use the carton box in which the product was delivered or a box with equivalent cushioning materials.

## 5.5 Troubleshooting Guide

If this product does not appear to be operating normally, please refer to "Table 5.1 Troubleshooting Guide". The checking procedures described in Table 5.1 can be safely performed by end users. Before contacting lwatsu's service staff, please check the Troubleshooting Guide to get a better understanding of any problem that may exist, which will also help to resolve the problem more smoothly.

If this product still does not operate normally after performing the troubleshooting described in Table 5.1, please contact an Iwatsu service center (see section 5.3 below or the separate document entitled "Sales Network Customer Service Center").

Problem	Check items	Action				
Does not start when POWER switch is turned ON.	Is the power cord plugged into an AC outlet?	Plug it into an AC outlet.				
	Is the power cord connected to the AC power input terminal on the rear panel?	Connect it to the AC power input terminal.				
	Is the fan motor running (on the left side this product)?	<ul> <li>Place your hand next to the ventilation holes (at left, facing the front). If you do not feel any air movement, the fan is not running.</li> <li>If the fan is running but the product will not start, it may be due to a broken backlight. In either case, contact lwatsu at the address listed at the end of this manual or our sales distributors.</li> </ul>				
After turning the POWER switch ON, the power suddenly	This product is equipped with an overheating protection function.					
shuts off.	Is the ambient temperature in the operating temperature range of 0°C to 40°C?	Only use this product when the ambient temperature is within the operating temperature range. Set the power switch to Standby for a while before setting it ON.				
	Is anything obstructing the holes on the left and right sides that are used by the ventilation fan?	After removing obstructions, set the power switch to Standby for a while before setting it ON.				
Screen is hard to see due to poor contrast and low intensity.	Is the ambient temperature in the operating temperature range of 0°C to 40°C?	Only use this product when the ambient temperature is within the operating temperature range.				
	Has intensity been set low for the waveform data and/or grid?	<ul> <li>Use the Waveform Intensity in Display menu to adjust and set the intensity value.</li> <li>Press the UTILITIES menu button, then select Config/Grid Intensity and turn the ADJUST knob to set the intensity value.</li> </ul>				
	Has intensity been set low for the backlight?	• Press the UTILITIES menu button, then select Medium/High in the Config $\rightarrow$ Power Management $\rightarrow$ Backlight Intensity menu.				
After signal input, there is no waveform display.	Are the vertical axis, horizontal axis, and trigger setups correct?	Press the AUTO SETUP execute button.				
	Has trace ON (screen display ON) been set for the target channel?	Connect an input signal, then press the CH menu button and set trace to ON. When trace is ON, the CH menu button lamp lights.				
	Is the probe damaged?	If the probe is damaged, replace it.				

Table 5.1 Troubleshooting Guide

Problem	Check items	Action
Synchronization does not work.	Was the sync signal selected correctly?	Press the TRIGGER menu button and then select the sync signal source under the Source menu item.
	Is the trigger level within the waveform amplitude range?	Make sure the trigger level mark on the right side of the screen is within the waveform amplitude range. Press the Trigger LEVEL control knob or turn it to adjust until the trigger level mark is inside the amplitude range.
The auto setup for probe ratio does not work correctly.	Does the probe being used have a probe sensor function?	Use a probe that has a probe sensor function.
Waveforms are wobbly.	Is the AC supply voltage too low?	Make sure the AC supply voltage is within the rated range.
The clock display in the lower right part of the screen is inaccurate.	Was the clock set correctly?	• Select the Config item in the UTILITIES menu and set the Date & Time. If the clock is still not accurate, it may be due to a depleted internal battery. Contact Iwatsu at the address listed at the end of this manual or our sales distributors.
Panel setups prior to last power-OFF are not restored when power is turned back ON.		Internal battery may be depleted. Contact Iwatsu at the address listed at the end of this manual or our sales distributors.
Auto Calibration does not work correctly. Self Calibration does not work correctly.		<ul> <li>Select the Calibration item in the UTILITIES menu and set Auto Calibration to ON.</li> <li>Disconnect all input signals, then run Self Calibration. If calibration still does not work after trying the above two actions, contact lwatsu at the address listed at the end of this manual or our sales distributors.</li> </ul>

## Chapter 6 Specifications Vertical axis (Y axis)

Specification features related to the vertical axis are described below. The following abbreviations will be used for some of the specification-related terms.

- FS: Full scale value
- Reading: Measured voltage value
- Voffset: Voltage value with offset

No. of input channels	For DS-5554A/5534A/5524A/5514A/5424/5414					
	4 (non-interleave):					
	2 (interleave)					
	For DS-5552A/5532A/5522A/5512A/5422/5412					
	2 (non-interleave):					
	1 (interleave)					
	Note) Non-interleave:	Use CH1 to CH4 (4CH model)				
		Use CH1 to CH2 (2CH model)				
	Interleave:	Combine CH1 and CH3, CH1 and				
		CH4, CH2 and CH3, or CH2 and				
		CH4 (4CH model)				

#### Frequency bandwidth (-3 dB)

DS-5554A	2 mV/div to 500 mV/div: 500 MHz (-3 dB)
DS-5552A	1 V/div to: 500 MHz (-3 dB) <sup>Note)</sup>
	* At internal 50 $\Omega$ termination, or at tip of SS-101R probe
DS-5534A	2 mV/div to 500 mV/div:350 MHz (-3 dB)
DS-5532A	1 V/div to: 350 MHz (-3 dB) <sup>Note)</sup>
	* At internal 50 $\Omega$ termination, or at tip of SS-101R probe
DS-5524A	2 m (//div to 500 m) //div 200 M( - (2 dD))
DS-5522A	
DS-5424	1 V/div to: 200 MHz (-3 dB) <sup>Note</sup>
DS-5422	* At 50 $\Omega$ termination, or at tip of SS-0130R probe
D0-5422	
DS-5514A	2 mV/div to 500 mV/div:100 MHz (-3 dB)
DS-5512A	1 V/div to: 100 MHz (-3 dB) <sup>Note</sup> )
DS-5414	100  WHZ (-3  GB)
DS-5412	At 50 $\Omega$ termination, or at tip of SS-0130R probe

CH1 only or CH2 only (2CH model)

Note) The reference values are inferred from the probe characteristics of the SS-101R or SS-0130R that has linear input voltage and frequency characteristics.

#### Rise time

750 poNote (torminated at internal 50.			
750 ps (terminated at internal 50 12)			
1 noNote (terminated at internal EQ. Q)			
$1 \text{ is}$ (terminated at internal 50 $\Omega$ )			
1 75 no <sup>Note</sup> (terminated at 50 O)			
$1.75 \text{ ns}$ (terminated at $50 \Omega$ )			
O E - Note (to main a to dia to EO O)			
3.5 ns <sup><math>(100) (terminated at 50 <math>\Omega</math>)</math></sup>			

# Note) The rise time Tr is a representative value, and not a guaranteed value.

## Frequency bandwidth limit

Analog form

	DS-5554A	200 kHz ± 60 kHz (-3 dB)			
	DS-5552A	2 MHz ± 0.6 MHz (-3 dB)			
	DS-5534A	<b>20 MHz ± 6 MHz</b> (-3 dB)			
	DS-5532A	100 MHz $\pm$ 30 MHz (-3 dB)			
	DS-5524A/5422A				
	DS-5514A/5512A	$200 \text{ KHz} \pm 60 \text{ KHz} (-3 \text{ dB})$			
	DS-5424/5422	$2 \text{ MHz} \pm 0.6 \text{ MHz} (-3 \text{ dB})$			
	DS-5414/5412	20 MHZ $\pm$ 6 MHZ ( $-3$ dB)			
Digital form	Hardware processing, 4CH can be independently set.				
	* This function is installed only for the DS-5500A Series.				
Kind	Either of LPF/HPF/OFF is selected with each channel.				
Cutoff frequency range	Minimum value to be set : Sampling frequency $\times$ 0.040				
	Maximum value to be set : Sampling frequency × 0.460				
	Number of set step	s : 421 step in each sampling frequency			
Attenuation of	-6 d B				
cutoff point					
Filter type	FIR, Hamming window				
Input impedance					
	DS-5554A				
	DS-5552A	1 MΩ ±1.0%    16 pF ±2 pF (DC1MΩ),			
	DS-5534A	50 Ω ±1.0%			
	DS-5532A				
	DS-5524A/5422A				
	DS-5514A/5412A				
	DS-5424/5422	$1 \text{ M}\Omega \pm 1.0\%$    20 pF ±2 pF (DC1M $\Omega$ )			
	DS-5514/5412				

#### Input coupling

DS-5554	
DS-5552	
DS-5534	
DS-5532	
DS-5524	
DS-5522	
DS-5514	
DS-5512	

Maximum input voltage				
		-400 Vmax (DC + peak AC ≤ 5 kHz		
	DS-5554A	CAT I (1 MΩ)		
	DS-5552A	-300 Vn	nax (DC + peal	$k AC \le 5 kHz$
	DS-5534A	CAT II (1 MΩ)		
	D3-3332A	-5 V <sub>rms</sub> (50 Ω)		
	DS-5524A/5422A	5422A -400 Vmax (DC + peak AC ≤ 5 kHz		
	DS-5514A/5512A	CAT I (1 MΩ)		
	DS-5424/5422	-300 Vmax (DC + peak AC $\leq$ 5 kHz		
	DS-5414/5412	CAT II (1 MΩ)		
Input sensitivity (course)				
	DS-5554A	2 mV/di	v to 10 V/div	
	DS-5552A	(DC 1 MΩ, AC 1 MΩ, 1-2-5 steps),		
	DS-5534A	2 mV/div to 2 V/div		
	DS-5532A	(50 Ω	, 1-2-5 steps)	
	DS-5524A/5422A			
	DS-5514A/5512A			
	DS-5424/5422	2 mV/di	v to 10 V/div (	1-2-5 steps)
	DS-5414/5412			
Input sensitivity (fine)	It can be an expans	sion from	the center of	the display with
	firmware software.			
Offset variation range				
	2 mV/div to 50 mV	/div	±1 V	
	50.2 mV/div to 500	mV/div	±10 V	
	502 mV/div to 10 V	//div	±100 V	
DC gain accuracy	±(1.5% + 0.5% of F	S)		
Offset accuracy				
	2 mV/div to 50 mV	/div	±(0.5%+ 0.5%	6 of FS + 1 mV)
	50.2 mV/div to 500	mV/div	±(0.5%+ 0.5% of FS + 10 mV)	
	502 mV/div to 10 V	//div	±(0.5%+ 0.5%	6 of FS + 100 mV)
DC measurement accurat	cy (relative voltage)		±{0.015 x (Re	ading) + 0.005 x FS}
DC measurement accurat	cy (absolute voltage	)		
	2 mV/div to 50 mV	/div	±{0.015 x (Re	ading – Voffset) + 0.005
			x Voffset + 0.	01 x FS + 1 mV}
	50.2 mV/div to 500 mV/div 502 mV/div to 10 V/div		±{0.015 x (Reading - Voffset) + 0.005	
			x Voffset + 0.01 x FS + 10 mV}	
			±{0.015 x (Reading - Voffset) + 0.005	
			x Voffset + 0.	01 x FS + 100 mV}
Deskew	$0\!\sim\!500~\text{ns}$			
	* When the Horizor	ntal/Prefe	erence menu is	Deskew
Invert	Software-based inversion function			
Rescale	The display of inpu	t voltage	sensitivity car	n be changed:
	a × input voltage + b (a and b are user-specified values)			
Unit conversion	Volt, Ampere, Watt, °C(Degrees C), No Unit			
Probe sense	1:1, 5:1, 10:1, 20:1, 50:1, 100:1, 200:1, 500:1, 1000:1, 2000:1			

(1:1, 10:1, 100:1, and 1000:1 can be recognized automatically)
10 Hz or less
When an excessive voltage is input, the input coupling is
automatically switched to GND
* Only for 500 MHz and 350 MHz models

## Sampling system

Maximum sampling rate

DS-5554A/5552A	
DS-5534A/5532A	2 GS/s (during interleave),
DS-5524A/5522A	1 GS/s (during non-interleave)
DS-5424/5422	
DS-5514A/5512A	1.00/2
DS-5414/5412	1 GS/S

Vertical axis resolution Peak (Peak Detect) 8 bits

Period: 1 ns

Peak Detect operation range (see table below)

•	<b>o</b> (
Memory Length	Peak Detect Range
500	500 ns/div to 20 s/div
1 k	500 ns/div to 50 s/div
10 k	2 μs/div to 50 s/div
100 k	20 µs/div to 50 s/div
500 k	500 µs/div to 50 s/div
1 M	200 µs/div to 50 s/div

\* The memory length 1M can be selected only for the DS-5500A Series.

Roll Mode Max Memory Length 50 ms/div to 50 s/div (100 kS/s max)

500, 1 k, 5 k, 10 k, 50 k, 100 k, 500 k, 1 M points

\* The memory length 1M can be selected only for the DS-5500A Series.

## Horizontal axis (X axis)

Sweep range

	DS-5554A	500 pc/div to 50 c/div	
	DS-5552A	500 ps/ulv to 50 s/ulv	
	DS-5534A	1 po/div to 50 o/div	
	DS-5532A		
	DS-5524A/5522A	2 no/div to 50 o/div	
	DS-5424/5422		
	DS-5514A/5512A		
	DS-5414/5412	5 ns/div to 50 s/div	
Clock accuracy	10 ppm max.		-
Equivalent Sample rate	Max. 100 GS/s		
Acquisition modes	Normal (Normal	Sampling), Peak (Pea	ak Detect), and
	Average		
Averaging iterations	2 to 256 times (power-of-two increments)		
Delay range	During Run mode		
	During Kun mode		
	-500 s to +5 div (10	0 ms/s to 50 s/s)	
	-500 s to +5 div (10 -5 s to +5 div (10 μ	0 ms/s to 50 s/s) Is/s to 5 ms/s)	
	-500 s to +5 div (10 -5 s to +5 div (10 μ -5 ms to +5 div (to	0 ms/s to 50 s/s) is/s to 5 ms/s) 5 μs/s)	
	-500 s to +5 div (10 -5 s to +5 div (10 -5 ms to +5 div (to When stopped	0 ms/s to 50 s/s) is/s to 5 ms/s) 5 μs/s)	
	-500 s to +5 div (10 -5 s to +5 div (10 μ -5 ms to +5 div (to When stopped -500 s to +750 s	0 ms/s to 50 s/s) is/s to 5 ms/s) 5 μs/s)	

Trigger system				
Trigger mode	AUTO, NORMAL, SINGLE, STOP			
Trigger source	CH1, CH2, CH3, CH4, Ext (100 mV/div), Ext 10 (1 V/div), Line,			
	* CH3. CH4: only for D	)S-5554A/5534A/5524A/5514	A/5424/5414	
Coupling	AC. DC. HF Reject. LF	- Reject, DC Noise Reject		
oodp9	*DC Noise Reject: Cannot be synchronized with signal for less			
	than about 1 div.		<u> </u>	
Cutoff frequency	AC: 7.5 Hz typ.			
	HF-Rej, LF-Rej: 50 kHz typ.			
	Single-pole filter: 20 dB/decade			
	AC, LF Reject:			
	At cutoff frequency: 1.0 div, synchronized			
	At 0.1 × cutoff frequ	ency: 1.0 div, cannot be syne	chronized	
	HF Reject:			
	At cutoff frequency: 1.0 div, synchronized			
	At 10 × cutoff freque	ency: 1.0 div, cannot be sync	hronized	
Slope	Rising and falling (positive and negative)			
Trigger level range	Center on rear panel ±	±5.0 div		
Level accuracy	$\pm$ (5% + 30% of input sensitivity [volts/div]) (with 1 kHz sine			
	wave)			
Trigger Type	Edge, Edge ALT, Edge OR, Pulse Count, Pulse Width, Period,			
	Dropout, TV, OR, NOR, AND, NAND			
	* Trigger Types of Edg	e ALT, Edge OR, OR, NOR, A	AND and	
Educ trianes	NAND are installed	only for the SDS-5500A Serie	es.	
Edge trigger	See the model energie	a information below		
nigger sensitivity				
	DS-55524	to 250 MHz	0.5 div	
	D0-002A	to 500 MHz	1.5 div	
	DS-5534A	DC (30 Hz) to 10 MHz	0.5 div	
	DS-5532A	to 250 MHz	1.0 div	
		to 350 MHz	1.5 div	
	DS-5524A/5522A	DC (30 Hz) to 10 MHz	0.5 div	
	DS-5424/5422	to 200 MHz	1.5 div	
	DS-5514A/5412A	DC (30 Hz) to 10 MHz	0.5 div	
	DS-5414/5412	to 100 MHz	1.5 div	
	* Trigger sensitivit	y attenuates depending c	on the filter	
	characteristics in	the case of coupling other t	han DC (AC,	
	LF Reject, or HF F	Reject).		
Edge ALT trigger	* Only for DS-5500A	A Series		
	Trigger at both slopes (positive and negative)			
Trigger sensitivity	Same as edge trigger			
Edge OR trigger	* Only for DS-5500A Series			
	Trigger at edge of multiple selected channels			
-----------------------	---	--	--	
Target CH	CH1 to CH4 (DS-5554A/5534A/5524A/5514A)			
	CH1, CH2 (DS-5552A/5532A/5522A/5512A)			
CH setup	Rise, fall, or invalid can be selected for each channel			
Trigger sensitivity	DC to 250 MHz 1.5 div (DS-5554A/5552A/5534A/5532A)			
	DC to 200 MHz 1.5 div (DS-5524A/5522A)			
	DC to 100 MHz 1.5 div (DS-5514A/5512A)			
Trigger skew between	Less than 1 ns			
channels				
Pulse count (Event)	Maximum trigger frequency: 33 MHz			
	Minimum Pulse Width: 15 ns			
Pulse Width	15 ns to 50 s			
Period	40 ns to 50 s			
Dropout	50 ns to 50 s			
Pulse Count	1 to 9999			
Pattern trigger	* Only for DS-5500A Series			
r attern trigger	Triggered when logical operation results are obtained for the			
	multiple selected channels			
Logical operations				
	CH1 to CH4 (DS-5554 $a$ /5534 $a$ /5524 $a$ /5514 $a$ )			
larger off	$CH1 CH2 (DS_{5552})/5532}/5522A/5512A)$			
	High Low Don't Care (invalid) can be colocted for each channel			
	High, Low, Don't Care (invalid) can be selected for each channer			
chappels	Less than Ths			
Trigger consitivity	1 E div			
	1.5 UIV			
width	2  IIS (DS-3554A/3534A/3524A/3514A)			
width	2.3  IIS  (DS-5524A/5522A)			
	5 ns (DS-5514A/5512A)			
Minimum operation	in operation result pulse width is too short, stable operation is			
result pulse width				
	2 ns (DS-5554A/5552A/5534A/5532A)			
	2.5 ns (DS-5524A/5522A)			
	5 ns (DS-5514A/5512A)			
I v trigger	NTSC, PAL, Custom			
	Field selection: 1, 2, 4, 8			
Irigger jitter				
Dropout trigger	10 ns or less			
Holdoff	Off, 200 ns to 50 s (valid only for edge or Edge ALI)			
External trigger				
Input impedance	1 MΩ ±1.0% // 16 pF +/- 3 Pf			
	(DS-5554A/5552A/5534A/5532A)			
	1 MΩ ±1.0% // 20 pF +/- 3 pF			
	(DS-5524A/5522A/5514A/5512A/5424/5422/5414/5412)			
Maximum input voltage	400 Vmax (DC + peakAC $\leq$ 5 kHz) CAT I			
	300 Vmax (DC + peakAC $\leq$ 5 kHz) CAT II			

Slope	Positive, Negative				
Coupling	AC, DC, HF Reject, LF Reject				
Cutoff frequency	AC: 7.5 Hz typ.				
	HF-Rej, LF-Rej: 50	kHz typ.			
	Single-pole filter: 20 dB/decade				
Level range	Ext: ±0.5 V				
	Ext 10: ±5.0 V				
Input voltage range	Ext : -1 V to +1 V				
	Ext 10: -10 V to +1	10 V			
Level accuracy	Ext:±(10% + 50 m	ιV)			
	Ext 10: ±(10% + 0.5 V)				
	* By 1kHz sign wav	е			
	50 $\Omega$ termination, as shown in the following table.				
Trigger sensitivity	50 $\Omega$ termination, a	as shown in the following t	able.		
Trigger sensitivity	50 Ω termination, a	s shown in the following t Frequency	Ext	Ext 10	
Trigger sensitivity	50 Ω termination, a Model DS-5554A	AS shown in the following to Frequency DC (30 Hz) to 10 MHz	Ext 50 mV	<b>Ext 10</b> 0.5 V	
Trigger sensitivity	50 Ω termination, a Model DS-5554A DS-5552A	Trequency DC (30 Hz) to 10 MHz to 250 MHz	<b>Ext</b> 50 mV 0.1 V	<b>Ext 10</b> 0.5 V 1 V	
Trigger sensitivity	50 Ω termination, a Model DS-5554A DS-5552A	BS shown in the following to Frequency DC (30 Hz) to 10 MHz to 250 MHz to 500 MHz	able. <b>Ext</b> 50 mV 0.1 V 0.15 V	<b>Ext 10</b> 0.5 V 1 V 1.5 V	
Trigger sensitivity	50 Ω termination, a <b>Model</b> DS-5554A DS-5552A DS-5534A	The following the following the following the following to following the	Ext 50 mV 0.1 V 0.15 V 50 mV	Ext 10 0.5 V 1 V 1.5 V 0.5 V	
Trigger sensitivity	50 Ω termination, a <b>Model</b> DS-5552A DS-5534A DS-5532A	The following th	able. <b>Ext</b> 50 mV 0.1 V 0.15 V 50 mV 0.1 V	Ext 10 0.5 V 1 V 1.5 V 0.5 V 1 V	
Trigger sensitivity	50 Ω termination, a Model DS-5554A DS-5552A DS-5534A DS-5532A	The following th	Ext           50 mV           0.1 V           0.15 V           50 mV           0.15 V	Ext 10 0.5 V 1 V 1.5 V 0.5 V 1 V 1.5 V	
Trigger sensitivity	50 Ω termination, a <b>Model</b> DS-5552A DS-5534A DS-5532A DS-5532A DS-5524A/5522A	Trequency DC (30 Hz) to 10 MHz to 250 MHz to 500 MHz DC (30 Hz) to 10 MHz to 250 MHz to 350 MHz DC (30 Hz) to 10 MHz	Ext           50 mV           0.1 V           0.15 V           50 mV           0.15 V           50 mV           50 mV           0.1 V           50 mV	Ext 10 0.5 V 1 V 1.5 V 0.5 V 1 V 1.5 V 0.5 V	
Trigger sensitivity	50 Ω termination, a Model DS-5554A DS-5552A DS-5534A DS-5532A DS-5524A/5522A DS-5524A/5522A	Trequency DC (30 Hz) to 10 MHz to 250 MHz to 500 MHz DC (30 Hz) to 10 MHz to 250 MHz to 250 MHz to 350 MHz DC (30 Hz) to 10 MHz to 200 MHz	Ext           50 mV           0.1 V           0.15 V           50 mV           0.15 V           50 mV           0.15 V	Ext 10 0.5 V 1 V 1.5 V 0.5 V 1 V 1.5 V 0.5 V 1.5 V	
Trigger sensitivity	50 Ω termination, a <b>Model</b> DS-5554A DS-5552A DS-5534A DS-5532A DS-5524A/5522A DS-5524A/5522A DS-55424/5422 DS-5514A/5512A	Frequency           Frequency           DC (30 Hz) to 10 MHz           to 250 MHz           to 500 MHz           DC (30 Hz) to 10 MHz           to 250 MHz           to 250 MHz           DC (30 Hz) to 10 MHz           to 350 MHz           DC (30 Hz) to 10 MHz           to 200 MHz           DC (30 Hz) to 10 MHz           to 200 MHz           DC (30 Hz) to 10 MHz	Ext           50 mV           0.1 V           0.15 V           50 mV           50 mV	Ext 10 0.5 V 1 V 1.5 V 0.5 V 1 V 1.5 V 0.5 V 1.5 V 0.5 V	
Trigger sensitivity	50 Ω termination, a Model DS-5554A DS-5552A DS-5534A DS-5532A DS-5524A/5522A DS-5424/5422 DS-5514A/5512A DS-5414/5412	Frequency           DC (30 Hz) to 10 MHz           to 250 MHz           to 500 MHz           DC (30 Hz) to 10 MHz           to 250 MHz           DC (30 Hz) to 10 MHz           to 350 MHz           DC (30 Hz) to 10 MHz           to 350 MHz           DC (30 Hz) to 10 MHz           to 200 MHz           DC (30 Hz) to 10 MHz           to 200 MHz           DC (30 Hz) to 10 MHz           to 100 MHz	Ext           50 mV           0.1 V           0.15 V           50 mV           0.15 V	Ext 10 0.5 V 1 V 1.5 V 0.5 V 1 V 1.5 V 0.5 V 1.5 V 0.5 V 1.5 V	

 Trigger sensitivity attenuates depending on the filter characteristics in the case of coupling other than DC (AC, LF Reject, or HF Reject).

# Display

- 17	
LCD	7.5-inch, VGA color TFT
Resolution	640 × RGB × 480
Touch screen	Included
Display Type	YT display, XY display, XY display (valid trigger)
	* X: CH1, Y: CH2 (fixed display)
Vector connection	OFF (dot display) or ON (interpolated data display)
Graticule	Grid, Axis, and Frame (three types)
Waveform intensity	0 to 100% (can be set in 1% increments)
Grid Intensity	0 to 100% (can be set in 10% increments)
Backlight intensity	Select from three levels: High, Medium, or Low
Persistence	Time setup and display color gradation can be specified
Time	Off, 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, ∞
Display color gradation	Single or Spectrum (selectable)
Replay function	For the DS-5500A Series
	up to 2048 screens of acquisition data can be displayed.
	For the DS-5400 Series
	up to 1024 screens of acquisition data can be displayed.

# Functions

Auto Measure			
Vertical axis measure	Maximum value, minimum value, Peak-Peak, RMS,		
items	Cycle RMS, Mean, Cycle Mean, Top, Base, Top-Base		
	+Overshoot, -Overshoot		
Horizontal axis measure	Tr 20 – 80%, Tf 20 – 80%, Tr 10 – 90%, Tf 10 – 90%		
items	Frequency, Period, No. of +Pulse, No. of -Pulse,		
	+Pulse Width, –Pulse Width, Duty Cycle		
Other measure items	Integral, Skew, Skew @ level		
No. of measure items	Four, based on four Auto Measure types		
Statistic display	Max (Maximum) / Min (Minimum) /		
	Num (Number of the total waveforms)		
Pass/Fail	* This function is installed only for the DS-5500A Series.		
Judgment mode Condition	Select between Parameter judgment and Mask judgment		
	During parameter judgment (Measure)		
	Judgment target: select one of four parameter types (A, B, C,		
	D)		
	Comparison ranges: Large/small comparison, within		
	range/outside range comparison		
	Parameter creation: Parameter measurement result from		
	MEASURE		
	During mask judgment		
	Judgment target: select one among CH1 to CH4 (2CH model:		
	CH1 to CH2) and Math		
	Comparison range: All In or All Out for 1 to 4 areas		
	Mask creation: Horizontal or vertical direction, from among		
	CH1 to CH4 (2CH model: CH1 to CH2), Math, and REF1 to 5		
Judgment count display	Up to 99999 times ( is shown when over 99999 times)		
Actions during Pass/Fail j	udgment		
	Settings for:		
	Stop waveform capture/Save screen (USB memory)/Save		
	waveform (USB memory)/Beep/Pulse output (when equipped		
	with DS-578 option)		
	Output of judgment results to logs		
Other	Page search (during parameter judgment)		
	The searched object		
	: Either of Pass or Fail is specified.		
	The direction of the search		
	: Rear or forward direction against the page under the		
	selection		
Logging	* This function is installed only for the DS-5500A Series.		
Logging items	Time and parameter measurement results (conditions A, B, C,		
	D), Pass/Fail judgment results		
Log output destinations			
When recording	Pop-up window, internal memory (up to 86400 entries)		

After recording	USB memory
Cursor measurement YT display	The following four types of cursor measurement are possible. Time: Time differential in vertical direction between two cursors Value of time at each cursor position of vertical direction (Trigger point standard) Amplitude: Voltage differential in horizontal direction between two cursors Voltage value in horizontal direction at each cursor position Time & Amplitude: The Display of each two cursors in horizontal and vertical direction and the display of $\Delta t$ and $\Delta V$ Time differential in vertical direction between two cursors (Trigger point standard) Voltage differential in horizontal direction between two cursors (GND standard) Value at Cursor: Voltage values at intersect point between each cursor in vertical direction and waveform data Time values at intersect point between each cursor in vertical and waveform data Difference value of times ( $\Delta t$ ) between two cursors in vertical
XY display	<ul> <li>direction</li> <li>The following three types of cursor measurement are possible.</li> <li>Amplitude (X):</li> <li>Voltage differential in vertical direction between two cursors</li> <li>Voltage value at each cursor position in vertical direction</li> <li>Amplitude (Y):</li> <li>Voltage differential in horizontal direction between two cursors</li> <li>Voltage value at each cursor position in horizontal direction</li> <li>Amplitude (X &amp; Y):</li> <li>The Display of each two cursors in horizontal and vertical</li> <li>direction and the display of ΔVx and ΔVy</li> <li>Voltage value at each cursor position in vertical direction</li> <li>Voltage value at each cursor position in vertical direction</li> </ul>
Reference waveform	
Save/Recall Display	Up to five sets of waveform data can be saved and recalled. Can be displayed in white at same time as observed waveform Display can be turned On and Off
Save/Recall	
Internal memory	
Target data	Panel setup (setting condition and 5 pieces or less)
Operation	Save/Recall
USB memory	
Target data	Panel setup, waveforms

	Operation	Save / Recall / Delete / The USB memory is formatted.
	Default setup	
	Target data	Panel setup
	Operation	Returning to the default setup
Math fu	Inction	Addition(+), Subtraction(-), Multiplication(x), FFT, Integral, Derivative
		* The operation functions of Integra 1 and Derivative are installed only for the DS-5500A Series.
CLEAR	function	Clearness by panel operation
	Target of clearness	Waveform of Replay function, Averaged waveform, Persistent Waveform, Max / Min / Num, Result and number of judgement of Pass/Fail and LOG
Print		
	Device	USB memory (connects to USB connector on front panel) PictBridge-compliant printer (connects to USB connector on rear panel)
	File format	USB memory: TIFF/BMP/PNG
		PictBridge-compliant printer: JPEG
	Background colors	White or black (selectable)
Langua	ge selection	The following languages can be selected via menus or the
		HELP menu.
		English, Japanese, or Chinese
Interna	I CLOCK	
Date &	time display modes	Select among hide, current date and time, and time stamp (trigger time). Date and time can be set.
Accura	асу	Within 60 seconds the moon difference
Offset	setup	Select from division-based or voltage-based
Power	Management	
	Brightness of back li	ight
		Selection from 3 steps of High / Medium / Low
	Backlight Off	Never, 15 sec, 1 min, 5 min, or 15 min (selectable)
	Power Off	Never, 5 min, 15 min, 30 min, or 60 min (selectable)
Веер		On or Off (selectable)
Panel	Lock	On or Off (selectable)
AUTO	SETUP	Press the button to display input signal on screen. *The Undo function can be used to restore the last previous panel setups.
Probe	setup	
	Correspondence pro	be
		It is four kinds in the CH/Probe menu as for the setting of our specified probe and the custom setting.
	Call	It is a call as for the content of selected probe or custom set.
	Preservation	A current set content is preserved in the selected custom setting.
	Set object	Unit of vertical axis, Probe attenuation ratio, Coupling Bandwidth, Rescale, and Deskew

Trigger counter	6-digit display of tri	gger frequency, On or O	off (selectable)
Accuracy	10 ppm		
Frequency range			
	DS-5554A		
	DS-5552A		
	DS-5534A		
	DS-5532A	4 HZ to 350 MHZ	
	DS-5524A/5522A		
	DS-5424/5422	4 HZ to 200 MHZ	
	DS-5514A/5512A		
	DS-5414/5412	4 HZ to 100 MHZ	
Calibration			-
Auto Calibration	On or Off selectable	e (On is set at shipment)	)
	* A self calibration (	Full-scale of building Al	DC into and the
	offset and linearity	are proofread). automa	tically starts after
	three minutes of th	e main body start, and t	the ambient
	temperature 5 $^\circ\!\mathrm{C}$ c	hange. It is necessary to	o turn on an
	automatic proofrea	ding to guarantee the p	erformance with
	10℃-35℃.		
Self Calibration	Push-button operati	on enabled	
	Calibrates V axis	sensitivity, offset, and t	rigger level

# Calibration signal output

Waveform type	Square wave
Output voltage	3.0 V ±3%
Frequency	1 kHz ±0.5%

## Interface

Remote I/F	
USB2.0 (standard)	
Host port	Front panel: USB memory
Device port	PC connection terminal on rear panel, remote control enabled
	Output to PictBridge-compliant printer enabled
LAN (standard)	Supports 100Base-TX, connection with PC, and remote control.
	* The interface of LAN (TCP/IP) the standard is installed only for
	the DS-5500 Series to the standard.
GPIB (factory option)	DS-576 option enables connection with PC and remote control.
AUX interface	Connection at time equipped with an external option (DS-579
	option)

#### General specifications

#### **Environmental conditions**

	For indoor use only
Temperature and	+10°C to +35°C
humidity ranges for	
guaranteed specification	
Operating temperature	0°C to +40°C,
and humidity ranges	5% to 80% RH or less (30°C or less, non-condensation)
	Upper limit: 55% RH (40°C, non-condensation)
Operating elevation	Upper limit: 2,000m (25°C or less)
Storage temperature	$-20^\circ C$ to +60°C, 5% to 80% RH (40°C, non-condensation)
and humidity ranges	
Storage elevation	Upper limit: 12,192m
Warm-up period	20 minutes

#### Accessories

Front panel cover	1		
Probe	The probes for e	ach model are listed below.	
	DS-5554A		
	DS-5552A		
	DS-5534A	SS-101R (multi-channel)	
	DS-5532A		
	DS-5524A/5522A		
	DS-5514A/5512A		
	DS-5424/5422	SS-0130R (multi-channel)	
	DS-5414/5412		
Power cord	1		
Cord strap	1		
Instruction manual			
	CD:	1 set	
	* Contains: Ins	truction Manual (PDF data), Remote Control	
	Manual (PDF	data), Readme	
	User's Guide:	1	
Sales network			
Fan motor	Forced air coolir	ng by fan motor	
MTBF	35,000 hours (40	0°C, 55% RH)	
Power source			
Input voltage, frequenc	y AC 90 to 240 Vrr	ns, 47 to 63 Hz	
	AC 90 V to 132 \	/rms, 380 to 420 Hz	
Power consumption	95 VA max (60 W	95 VA max (60 W max)	
Standby power	2 W max		
consumption			
Weight and dimensions	(See appearance		
Weight	3.7 kg ±10% (not	t including accessories)	
Dimensions	(330 ±2) W × (19	10 ±2) H × (124 ±2) D [mm]	

#### Appearance



- Unit : mm
- $\circ$  As for externals size, it is common in the DS-5500A Series and the DS-5400 Series.
- $\circ$  The above figure is externals chart of DS-5554A.
  - Each terminal of the terminal, AUX IO1, and AUX IO2 of TCP/IP (LAN) in the back is installed only in the DS-5500A Series.
  - The number of the CH buttons of input terminals and VERTICAL CH buttons, the offset adjustment knob, and range change knobs is different between 4CH model and 2CH model. 4CH model has 4 each parts and 2CH model has 2 each parts.

Options			
○AUX IO (factory option)	* This option can be installed only for the DS-5500A Series.		
CH1/CH2 output	Output is enabled via DS-577 option		
Output terminal	AUX IO1: Output of CH1 input signal with applied offset voltage		
CH1/TRIG output	Output is onabled via DS 578 option		
	ALLY IO1: Output of CH1 input signal with applied offset voltage		
Output terminal	AUX 101: Blovel pulse signal output ensure under the following		
	conditions		
	• Output when triggered		
	(When Trigger signal is calcoted via AUX IO 2 in Utilities manu)		
	• Output when Pass/Enil judgment result becomes Pass or Fail		
	(When Pass/Fail Signal is selected via ALIX IO 2 in Itilities menu)		
	50 O ±5%		
Output resistance			
Erogueney	$\pm 30 \text{ mV}$ (with $50 \Omega$ termination)		
Frequency	Maximum fragmenter handwidth (2 / 2 dD with E0 O termination)		
	Maximum frequency bandwidth/2 ( $-3$ dB, with 50 $\Omega$ termination)		
	$30 \text{ mV/div} \pm 10\%$ (with $50 \Omega$ termination)		
Sensitivity			
Rig output of Pass/Fi			
	$120 \Omega \pm 10\%$		
H level	0.9 V or above (with 50 $\Omega$ termination), 3 V or above		
	(with 1 M Ω load)		
L level	0.1 V or less (with 50 $\Omega$ termination), 0.2 V or less		
	(with 1 M $\Omega$ load)		
Pulse Width	1.5 $\mu$ s ±0.5 $\mu$ s (when TRIG output is selected)		
	8 ms to 10 ms (when Pass/Fail output is selected)		
* Any option added after pu	rchase of main unit is a factory option.		

○ Probe power opution DS-579

Number of output	2					
channels						
Maximum output electric	9 VAmax					
power	*The sum total of the current consumption of 2CH					
Offset output voltage	Each channel can be set from the CH menu of ViewGo $ \mathrm{I\!I}$					
	(DS-5500A/DS-5400) Series.					
Voltage range	- 100 % to +100 %					
	(-1.6 V to +1.6 V or more and changeable)					
Setting resolution	0.01 %					
Places refer to the DS 570 manual for detailed analifications						

 $^{\ast}$  Please refer to the DS-579 manual for detailed specifications.

# **Probe SS-101R Instruction Manual**

#### General

The SS-101R is a high-impedance passive probe that has a wide measurement range. It can be attached to an oscilloscope to measure high-impedance circuits. \*The SS-101R probe is used for models DS-5554A/5552A/5534A/5532A.

### Precautions for safe use

#### **Operation environment**

Use the specified environment. The probe can be used within the following temperature and humidity ranges.

Operation environment: Indoor use

Temperature:	0°C to 40°C (guaranteed performance range: 10°C to 35°C)
Humidity:	at 40°C, less than 90% RH (no dew condensation)

Probe complies with IEC61010-031, installation (overvoltage) category  $\,\, {\rm II}$  , 600 V, contamination level 2.

#### Safety symbols

The following warning symbols are used on the probe and its instruction manual to help ensure safety.

Symbols	Meanings
Â	See the attached document (safety-related caution points).
Â	Risk of electrical shock.
Caution	If this caution is ignored and the probe is mishandled, physical injury or equipment damage may occur.
Warning	If this caution is ignored and the probe is mishandled, serious or even fatal injury may occur.

#### Applications

Only use this probe with equipment that has a ground connection via the input BNC connector. Connect the ground lead on the probe to the ground on the measured equipment.



Warning • Do not apply a voltage exceeding the rated value to the input terminal.

- Do not directly touch any measurement points.
- Use the provided non-conductive screwdriver as the screwdriver for phase adjustment. If a conductive screwdriver is used, an electric shock may occur.

/ Warning

- The probe tip is sharp. Handle it with care.
  - Securely connect the probe to the device under testing.
  - Do not use the probe in an environment that contains explosive gas.



#### Configuration



#### Adjustment

#### Probe phase adjustment

To adjust low-frequency compensation, connect the probe to a signal source and adjust the compensation trimmer on the probe box. Now connect the SS-101R's BNC connector to a channel in the oscilloscope. Connect the arrow tip 1 and the grounding lead 2 to the CAL and GND terminals on the oscilloscope. Press Auto Setup, then adjust volts/div and time/div to set up the waveform such as shown in the figure below. Use the supplied screwdriver to adjust the probe phase, as shown in the figure below.

Caution: The screwdriver is made of plastic, so do not press it too forcefully. Align the screwdriver tip with the probe trimmer and turn the screwdriver.

Insufficient compensation	Sufficient compensation	Excess compensation
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#### Voltage derating curve

Input impedance characteristics (example)

#### Specifications

Frequency bandwidth ( $-3$ dB)	: 500 MHz
Attenuation	:10x ±2%
Input RC	: 10 MΩ//12 pF
Input capacity	
enabling waveform compensation	: from 13 pF to 23 pF
Cable length	: 1.2 m
Connector type	: BNC
Input voltage	: 600 V (DC + Peak AC) (see voltage derating curve)
Probe sense	: Included

#### **Cleaning and maintenance**

To clean the probe and cables, wipe with a soft cloth dampened with water or detergent (diluted). Use of strong cleansers or other solvents may cause discoloration and unexpected malfunctions. Make sure the probe tip that is provided as an accessory has not been damaged.

For repairs or maintenance, send the probe to an authorized service center.

# Probe SS-0130R Instruction Manual General

The SS-0130R probe is a passive probe that can be used with oscilloscopes having input resistance of 1 M  $\Omega$  .

The SS-0130R has a readout compensation function with 10:1 attenuation.

\*The SS-0130R probe is used for models

DS-5524A/5522A/5514A/5512A/5424/5422/5414/5412.

#### Precautions for safe use

To help ensure safe use of this product, this instruction manual uses  $\triangle$ Warning and  $\triangle$ Caution symbols when describing caution items for preventing physical injury and/or property damage. For safety's sake, be sure to note these symbols.

<ul> <li>Do not remove the probe case. Removing the case can result in electric shock.</li> <li>Do not disassemble or modify the probe. Disassembling or modifying the probe can result in electric shock, fire, or malfunctions.</li> <li>Do not directly touch any measurement points. Directly touching a measurement point can result in electric shock.</li> <li>During measurement, do not remove the probe's output connector from the connected device. Removing it from the connected device can result in electric shock.</li> <li>Connect the ground terminal to a ground potential on the device under testing. Failure to connect to a ground potential can result in electric shock.</li> <li>Do not use this probe when it is wet or when your hands are wet.</li> </ul>
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<ul> <li>Removing it from the connected device can result in electric shock.</li> <li>Connect the ground terminal to a ground potential on the device under testing. Failure to connect to a ground potential can result in electric shock.</li> <li>Do not use this probe when it is wet or when your hands are wet.</li> </ul>
<ul> <li>Connect the ground terminal to a ground potential on the device under testing. Failure to connect to a ground potential can result in electric shock.</li> <li>Do not use this probe when it is wet or when your hands are wet.</li> </ul>
• Do not use this probe when it is wet or when your hands are wet.
Using the probe when it is wet or when your hands are wet can result in electric shock,
fire, or malfunctions.
• Do not use this probe if it is damaged.
Using a damaged probe can result in eletric shock or fire.
If the probe is damaged, contact an Iwatsu service center to request repair.
<b>∆</b> Cautions
• The probe tip is pointed to facilitate measurement. Be careful to avoid injury to
your fingers from this tip.
• Do not apply a voltage exceeding the rated voltage to an input terminal.
Applying a voltage exceeding the rated voltage can result in malfunctions.
Refer to the maximum input voltage noted (as Input voltage) in the Performance section
below.
Use within the specified operation range.
Use outside of the specified operatioin range can result in malfunctions.

Refer to the temperature and humidity ranges for use in the Performance section below.

#### Configuration

The probe and its accessories are configured as shown in the figure below.



#### Accessories Lists

Items	Quantities
Arrow tip	1
Grounding lead	1
Grounding attachment	1
IC test chip	1
Color ring (red, yellow, blue, green)	4×2
Screwdriver for adjustment	1

#### **Specifications**

Frequency bandwidth (probe only)	: DC to 200 MHz, $\pm 3 \text{ dB}$
Attenuation	:10x ±3%
Input RC	: 10 M $\Omega$ $\pm$ 2 %//12.5 pF $\pm$ 2 pF
Input capacity	
enabling waveform compensation :	18 pF to 38 pF
Length	: Approximately 1.5 m
Connector type	: BNC
Input voltage	: 600 V (DC + Peak AC)
Environmental conditions	
Guaranteed temperature range	: +5°C to +40°C
Guaranteed humidity range	: 80% RH (+5°C to +31°C)
Storage temperature range	: −20°C to +70°C
IEC standard	: Complies with IEC61010 (device category
	II, pollution degree 2)

[Caution] The supplied screwdriver for phase compensation is a simple type that is not very durable. A separately sold screwdriver is available upon request for more frequent adjustments.

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